DETERMINING THE FINANCIAL AND RESOURCE MANAGEMENT IMPACTS OF INTEGRATING MEAT GOAT AND BEEF CATTLE ENTERPRISES

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DETERMINING THE FINANICAL AND RESOURCE MANAGEMENT IMPACTS OF INTEGRATING MEAT GOAT AND BEEF CATTLE ENTERPRISES

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CHAPTER I

INTRODUCTION

Background

Goat meat is widely consumed around the world. In the United States, in recent years meat goat production has been gaining in popularity, with both an increase in goat meat consumption and in meat goat production .The Foreign Agricultural Service (FAS) reports that there has been a linear annual increase in goat meat imports (at an annual rate of 30%) since 1994. Exports of goat meat have decreased quadratically which makes the goat industry the fastest growing industry in meat consumption in the US. The US Agricultural Census of 2002 revealed a 57% increase in meat goat numbers over 1997 results. As of January 2007, meat goats make up 82% of all goats in the US and are showing the fastest growth (USDA). Browning et al. characterized goat production in the US as an emerging, not-traditional, alternative agricultural enterprise. Sparks also stated that meat goats have become the fastest growing livestock species in Oklahoma and nationally.

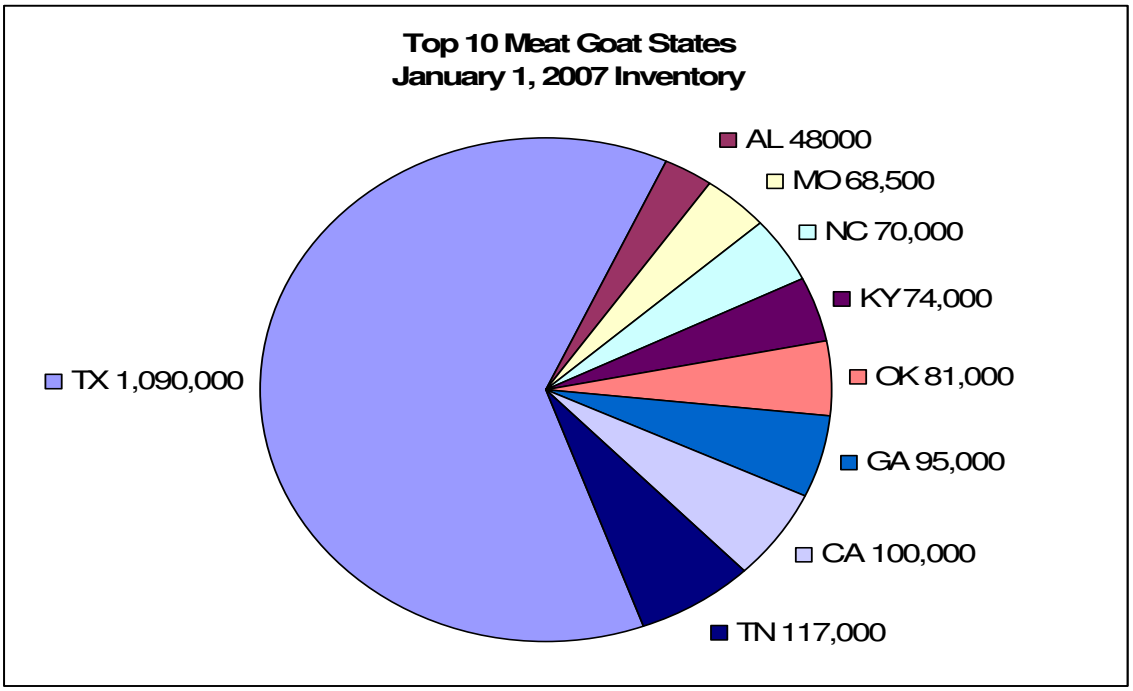

Figure I-1. Top 10 Meat Goat States in United States, 2007 Inventory
Source: NASS, USDA, *Overview of the Sheep and Goat Industry, September, 2007*

Changes in demographics, especially the increasing ratio of foreign born population of Hispanics, Asian, and African Americans, is considered the major contributing factor for increased meat goat consumption in the US. This fact is supported by "A Report on Market Analysis of Meat Goat in Ohio," which states that the enormous increase in meat goat consumption is largely attributed to the growing ethnic population and the sociological and economical changes among them. The population trend between 1990 and 2000 shows that the Hispanic, African American and Asian ethnicity population has increased by 57.94%, 48.26% and 15.58% respectively (US Census Bureau). Increasing ethnic household income is another major factor for increased meat goat consumption in the U.S. as cited by the report. According to the US Census Bureau, there has been an increase of 18.79% in average household income during 1990-2000 with the Asian household income increasing at the rate of 51.32% after adjusting for

inflation, followed by African American at 25.76% and Hispanics at 18.09%. The report also suggests increased consumption of goat meat in ethnic households with more disposable income.

Domestic demand for goat meat has increased dramatically over the last two decades, as indicated by US goat consumption (Figure I-2).

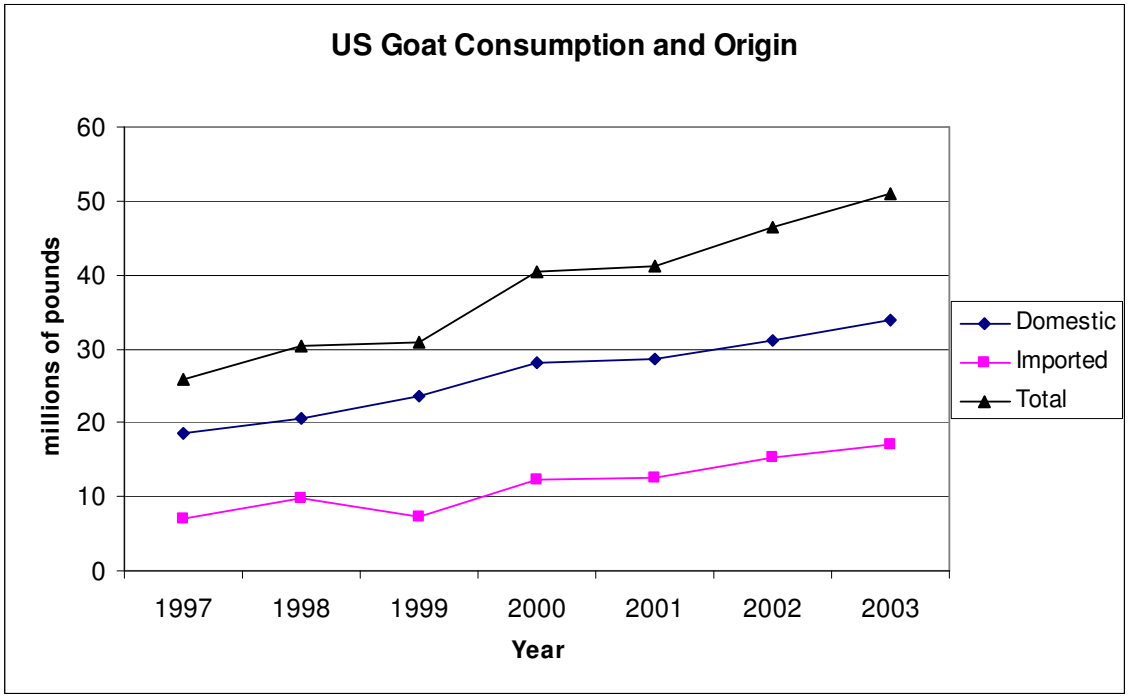

Figure I-2. US Goat Consumption and Origin
Source: Shurley and Craddock, 2005

Over roughly the same amount of time (1987/1990 to 1997/2000),the annual rate of growth for the US meat-goat herd was approximately 9.6%, more than double the rate of growth of the immigrant population (Sande, Houston and Epperson).

The US shifted from shifted from a net exporter to a net importer in 1991 (FAS) as suggested by Table I-1 and now the US is the top importer of goat meat (Machen). Since 1999-2003, there has been a 151% increase in meat goat imports and the import value has increased by 174 % (USDA).

Table I-1. US Meat Goat Import and Export Balance

Year	Imports to US	Exports from US	Balance
1989	86067	122,056	+35,989
1990	99353	115,413	+16,060
1991	122,932	53,246	-71,056
1992	172,280	60,444	-148,836
1993	136,634	3504	-132,860
1994	138,481	None	-138,481

Source: USDA, NASS, Livestock Slaughter: 2004 Summary

Australia with 92.5% of all imports in 2003 is the origin of most goat meat imported into the U.S with New Zealand accounting for nearly all of the rest (Machen).

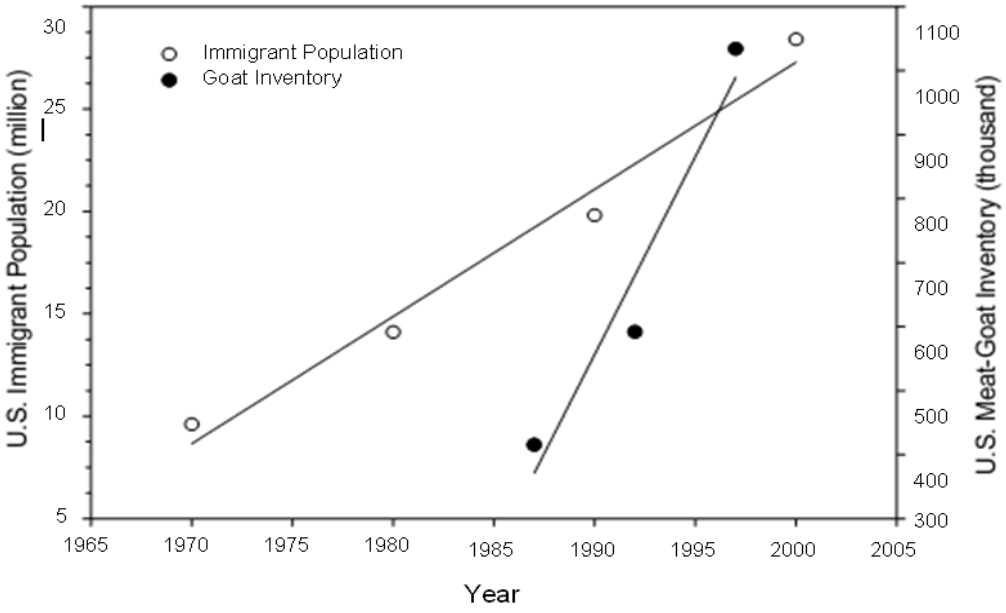

Figure I-3. The Relationship between US Immigrant Population and Meat Goat Inventory
Source: Sande, Houston and Epperson, 2005

Due to the growing demand for goat meat, live animal prices have been increasing consistently over the past decade. For example in Texas, prices for slaughter kids have risen from $0.75 per pound in 1996 to approximately $1.36 per pound in 2005, resulting in an 81% increase (Figure I-4).

Figure I-4. Average Price Trend of Slaughter Kids Sold in Texas
Source: Shurley and Craddock, 2005

Johnson suggested that although the imported chevon prices set the floor for the domestic market, domestic producers will have a market for their product as long as the various ethnic groups in the United States prefer fresh meat and are willing to pay a premium. Knudson also believes that many customers prefer the taste of fresh goat meat so the potential exists to expand the market for meat goat production in the U.S.

Agriculture Utilization Research Institute states that recent demand from ethnic groups and from a health conscious sector has fueled a new interest in producing meat goats in the US. With the current high value and demand for meat goat, ideas are shifting from “brush goats” to “meat goats” even when they are the same goats (Sparks). This is

evident by the increasing number of meat goat farms and increasing number of meat goats in the US (Table I-2).

Table I-2. Changes in Meat Goat Farms from 1997 to 2002 in the US

	1997	2002	% Increase
Number of Farms	63,422	74,980	18%
Number of Goats	1,762,231	1,938,924	57%
Number of Goats Sold	532,792	1,109,619	108%

Source: USDA, 2002 Census of Agriculture

As the major demand for chevon is ethnic based and the desire for immigrants to maintain their identity is strong, some researchers have theorized that the price elasticity of demand is relatively inelastic (Harwell and Pinkerton, 1999; Lillywhite). Knights and Knights believe that the elastic and upward shifting supply function and upward shifting demand both indicate a growing industry.

There are several advantages in meat goat farming when compared to large animals. According to Devendra, the higher reproductive rates lower initial investment and operating costs per animal and, lower death rates due to higher adaptability and suitability for many different environments are the special advantages of meat goats. Similarly Tadese finds meat goats attractive to small scale producers with limited resource situations.

Gebremedhin and Gebrelul observed that limited resource farmers confront critical problems in terms of maintaining an adequate level of family income and reducing income variation by controlling risk. They suggest diversification into alternative enterprises as one means to boost family income and also offer an alternative source of high quality food for consumers.

According to Rawlins, forage management is the weakest component of beef cattle operations and thus he stresses finding new methods to lower the production cost. A meat goat enterprise, known for sound vegetation management, can be a good fit with beef cattle operations, increasing enterprise profit and promoting environmentally desirable farming practices.

Glimp, Ospina and Yazman concluded in their study that the feed resource potential for goat production, especially shrubs and forbs, is excellent and based on traditional consumption patterns, the populations exist in North America for a significant increase in goat meat consumption at market prices profitable to the producer.

Yazman et al. see meat goat production as an opportunity to make use of available family labor and surplus land of marginal quality as a part time enterprise for the farm families and rural residents who also hold off farms jobs in rural communities.

Coffey states that meat goats are one of the cheapest livestock enterprises to start up, as they do not require much capital to purchase or feed. Due to the quick herd building capability and the ability to reach market size quickly, the initial investment can be quickly recouped, and cash flow is more favorable than for cattle enterprises. Goats have been used for sound vegetation management in the US for over a hundred years (Taylor and Ralph).

Pinkerton, Scarfe and Pinkerton stated that local opportunities for selling more goats at higher prices have heightened interest in small scale commercialization of meat goats in Oklahoma, although there are no precise statistics concerning the production of goats for meat in Oklahoma.

Despite all the advantages and potential to expand meat goat farming in the US, it is still a fledgling industry and is not free from limitations. Hart claims that the foremost

limitation for the expansion of the goat enterprise is the social stigma attached to goats and thus meat goats may not be easily accepted by lifelong cattlemen. But, he maintains the economic and ecological pressures and success stories in increased return and vegetation management may provide considerable motivation for adding meat goat enterprises.

Since there should be modification in fences and water sources to accommodate goats, this requires substantial changes from a cattle only enterprise. Hart observes lack of an infrastructure (animal markets, source of large numbers of adapted animals, producer experience and knowledge base) as a serious constraint to meat goat industry expansion but still expects that it will be gradually overcome.

With the increasing ethnic population which prefers goat meat and continuing increase in their household income, the US goat industry is growing and in this context meat goat production along with beef cattle may be profitable. The research question is, "what is the effect on the income potential of the farms that include a meat goat enterprise with beef cattle production?" This study has direct implications for livestock farmers and ranchers and extension educators.

Objectives

General Objective

Analyze the net returns to management and capital of producers through effective utilization of the natural resource base by integrating meat goat enterprises with beef cattle operations.

Specific Objectives

1. Estimate the costs and benefits of integrating meat goats with beef cattle enterprises.
2. Determine the complementary and competitive aspects of meat goats on resource use.
3. Identify the profit-maximizing livestock and pasture combinations for representative farms.

Organization of the Study

The general background and introduction is covered in chapter I. The literature review is presented in Chapter II. Chapter III includes the model description and the data sources including the description of base scenario. Chapter IV includes the results of the base scenario and the alternative scenarios. Chapter V provides a summary, conclusion and recommendations, limitations of the study, and suggestions for future research.

CHAPTER II

REVIEW OF LITERATURE

Goats have several advantages when compared to other large animals. Goats require a low initial investment so are lower risk. They are prolific breeders, so build the herd faster than cattle and reach market size quickly. Goats can improve and maintain pasture land by reducing noxious weeds and bush encroachment. The goat meat is more lean (low cholesterol) and relatively good for people who prefer a low fat diet. Finally, goats are considered ideal for mixed species grazing as they can thrive well on almost any type of vegetation.

Goat meat is popular in the world and in recent years, meat goat is gaining popularity in the United States, mainly due to the influx of immigrants who prefer goat meat and to the health conscious sector who avoid red meat. But according to Haenlein, there are few studies on marketing, investment requirements, and production costs and returns for meat goats in the US when compared to other livestock species.

Enterprise Returns

Studies in meat goat production by Galina et al and Yazman, Norman and Redfern have concluded that feed costs make up 60 to 70 percent of total cost. According to Galina et al and Ospina, Yazman and Glimp, net returns to land, labor and capital for a 100 doe meat goat herd on brush and woodland grazing were projected at $23.52 per doe and could be raised to $44.92 by providing pasture for part of the year. Ospina estimated that raising 50

kids for slaughter could yield returns to producers of $16.54 (130 percent weaning) and $21.68 (170 weaning) per doe on an early-weaning program and $14.16 (130 percent weaning) and $18.55 (170 percent weaning) per doe with partial suckling. By analyzing the economic and financial data of three meat goat enterprises, Gebremedhin and Gebrelul, concluded that meat goat presents a viable enterprise for small scale producers and also concluded that meat goat production was a profitable enterprise at least by the beginning of the third year of operation. Yazman et al. find this consistent with the research studies of Winrock International.

Multi-species Grazing

As stated by Knight and Knight, the major system of rearing meat goats in the United States is land extensive, that is both the breeding herd and salable off-spring are maintained and grown on a forage and shrub-based diet with some supplement being fed occasionally and under this system, multi species grazing is widely used.

According to Luginbuhl et al., because of the complementary grazing habits, goats can be grazed with beef cattle, resulting in better pasture utilization and greater production, without adversely affecting the feed supply of the beef herd. They find goat production along with beef cattle as an intermediate cash flow potential for beef producers. This is supported by a study by Sikosana and Gambiza, in which they found that mixed grazing of cattle and goats has profit potential due to increased productivity.

According to Neary et al., a study conducted on co-grazing sheep and cattle concludes that there was an increase in total weight weaned and gain per acre relative to either species grazed alone. The same study also found that grazing cattle and sheep simultaneously increased animal gain per acre by 40 lbs when compared to cattle only and by

88 lbs when compared to sheep grazed alone. There seemed to be no detrimental effect on gain and performance of either livestock species with multi-species grazing strategy when compared to the performance of the respective animal species grazed alone. But Neary also states that the extent to which knowledge from cattle and sheep stocking trials can be transferred to goat production systems is not known.

A study which examined dietary overlap found that when averaged across a wide range of studies, multi-species grazing resulted in an overall increase in meat production of 24 percent compared to cattle only grazing (Walker).

Umberger et al. found that adding one ewe per cow resulted in an increase in net profit of 29% when compared to cattle grazed alone.

As mentioned by Pinkerton et al. and Alford et al., with a carefully chosen ratio of goats to cattle and/or sheep, mixed species grazing has been proven biologically practical and economically feasible, generating an equivalent of $40 to $70 per breeding female per year in brush control and pasture improvement. Similarly according to Pinkerton et al., budget estimates for goat enterprises used primarily for brush control compared with those used for meat production shows return to factors of production to be $40/doe for the latter and $24/doe for the former (where no monetary value was credited for pasture improvements). Rector, in a native range situation in Texas, observed that the difference in diet preference not only makes goat and cattle compatible but also complementary. A review of Texas studies by Merrill and Taylor showed that pasture utilization and carrying capacity were improved 10 to 25 percent by grazing with a combination of cattle, sheep and goat.

There are several other studies, including those by Child et al., Glimp et al., Gunderson and Ospina, Shelton, Mercado et al., which state that meat goats can be profitable

to produce and that the apparent market demand for goat meats in the US exceeds the current supply.

According to Lusigi et al., goat is a mixed pasture-browsing animal, so native or improved grass-only production may not provide the best forage class. With the number of goats increasing in the Cross Timbers and Prairies region, an area of 67,000 km^2 (Diggs et al.) , Goodwin suggests that the sustainable cultivated forage systems with forbs as a planned component may support expansion of the meat goat industry without overstocking native pastures.

Child et al. estimated that at least 20 million acres in the southeastern US could benefit from using goats to control shrubs, kudzu and other viniferous species on pasture lands and in forests and to control tree and shrub sprouts on cleared lands.

According to Hart, producers have been using goats both for vegetation management with a motive to grow more grass to produce more beef and for enhancing the productivity of degraded range sites. Luginbuhl et al. report the effectiveness of goat species to substantially increase vegetative cover by favorable grass and legume species, reduce multiflora rose presence, while achieving daily gains and gain/ha of 79 ±19 g/day and 66.2 ± 12 kg/ha.

Taylor and Ralph observed that in Texas some owners make money from leasing out the goats for weed control and see the possibility to charge more money in other areas of country where weeds are a major problem and goats are in short supply.

Multispecies grazing requires substantial changes from a cattle only enterprise and some problems may arise in its practice. A prerequisite for implementation in integrated systems is determining an appropriate mix of cattle and goats (Sikosana and Gambiza).

Mixed species may have some ecological limitations too. According to Armstrong, conclusions drawn from the studies conducted on food habits of white-tailed deer, domestic livestock and the major exotics found in Texas suggest that while goats compete with deer for the more stable drought-resistant browse, cattle on properly stocked ranges are the least competitive with white-tailed deer.

Extensive and Intensive Grazing

Although mixed species grazing seems a promising option, it is very difficult to answer basic management questions regarding the ideal production system, meat goat species, the grazing density (head/acre), optimum grazing pattern (frequency and duration), and needs for supplemental feeding (protein, energy and minerals). According to Pinkerton, meat goat production in southwestern rangelands and southwestern woodlands is under extensive management with the foci on the near year-round grazing schemes, minimum supplemental feeding, limited environmental protection and minimal health care practices. As stated by Agricultural Utilization Research Institute (AURI), extensive production consists of generally larger herds of goats over vast areas usually in the arid or semi-arid regions of the country and using native brush and grasses to provide the primary sources of nutrient for goats. In addition AURI states that research on extensive production systems has demonstrated that nursing does can effectively utilize pasture and understory vegetation in hardwood forest. Under this system, supplemental feeding of protein and energy is restricted to winter months and extreme drought periods (Pinkerton et al., Pinkerton and Pinkerton).

Pinkerton and Harwell have observed that many Spanish goats are also raised under extensive conditions in the southeastern US. Carrying capacities in these "wet brush" areas may be 2-3 goats per acre initially and thereafter 1-2 per acre for the long growing season as

compared to 2-4 acres per goat in the more arid southwest. Coffey stresses the need for some form of predator protection as extensive grazing requires large tracts of land.

Similarly, AURI states that intensive goat enterprises are usually smaller (20-100 head) using fewer but more productive acres and use improved pastures, rotational grazing, supplemental forage and concentrates and better medical care than usually found in extensive units. In addition, when well managed, does kidding may approach 100% and weaning rates may be 180% with kids considerably heavier than their extensively grown counterparts. As evident from Harwell and Pinkerton and AURI, the relative profitability of intensive systems is subject to many variables reflecting site-specific operations. Coffey points out some negative management aspects in terms of more time and attention from the producer, much higher fencing costs and the producer must learn how to manage pastures. Coffey argues that while pasturing goats in intensive grazing system without rotation may save initial fence cost and labor and is easier, there will be offsets in terms of degraded herd health and increased feed costs, so it may be less profitable or sustainable over time.

Thompson and Shelton observed that increased management inputs increased productivity, however lower input –lower output production systems were the most profitable.

Meat Goat Breeds

According to Gipson, several goat breeds are potential meat producers but all of them have not yet been tested in North American production systems and some are lacking in some aspects of performance. Browning et al. consider reproductive performance of the doe herd as having a major impact on the sustainability and profitability of commercial meat goat enterprises. An evaluation report by Browning et al. focused on reproductive rates and other

fitness indicators of Boer, Kiko and Spanish does under the humid, subtropical pasture conditions of the southeastern United States (Table II-1).

Table II-1. Litter Traits and Fitness Indicators as Influenced by Breed of Doe.

Trait	Breed of Doe			s.e.
	Boer	Kiko	Spanish	
Per Doe Weaning Kids				
Litter size, kids/dam	1.51^{B}	1.69^{AB}	1.79^{A}	0.07
Litter Weight, kg	26.5	30.2	28.0	1.2
Per Doe Exposed to Bucks				
Litter Size , kids/dam	1.03^{B}	1.54^{A}	1.54^{A}	0.09
Litter Weight, kg	18.4^{B}	28.1^{A}	24.2^{A}	1.6
Annual Doe Survival Rate, %	78.5^{B}	99.1^{A}	93.9^{A}	3.1
Lameness Cases/doe/yr	2.02^{B}	0.58^{A}	0.79^{A}	0.16
^{AB} means with different letters differ significantly				

Source: Browning et al. 2006

According to Browning et al., Spanish and Kiko breeds appear to be more suitable for commercial meat goat production in the humid, subtropical region of southeastern US. But Pinkerton et al. reported that there is no well-defined US meat breed comparable to the African (Boer). Gipson also states the Boer is the only known goat breed routinely involved in a performance test for meat production. The Boer breed of goat developed in South Africa has growth rates and lean meat production levels superior to those of any recognized breed in the United States (Casey and Van Niekerk, Van Niekerk and Casey). Lu also considers Boer goat as one of the most desirable goat breeds for meat production as it has worldwide recognition for excellent body conformation, fast growing rate, good carcass quality and prolificacy. Lu finds Boer goats as excellent candidates for mixed grazing with cattle and

sheep as they do not dig out the roots of plants under harsh grazing conditions and Barry and Godke finds Boer goats less susceptible to contamination by internal parasites.

Stocking Rates for Meat Goats

Stocking rates for mixed-species grazing have not been fully studied. But according to Pinkerton et al., several rules of thumb for grazing can be typically applied, e.g. 6 mature goats equal 1 cow on native or improved pastures or 10 goats equal 1 cow on browse or understory brushy areas. Pinkerton et al. also report that Oklahoma Angora goat owners have routinely grazed 10-12 goats per acre of good wheat pasture and 12-15 (occasionally more) goats per acre on alfalfa pastures. Similarly Angora producers have also reported grazing densities of 2-3 head per acre on good native pastures in the South central area and 1-2 head per acre of brushy fields (go back land) in the southeastern area; Texas rangelands typically require 4 acres per goat (Pinkerton, Scarfe and Pinkerton).

According to Sikosana and Gambiza, goat performance under the lightest stocking rate (4 cattle and 36 goats or 3.3 ha/Livestock Unit) was higher. They also reported that weaner production from goats increased when total stocking rate was low and this was also the trend in the overall doe productivity.

Table II-2. Estimated Stocking Rates or Feed Needs for Goats, Sheep and Cattle Pasture

Pasture Type	Goats	Sheep	Cow
	Head [1]		
Good quality pasture system	6-8	5-6	1
Good brush-browse system	9-11	6-7	1
	Head/acre		
Wheat/alfalfa system	10-12	8-9	1.5
Alfalfa pasture, Oklahoma	12-15	10-11	1.9
[1] Number of animals to consume similar amount of feed.			

Source: Luginbuhl et al.1996

According to Luginbuhl et al. because of their grazing behavior, goats will still perform well when the density of high quality forage is low and the stocking rates are low, even though their nutrient requirements exceed those of most domesticated ruminant species. Using goats at the high stocking rates required to achieve effective brush control however may reduce kidding rates or kid weaning weights (Pinkerton et al.).

The ideal stocking rates for goats grazing winter cultivated pastures have not been studied (Muir, Ocumpaugh and Butler). As reported by Osoro and Martinez, research has shown that an increased sward height (negatively correlated to stocking rate) benefits daily gains in kids. Lack of stocking rate studies for cultivated cool season pasture systems for goats has managers dependent on data collected from cattle and sheep systems, for which a large body of animal performance vis-à-vis herbage availability exists (Wu and Rykiel, 1986).

Meat Goat Nutrient Requirements

Pinkerton and Pinkerton suggest only two notable differences when it comes to the nutritional requirements of goats managed primarily for milk production and meat production. According to them, one of them is meat goats need only achieve 4-7 month lactation with high initial milk flow, persistency beyond 4 months being of lesser concern. Secondly, dairy goats are typically fed considerable concentrates (grain mixtures) to encourage maximum and persistent milk flow.

As suggested by Pinkerton et al. meat goats must solely depend on forage to meet their nutritional needs and utilize grasses, browse, weeds, forbs and seasonally, small grains, hays and occasionally, silages. They also emphasize that goats actually prefer to browse on brush rather than on grass commonly taking about 60% browse and 40% grass in mixed populations and respond quite favorably to increased quality/quantity of feedstuffs.

Table II-3. Diet Preference of Cattle and Goats

Plant Type	**Cattle**	**Goats**
Grass	70%	20%
Forbs	20%	20%
Browse(shrubs, trees)	10%	60%

Source: Luginbuhl et al.1996

The feeding strategy of goats appears to be to select grasses when the protein content and digestibility are high but to switch to browse when the latter overall nutritive value may be higher (Luginbuhl et al.). Goats survive well on poor or fair grazing areas with sufficient grazing material without compromising biological efficiency, because they usually are more proficient than other species at selecting the most nutritious parts of the plant (Gipson, Luginbuhl et al., Hart).

Although goats can survive, production may not be optimal if nutrient intake is limited so in these cases, providing supplemental nutrients as either forage or concentrate may provide an economic benefit to the producer (Bateman et al.). Pinkerton and Pinkerton suggest proper supplements should be offered in adequate quantities when the available forage is insufficient in protein or energy or minerals to support desirable levels of goat performance considering the likely cost-benefit exchange involved. A study by Walz et al. revealed that kids supplemented with energy or protein increased empty Body Weight (BW), body water, protein, fat, ash and gross energy when compared with unsupplemented kids.

Pinkerton and Pinkerton state that protein blocks of about 37% CP are widely used during Southwestern winters and also suggest that feeding a hay of sufficient protein as the optimum solution when the plants are too low in protein (or in which forage quantity is much reduced).

Depending on the quantity and quality of available forage, flushing may or may not be necessary for meat goat production and if necessary can be accomplished by a cost effective method of moving breeding does to a lush nutritious pasture approximately 4 weeks prior to the introduction of the bucks (Luginbuhl).

Meat Goat Markets

It has been reported by Pinkerton, Scarfe and Pinkerton that the production and marketing of goats and goat meat in 1990 was widely perceived by southern goat owners and extension service personnel to be largely unorganized, unobserved and unrecorded and was, accordingly, thought to be erratic over time and place as to numbers, price, and availability of retail product and consistency of quality. Similarly, equitable distribution of marketing margins across producers, middlemen, processors, and purveyors was also thought to be only

imprecisely achieved. Harwell also concludes that goat supply is not in close accord with consumer demand across time thus, there are wide fluctuations in prices received by producers and paid by consumers and this in turn tends to discourage improvements in production.

According to Gipson, ethnic demand constitutes the major demand component, so market demand for chevon in the US tends to be seasonal, centered on cultural and religious holidays. Coffey has categorized the meat goat business in terms of meat for ethnic holiday markets, for the open market, for on-farm sale, for brush control, breeding stock for commercial herds and breeding stock for show herds. Coffey also states that if producers want to target ethnic markets, then they need to have timing of breeding to meet the holiday demand.

Besides direct marketing to ethnic groups, Engle et al. suggest two other largely untapped and real opportunities for producers, namely target markets serving health conscious consumers who want a low cholesterol diet and the restaurant trade serving ethnic or gourmet food featuring goat meat.

Stanton has described different types of market goats for ethnic holiday markets such as newborn kids, suckling kids, market kids, wethers and cull does. According to Sultan, a typical supply chain would have a farmer selling goats at a local auction with opportunities for shortcuts along this chain that shift more responsibility on producer.

Stanton reports live market auctions as an easy way to market live goats without effort and with a guaranteed payment but here producers have no control on price. Another alternative is to bypass dealers and packers and instead sell animals directly to wholesale and

retail businesses but it takes much more responsibility and the producers must make all slaughter, processing, and transport arrangements and pay these expenses up front.

Coffey suggests producers in areas with large enough populations set their own prices and sell animals from their farm premises with the advantages including reduced risk of low prices and lower marketing cost (hauling charges, sale barn commission or shrink loss). Sultan suggests market pooling as an alternative to many farmers with few animals so that they can negotiate directly with a volume buyer.

Factors Affecting Expansion of Production

While the goat industry holds much promise for new producers there are various factors that limit industry expansion and production. Seasonality of breeding which leads to an inconsistent year round supply of goat meat is probably the greatest problem. In addition, some goat producers are challenged by a lack of knowledge about goats as the interest in meat goats has been recent and many people are new to the business (Coffey). Another factor to overcome is the mental recalcitrance of cattle producers to add goats on their farm (Hart).

Other problems as reported by Coffey are fencing, internal parasites, predation and lack of knowledge. Farmers adding goats to their farms will need to adapt and improve the fences which cost money and time and this is probably the major stumbling block at the producer level as fencing for goats is more expensive than for other livestock. Harwell and Pinkerton also suggest that the small size, agility and climbing nature of goats, as well as the presence of domestic and wild predators necessitates construction of effective housing and facilities for goats. Goats are vulnerable to predators, primarily coyotes and dogs, but also bears, wolves, bobcats and other predators. Coffey notes that dogs will likely be the biggest problem in heavily populated areas. The predator problem can be acute and may come from

several sources, and demands constant vigilance. For best control, a combination of methods, i.e., a guardian animal and a good fence, is necessary. In certain circumstances, total control may be difficult to achieve.

Despite the previous research showing the contributions of goats to livestock and forage production systems in multi-species grazing pastures, the economic aspects of adding a meat goat enterprise to an existing beef operation have not been fully studied and quantified. Information on both financial feasibility and profitability is needed. Further analysis of economic and production roles of meat goats when they interact with beef cattle would benefit educators as well as farmers and ranchers. This information can be used by individual producers or extension educators to develop and evaluate different production options. Research based information and knowledge of production alternatives with accurate estimates of the income expected from these alternatives will help strengthen producer's competitiveness.

CHAPTER III

METHODOLOGY

MODEL

This study seeks to determine the profitability of integrating beef and meat goat enterprises, given a specified amount of land and capital plus assumptions concerning available farm resources and productivity levels. A whole farm approach is needed to understand the optimal allocation of resources. Enterprise budgets capture long run profitability but not the interactions between cattle and goat production systems in terms of forage use and productivity, labor and equipment use, and/or constraints or other resources. Linear Programming (LP) utilizes the concept of marginal analysis for determining the optimal allocation of resources to the activities producing the greatest return. It thus suggests the farm plan that has the largest possible total gross margin subject to the limited resources available to the farm decision maker. According to Rawlins, LP accomplishes this task by selecting that combination of activities that provides the highest return, gross margin or other objective with the specified constraints. Rather than specifying a single level of resource use as in an enterprise budget, the resource constraint is specified along with the technical coefficients about resource use such that resource allocations can be optimized in the LP solution.

The Lagrangean form of the Mathematical Programming model will be;

$$Z(X_j, P_i) = \sum_{j=1}^{n} C_j X_j + \sum_{i=1}^{m} P_i (b_i - \sum_{j=1}^{n} a_{ij} X_j)$$

Subject to the constraints:

$$\sum_{j=1}^{n} a_{ij} X_j \leq b_i \text{ for } i = 1 \ldots\ldots m$$

$$X_j \geq 0 \quad \text{for } j = 1 \ldots. n$$

Where:

X_j = level of activity j

P_i = Lagrangean multiplier (shadow price) of resource i

C_j = income or costs of activity j

Here, set j includes the n activities, set i includes the m constraints.

a_{ij} = quantity of resource i required per unit of activity j

b_i = quantity of resource i.

The LP tableau for this model adapts the modeling framework of Smith which was built on Microsoft Excel 1997 and the framework for meat goats was added to it. The tableau is linked with other worksheets which contain data, formulas and calculations regarding nutrient requirements for animals, and other user entered information on farm resources and production alternatives. Spring and fall calving cow enterprises, stockers, intensively and extensively managed breeding goats and goat stockers, forage and crop enterprises including forest are the potential production activities for the model. The land available, the available hours of owner labor, the capital owned, hay availability and the available DM are some of

the potential constraints in the model. Solver Premium Plus version from Frontline Systems was used as the tableau exceed the limit for the standard Excel Solver.

Input for Land and Forage

The LP model is used to solve for profit-maximizing enterprise combinations for farms of three sizes (small, medium and large) for two regions of Oklahoma, South East and North East. In alternative scenarios, four categories of land have been specified for use, e.g. cropland, improved pasture land, native pasture land and forest land. Cropland can be used for crops or for use as improved pasture. Improved pasture land is land with established non-native forages or former cropland. Native pasture land has forages native to a specific area and needing no establishment. Forest land is a mix of grasses, forbs, shrubs and trees and it is not cultivated. The user enters the total number of acres in each of the four categories of land, numbers of acres in a specific forage and expected annual production per acre for each forage types. For this model, forest land is a mix of 50% shrubs, 30% forbs and 20% trees.

If the forage is not used in a given month, the total amount of DM carry over is expected to degrade each month. As the actual percentage of monthly transfers of all the forages is unknown, some estimated default values are provided. As suggested by Smith, the most common default value used is 90 percent, with 80 and 75 percent during the non-growing months of each forage. The user can change the percentage of each forage that can be transferred to the next month.

The animal harvest efficiency is the percentage of forage that is actually usable by the animal. Experts debate on the level of animal harvest efficiency, so the provided default values are based on expert opinion adjusted through trial runs to give realistic results (Moseley and Lalman). Establishing a default value for the harvest efficiency of the animal

for forest species is especially difficult, so as suggested by Bidwell, a default value of 25% is used, recognizing that it would also vary by species of trees, shrubs and vines as well as the diet preferences of animals. Users may change the percentage of harvest efficiency by animal for each forage.

The user also needs to specify the monthly labor hour requirements and the operating capital needed for each forage activity. For each land use activity, the user also needs to enter the total costs excluding labor and capital costs. Default estimates of monthly labor hour requirements, operating capital needed and total remaining costs are based on forage enterprise budgets developed by Department of Agricultural Economics, Oklahoma State University.

Input for Livestock

The user can enter or use the default values for the average body weight (BW) of the cows in the herd, average body condition score (BCS) for cows (NRC), average milk production, average expected calf birth weight, expected percent calf crop, expected percent of replacement heifers, expected calf weaning weights, expected stocker starting weight and desired stocker average daily gain (ADG).

For the meat goat enterprise, the user needs to enter the value for the average body weight for the goats, the average BCS, average milk production per goat, average expected birth weight of a kid, the kidding percentage, expected kid weaning weights, the expected starting weight for goat stockers, the desired average daily gain and the finishing weight for the stockers.

For each livestock activity, the user must also enter the labor hours required and the operating capital needed. The user also needs to enter the total costs excluding labor, feed

and capital costs. Default estimates of the labor requirements, operating capital needed and total remaining costs are based on Oklahoma State University Department of Agricultural Economics livestock enterprise budgets. Buy and sell prices of cattle and meat goats at different weights and different times of the year are required. Historical average prices over several years are included as reference or the user can enter the appropriate value.

Calves from the cow calf operation may either be sold or transferred into a stocker operation. In addition to utilizing stockers from the cow-calf operations, stockers may be purchased.

The intensively managed breeding goats would have a kidding rate of 180% and they are assumed to kid three times in two years whereas the extensively managed breeding goats will kid only once a year. The kids from both intensive and extensively managed breeding meat goats operation are sold when they would be 3-4 months old targeting the Easter ethnic market. For the stocker goat operations, the user can choose the starting weight for stockers and purchase them for appropriate prices.

General Input for the Whole Farm

The user must enter the general farm information, such as starting operating capital, maximum capital that can be borrowed, annual percentage rate (APR) on the borrowed capital, monthly labor hours available from the owner/operator and wage rate of potential hired labor. If labor is a limiting factor in any month, additional labor may be hired up to a user specified limit.

DATA

Since limited work has been done on beef and goat grazing systems, there is no comprehensive single data source that combines cattle and goat production systems. Different sources have been used for data collection on various aspects of the model.

Farm

The Census of Agriculture in 1997 has defined the acreage for the farms in northeastern and southeastern Oklahoma as small, medium and farms (Table III-1)

Table III-1. Representative Oklahoma Farm Acreages

	Small	Medium	Large
SE	50	300	2360
NE	50	285	2710

Source: USDA, Census of Agriculture, 1997

Using 1992, 1997 and 2002 Census of Agriculture, Oklahoma fact sheets (USDA), states total farm land is estimated to include 44.1% cropland, 46.7% pastureland and 6.7% woodland. For pasture only scenarios, as assumed by Smith, total pastureland consists of 80% native pasture and 20% improved pasture.

Forages

As suggested by Smith, it is important for producers to treat their forages as individual enterprises of their operation, because forages are an extremely important input into a livestock operation.

The forage data for this model consists of DM, CP and TDN for the common Oklahoma pasture forages and forest species. The forages used in this model are winter wheat, bermuda, tall fescue, old world bluestem, tall grass prairie and some common species of trees, shrubs and forbs found in Oklahoma. The shrub is defined as a woody plant with

multiple stems from a base but lacking a single trunk whereas a tree is defined as a perennial woody plant of considerable stature at maturity with one trunk. Forbs are any herbaceous plant other than members of grasses, sedges and brushes (Bidwell).

The forage enterprise budgets for each of the above mentioned forages breaks down forage production into measurements of monthly DM, CP content, energy content represented by TDN. These data came from Oklahoma Experiment Station bulletins and reports as cited by Smith. The costs associated with that production are from OSU Enterprise Budgets.

The data for annual production (lbs/ac) of shrubs, forbs and trees came from the Ecological Site Characteristics published by the NRCS, USDA. Shallow Savanna was selected as the benchmark for the annual production of the forest species including shrubs/vines, forbs and trees as suggested by Bidwell (Table III-2).

Table III-2. Plant Types and Their Annual Production

Plant Types	Annual Production (lbs/ac)		
	Low	RV	High
Grass/Grass-like	980	2100	2600
Forbs	70	320	400
Shrub/Vine	60	300	375
Tree	350	480	600

Source: OK-FOTG Notice 450- Section II, OK NRCS, April 2001

Livestock

This model uses mixed enterprises consisting of beef cattle and meat goats. The beef cattle nutrient requirements and calculations were done by Smith for her MS thesis entitled “Optimizing Forage Programs for Oklahoma Beef Production”. The beef cattle enterprise includes spring calving (March) cows and fall calving (October) cows which is

typical for Oklahoma cow-calf operations. Stocker activities were selected by Smith from *Beef and Pasture Systems for Oklahoma*, *A Business Management Manual*, developed by Walker, Lusby and McMurphy. The beef stocker activities include steers bought in November and sold in March, calves bought in November and sold in May, and calves bought in May and sold in September.

The nutrient requirements for beef cattle are available from the *Nutrient Requirements of Beef Cattle* as developed by the National Research Council, Committee on Animal Nutrition (NRC). The model uses prediction equations as formulated by NRC to calculate required TDN and CP per day for beef cows. The nutrient requirements calculations have been divided into three stages of production. Stage one represents beef cows from 180 days of lactation, stage two representing beef cows in their middle third (90 days) of gestation and stage three represents beef cows in their last third (90 days) of gestation.

The meat goat enterprise alternatives include breeding goats (intensive and extensive) and stocker enterprises. Extensive management has a single kidding per year. The breeding plan targets the Easter market, with breeding starting in June, kidding out beginning in December, weaning kids in March and selling them in April when at 3-4 months of age.

Intensive goat enterprises are typically small (usually between twenty and one hundred head of goats) and use only a few acres of land. Intensive management would strive to get three sets of kids in 2 years. As suggested by Jones, when compared to the extensive enterprises, there would be an increase of 15 % in management costs, 35% in labor hours used with a 15% increase in production. As suggested by NRC, in intensive management, there would be 25% increase in nutrition requirements for does compared to extensively

managed does. The kids would gain weight faster and weigh more at weaning than the extensive counterparts.

Two goat enterprises are included based on observed practices as suggested by Jones. The most common goat stocker enterprise is the Summer Goat Stockers, which is usually practiced from June to October and feeds on summer forage. Another less common goat stocker operation is from December to April which is dry lotted, that is fed grain and hay with increased labor requirements for feeding when compared to summer goat stockers.

The nutrient requirements for meat goats are available from the *Nutrient Requirements of Goats* 1981 developed by the National Research Council, Committee on Animal Nutrition. For meat goats, the nutrient calculations are divided into different stages of production, namely early pregnancy, late pregnancy and lactation, both in extensive and intensive management.

The first stage is maintenance and early pregnancy, which includes the first 90 days of the gestation period of 150 days. The energy requirements for maintenance of goats have been reported in terms of kilo calories (kcal) Metabolizable Energy (ME)/Weight (W) $kg^{0.75}$ per day. The average is 101.38 kcal ME/ $Wkg^{0.75}$ and this value has been used to determine goat maintenance requirements for body weights ranging from 10 to 100 kg. As suggested by NRC, a 25 % increment was applied to the basic maintenance requirements in intensive management scenarios. No extra energy requirements for early pregnancy have been specified.

The mean value for protein requirements for maintenance and early pregnancy is 4.15g TP/ $Wkg^{0.75}$, with an average digestibility of 68% for total protein. The protein requirements have been presented in terms of total protein (TP) and digestible protein (DP).

The second stage is late pregnancy, the last two months (60 days) of gestation period of 150 days. The mean value for energy requirements for pregnancy is 177.27 kcal ME/ $Wkg^{0.75}$. No differentiation has been made between does producing single kids and those producing twins. No experimental values have been found for protein requirements of pregnancy but a mean value of 6.97g TP/ $Wkg^{0.75}$ has been suggested.

Another stage of production is lactation. The mean value of 1246.12 kcal ME/kg has been suggested as the energy requirements for 4% fat-corrected milk (FCM). For each 0.5 percent change in fat content from 4 percent milk, an addition or subtraction of 16.28 kcal ME has been applied. Mean value for protein requirements for milk production is 81.71 g TP/kg of milk with 4.86 percent fat.

Similarly, the mean value for energy requirements for weight gain is 7.25 kcal ME/g gain. Additional values for all growing goats with daily weight gains of 50, 100 and 150g have been based on 7.25 kcal ME/g of gain. The mean value for protein requirements for weight gain is 0.284 g TP/g gain.

In meat goat production, supplemental feeding is not practiced commonly but 20% and 38% range cubes can be used when needed.

Base Case Scenario

The native pasture scenario in which all the farm land is native pasture is considered the base case. The small and medium farm in both NE and SE Oklahoma are assumed to consist of the same acreages and land use; large farms in SE and NE regions differ in that the large NE farm includes cropland. Alternative land scenarios are specified in Table III-3.

Table III-3. The Land Allocation for Different Farm Sizes and Scenarios.

	Scenario 1	Scenario 2		Scenario 3			Scenario 4			
Farm Size	Nat Past	Nat Past	Forest Land	Nat Past	Imp Past	Forest Land	Nat Past	Imp Past	Forest Land	Crop Land
Small SE/NE	50	40	10	32	8	10				
Medium SE/NE	300	250	50	200	50	50				
Large SE	2300	2000	300	1600	400	300				
Large NE	2700	2350	350	1880	470	350	1600	400	350	350

In all scenarios, Tall Grass prairie is the native pasture. Assumed yields and harvest efficiencies for alternative forages are summarized in Table III-4. For scenarios 3 and 4 improved pastures such as wheat forage, bermuda, fescue, old world bluestem can be included along with forest land. The forest land is defined as 50% shrubs, 30% forbs and 20% tree cover.

Table III-4. Annual Production and Harvest Efficiency (HE) for Different Forages

Forage Species	Units	Production Per Acre	Forage lbs / Acre	HE for Cows	HE for Goats
Wheat Grain	bu.	40	-	-	-
Wheat-Dual Purpose	bu.	33	1000	-	-
Wheat Forage		-	6300	45%	20%
Bermuda		-	8000	35%	20%
Fescue		-	7000	35%	20%
Old World Bluestem		-	6500	25%	20%
Tall Grass Prairie		-	5000	20%	20%
Forbs		-	320	25%	25%
Shrub/Vine		-	300	25%	25%
Tree		-	480	10%	10%

The goats are assumed to have the harvest efficiency of 20% for all the improved forages and TGP and 25% for shrubs and 10% for trees. Within the model the HE of goats was compared to those of cows in terms of percentage and the average value is used to calculate the factor for efficiency of goats with reference to cows. The TDN and CP content

is multiplied by the factor thus calculated, which shows that the goats are inefficient harvesters when compared to cows.

There are wide variations, both species and temporal, across forage species and forest land species in terms of the DM, TDN and CP content. Research data on the DM % as of annual production, TDN as % of DM and CP as % of DM for improved pastures such as wheat forage, bermuda, fescue, OWB and for TGP was collected by Smith. Due to lack of relevant literature for forest species such as forbs, shrubs and trees, the months of production are assumed to be May – September and the DM % of annual production is equally distributed across months at 20%. The TDN and CP content as % of DM is based on the research on forage quality (Willoughby and Lane, 2004). Table III-5 summarizes the values used.

Table III-5. DM, TDN and CP Content Specified across Months for Different Forage Enterprises.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wheat Forage												
DM%[1]	7.9	7.2	14.4	28.7	28.7	0.0	0.0	0.0	0.0	0.0	5.1	7.9
TDN%[2]	71.3	70.6	70.6	70.6	70.6	0.0	0.0	0.0	0.0	0.0	73.6	73.7
CP%[3]	22.4	18.2	18.2	18.2	18.2	0.0	0.0	0.0	0.0	0.0	29.6	25.1
Bermuda												
DM%	0.0	0.0	0.0	8.0	20.0	30.0	20.0	10.0	10.0	2.0	0.0	0.0
TDN%	0.0	0.0	0.0	0.0	60.2	59.5	59.9	60.6	59.6	69.3	60.8	0.0
CP%	0.0	0.0	0.0	0.0	14.1	12.5	12.6	13.3	12.6	11.5	10.1	0.0
Tall Fescue												
DM%	2.0	5.0	15.0	22.0	19.0	8.0	0.0	0.0	8.0	10.0	8.0	3.0
TDN%	62.2	63.2	64.6	66.3	61.0	60.1	58.7	0.0	0.0	61.8	60.6	61.8
CP%	13.0	13.7	16.1	19.2	16.1	12.6	11.9	0.0	0.0	16.0	15.0	13.7
Old World Bluestem												
DM%	0.0	0.0	0.0	5.0	20.0	30.0	20.0	15.0	10.0	0.0	0.0	0.0
TDN%	55.7	50.0	60.0	63.5	67.5	68.5	70.4	67.3	61.0	55.0	53.0	50.0
CP%	5.0	5.3	6.7	13.5	16.2	13.5	11.5	9.9	9.5	8.0	7.0	5.1
Tall Grass Prairie												
DM%	0.0	0.0	0.0	14.0	35.0	27.0	10.0	4.0	8.0	2.0	0.0	0.0
TDN%	51.7	49.0	57.0	63.5	70.0	67.5	66.5	61.5	58.5	59.5	55.5	52.0
CP%	4.6	5.2	7.0	13.8	14.6	11.5	10.5	9.7	9.0	8.2	5.3	5.2
Forbs												
DM%	0.0	0.0	0.0	0.0	20	20	20	20	20	0.0	0.0	0.0
TDN%	0.0	0.0	0.0	0.0	74.0	67.0	66.0	72.0	65.0	0.0	0.0	0.0
CP%	0.0	0.0	0.0	0.0	20.0	18.4	12.8	10.8	9.0	0.0	0.0	0.0
Shrubs/Vines												
DM%	0.0	0.0	0.0	0.0	20	20	20	20	20	0.0	0.0	0.0
TDN%	0.0	0.0	0.0	0.0	84.0	83.0	82.0	83.0	80.0	0.0	0.0	0.0
CP%	0.0	0.0	0.0	0.0	23.4	15.3	14.5	9.9	7.0	0.0	0.0	0.0
Trees												
DM%	0.0	0.0	0.0	0.0	20	20	20	20	20	0.0	0.0	0.0
TDN%	0.0	0.0	0.0	0.0	70.0	70.0	70.0	70.0	70.0	0.0	0.0	0.0
CP%	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	5.0	0.0	0.0	0.0
1 DM content is expressed as % of Annual Production												
2 TDN expressed as % of DM												
3 CP expressed as % of DM												

The operating cost and the labor requirements for different forages were calculated using the wheat (forage, dual and grain) budget and perennial forage budgets developed by the OSU Department of Agricultural Economics. The operating costs for those forage

enterprises excluding the labor are specified in the table III-6. For forest species, including trees, shrubs and forbs, the model assumes only a minimum maintenance and fencing cost.

Table III-6. The operating costs and the labor hours required for different forage and forest species.

		Wheat grain	Wheat dual	Wheat forage	Bermuda	Fescue	OWB[1]	TGP[2]	Forbs	Shrub/ vine	Tree
Median month of output		6	6	3	6	11	6	6	5	5	5
	Jan	0.46	0.46	0.00	1.10	1.10	1.10	0.82	$0.05	$0.05	$0.05
	Feb	7.82	7.82	7.82	0.09	40.49	0.09	0.09	$0.05	$0.05	$0.05
	Mar	0.00	0.00	0.00	0.09	0.09	0.09	0.09	$0.05	$0.05	$0.05
	Apr	0.00	0.00	0.00	1.64	0.09	26.56	0.09	$0.05	$0.05	$0.05
	May	0.00	0.00	0.00	38.16	7.15	7.15	0.09	$0.05	$0.05	$0.05
	Jun	12.20	13.13	2.10	1.64	0.09	20.14	0.09	$0.05	$0.05	$0.05
	Jul	0.00	0.00	0.00	27.84	0.09	0.09	0.09	$0.05	$0.05	$0.05
	Aug	26.77	32.97	25.29	0.09	0.09	0.09	0.09	$0.05	$0.05	$0.05
	Sep	0.00	21.20	21.20	0.09	29.39	0.09	0.09	$0.05	$0.05	$0.05
	Oct	10.60	0.00	0.00	0.09	0.09	0.09	0.09	$0.05	$0.05	$0.05
	Nov	0.00	0.00	0.00	0.09	0.09	0.09	0.09	$0.05	$0.05	$0.05
	Dec	0.00	0.00	0.00	0.09	0.09	0.09	0.09	$0.05	$0.05	$0.05
	Total	$57.85	$75.58	$56.41	$71.04	$78.87	$55.69	$1.85	$0.60	$0.60	$0.60
Labor Hrs. per acre											
	Jan	0.000	0.000	0.000	0.005	0.005	0.005	0.008	0.000	0.000	0.000
	Feb	0.064	0.060	0.070	0.005	0.056	0.056	0.008	0.000	0.000	0.000
	Mar				0.005	0.005	0.005	0.008	0.000	0.000	0.000
	Apr				0.005	0.005	0.005	0.059	0.000	0.000	0.000
	May				0.056	0.005	0.005	0.008	0.000	0.000	0.000
	Jun	0.280	0.280	0.260	0.005	0.005	0.005	0.008	0.000	0.000	0.000
	Jul	0.220	0.220	0.500	0.056	0.005	0.005	0.008	0.000	0.000	0.000
	Aug	0.430	0.430	0.290	0.005	0.005	0.005	0.008	0.000	0.000	0.000
	Sep	0.250	0.250	0.000	0.005	0.056	0.056	0.008	0.000	0.000	0.000
	Oct	0.000			0.005	0.005	0.005	0.008	0.000	0.000	0.000
	Nov				0.005	0.005	0.005	0.008	0.000	0.000	0.000
	Dec				0.005	0.005	0.005	0.008	0.000	0.000	0.000
	Total Hours	1.244	1.240	1.120	0.162	0.162	0.162	0.147	0.000	0.000	0.000

1 Old World Bluestem
2 Tall Grass Prairie

The operating cost for the livestock enterprise were calculated using the OSU livestock budgets, namely Cow Calf 2.1, Stocker 2.1, Meat Goats 2.1 and Meat Goat Stocker 2.1. The required amount of capital and the monthly expenses with the labor hours required for each enterprise are specified in the Table III-7.

Table III-7. Operating Cost and the Labor Hour Requirements for Livestock Enterprises

Inputs	Spring Calving	Fall Calving	Stkr1 Sep-Jun 350#	Stkr2 Oct-Jun 450#	Stkr3 Oct-Mar 450#	Stkr4 Oct-Mar 550#	Ext. Goats	Int. Goats	GtStkr#1 Jun-Oct 50#	GtStkr#2 Dec-Apr 50#
Operating Cost	72.42	71.61	22.39	22.39	22.39	22.39	24.52	28.20	8.93	8.93
Operating Capital	36.21	35.81	11.20	11.20	11.20	11.20	12.26	14.10	4.46	4.46
Monthly Expenses										
Jan	35.65	35.35	2.03	2.16	2.55	2.29	8.98	10.33	0.14	0.53
Feb	2.01	2.01	6.02	6.15	6.54	6.54	1.24	1.42	0.00	0.39
Mar	2.01	2.17	1.22	1.35	1.74	1.74	1.42	1.63	0.00	0.39
Apr	3.07	3.07	1.22	1.35	1.74	1.74	1.53	1.76	0.00	0.39
May	2.82	3.13	1.22	1.35	0.00	0.00	1.24	1.42	1.73	2.11
Jun	2.69	2.69	1.22	1.35	0.00	0.00	1.95	2.24	0.89	0.00
Jul	9.84	2.01	0.00	0.00	0.00	0.00	1.53	1.76	0.39	0.00
Aug	2.01	2.01	0.00	0.00	0.00	0.00	1.52	1.74	0.39	0.00
Sep	2.01	8.92	1.22	0.00	0.00	0.00	1.24	1.42	0.39	0.00
Oct	2.53	2.36	5.81	5.94	6.33	6.33	1.24	1.43	4.64	4.25
Nov	5.47	5.65	1.22	1.35	1.74	1.74	1.40	1.61	0.39	0.00
Dec	2.33	2.27	1.22	1.35	1.74	1.74	1.24	1.42	0.00	0.89
Total	72.42	71.61	22.40	22.35	22.38	22.12	24.52	28.20	8.93	8.93
Labor Hrs.										
Jan	0.22	0.62	0.30	0.30	0.30		0.79	1.06		0.15
Feb	0.22	0.85	0.30	0.30	0.30		0.58	0.78		0.15
Mar	1.68	0.82	0.30	0.30	0.30	0.45	0.27	0.36		0.15
Apr	1.26	0.57	0.30	0.30	0.30	0.30	0.13	0.17		0.15
May	0.61	0.41	0.30	0.30		0.30	0.10	0.14		
Jun	0.29	0.36	0.30	0.30		0.30	0.10	0.14	0.15	
Jul	0.23	0.32				0.30	0.10	0.14	0.10	
Aug	0.22	0.31					0.10	0.14	0.10	
Sep	0.22	0.44	0.45				0.10	0.14	0.10	
Oct	0.22	0.53	0.30	0.45	0.45		0.10	0.14	0.10	
Nov	0.22	0.53	0.30	0.30	0.30		0.10	0.14		
Dec	0.22	0.45	0.30	0.30	0.30		0.55	0.74		0.20
Total Hrs	5.62	6.18	3.15	2.85	2.25	1.65	3.00	4.05	0.55	0.80

The budgets for spring and fall calving cows are calculated for 100 cow unit size with a 86.1% calving rate for spring calving and 89.1% for fall calving. The budget excludes all the pasture costs, supplements, labor requirements and operating interest and includes the taxes and insurance for the respective enterprise (Table III-8).

Table III-8. Operating Cost for Spring and Fall Cow calf Enterprise Excluding Pasture costs, Supplements, Labor, and Operating Interest

			Spring Calving		Fall Calving	
Operating Inputs	Unit	Quantity	Price	Total	Price	Total
Salt	Head	1	$2.81	$281	$2.76	$276
Minerals	Head	1	$13.68	$1,368	$13.43	$1,343
Vet Services/Medicine	Head	1	$6.14	$614	$6.12	$612
Vet Supplies	Head	1	$1.16	$116	$1.16	$116
Marketing	Head	1	$7.39	$739	$6.91	$691
Machi/Equip Fuel, Lube, Repairs	Head	1	$24.09	$2,409	$24.09	$2,409
Insurance	Dollar		$5.69	$569.50	$5.69	$569.50
Taxes	Dollar		$11.45	$1,145.45	$11.45	$1,145.45
				Total	$7,161.00		$7,242.00
				Per Head	$71.61		$72.42

Table III-9. Operating Cost for Beef Stocker Enterprises Excluding Pasture Costs, Supplements, Labor, and Operating Interest

			Stockers
Operating Inputs	Unit	Quantity	Price/Hd
Salt	Head	1	$0.12
Minerals	Head	1	$0.14
Vet Services/Medicine	Head	1	$3.88
Vet Supplies	Head	1	$0.71
Marketing	Head	1	$4.80
Machi/Equip Fuel, Lube, Repairs	Head	1	$12.19
Insurance	Dollar		$0.14
Taxes	Dollar		$0.41
		Total per head	$22.39

Four meat goat enterprises are defined. Extensive and intensive breeding goat enterprises plus two meat goat stocker enterprises. The initial operating cost was calculated for meat goats for the SE regions for a 50 doe unit size. The extensive meat goat enterprise uses a 125% kidding rate and a death loss of 10% whereas the intensive meat goat enterprise uses a kidding rate of 180% with a lower death rate of 7%. For the intensive enterprise, nutrient requirements are 25% higher with a 15% increase in labor requirement and costs, plus an overall gain of 15% more in weight of weaned kids when compared to the extensive enterprise.

Table III-10. Operating Cost for Extensive and Intensive Meat Goat Enterprise Excluding Pasture Costs, Supplements, Labor, and Operating Interest

			Extensive Goats		Intensive Goats
Operating Inputs	Unit	Quantity	Price	Total	Total
Salt/Minerals	Head	1	$1.90	$95	$109
Vet Services/Medicine	Head	1	$2.09	$105	$121
Vet Supplies	Head	1	$3.25	$163	$187
Marketing	Head	1	$8.50	$425	$489
Machi/Equip Fuel, Lube, Repairs	Head	1	$6.33	$317	$365
Insurance	Dollar		$0.72	$36.0	$41
Taxes	Dollar		$1.73	$86.5	$86.5
			Total	$1227.5	$1399
			Per Head	$24.55	$28.20

Table III-11. Operating Cost for Goat Stockers Excluding Pasture Costs, Supplements, Labor, and Operating Interest

			Goat Stockers #1 and #2
Operating Inputs	Unit	Quantity	Price/Head
Salt/Minerals	Head	1	$0.15
Vet Services/Medicine	Head	1	$0.50
Vet Supplies	Head	1	$1.37
Marketing	Head	1	$4.25
Machi/Equip Fuel, Lube, Repairs	Head	1	$2.31
Insurance	Dollar		$0.04
Taxes	Dollar		$0.10
		Total per head	$9.00

Table III-12. Operating Cost for Different Forage Enterprises Excluding the Operating Interest and Labor

	Wheat ($/acre)			Bermuda	Fescue	Old World Bluestem	Tall Grass Prairie
	Grain	Forage	Dual	($/acre)	($/acre)	($/acre)	($/acre)
Seed	10.6	21.2	21.2				
Fertilizer	31.08	29.6	36.61	58.76	66.60	43.42	-
Pesticide	3.51	3.51	3.51	2.99	2.99	2.99	-
Custom Hire				4.07	4.07	4.07	-
Machinery, Fuel, Lube, Repairs	10.1		10.1	3.09	3.09	3.09	-
Equipment, Fuel, Lube, Repairs				1.12	1.12	1.12	1.12
Insurance	2.23	2.10	2.23	0.25	0.25	0.25	0.17
Taxes	0.34	0	0.34	0.76	0.76	0.76	0.56
Total per acre	57.85	56.41	73.99	71.04	78.87	55.7	1.85

CHAPTER IV

STUDY RESULTS

Southeast Oklahoma and Northeast Oklahoma were chosen as representative areas for the study as meat goats are popular in those areas. The resource constraints and assumptions depend on the farm size and location, so the study will determine the optimal level of resource use for small, medium and large farms in Northeast and Southeast Oklahoma. Different farm scenarios are used to test the sensitivity of results to changes in constraints and certain resource assumptions.

The main concern here is how differences in the available land base affect the optimal solution. Hence alternative scenarios for the land base have been defined.

1. Base case scenario, where all of the available land is used for native pasture
2. Scenario 2, native pasture with forest land
3. Scenario 3, native and improved pasture with forest land
4. Scenario 4, native, improved pasture, forest and cropland for large farm NE

For each of the scenarios, the model was solved without livestock constraints, with beef precluded (labeled goat only) and with goat precluded (beef only).

Results for the Base Scenario

The number of livestock species for various scenarios differs greatly as evident from Table IV-1. For the base scenario, the small farm with livestock restricted to goat and goat stockers only includes almost equal numbers of extensive and intensively managed breeding

goats and only #2 goat stockers (December to April enterprise). On the medium and large farm SE/NE, the #1 goat stockers are added with the #2 goat stockers, due to the availability of owner labor and forage. More extensively managed breeding goats are included in goat only scenarios whereas only the intensively managed breeding goats are included in unrestricted scenarios that can include a mix of beef and goat enterprises. The stocking rate for the goat only scenario appears to be lower than what might be feasible on medium and large farms because of the higher labor requirement; owner labor hours are not sufficient and additional labor needs to be hired.

For the beef only scenario on the small farm, only #1 stockers (light weight steers purchased in September and grazed throughout June) are included. On medium and large farms for beef only scenarios, the fall calving cows dominate the spring calving ones. No spring calving cows are included in the optimal solution for large farms in NE. In addition to cows, both stocker #1 and #4 are included in optimal solutions for large farm, both in beef only and unrestricted scenarios, the #4 stockers increased relative to the #1 stockers. The #2 and #3 stockers were never included in solutions for any of the scenarios. The stocking rate for cows and stockers seems to be higher than normal for small farms and medium farms, but supplemental hay and range cubes are provided to supplement native pasture. In the unrestricted solutions, breeding goats substitute for beef stockers, stocker goats are eliminated, and beef cow numbers increase on all farm sizes, which indicate that the beef cows and breeding goat enterprises are complementary.

The Table IV-1 also includes the net returns before taxes to land, overhead, own labor and own capital. Naturally, the farm with the unrestricted enterprise mix results in the highest

net return. It is followed closely by the beef only scenario with the goat only scenario yielding least net returns.

The labor inputs shown in Table IV-2 follows from the individual enterprise budgets in the previous chapter in that labor requirement for goats only scenarios are highest, followed by farms with beef and goat (the unrestricted scenario) and finally beef only scenarios requiring the least hours. For the small farm, the assumed 100 hrs per month of owner labor is enough for all scenarios. For medium farms with goat and goat stockers, an additional labor is required in January, February and December, but no hired labor is required in unrestricted or beef only scenarios on medium farms. For large farms, the assumed owner labor hours of 200 hours per month falls short in each case, and additional labor needs to be hired in every livestock combination.

For each farm size, the beef stocker enterprise is capital intensive, thus beef only scenarios demanding the most capital followed by the unrestricted enterprise, with the goat only scenarios requiring the least amount of capital. It is evident from the results that the addition of goat enterprises to the beef cows lowers the amount of capital required when compared to beef only enterprise. For the small and medium farm category, the assumed level of owner capital ($200,000 per month) is sufficient and no extra capital needs to be borrowed. For large farms in SE and NE, the assumed level of owner capital ($200,000 per month) is not sufficient and additional capital is borrowed.

Table IV-3 indicates that the minimum DM required for cow calf and stocker enterprises is the greatest, followed by the unrestricted enterprise, with the goat enterprises requiring the least amount of DM. In the base case scenario, as stated previously, the Tall Grass Prairie is the sole source of DM for grazing. The statistics show the unrestricted

enterprise utilizes the most TGP. On small and large NE farms, the goat enterprises use the second most TGP, and both utilize more than the beef only scenario.

Supplemental hay is used to eliminate the DM deficit for the livestock species. The higher DM requirement for the beef and stocker enterprises requires more hay for the cow-calf enterprises followed by the unrestricted enterprise and goat only enterprise. The hay constraint limited livestock on large farms where 20 tons per month from March to October were fed (the maximum level of hay utilized was 35,200 lbs per month due to harvest efficiency) totaling to 211,200 lbs of hay for large farms with beef in NE and SE and large farm with beef and goats in NE (Table IV-3).

There is a big difference between the supplements required for beef and stocker enterprises, which require the most supplementation and the goat enterprise which requires the least supplementation. It appears that most farm situations are self sufficient in DM availability from May to September, as no hay and supplements are provided in these months (the small farm with beef included is the exception).

Table IV-1. Net Returns and Livestock Statistics for the Base Scenario

	Net Returns ($)	No. of Cows		No. of Beef Stockers		No. of Goats		No. of Goat Stkr	
		Spring calving	Fall calving	Sep-Jun 450#	Oct-Mar 550#	Ext Mgmt	Int Mgmt	Jun-Oct 50#	Dec-Apr 50#
Small Farm (50 acres)									
Goat Only[1]	3,286	0	0	0	0	30	32	0	66
Beef Only[2]	5,541	0	0	45	0	0	0	0	0
Unrestricted	6,025	0	0	25	0	4	31	0	0
Medium Farm (300 acres)									
Goat Only	10,293	0	0	0	0	87	81	352	148
Beef Only	24,615	2	18	101	79	0	0	0	0
Unrestricted	25,757	5	28	58	57	0	60	0	0
Large Farm SE (2300 acres)									
Goat Only	31,843	0	0	0	0	242	131	2106	431
Beef Only	81,031	1	102	191	307	0	0	0	0
Unrestricted	82,047	0	114	51	391	0	123	0	0
Large Farm NE (2700 acres)									
Goat Only	33,554	0	0	0	0	236	130	3063	422
Beef Only	89,223	0	132	188	306	0	0	0	0
Unrestricted	90,453	0	137	74	373	0	135	0	0
1 Goat only scenario precludes beef cows and stockers									
2 Beef only scenario precludes all goat enterprises									

Table IV-2. The Summary of Labor Hours and Capital Inputs for the Base Scenario.

	Annual Labor		Sales ($)	Expenses ($)	Capital Required [3] ($)	Capital Borrowed ($)	Annual Interest($)
	Owner	Hired					
Small Farm (50 acres)							
Goat Only[1]	291	0	11,320	8,033	24,263	0	0
Beef Only[2]	162	0	28,316	22,774	176,391	0	0
Unrestricted	239	0	20,825	14,800	105,790	0	0
Medium Farm (300 acres)							
Goat Only	803	173	52,551	42,254	136,325	0	0
Beef Only	703	0	136,081	111,463	632,991	0	0
Unrestricted	821	0	104,399	78,640	416,878	0	0
Large Farm SE (2300 acres)							
Goat Only	2,121	1,001	210,868	178,969	612,642	39,519	263
Beef Only	1,887	418	409,930	328,842	1,670,654	708,242	4722
Unrestricted	1,881	738	410,238	328,136	1,377,552	757,996	5,053
Large Farm NE (2700 acres)							
Goat Only	2,126	1,553	275,011	241,396	819,337	239,966	1600
Beef Only	1,927	605	419,317	330,026	1,674,175	709,601	4,731
Unrestricted	1,936	960	420,921	330,400	1,437,153	746,442	4,976
1 Goat only scenario precludes beef cows and stockers							
2 Beef only scenario precludes all goat enterprises							
3 Capital requirement constrained within month, this is a sum of the monthly capital requirement for the year							

Table IV-3. Summary of Forage and DM Statistics for Different Farm categories in SE/NE Oklahoma for the Base Scenario.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Small Farm with Goat only													
Min DM required (lbs)	5,616	5,327	6,180	4,878	3,405	3,295	3,405	3,405	3,405	3,405	3,295	4,431	50,049
Grazing, TGP (lbs)	0	0	0	7,000	4,939	4,867	5,960	6,445	8,242	1,000	0	0	38,453
Hay bought (lbs)	13,594	12,322	16,982	0	0	0	0	0	0	6,874	7,910	10,934	68,616
Supplements (lbs)	0	0	0	628	0	0	0	0	0	0	0	1,051	1,679
Small Farm with Cow only													
Min DM required (lbs)	10,972	10,817	12,980	13,565	15,055	7,787	0	0	3,416	7,842	8,593	9,918	100,945
Grazing, TGP (lbs)	0	0	0	9,534	15,055	7,787	0	0	3,338	0	0	0	35,713
Hay bought (lbs)	13,548	12,237	13,548	0	0	0	0	0	0	13,548	13,111	13,548	79,540
Supplements (lbs)	0	0	0	4,032	0	0	0	0	2,016	0	0	0	6,047
Small Farm with Combination													
Min DM required (lbs)	8,168	7,891	9,306	9,575	10,482	6,299	1,948	1,948	3,885	6,394	6,757	7,570	80,222
Grazing, TGP (lbs)	0	0	0	7,289	10,482	6,299	4,276	4,623	8,188	0	0	0	41,157
Hay bought (lbs)	12,045	10,922	14,206	0	0	0	0	0	0	12,092	11,733	14,641	75,640
Supplements (lbs)	0	0	0	2,285	0	0	0	0	1,143	0	0	0	3,428
Medium Farm With Goat Only													
Min DM required (lbs)	14,229	13,424	15,495	12,517	9,261	19,229	21,771	23,357	24,413	9,816	8,962	11,564	184,038
Grazing, TGP (lbs)	0	0	2,662	19,847	13,250	36,288	41,103	44,445	49,580	0	0	0	207,176
Hay bought (lbs)	34,338	31,126	35,200	0	0	0	0	0	0	22,666	21,591	28,847	173,768
Supplements (lbs)	0	0	4,576	0	0	0	0	0	0	0	0	2,362	6,938
Medium Farm With Cow Only													
Min DM required (lbs)	35,261	33,885	59,135	62,126	68,651	53,107	24,320	10,452	17,794	28,141	29,509	32,843	455,225
Grazing, TGP (lbs)	0	0	8,081	45,843	68,651	53,107	24,320	10,452	21,352	3,324	0	0	235,131
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	2,524	0	16,588	16,283	0	0	0	0	0	0	1,570	2,493	39,458
Medium Farm With Combination													
Min DM required (lbs)	34,391	32,201	50,788	52,322	56,911	47,780	30,348	20,299	24,065	30,297	30,616	32,976	442,995
Grazing, TGP (lbs)	0	0	9,556	42,000	56,911	47,780	30,348	20,299	31,572	0	0	0	238,467
Hay bought (lbs)	35,200	34,644	35,200	0	0	0	0	0	0	35,200	35,200	35,200	210,644
Supplements (lbs)	2,045	0	10,496	10,322	0	0	0	0	0	1,894	1,066	5,376	31,198

Table IV-3. Continued…

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Large Farm With Goat only														
	Min DM required (lbs)	35,004	33,285	38,699	30,219	20,503	81,280	95,364	104,856	111,172	23,826	19,841	27,227	621,277
	Grazing, TGP (lbs)	53,687	47,512	57,955	45,836	27,337	166,024	182,680	197,532	208,217	50,304	48,221	31,640	1,116,946
	Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	0	0	35,200	140,800
	Supplements (lbs)	0	0	13,356	0	0	0	0	0	0	0	0	6,893	20,249
Large Farm With Cow only														
	Min DM required (lbs)	99,589	93,819	183,061	191,610	210,570	182,680	107,072	53,143	65,684	86,209	87,718	95,075	1,456,230
	Grazing, TGP (lbs)	56,551	42,544	116,752	191,610	210,570	182,680	107,072	53,143	65,684	59,835	60,983	44,859	1,192,284
	Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
	Supplements (lbs)	7,838	16,075	45,471	0	0	0	0	0	0	0	0	15,016	84,400
Large Farm with Combination														
	Min DM required (lbs)	77,536	71,063	175,172	183,604	201,267	197,090	134,070	65,544	67,157	73,976	72,732	76,336	1,395,547
	Grazing, TGP (lbs)	38,656	31,584	142,508	200,796	201,267	197,090	134,070	65,544	73,012	38,776	39,142	47,678	1,210,124
	Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
	Supplements (lbs)	3,680	4,279	39,967	0	0	0	0	0	0	0	0	4,738	52,663
Large Farm With Goat only NE														
	Min DM required (lbs)	34,339	32,649	37,955	29,655	20,151	108,867	129,040	142,847	152,034	24,985	19,501	26,730	758,752
	Grazing, TGP (lbs)	51,934	45,840	56,186	45,022	26,911	228,765	250,740	271,125	283,017	51,995	47,376	30,439	1,389,349
	Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	0	0	35,200	140,800
	Supplements (lbs)	0	0	13,068	0	0	0	0	0	0	0	0	6,745	19,812
Large Farm With Cow only NE														
	Min DM required (lbs)	113,792	106,590	196,797	204,788	224,079	196,190	122,166	68,246	79,963	100,638	101,612	109,360	1,624,222
	Grazing, TGP (lbs)	74,934	55,577	125,762	204,788	224,079	196,190	122,166	68,246	79,963	70,073	71,618	63,643	1,357,038
	Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
	Supplements (lbs)	3,659	15,813	45,058	0	0	0	0	0	0	0	0	10,517	75,047
Large Farm with Combination NE														
	Min DM required (lbs)	95,437	87,690	189,495	197,349	215,495	206,950	143,443	77,999	80,882	90,296	89,033	93,705	1,567,774
	Grazing, TGP (lbs)	55,056	46,310	150,610	207,237	215,495	206,950	143,443	77,999	86,887	55,096	56,081	64,072	1,365,237
	Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
	Supplements (lbs)	5,181	6,180	40,375	0	0	0	0	0	0	0	0	6,842	58,578

Native Pasture with Forest Included (Scenario 2)

In this scenario, the land base includes both native pasture and forest land and the number of acres of pasture land is reduced. When comparing the number of livestock species in Table IV-4 with those of base case scenario (Table IV-1), there is a 20% decrease in number of extensively managed goats, intensively managed goats and #2 goat stockers for the small farm with goat only. In the beef only scenario, there is a 20% decrease in #1 stockers. Similarly for the small farm, with unrestricted livestock, there is a 20% decrease in the number of Dec-April goat stockers and both extensively and intensively managed breeding goats respectively.

On the medium farm with goats, there is a significant decrease of 29% in #1 goat stockers, while the number of extensively managed goats, intensively managed goats and #2 goat stockers changes less. In the case of beef cows and stockers only, the spring cows were not included in the solution, while there is 15% decrease in the number of fall calving cows and a 16% decrease in #4 stockers with no significant change in #1 beef stockers. For the medium farm with beef and goats, there is almost 50% reduction in spring calving cows while the fall calving cows has gone up by 36%. The #1 and #4 beef stocker has decreased by 40% and 68% respectively whereas there was an increase of 25% in the number of intensive goats.

For large farms in SE Oklahoma with goat and goat stockers only, with forest land as 20% of the land base, there is a decrease of 14% in the number of extensively managed goats and #2 goat stockers respectively and 7% decrease in both intensively managed goats and #1 goat stockers. In the beef only scenario, spring calving cows increase from 1 head to 5 head, while there is a 19% reduction in fall calving cows. For the unconstrained scenario, there is a

15% decrease in number of fall cows and 33% decrease in #1 beef stockers with a slight increase in #2 goat stockers and a slight decrease in intensively managed breeding goats.

For the large farm in NE Oklahoma with goats only, there is a significant decrease of 27% in #1 goat stockers and a slight increase in number of intensively and extensively managed breeding goats and #2 goat stockers. With beef only enterprises, there is a 19% decrease in number of fall cows. Similarly in the case of beef and goat enterprises, there appears a 15% decrease in fall calving cows, a 27% decrease in #1 stockers and an 8% decrease in number of intensively managed breeding goats.

Table IV-4 shows that stocking rates for livestock, particularly beef, decrease when forest land replaces native pasture. The enterprise mix pattern is the same across farm types and sizes except that in the goats only scenario for the large farm NE, extensively managed goats and #2 goat stockers increase while #1 goat stockers decrease significantly. It is because there is more land base available for extensively managed goats and the #1 goat stockers which are forage fed are replaced by dry lotted #2 goat stockers.

As evident from table IV-4, when the forest land replaces native pasture, there is an average 20% decrease in owner labor required on small farms, 8% decrease on medium farm, 2% decrease on large farm SE and an average 1% decrease on the large farm NE. Similarly, there is an average 25% decrease in hired labor for large farms SE and 26% decrease for the large farm NE. These decreases are directly correlated with decrease in the number of livestock.

When the forest land is included, the livestock species utilize only shrubs as a source of DM in addition to the native pasture. Forbs and tree species are not being shown to be utilized by any of the livestock species. When comparing the utilization of shrubs across the

livestock enterprises, it appears that the goat only and beef only enterprises are utilizing almost the same amount of shrubs, with a slightly higher utilization by cows, but the shrub utilization drops by almost half when both enterprises are integrated. The results also show that from the May to September supply of shrubs/vines, goats are utilizing shrubs only in August and September whereas the cow calf enterprise is utilizing shrubs in May, July and August. In the case of unconstrained livestock enterprises, the shrubs are being used in May and June only, in equal amounts.

When the capital required for the native pasture scenario is compared with the native pasture and forest scenario, not surprisingly given the lower number of animals, there is a significant decrease in capital required for the goat only scenario, with a decrease of 20% in small farms (which is also true for beef only and unconstrained scenarios), 16% in medium farms, 9% in large farm SE and 22 % in large farm NE. The beef only scenario has no significant changes in capital required except in the small farm situation, whereas the unconstrained scenario shows an almost 50% reduction on the medium farm and no significant reduction on the large farms.

For net returns, it appears that for the small farm scenario, there is a 20% decrease for goat only, beef only and unrestricted scenarios respectively. The results also show that the decrease in net returns is least for the goat only scenario, followed by unconstrained scenario and beef only scenario.

Table IV-4. Net Returns and the Livestock Statistics for Native Pasture with Forest Land Scenario.

	Net Returns ($)	No. of Cows		No. of Beef Stockers		No. of Goats		No. of Goat Stkr	
		Spring calving	Fall calving	Sep-Jun 450#	Oct-Mar 550#	Ext Mgmt	Int Mgmt	Jun-Oct 50#	Dec-Apr 50#
Small Farm (50 acres)									
Goat Only[1]	2,635	0	0	0	0	24	25	0	53
Beef Only[2]	4,439	0	0	36	0	0	0	0	0
Unrestricted	4,826	0	0	20	0	4	25	0	0
Medium Farm (300 acres)									
Goat Only	9,403	0	0	0	0	86	81	249	146
Beef Only	22,036	0	15	100	67	0	0	0	0
Unrestricted	23,494	2	39	34	18	0	76	0	0
Large Farm SE (2300 acres)									
Goat Only	30,730	0	0	0	0	209	124	1949	372
Beef Only	74,845	5	83	184	314	0	0	0	0
Unrestricted	75,917	0	97	34	405	0	114	0	0
Large Farm NE (2700 acres)									
Goat Only	32,266	0	0	0	0	241	131	2226	430
Beef Only	82,271	0	107	190	308	0	0	0	0
Unrestricted	83,302	0	117	54	389	0	125	0	0
1 Goat only scenario precludes beef cows and stockers									
2 Beef only scenario precludes all goat enterprises									

Table IV-5. Labor and Capital Input Summary for the Native Pasture and Forest Scenario.

	Annual Labor		Sales ($)	Expenses ($)	Capital Required[3] ($)	Capital Borrowed ($)	Annual Interest ($)
	Owner	Hired					
Small Farm (50 acres)							
Goat Only[1]	232	0	9,056	6,432	19443	0	0
Beef Only[2]	130	0	22,653	18,226	141146	0	0
Unrestricted	191	0	16,660	11,846	84665	0	0
Medium Farm (300 acres)							
Goat Only	737	167	45,196	35,849	114567	0	0
Beef Only	631	0	122,886	100,907	587510	0	0
Unrestricted	767	0	64,581	41,145	223908	0	0
Large Farm SE (2300 acres)							
Goat Only	2,084	730	192,465	162,047	554878	5026	34
Beef Only	1,846	309	403,803	329,270	1653260	710793	4739
Unrestricted	1,840	571	402,080	326,477	1333360	766561	5110
Large Farm NE (2700 acres)							
Goat Only	2,121	1,070	218,886	186,983	639634	64680	431
Beef Only	1,893	441	410,986	329,077	1668795	709228	4728
Unrestricted	1,888	765	411,404	328,465	1385594	756434	5043
1 Goat only scenario precludes beef cows and stockers							
2 Beef only scenario precludes all goat enterprises							
3 Capital requirement constrained within month, this is a sum of the monthly capital requirement for the year							

Table IV-6. The Summary of Statistics for the Forage and the Supplements for Native Pasture with Forest Scenario

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Small Farm with Goat only													
Min DM required (lbs)	4,493	4,262	4,944	3,902	2,724	2,636	2,724	2,724	2,724	2,724	2,636	3,544	40,039
Grazing , TGP (lbs)	0	0	0	5,600	3,951	3,894	4,768	5,156	6,594	800	0	0	30,762
Shrub (lbs)	0	0	0	0	0	0	0	205	75	0	0	0	280
Hay bought (lbs)	10,875	9,857	13,586	0	0	0	0	0	0	5,499	6,328	8,747	54,893
Supplements (lbs)	0	0	0	503	0	0	0	0	0	0	0	841	1,343
Small Farm with Cow only													
Min DM required (lbs)	8,778	8,654	10,384	10,852	12,044	6,229	0	0	2,733	6,274	6,875	7,934	80,756
Grazing , TGP (lbs)	0	0	0	7,627	12,044	6,229	0	0	2,670	0	0	0	28,570
Shrub (lbs)	0	0	0	0	75	0	131	75	0	0	0	0	281
Hay bought (lbs)	10,838	9,790	10,838	0	0	0	0	0	0	10,838	10,489	10,838	63,632
Supplements (lbs)	0	0	0	3,225	0	0	0	0	1,613	0	0	0	4,838
Small Farm with Combination													
Min DM required (lbs)	6,534	6,313	7,444	7,660	8,386	5,039	1,559	1,559	3,108	5,115	5,405	6,056	64,177
Grazing , TGP (lbs)	0	0	0	5,831	8,386	5,039	3,420	3,698	6,550	0	0	0	32,926
Shrub (lbs)	0	0	0	0	75	75	0	0	0	0	0	0	150
Hay bought (lbs)	9,636	8,738	11,365	0	0	0	0	0	0	9,674	9,387	11,713	60,512
Supplements (lbs)	0	0	0	1,828	0	0	0	0	914	0	0	0	2,742
Medium Farm With Goat Only													
Min DM required (lbs)	14,062	13,265	15,311	12,373	9,159	16,132	18,016	19,139	19,886	9,553	8,864	11,433	167,194
Grazing , TGP (lbs)	0	0	2,219	19,615	13,103	29,361	33,566	36,295	41,239	0	0	0	175,398
Shrub (lbs)	0	0	0	0	0	0	0	1,025	375	0	0	0	1,400
Hay bought (lbs)	33,935	30,761	35,200	0	0	0	0	0	0	22,143	21,356	28,522	171,916
Supplements (lbs)	0	0	4,515	0	0	0	0	0	0	0	0	2,331	6,846
Medium Farm With Cow Only													
Min DM required (lbs)	32,203	31,104	52,987	55,726	61,666	46,301	19,548	7,854	15,151	25,239	26,659	29,856	404,294
Grazing , TGP (lbs)	0	0	2,489	40,727	61,666	46,301	19,548	7,854	19,352	1,080	0	0	199,016
Shrub (lbs)	0	0	0	0	375	0	656	375	0	0	0	0	1,406
Hay bought (lbs)	35,200	32,853	35,200	0	0	0	0	0	0	35,200	35,200	35,200	208,853
Supplements (lbs)	787	0	15,298	14,999	0	0	0	0	0	0	0	787	31,871

Table IV-6. Continued…

	Jan	Feb	March	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Year
Medium Farm With Combination													
Min DM required (lbs)	33,674	31,097	39,654	39,752	42,360	36,242	28,828	25,366	27,183	31,237	31,002	32,835	399,229
Grazing , TGP (lbs)	0	0	400	35,000	42,360	36,242	28,828	25,366	34,463	1,081	0	2,897	206,637
Shrub (lbs)	0	0	0	0	375	375	0	0	0	0	0	0	750
Hay bought (lbs)	35,200	33,011	35,200	0	0	0	0	0	0	35,200	35,200	35,200	209,011
Supplements (lbs)	822	0	4,855	4,752	0	0	0	0	0	0	0	3,207	13,635
Large Farm With Goat only													
Min DM required (lbs)	30,783	29,244	33,972	26,636	18,270	74,550	87,563	96,349	102,196	21,346	17,681	24,073	562,662
Grazing , TGP (lbs)	42,553	36,895	46,722	40,666	24,633	152,997	168,445	182,139	192,097	44,946	42,854	24,014	998,961
Shrub (lbs)	0	0	0	0	0	0	0	6,152	2,250	0	0	0	8,402
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	0	0	35,200	140,800
Supplements (lbs)	0	0	11,525	0	0	0	0	0	0	0	0	5,948	17,473
Large Farm With Cow only													
Min DM required (lbs)	90,057	85,030	174,693	183,553	202,242	175,895	100,145	45,273	57,573	77,137	78,774	85,663	1,356,035
Grazing , TGP (lbs)	46,183	34,372	112,432	186,137	202,242	175,895	100,145	45,273	57,573	51,711	28,061	34,859	1,074,885
Shrub (lbs)	0	0	0	0	2,250	0	3,938	2,250	0	0	0	0	8,438
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	8,673	15,458	45,358	0	0	0	0	0	0	0	16,562	15,604	101,655
Large Farm with Combination													
Min DM required (lbs)	64,132	58,613	164,399	173,258	190,552	189,643	127,018	56,218	56,880	61,756	60,526	63,331	1,266,327
Grazing , TGP (lbs)	26,376	20,558	136,386	195,901	190,552	189,643	127,018	56,218	62,623	26,556	26,459	35,403	1,093,692
Shrub (lbs)	0	0	0	0	2,250	2,250	0	0	0	0	0	0	4,500
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	2,556	2,856	39,643	0	0	0	0	0	0	0	0	3,162	48,216
Large Farm With Goat only NE													
Min DM required (lbs)	34,920	33,206	38,606	30,149	20,459	84,729	99,574	109,605	116,280	23,971	19,799	27,165	638,461
Grazing , TGP (lbs)	53,468	47,303	57,734	45,734	27,284	173,867	191,187	206,731	217,567	50,515	48,116	31,490	1,150,996
Shrub (lbs)	0	0	0	0	0	0	0	7,178	2,625	0	0	0	9,803
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	0	0	35,200	140,800
Supplements (lbs)	0	0	13,320	0	0	0	0	0	0	0	0	6,875	20,195

Table IV-6. Continued…

	Jan	Feb	March	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Year
Large Farm With Cow only NE													
Min DM required (lbs)	101,166	95,211	184,721	193,197	212,185	184,538	109,275	55,198	67,518	87,922	89,335	96,703	1,476,971
Grazing , TGP (lbs)	58,857	44,090	117,953	193,197	212,185	184,538	109,275	55,198	67,518	60,874	62,067	47,307	1,213,061
Shrub (lbs)	0	0	0	0	2,625	0	4,594	2,625	0	0	0	0	9,844
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	7,108	15,921	45,359	0	0	0	0	0	0	0	0	14,196	82,584
Large Farm with Combination NE													
Min DM required (lbs)	79,799	73,165	176,927	185,279	202,995	198,262	135,215	67,119	68,892	76,039	74,793	78,532	1,417,016
Grazing , TGP (lbs)	40,729	33,446	143,468	201,526	202,995	198,262	135,215	67,119	74,766	40,839	41,284	49,751	1,229,400
Shrub (lbs)	0	0	0	0	2,625	2,625	0	0	0	0	0	0	5,250
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	3,869	4,519	39,997	0	0	0	0	0	0	0	0	5,004	53,390

Native and Improved Pasture with Forest Land (Scenario 3)

In this scenario, compared to the base scenario, the total pasture acreage is allocated as 80% for native pasture and 20% for improved pasture and the scenario also contains the forest land (which is made up of shrubs, forbs and tree species).When comparing the number of livestock species in optimal solutions for the two scenarios (Table IV-7 with Table IV-1), adding improved pasture to the land base allows a small increase of 5% in number of both extensively managed goats and #2 stockers and an increase of 7% in intensively managed goat numbers for the small farm with goat and goat stockers only. For the beef only enterprise, there is a 37% increase in #1 beef stockers. Similarly for the small farm with no livestock constraints, there is a significant increase in #1 goat stockers from 25 head to 60 head, at the cost of extensively managed and intensively managed breeding goats with a decrease in their numbers by 100% and 90%, respectively.

On the medium farm with goats, #1 goat stocker numbers decreased by half while the number of extensively managed breeding goats increased by 16%, intensively managed goats by 18% and #2 goat stockers increased by 8%. In the beef only scenario, the spring cows increase significantly in numbers from 2 head to 12 head, and #1 beef stockers increase by 55% while there is a decrease of 70% in fall calving cows and no significant decrease in #4 stockers. For the medium farm with beef cows and goats, there is an almost 50% reduction in fall calving cows while the number of spring calving cows doubled from 5 head to 10 head. There is a significant increase of 117% in #1 beef stockers compared to a 7% increase in #4 beef stockers accompanied by 34% decrease in the number of intensively managed goats on the farm.

For large farms in SE with goat and goat stockers only, the number of extensively managed goats decreased 10%, 21% decrease in #1 goat stockers and 33% decrease in #2

goat stockers whereas there is a 78% increase in intensively managed breeding goat numbers. For the beef only scenario, spring cows are no longer in the solution and fall calving cows increase by 85%. The #1 beef stocker numbers increased by 7% while #4 stockers decreased by 13%. For the unconstrained scenario, fall calving cows increased from no head in the base scenario to 30 head, accompanied by 62% increase in fall calving cows and a decrease of 10% in both #1 and #4 beef stockers. Intensively managed breeding goats increased from 123 to 334 head.

For the large NE farm with goat only scenario, the number of intensive goats increased by 94%, without much change in the extensive goats accompanied by a decrease in #1 and #2 Stockers. In the beef only enterprise, there is a 77% increase in number of fall cows, and a small increase of 7% and a decrease of 15% respectively for #1 and #4 stockers. Similarly in the unrestricted scenario, there is an almost 60% increase in the number of fall calving cows, accompanied by 22% and 11% decrease in number of #1 and #4 beef stockers respectively. Intensive goats increased almost 200%, from 123 head in the base scenario to 403 head.

The output as shown by the LP model for this scenario in Table IV-8 indicates that the labor hour requirement for every scenario has increased, with the greatest in the beef only scenario, followed by the unrestricted scenario and goat only scenario respectively. For hired labor, there is a greater increase for unrestricted, beef only and goat only scenario.

When the results are compared to the base scenario for the supplemental hay, the minimum DM requirement is greater as more livestock can be supported with improved pasture. It leads to the need for more supplemental hay, with the goat only scenario requiring the least amount and the beef only and unrestricted enterprise requiring the same amount for different farm sizes.

When the capital required for the base scenario is compared with the native and improved pasture with forest scenario, there is an increased capital requirement for all the enterprises in small farm categories, with the greatest capital requirement in unrestricted scenario, followed by beef only and goat only respectively. For the goat only scenario on the small farm, 18% more capital is required, whereas decrease in the capital requirement for all the medium, large SE with goat and goat stockers, the greatest decrease of 28% in large farm NE. The increase in capital required is greatest for all the farm sizes for integrated beef cows and goat enterprise, which is 130% in case of small farm, 71% in case of medium farms and almost 11% increase in case of large farms in SE and NE. the beef cows and stocker enterprise is second in increase in capital requirement , with a 40% increase in case of small farm, 38% increase in case of medium farm and almost 11% increase in case of large farms , which is the same as the beef and goat combined enterprise.

When comparing the results for net returns, it appears that for the small and medium farm with goat and goat stockers only, there is a decrease of 11% in net returns, with no significant increase in large farm SE and NE. The beef and stocker enterprise shows relatively more increase in net returns for small and medium farms, and no significant increase for large farms SE and NE. The integrated enterprise shows almost constant percentage increase in net returns across the farm sizes.

Table IV-7. Net Returns and Livestock Statistics for Native and Improved Pasture with Forest Land Scenario

	Net Returns ($)	No. of Cows		No. of Beef Stockers		No. of Goats		No. of Goat Stkr	
		Spring calving	Fall calving	Sep-June 450#	Oct-Mar 550#	Ext Mgmt	Int Mgmt	Jun-Oct 50#	Dec-Apr 50#
Small Farm (50 acres)									
Goat Only[1]	2,935	0	0	0	0	32	34	0	69
Beef Only[2]	6,484	0	0	61	0	0	0	0	0
Combination	6,582	0	0	60	0	0	3	0	0
Medium Farm (300 acres)									
Goat Only	9,194	0	0	0	0	101	97	169	157
Beef Only	26,424	12	5	157	78	0	0	0	0
Combination	26,941	10	14	125	61	0	40	0	0
Large Farm SE (2300 acres)									
Goat Only	32,031	0	0	0	0	216	233	1659	287
Beef Only	81,834	0	189	206	266	0	0	0	0
Combination	88,984	0	184	45	352	0	334	0	0
Large Farm NE (2700 acres)									
Goat Only	34,020	0	0	0	0	243	252	1659	316
Beef Only	88,327	0	234	201	260	0	0	0	0
Combination	98,509	0	219	58	331	0	403	0	0
1 Goat only scenario precludes beef cows and stockers									
2 Beef only scenario precludes all goat enterprises									

Table IV-8. Labor Hours and Capital Input Summary for Native and Improved Pasture with Forest Scenario.

	Annual Labor (Hours)		Sales ($)	Expenses ($)	Capital Required[3] ($)	Capital Borrowed ($)	Annual Interest ($)
	Owner	Hired					
Small Farm (50 acres)							
Goat Only	306	0	11,982	9,059	28719	0	0
Beef Only	218	0	38,809	32,336	246933	0	0
Unrestricted	227	0	38,607	32,036	243642	0	0
Medium Farm (300 acres)							
Goat Only	820	242	49,145	40,008	129400	0	0
Beef Only	845	0	168,910	142,546	876318	76938	0
Unrestricted	896	0	143,373	116,491	711546	1773	0
Large Farm SE (2300 acres)							
Goat Only	2,269	912	192,368	160,664	573806	0	0
Beef Only	2,043	785	426,928	345,415	1838650	775817	5172
Unrestricted	2,127	1716	439,320	350,660	1522935	746391	4976
Large Farm NE (2700 acres)							
Goat Only	2,274	1,116	198,714	165,071	589610	0	0
Beef Only	2,083	1038	437,472	349,518	1865151	790239	5268
Unrestricted	2,191	2166	453,637	355,501	1586939	733503	4890
1 Goat only scenario precludes beef cows and stockers							
2 Beef only scenario precludes all goat enterprises							
3 Capital requirement constrained within month, this is a sum of the monthly capital requirement for the year							

Table IV-9. Forage and Supplement Statistics by Months for Native and Improved Pasture with Forest Scenario

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Small Farm with Goat only													
Min DM required (lbs)	5,939	5,633	6,533	5,160	3,607	3,490	3,607	3,607	3,607	3,607	3,490	4,688	52,967
Grazing, Bermuda (lbs)	0	0	0	0	0	0	1,984	6,941	1,595	319	0	0	10,840
Fescue (lbs)	0	0	0	2,082	0	1,255	0	0	0	903	0	508	4,748
Tall Grass Prairie (lbs)	0	0	0	4,665	5,239	4,045	4,540	0	7,128	0	0	0	25,617
Shrub (lbs)	0	0	0	0	75	0	0	173	75	0	0	0	323
Hay bought (lbs)	14,372	13,027	17,953	0	0	0	0	0	0	7,008	8,375	11,065	71,799
Supplements (lbs)	0	0	0	1,109	0	0	0	0	0	0	0	1,109	2,217
Small Farm with Beef only													
Min DM required (lbs)	15,038	14,825	17,789	18,592	20,634	10,672	0	0	4,682	10,748	11,778	13,593	138,351
Fescue (lbs)	0	0	0	8,350	3,724	1,568	0	0	0	0	0	0	13,642
Tall Grass Prairie (lbs)	0	0	0	4,716	11,200	8,640	0	0	5,477	0	0	0	30,033
Shrub (lbs)	0	0	0	0	75	75	75	75	75	0	0	0	375
Hay bought (lbs)	18,568	16,772	18,568	0	0	0	0	0	0	18,568	17,969	18,568	109,015
Supplements (lbs)	0	0	0	5,526	5,710	464	0	0	2,119	0	0	0	13,819
Small Farm with Combination													
Min DM required (lbs)	14,960	14,734	17,666	18,450	20,465	10,659	166	166	4,771	10,739	11,747	13,538	138,062
Fescue (lbs)	0	0	0	8,350	3,724	1,568	0	0	0	0	0	0	13,642
Tall Grass Prairie (lbs)	0	0	0	4,665	11,200	8,640	389	421	5,082	0	0	0	30,397
Shrub (lbs)	0	0	0	0	75	0	131	75	0	0	0	0	281
Hay bought (lbs)	18,634	16,834	18,798	0	0	0	0	0	0	18,638	18,037	18,886	109,827
Supplements (lbs)	0	0	0	5,436	5,541	451	0	0	2,718	0	0	0	14,146
Medium Farm With Goat Only													
Min DM required (lbs)	16,129	15,177	17,477	14,275	10,838	15,412	16,837	17,597	18,103	11,105	10,489	13,292	176,729
Fescue (lbs)	0	0	0	0	0	0	0	9,297	9,297	1,859	0	0	20,453
Tall Grass Prairie (lbs)	823	0	7,716	0	0	0	0	0	0	0	0	7,407	15,946
Shrub (lbs)	2,457	0	0	22,676	15,554	26,470	30,776	24,117	29,550	0	0	0	151,599
Hay bought (lbs)	0	0	0	0	375	0	0	867	375	0	0	0	1,617
Supplements (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	23,495	25,249	25,908	180,252

Table IV-9. Continued…

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Medium Farm With Cow Only													
Min DM required (lbs)	47,584	46,079	73,517	77,242	85,527	60,955	22,474	8,939	20,627	36,451	38,801	43,738	561,935
Fescue (lbs)	2,450	6,125	16,894	28,061	15,527	15,611	0	0	0	16,518	12,111	3,675	116,972
Tall Grass Prairie (lbs)	0	0	0	28,000	70,000	45,344	22,474	8,939	17,763	0	3,400	0	195,921
Shrub (lbs)	0	0	0	0	375	375	375	375	375	0	0	0	1,875
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	11,134	4,754	21,654	21,182	0	0	0	0	6,935	0	0	10,068	75,726
Medium Farm With Combination													
Min DM required(lbs)	45,373	43,452	65,645	68,334	75,122	55,258	25,171	14,590	23,709	36,490	38,125	42,301	533,571
Bermuda (lbs)	0	0	0	1,425	0	0	9,571	1,781	1,781	356	0	0	14,914
Fescue (lbs)	2,138	5,346	16,038	23,522	5,122	14,286	3,892	266	0	14,491	10,515	3,208	98,824
Tall Grass Prairie (lbs)	0	0	0	28,000	70,000	40,973	11,708	12,543	23,653	0	3,400	0	190,277
Shrub (lbs)	0	0	0	0	375	0	656	375	0	0	0	0	1,406
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	10,011	4,158	17,119	15,388	0	0	0	0	5,645	0	0	11,327	63,648
Large Farm With Goat only													
Min DM required (lbs)	34,398	32,182	36,862	30,851	24,729	72,319	83,688	91,163	96,137	27,347	23,932	29,213	582,822
Fescue (lbs)	7,509	18,774	56,321	0	0	0	0	0	0	0	0	67,585	150,189
Tall Grass Prairie (lbs)	41,046	20,007	0	49,544	36,021	144,928	162,283	175,477	190,948	57,647	42,640	0	920,542
Shrub (lbs)	0	0	0	0	2,250	0	0	5,203	2,250	0	0	0	9,703
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	0	14,352	6,390	126,342
Supplements (lbs)	0	0	8,905	0	0	0	0	0	0	0	0	4,596	13,502
Large Farm With Cow only													
Min DM required (lbs)	146,962	136,899	221,074	227,358	246,751	214,496	144,917	97,422	109,330	132,600	132,930	142,122	1,952,860
Fescue (lbs)	19,600	49,000	147,000	24,929	0	214,496	0	29,496	11,117	97,400	97,730	43,625	734,393
Tall Grass Prairie (lbs)	92,162	52,699	0	202,429	246,751	0	144,917	67,926	98,212	0	0	63,298	968,394
Shrub (lbs)	0	0	0	0	2,250	2,250	2,250	2,250	2,250	0	0	0	11,250
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	0	0	38,874	0	0	0	0	0	0	0	0	0	38,874

Table IV-9. Continued…

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Large Farm with Combination SE													
Min DM required (lbs)	123,602	112,558	211,336	217,164	234,767	229,348	175,508	113,291	113,076	120,437	117,568	122,536	1,891,190
Fescue (lbs)	19,600	43,008	151,494	215,600	104,235	77,621	0	438	0	85,237	82,368	66,679	846,279
Tall Grass Prairie (lbs)	70,236	30,544	18,390	1,564	130,531	151,727	175,508	112,853	138,935	0	0	43,593	873,882
Shrub (lbs)	0	0	0	0	2,250	0	3,938	2,250	0	0	0	0	8,438
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	4,213	3,805	35,877	0	0	0	0	0	0	0	0	4,213	48,108
Large Farm With Goat only NE													
Min DM required (lbs)	37,865	35,426	40,579	33,960	27,218	74,748	86,202	93,680	98,657	29,837	26,340	32,156	616,669
Fescue (lbs)	7,094	1,279	65,546	0	0	0	0	0	0	0	0	63,845	137,764
Tall Grass Prairie (lbs)	26,078	15,085	0	0	0	134,787	159,762	172,750	206,071	90,692	57,656	0	1,012,173
Shrub (lbs)	0	0	0	0	2,625	0	0	6,070	2,625	0	0	0	11,320
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	0	0	17,579	123,179
Supplements (lbs)	0	0	9,806	0	0	0	0	0	0	0	0	5,061	14,868
Large Farm With Cow only NE													
Min DM required (lbs)	169,127	156,827	241,432	246,740	266,499	234,130	167,608	120,900	131,552	155,084	154,587	164,395	2,208,881
Fescue (lbs)	23,030	57,575	172,725	0	67,079	234,130	0	36,604	17,115	119,884	119,387	43,075	890,604
Tall Grass Prairie (lbs)	81,224	41,979	0	184,452	42,869	0	183,526	133,235	118,209	0	11,555	67,562	1,073,570
Shrub (lbs)	0	0	0	0	2,625	2,625	2,625	2,625	2,625	0	0	0	13,125
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	0	0	33,507	0	0	0	0	0	0	0	0	0	33,507
Large Farm with Combination NE													
Min DM required (lbs)	148,099	134,930	231,308	236,078	254,043	245,621	193,831	134,946	134,972	144,081	140,722	146,745	2,145,377
Fescue (lbs)	19,600	49,000	147,000	124,740	0	103,152	109,914	0	0	144,841	59,234	50,502	978,717
Tall Grass Prairie (lbs)	54,120	13,668	0	0	0	183,852	133,281	183,433	215,789	0	79,905	0	1,005,933
Shrub (lbs)	0	0	0	0	2,625	0	4,594	2,625	0	0	0	0	9,844
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lbs)	5,348	4,830	35,138	0	0	0	0	0	0	0	0	5,348	50,664

Native Improved and Cropland with Forest (Scenario 4)

This scenario consists of 350 acres of cropland which can be allocated for improved forages in addition to the land base for native pasture, improved pasture and forest which remains the same.

As shown in table IV-10, for the large farm in NE goat only scenario the number of intensive goats increased greatly, almost 350% , from 130 head in the base scenario to 585 head, accompanied by a decrease of 27% in extensive goats and almost 60% decrease in both #1 and #2 goat stockers respectively. In the beef only scenario, there was a 95% increase in the number of fall cows, and a small decrease of 13% and 9% respectively for #1 and #4 stockers. Similarly in the unrestricted scenario, the number of fall calving cows increased by 90%, accompanied by a 94% decrease in #1 stockers, with little change in #4 stockers. Intensively managed breeding goats increased almost 320%, from a 135 head in the base scenario to 567 head.

When compared to the large farm NE in the base scenario, there is an increase in labor required, the highest for beef only enterprises and beef with goat and the least for goat only enterprises. The requirement for hired labor significantly increased for the unrestricted scenario, somewhat less for beef only and least for the goat only enterprises.

As evident from table IV-13, with the inclusion of improved pasture and some cropland for large farm in NE Oklahoma, more pasture species are being utilized. In addition to the Tall grass prairie and the shrub previously being utilized, the acreage for improved pasture is being utilized for bermuda and fescue. The 350 acres of cropland allocated for large farms in NE is being used for a combination of wheat for forage, wheat dual purpose and wheat for grain. Bermuda pasture is included in the results for both the small and medium farm with goat only and the medium farms with unrestricted scenario. Fescue is included in all farm sizes with every scenario. On the large

farm, all of the improved pasture land is used for fescue. In these scenarios, only the shrub component of forest land is used. The results show that the amount of shrub being utilized has increased, but with the same pattern, beef only scenario utilizing the most, followed by the mixed one and the goats only utilizing the least amount. This is counter-intuitive and results from a deficiency in the model, namely that the harvest efficiency for goats should be higher than that of the cattle. When comparing the utilization of fescue, unrestricted scenario utilizes most, followed closely by the beef only scenarios. Goat only scenarios utilize the least fescue with a big difference from other scenarios. Bermuda pasture is utilized mostly by goats as it is not included in beef and stocker only scenarios. Results show a decrease in the amount of TGP being used because of decreased acres in native pasture compared to the base scenario.

With crop land and improved pasture included, there is no need to buy range cubes for beef only scenarios, very low amounts in unrestricted scenarios and somewhat higher amounts purchased in goat only enterprises. There is no need to buy range cubes for cow only enterprises, very low amount in case of beef and goat enterprises and somewhat higher in case of goat only enterprises. The reason may be the addition of DM, TDN and CP from cropland which is being used for wheat forage or wheat dual.

For the large farms in the NE, 350 acres of cropland is used for wheat for grain, wheat for dual purpose and wheat for forage depending on the livestock enterprise combination. For the large farm with goat and goat stockers only, out of 350 acres of cropland, 262 acres of land is used for wheat dual purpose producing 8,652 bushels of wheat and the remaining 88 acres is used for wheat forage production. For the large farm with beef and beef stockers only, 189 acres is allocated for wheat grain producing 7,559 bushels of wheat and the remaining 161 acres in wheat

forage. For the unrestricted scenario, only 72 acres has been allocated for wheat dual purpose producing 2,364 bushels of wheat with the remaining 278 acres in wheat forage.

When compared with the large farm NE in base scenario, it appears that net returns increased 80% in goat only scenario, followed by 35% for the unrestricted scenario and 18% for beef only scenario. So the addition of cropland improves the nutrient availability on the farm, and yields higher net returns. The significant increase in net returns on the large farm NE compared to the base scenario can be attributed to the addition of cropland to the scenario, which adds returns from the wheat grain sale and allows for more intensive stocking of beef on wheat pasture.

Table IV-10. Net Returns and the Livestock Statistics for Native and Improved Pasture, Cropland and Forest Land Scenario

		No. of Cows		No. of Beef Stockers		No of Goats		No. of Goat Stockers		
Large Farm NE (2700 acres)	Net Return ($)	Spring calving	Fall calving	#1	#4	Ext Mgmt	Int Mgmt	#1	#2	Wheat bu
Goat Only[1]	60,556	0	0	0	0	173	585	1026	165	8652
Beef Only[2]	105,036	0	258	164	280	0	0	0	0	7559
Unrestricted	121,923	30	259	5	352	0	567	0	0	2364
1 Goat only scenario precludes beef cows and stockers										
2 Beef only scenario precludes all goat enterprises										

Table IV-11. Key Input Statistics for Native and Improved Pasture, Cropland and Forest Land Scenario

	Annual Labor (hours)		Sales	Expenses	Capital Required[3]	Capital Borrowed	Annual Interest
Large Farm NE (2700 acres)	Owner	Hired	($)	($)	($)	($)	($)
Goat Only[1]	2,298	2,073	211,580	151,408	632174	0	0
Beef Only[2]	2,399	1168	464,966	360,309	1870480	789907	5266
Unrestricted	2,400	3238	496,056	374,512	1604480	738827	4926
1 Goat only scenario precludes beef cows and stockers							
2 Beef only scenario precludes all goat enterprises							
3 Capital requirement constrained within month, this is a sum of the monthly capital requirement for the year							

Table IV-12. Forage and Supplement Statistics by Months for Native and Improved Pasture and Cropland with Forest Scenario

Large Farm With Goat only NE													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Min DM required (lbs)	47,254	43,322	48,673	44,327	41,688	70,274	78,158	82,782	85,859	43,307	40,343	44,269	670,255
Wheat Dual (lbs)	33,249	30,031	0	0	0	0	0	0	0	0	0	49,337	112,617
Wheat Forage (lbs)	956	0	59,752	71,502	67,936	0	0	0	0	0	0	29,367	229,513
Fescue (lbs)	4,098	10,245	30,735	0	0	0	0	0	0	0	0	36,882	81,961
Tall Grass Prairie (lbs)	26,078	15,085	0	0	0	134,787	159,762	172,750	206,071	90,692	57,656	0	862,881
Shrub (lbs)	0	0	0	0	2,625	0	4,594	2,625	0	0	0	0	9,844
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	0	35,200	0	140,800
Supplements (lb)	0	0	5,127	0	0	0	0	0	0	0	0	2,646	7,773
Large Farm With Beef Only NE													
Min DM required (lbs)	172,311	158,955	247,752	252,677	272,299	245,841	183,526	133,235	140,593	160,850	159,338	168,449	2,295,827
Wheat Forage (lbs)	36,287	32,776	65,552	0	229,431	0	0	0	0	0	23,411	36,287	423,744
Fescue (lbs)	0	0	0	0	0	0	0	0	0	0	0	0	0
Tall Grass Prairie (lbs)	19,600	49,000	147,000	68,225	0	245,841	0	0	22,384	125,650	89,171	29,400	796,272
Shrub (lbs)	81,224	41,979	0	184,452	42,869	0	183,526	133,235	118,209	0	11,555	67,562	864,611
Hay bought (lbs)	0	0	0	0	2,625	2,625	2,625	0	4,594	0	0	0	12,469
Supplements (lb)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Large Farm with Beef and Goats NE													
Min DM required (lbs)	180,733	163,128	266,429	269,562	287,984	287,004	243,195	180,318	175,012	180,041	174,339	180,260	2,588,004
Wheat Dual (lbs)	9,085	8,206	0	0	0	0	0	0	0	0	0	13,481	30,772
Wheat Forage (lbs)	62,728	56,657	113,314	144,822	287,984	0	0	0	0	0	0	93,080	758,584
Fescue (lbs)	19,600	49,000	147,000	124,740	0	103,152	109,914	0	0	144,841	59,234	50,502	807,983
Tall Grass Prairie (lbs)	54,120	13,668	0	0	0	183,852	133,281	183,433	215,789	0	79,905	0	864,047
Shrub (lbs)	0	0	0	0	2,625	2,625	2,625	0	0	0	0	0	7,875
Hay bought (lbs)	35,200	35,200	35,200	0	0	0	0	0	0	35,200	35,200	35,200	211,200
Supplements (lb)	0	397	0	0	0	0	0	0	0	0	0	440	837

Table IV-13. Forage Types and Acreage Summary for Different Scenarios

	Native Pasture (acres)	Shrubs (acres)	Forbs (acres)	Trees (acres)	Bermuda (acres)	Fescue (acres)	Wheat Grain (acres)	Wheat Dual (acres)	Wheat Forage (acres)	Unused (acres) Imp Pasture
Scenario 2: Native Pasture with Forest										
Small Farm SE/NE	40	5	3	2	-	-	-	-	-	-
Medium Farm SE/NE	250	25	15	10	-	-	-	-	-	-
Large Farm SE	2000	150	90	60	-	-	-	-	-	-
Large Farm NE	2350	175	105	70	-	-	-	-	-	-
Scenario 3: Native and Improved Pasture with Forest										
Small Farm SE/NE										
Goat Only	32	5	3	2	6	2	-	-	-	-
Beef Only, Unrestricted	32	5	3	2	8	0	-	-	-	-
Medium Farm SE/NE										
Goat Only[1]	200	25	15	10	33	17	-	-	-	-
Beef Only[2]	200	25	15	10	0	50	-	-	-	-
Unrestricted	200	25	15	10	6	44	-	-	-	-
Large Farm SE										
Goat Only	1600	150	90	60	0	153	-	-	-	247
Beef only, Unrestricted	1600	150	90	60	0	400	-	-	-	-
Large Farm NE										
Goat only	1880	175	105	70	0	145	-	-	-	325
Beef only, Unrestricted	1880	175	105	70	0	470	-	-	-	-
Scenario 4: Large Farm with Native and Improved Pasture with Forest and Cropland in NE										
Goat Only	1600	175	105	70	-	84		262	88	316
Beef Only	1600	175	105	70	-	400	189		161	-
Unrestricted	1600	175	105	70	-	400		72	278	-
1 Goat only scenario precludes beef cows and stockers										
2 Beef only scenario precludes all goat enterprises										

Table IV-14. Percentage Change in the Livestock and Key Inputs for the Native with Forest Scenario when Compared to the Base Scenario

	Net Returns	Labor Hour		No. of Cows		No. of Beef Stockers		No. of Goats		No. of Goat Stockers		Capital Required
		Owner	Hired	Spring Calving	Fall Calving	Sep-Jun 350#	Oct-Mar 550#	Ext Mgmt	Int. Mgmt	Jun-Oct 50#	Dec-Apr 50#	
Small Farm SE/NE (50 acres)												
Goat Only[1]	-20	-20	0	0	0	0	0	-20	-20	0	-20	-20
Beef Only[2]	-20	-20	0	0	0	-20	0	0	0	0	0	-20
Unrestricted	-20	-20	0	0	0	-20	0	-20	-20	0	0	-20
Medium Farm SE/NE (300 acres)												
Goat Only	-9	-8	-4	0	0	0	0	-1	-1	-29	-1	-16
Beef Only	-10	-10	0	-100	-15	-2	-16	0	0	0	0	-7
Unrestricted	-9	-7	0	-49	+36	-40	-68	0	+25	0	0	-46
Large Farm SE (2300 acres)												
Goat Only	-3	-2	-27	0	0	0	0	14	6	-7	-14	-9
Beef Only	-8	-2	-26	+635	-19	-4	+2	0	0	0	0	-1
Combination	-7	-2	-23	0	-15	-33	+4	0	-7	0	0	-3
Large Farm NE (2700 acres)												
Goat Only	-4	0	-31	0	0	0	0	+2	+1	-27	+2	-22
Beef Only	-8	-2	-27	0	-19	+1	+1	0	0	0	0	0
Unrestricted	-8	-2	-20	0	-15	-27	+4	0	-8	0	0	-4

1 Goat only scenario precludes beef cows and stockers

2 Beef only scenario precludes all goat enterprises

Table IV-15. Percentage Change in the Livestock and Key Inputs for the Native and Improved with Forest Scenario Compared to the Base Scenario

	Net Returns	Labor Hour		No of Cows		No. of Beef Stockers		No. of Goats		No. of Goat Stockers		Capital Required
		Owner	Hired	Spring Calving	Fall Calving	Sep-Jun 350#	Oct-Mar 550#	Ext Mgmt	Int. Mgmt	Jun-Oct 50#	Dec-Apr 50#	
Small Farm SE/NE (50 acres)												
Goat Only[1]	-11	+5	0	0	0	0	0	+5	+7	0	+5	+18
Beef Only[2]	+17	+35	0	0	0	+37	0	0	0	0	0	+40
Unrestricted	+9	-5	0	0	0	+138	0	-100	-90	0	0	+130
Medium Farm SE/NE (300 acres)												
Goat Only	-11	+2	+40	0	0	0	0	+16	+18	-52	+6	-5
Beef Only	+7	+20	0	+407	-70	+55	-2	0	0	0	0	+38
Unrestricted	+5	+9	0	+120	-50	+117	+7	0	-34	0	0	+71
Large Farm SE (2300 acres)												
Goat Only	+1	+7	-9	0	0	0	0	-10	+78	-21	+33	-6
Beef Only	+1	+8	+88	-100	+85	+7	-13	0	0	0	0	+10
Unrestricted	+8	+13	+133	0	+62	-11	-10	0	+171	0	0	+11
Large Farm NE (2700 acres)												
Goat Only	+1	+7	-28	0	0	0	0	+3	+94	-46	-25	-28
Beef Only	-1	-8	+72	0	+77	+7	-15	0	0	0	0	+11
Unrestricted	+9	+13	+126	0	+60	-22	-11	0	+198	0	0	+10

1 Goat only scenario precludes beef cows and stockers

2 Beef only scenario precludes all goat enterprises

Table IV-16. Percentage Change in the Livestock and Key Inputs for the Native and Improved with Forest and Cropland Scenario Compared to the Base Scenario

	Net Returns	Labor Hour		No of Cows		No. of Beef Stockers		No. of Goats		No. of Goat Stockers		Capital Required
		Owner	Hired	Spring Calving	Fall Calving	Sep-Jun 350#	Oct-Mar 550#	Ext Mgmt	Int. Mgmt	Jun-Oct 50#	Dec-Apr 50#	
Goat Only[1]	+80	+8	+33	0	0	0	0	-27	+350	-67	-61	-23
Beef Only[2]	+18	+24	+93	0	+95	-13	-9	0	0	0	0	+12
Unrestricted	+35	+24	+237	0	+89	-94	-5	0	+319	0	0	+12

1 Goat only scenario precludes beef cows and stockers

2 Beef only scenario precludes all goat enterprises

Sensitivity Results

Sensitivity analysis for the medium farm using scenario 3 with a combination of forage types (native and improved pasture with forest) was done with respect to livestock prices, owner labor availability and the hay prices. For livestock, an increase of $1 on the sale price for every beef enterprise including the spring and fall calving cows and the stocker enterprises was included. For goats, an increase of $1 on the sale price per kid from breeding enterprise and goat stockers sold was used.

When there is $1/cwt increase in beef sale prices, there is an increase of 9 % in net returns to the farm. There is a decrease in the number of both fall and spring calving cows and #1 stockers, while the number of #4 stockers almost doubled. Similarly there is a decrease in the number of intensively managed breeding goats as shown in Table IV-17. The owner labor requirement decreased by 5% and there is a need for hired labor as compared to the base situation. There is a 21% increase in the capital requirement with the increase in prices (Table IV-18).

With a $1 increase in the sale price for kids and stockers in goat enterprises, there is no significant change in the net returns. There is a significant increase of 95% for #4 beef stockers, whereas there is no any significant change in the number of fall and spring calving cows, and #1 beef stockers. The number of intensively managed breeding goats included on the optimal farm solution has gone up by 9%. There were no significant changes in the owner labor requirement and the capital requirement, with only some additional need for hired labor.

In the situation with no owner labor provided, net returns decrease approximately 28% as all labor must be hired. The number of spring calving cows decreases 60

% while the number of fall calving cows almost doubles. A 22% decrease in #1 beef stockers is accompanied by 25% increase in the number of #4 beef stockers. The intensively managed breeding goats included in the solution also decreased by 63%. There is a slight decrease of 6% in capital required for the farm.

The increase in the price of hay by $5/ ton of dry matter of hay has no significant effect on the net returns and the number of livestock in the farm remains unchanged. Similarly, the labor and capital requirement for the farm are also the same because the hay was constraining originally.

Table IV-17. Summary of Sensitivity Results for Net Returns and Livestock for the Medium Farm with No Restrictions on Livestock

	Net Return ($)	No. of Cows		No. of Beef Stockers		No of Goats	
		Spring calving	Fall calving	#1	#4	Ext Mgmt	Int Mgmt
Original	26,941	10	14	125	61	0	40
Increase in Beef Prices ($1/cwt)	29,390	7	8	102	125	0	27
Increase in Goat Prices ($1/cwt)	26,984	11	14	123	118	0	43
No Owner, Labor, Hired Only	19,460	4	30	98	75	0	15
Increase in Hay Prices ($5/ton)	26,340	10	14	125	61	0	40

Table IV-18. Summary of Key Inputs for Sensitivity Analysis of Medium Farm with No Restrictions on Livestock

	Annual Labor		Sales ($)	Expenses ($)	Capital Required ($)	Capital Borrowed ($)	Annual Interest ($)
	Owner	Hired					
Original	896	0	143,373	116,491	711,546	1,773	12
Increase in Beef Prices ($1/hd)	854	19	177,779	148,448	867,660	155,544	1037
Increase in Goat Prices ($1/hd)	898	22	143,528	116,604	706,094	1,768	12
No Owner, Labor, Hired Only	0	816	138,128	118,727	658,804	752	5
Increase in Hay Prices ($5/ton)	896	14	143,373	117,091	712,146	1873	12

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of Results

A review of model results across different scenarios indicated that in no scenario was either labor or capital a constraint. The DM availability from forage production together with the ability to purchase hay and supplements determines the stocking rate and the mix of livestock species. If the price of feed or borrowing is not high and capital is not limiting, higher stocking densities of beef and stockers may be observed compared to what might exist on a land base without supplemental feeding. The deficit DM, CP or TDN is supplemented by purchasing range cubes.

The goat enterprises use more owner labor and hired labor followed by beef and goats and beef cows and stocker enterprises.

For each farm scenario, TGP is the major source of DM as most acreage is pasture with additional nutritional needs supplied by hay and range cubes. When forest land is included, only shrubs are being utilized by livestock species. Improved pasture includes Bermuda and fescue and when cropland is added, wheat dual, wheat forage and wheat grain is being produced.

Every farm scenario with goat and goat stocker enterprises and the integrated beef and goat enterprise includes the intensively managed breeding goats. Initially, there are more extensively managed breeding goats in the goat only scenario and as the DM availability on

the farm increases, more of the intensive goats are included. For the unrestricted scenario, only intensively managed breeding goats are included except for small farms, where a very few extensively managed breeding goats are also included. For the goat only scenario, #2 goat stockers appear in each scenario. The goat only scenario consists mostly of #1 goat stockers, followed usually by #2 goat stockers, extensively managed breeding goats and intensively managed breeding goats respectively.

For beef only scenarios, #1 beef stockers are included in every farm scenario. Fall calving cows and #2 beef stockers are included in other farm scenarios except the small farm scenario, where only #1 beef stockers are included. Spring cows are included in only a few scenarios and their numbers increased as more DM was made available in the farm. For the unrestricted scenario, as more DM is made available, the livestock mix tilts towards the cows, with more cows and beef stockers included in the farm.

The capital required is greatest for stockers. Thus beef only scenarios require the most capital followed by unconstrained scenarios which include beef and goats and the goat only scenario requiring the least amount. Similarly when comparing the net returns, the unrestricted scenario when beef and goat are integrated yields the highest return in every case, followed by beef and stockers with the goat only scenario. The percentage return on capital required is greater for goats, followed by beef cows and goats and the beef only enterprises.

The sensitivity analysis shows that the #1 stockers decrease in number and #4 beef stockers number increases when the sale prices of beef is increased. On the farm, the cow numbers go up but there is some shift from spring calving to fall calving. The spring and fall calving cows number is more sensitive to owner labor followed by the beef prices.

Intensively managed breeding goat numbers reduced drastically when there is an increase in the sale price of beef and when all the labor needs to be hired.

So with the resource and constraints specified and the assumptions made, the results show that in every scenario and farm size, allowing goats to be included with cow-calf and stocker enterprise results in an increase in net returns, and also lowers the capital required as compared to the beef only enterprise. The addition of goats also has favorable effect on the forage and pasture utilization in the farm.

Limitations of the Model

The forage data used here was collected by Smith from different research sites across Oklahoma but as data was limited, there was no any region specific value for them. Similarly, due to unavailability of specific data on production and use of shrubs, forbs and tree species by livestock species, the values from most relevant literature on the production and use of forest land species were used along with some expert opinion in some cases. For the forest land species, i.e. forbs, shrubs and trees, the model specifies May-September as the production span for the forest species and the DM, CP and TDN availability is assumed constant across the months, which may not be realistic.

In the model, two livestock enterprises are harvesting the same forage, with different levels of efficiency, but due to the lack of data on overlapping of livestock species on utilization of forage species, the model specifies harvesting efficiency of goat enterprise in terms of fraction of beef cows. In the real world, separate values for harvest efficiency for beef and goat species would be specified and interaction due to overlap in grazing the same forage and pasture species would be identified. Except for the intensively managed breeding

goats, the model also does not account for grazing practice. It assumes for other livestock enterprises that the livestock can be moved among the various forage enterprise from month to month without additional cost.

The nutrient requirement equations for beef and goats are calculated for different stages of production and do not account for the change in values across time within the same stage. The nutrient requirement for meat goats are calculated from mean values across the world so may be different depending on the breed and the regional climate in US. For both beef and goat stockers, the nutrient requirement equations specify nutrient values based upon the average daily gain from a starting weight and days until finish, without any adjustments to increasing weight across time.

The model shows that only the shrubs are being utilized by the livestock, and the forbs and trees are not being utilized by any class of livestock.

Although intensively managed breeding goats are an enterprise alternative, no comparable intensively managed beef enterprises are included.

For goat enterprises, the loss from predators is accounted for in the model by assuming higher death rates in case of extensive goats and somewhat lower for intensive goats, but it may differ across the regions.

Recommendations for Future Research

There is not enough data on accurate measurement of DM, TDN and CP content of different forage species and the forest land species, and also the temporal variation in the percent availability.

Availability of data on monthly DM, TDN and CP content for different species of the forages, shrubs, forbs and tree, would certainly make the model results more realistic. The more realistic data on forage and forest species transfer of TDN, DM and CP across months and the degradation over time would certainly help to make the model more realistic. There is a need for further research on the harvest efficiency of goats for different forage and forest land species, and the overlapping factor also needs to be specified in case of beef and goat enterprise mix.

There is not enough literature to support the results of this model in interaction between the two livestock enterprises, in terms of stocking densities, the optimal mix of beef and goats in the farm and the utilization of forage, pasture, shrubs, forbs and tree.

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APPENDIXES

Appendix A -- Livestock Enterprise Budget for Fall Calving Cows Excluding Labor, Capital and Pasture Costs

Cow-Calf Enterprise Budget - 100 Cow Unit Size								
September calving percentage - 89.1%, calf death loss - 3.8%								
PRODUCTION		**Wt.**	**Unit**	**Price/Cwt**	**Quantity**		**Total**	**$/Head**
	Steer Calves	628.0	Lbs.	$108.65	42.86	Hd.	$29,242	$292.42
	Heifer Calves	587.4	Lbs.	$105.73	17.86	Hd.	$11,090	$110.90
	Cull Cows	1,150.0	Lbs.	$45.86	12.00	Hd.	$3,167	$31.67
	Cull Replacement Heifers	825.0	Lbs.	$89.15	12.00	Hd.	$8,826	$88.26
	Cull Bulls	1,750.0	Lbs.	$60.05	1.00	Hd.	$0	$0.00
	Other Income		Head	$ -	1.00		$ -	$ -
						Total Receipts	**$52,326**	**$523.26**
OPERATING INPUTS			**Unit**	**Price**	**Quantity**		**Total**	**$/Head**
	Pasture		Head	$ -	1		$ -	$ -
	Hay		Head	$ -	1		$ -	$ -
	Grain		Head	$ -	1		$ -	$ -
	Protein Supplement		Head	$ -	1		$ -	$ -
	Salt		Head	$ 2.81	1		$281	$2.81
	Minerals		Head	$13.68	1		$1,368	$13.68
	Other Feed Additives		Head	$ -	1		$ -	$ -
	Vet Services/Medicine		Head	$ 6.14	1		$614	$ 6.14
	Vet Supplies		Head	$1.16	1		$116	$1.16
	Marketing		Head	$7.39	1		$739	$7.39
	Mach/Equip Fuel, Lube, Repairs		Head	$24.09	1		$2,409	$24.09
	Machinery/Equipment Labor		Hrs.	$9.25	0.00		$ -	$ -
	Other Labor		Hrs.	$9.25	0.00		$ -	$ -
	Other Expenses		Head	$ -	1		$-	$ -
	Annual Operating Capital		Dollars	9.25%	0.00		$-	$ -
						Total Operating Costs	**$5,527**	**$55.27**
						Returns Above Total Operating Costs	**$46,799**	**$467.99**
FIXED COSTS			**Unit**	**Rate**			**Total**	**$/Head**
	Machinery/Equipment							

	Interest at		Dollars	9.00%			$563	$5.63
	Taxes at		Dollars	1.00%			$114	$1.14
	Insurance		Dollars	0.60%			$38	$0.38
	Depreciation		Dollars				$1,028	$10.28
	Livestock							
	Interest at		Dollars	9.00%			$7,980	$79.80
	Taxes at		Dollars	1.00%			$1,031	$10.31
	Insurance		Dollars	0.60%			$532	$5.32
	Depreciation		Dollars				$2,209	$22.09
	Land		$/Acre	$ -				
	Interest at		Dollars	0.00%			$ -	$ -
	Taxes at		Dollars	0.00%			$ -	$ -
						Total Fixed Costs	**$13,495**	**$134.95**
						Total Costs (Operating +Fixed)	**$19,022**	**$190.22**
						Returns Above all Specified Costs	**$33,304**	**$333.04**
Leflore County - Southeast Oklahoma, Used machinery complement								
25% heifer replacement rate with 1 purchased and 24 raised								
Primary forages - Native,								

Appendix B -- Livestock Enterprise Budget for Spring Calving Cows Excluding Labor, Capital and Pasture Costs

Cow-Calf Enterprise Budget - 100 Cow Unit Size							
February calving percentage - 86.1%, calf death loss - 3.8%							
PRODUCTION	**Wt.**	**Unit**	**Price/Cwt**	**Quantity**		**Total**	**$/Head**
Steer Calves	529.5	Lbs.	$112.93	41.41	Hd.	$24,764	$247.64
Heifer Calves	501.8	Lbs.	$105.19	16.41	Hd.	$8,664	$86.64
Cull Cows	1,150.0	Lbs.	$45.86	12.00	Hd.	$3,167	$31.67
Cull Replacement Heifers	825.0	Lbs.	$89.15	12.00	Hd.	$8,826	$88.26
Cull Bulls	1,750.0	Lbs.	$60.05	1.00	Hd.	$0	$0.00
Other Income		Head	$ -	1.00		$ -	$ -
				Total Receipts		**$52,326**	**$523.26**
OPERATING INPUTS		**Unit**	**Price**	**Quantity**		**Total**	**$/Head**
Pasture		Head	$ -	1		$ -	$ -
Hay		Head	$ -	1		$ -	$ -
Grain		Head	$ -	1		$ -	$ -
Protein Supplement		Head	$ -	1		$ -	$ -
Salt		Head	$2.76	1		$276	$ 2.76
Minerals		Head	$13.43	1		$1,343	$13.43
Other Feed Additives		Head	$ -	1		$ -	$ -
Vet Services/Medicine		Head	$6.12	1		$612	$6.12
Vet Supplies		Head	$1.16	1		$116	$1.16
Marketing		Head	$6.91	1		$691	$6.91
Mach/Equip Fuel, Lube, Repairs		Head	$24.09	1		$2,409	$24.09
Machinery/Equipment Labor		Hrs.	$9.25	0.00		$ -	$ -
Other Labor		Hrs.	$9.25	0.00		$ -	$ -
Other Expenses		Head	$ -	1		$ -	$ -
Annual Operating Capital		Dollars	9.25%	0.00		$ -	$ -
				Total Operating Costs		**$5,447**	**$54.47**
				Returns Above Total Operating Costs		**$46,799**	**$467.99**
FIXED COSTS		**Unit**	**Rate**			**Total**	**$/Head**
Machinery/Equipment							
Interest at		Dollars	9.00%			$563	$5.63
Taxes at		Dollars	1.00%			$114	$1.14
Insurance		Dollars	0.60%			$38	$0.38
Depreciation		Dollars				$1,028	$10.28
Livestock							
Interest at		Dollars	9.00%			$7,980	$79.80

	Taxes at		Dollars	1.00%			$1,031	$10.31
	Insurance		Dollars	0.60%			$532	$5.32
	Depreciation		Dollars				$2,209	$22.09
	Land		$/Acre	$-				
	Interest at		Dollars	0.00%			$ -	$ -
	Taxes at		Dollars	0.00%			$ -	$ -
						Total Fixed Costs	**$13,495**	**$134.95**
						Total Costs (Operating +Fixed)	**$18,942**	**$189.42**
						Returns Above all Specified Costs	**$26,479**	**$264.79**
Leflore County - Southeast Oklahoma, Used machinery complement								
25% heifer replacement rate with 1 purchased and 24 raised								
Primary forages - Native								

Appendix C-- Livestock Enterprise Budget for September- June 350# Beef Stockers Excluding Labor, Capital and Pasture Costs

Stocker Enterprise Budget - 150 Steers						
September purchase - 350 lbs., June sale - 869 lbs						
PRODUCTION:	**Wt.**	**Unit**	**Price/Cwt**	**Quantity**		**$/Head**
Stockers	869	Lbs.	$101.96	0.980	Hd.	$ 868.43
Other Income		Head	$ -	0.980	Hd.	$ -
Total Receipts						**$ 868.43**
OPERATING INPUTS:	**Wt.**	**Unit**	**Price**	**Quantity**		**$/Head**
Stockers	350	Lbs.	$119.50	1	Hd.	$418.25
Pasture		Head	$ -	1		$ -
Hay		Head	$ -	1		$ -
Grain		Head	$ -	1		$ -
Protein Supplement		Head	$ -	1		$ -
Salt		Head	$0.12	1		$0.12
Minerals		Head	$0.14	1		$0.14
Other Feed Additives		Head	$ -	1		$ -
Vet Services/Medicine		Head	$3.88	1		$3.88
Vet Supplies		Head	$0.71	1		$0.71
Marketing		Head	$4.80	1		$4.80
Mach/Equip Fuel, Lube, Repairs		Head	$12.19	1		$12.19
Machinery/Equipment Labor		Hrs.	$9.25	0.00		$ -
Other Labor		Hrs.	$9.25	0.00		$ -
Other Expenses		Head	$ -	1		$ -
Annual Operating Capital		Dollars	0.00%	323.03		$ -
Total Operating Costs						**$440.09**
Returns Above Total Operating Costs						**$428.34**
FIXED COSTS		**Unit**	**Rate**			**$/Head**
Machinery/Equipment		$/value				
Interest at		Dollars	9.00%			$2.09
Taxes at		Dollars	1.00%			$0.41
Insurance		Dollars	0.60%			$0.14
Depreciation		Dollars				$3.53
Land		$/Acres	$ -			
Interest at		Dollars	0.00%			$ -
Taxes at		Dollars	0.00%			$ -
					Total Fixed Costs	**$6.17**
					Total Costs (Operating +Fixed)	**$446.26**

Returns Above all Specified Costs	**$422.17**
Leflore County - Southeast Oklahoma	
Stocker phase - 273 day	
Average daily gain - 2 lbs., 2% death loss	
Used machinery complement	
Primary forage - Small Grain,	

Appendix D -- Livestock Enterprise Budget for October- March 450# Beef Stockers Excluding Labor, Capital and Pasture Costs

Stocker Enterprise Budget - 150 Steers						
October purchase - 450 lbs., March sale - 790 lbs						
PRODUCTION:	**Wt.**	**Unit**	**Price/Cwt**	**Quantity**		**$/Head**
Stockers	790	Lbs.	$92.94	0.980	Hd.	$719.16
Other Income		Head	$ -	0.980	Hd.	$ -
Total Receipts						**$ 868.43**
OPERATING INPUTS:	**Wt.**	**Unit**	**Price**	**Quantity**		**$/Head**
Stockers	450	Lbs.	$119.50	1	Hd.	$537.75
Pasture		Head	$ -	1		$ -
Hay		Head	$ -	1		$ -
Grain		Head	$ -	1		$ -
Protein Supplement		Head	$ -	1		$ -
Salt		Head	$0.12	1		$0.12
Minerals		Head	$0.14	1		$0.14
Other Feed Additives		Head	$ -	1		$ -
Vet Services/Medicine		Head	$3.88	1		$3.88
Vet Supplies		Head	$0.71	1		$0.71
Marketing		Head	$4.80	1		$4.80
Mach/Equip Fuel, Lube, Repairs		Head	$12.19	1		$12.19
Machinery/Equipment Labor		Hrs.	$9.25	0.00		$ -
Other Labor		Hrs.	$9.25	0.00		$ -
Other Expenses		Head	$ -	1		$ -
Annual Operating Capital		Dollars	0.00%	323.03		$ -
Total Operating Costs						**$559.59**
Returns Above Total Operating Costs						**$159.57**
FIXED COSTS		**Unit**	**Rate**			**$/Head**
Machinery/Equipment		$/value				
Interest at		Dollars	9.00%			$2.09
Taxes at		Dollars	1.00%			$0.41
Insurance		Dollars	0.60%			$0.14
Depreciation		Dollars				$3.53
Land		$/Acres	$ -			
Interest at		Dollars	0.00%			$ -
Taxes at		Dollars	0.00%			$ -
					Total Fixed Costs	**$6.17**
					Total Costs (Operating +Fixed)	**$565.76**

Returns Above all Specified Costs	**$153.40**
Leflore County - Southeast Oklahoma	
Stocker phase - 182 days	
Average daily gain - 2 lbs., 2% death loss	
Used machinery complement	
Primary forage - Small Grain,	

Appendix E -- Livestock Enterprise Budget for October- June 450# Beef Stockers Excluding Labor, Capital and Pasture Costs

Stocker Enterprise Budget - 150 Steers						
October purchase - 450 lbs., June sale - 908 lbs						
PRODUCTION:	**Wt.**	**Unit**	**Price/Cwt**	**Quantity**		**$/Head**
Stockers	908	Lbs.	$101.96	0.980	Hd.	$907.20
Other Income		Head	$-	0.980	Hd.	$ -
Total Receipts						**$868.43**
OPERATING INPUTS:	**Wt.**	**Unit**	**Price**	**Quantity**		**$/Head**
Stockers	450	Lbs.	$119.50	1	Hd.	$537.75
Pasture		Head	$ -	1		$ -
Hay		Head	$ -	1		$ -
Grain		Head	$ -	1		$ -
Protein Supplement		Head	$ -	1		$ -
Salt		Head	$0.12	1		$0.12
Minerals		Head	$0.14	1		$0.14
Other Feed Additives		Head	$ -	1		$ -
Vet Services/Medicine		Head	$3.88	1		$3.88
Vet Supplies		Head	$0.71	1		$0.71
Marketing		Head	$4.80	1		$4.80
Mach/Equip Fuel, Lube, Repairs		Head	$12.19	1		$12.19
Machinery/Equipment Labor		Hrs.	$9.25	0.00		$ -
Other Labor		Hrs.	$9.25	0.00		$ -
Other Expenses		Head	$ -	1		$ -
Annual Operating Capital		Dollars	0.00%	323.03		$ -
Total Operating Costs						**$559.59**
Returns Above Total Operating Costs						**$347.61**
FIXED COSTS		**Unit**	**Rate**			**$/Head**
Machinery/Equipment		$/value				
Interest at		Dollars	9.00%			$2.09
Taxes at		Dollars	1.00%			$0.41
Insurance		Dollars	0.60%			$0.14
Depreciation		Dollars				$3.53
Land		$/Acres	$ -			
Interest at		Dollars	0.00%			$ -
Taxes at		Dollars	0.00%			$ -
					Total Fixed Costs	**$6.17**
					Total Costs (Operating +Fixed)	**$565.76**

Returns Above all Specified Costs	**$341.44**
Leflore County - Southeast Oklahoma	
Stocker phase - 243 days	
Average daily gain - 2 lbs., 2% death loss	
Used machinery complement	
Primary forage - Small Grain,	

Appendix F -- Livestock Enterprise Budget for October- March 550# Beef Stockers Excluding Labor, Capital and Pasture Costs

Stocker Enterprise Budget - 150 Steers						
October purchase - 550 lbs., March sale - 887 lbs						
PRODUCTION:	**Wt.**	**Unit**	**Price/Cwt**	**Quantity**		**$/Head**
Stockers	887	Lbs.	$ 92.94	0.980	Hd.	$ 807.51
Other Income		Head	$ -	0.980	Hd.	$ -
Total Receipts						**$ 868.43**
OPERATING INPUTS:	**Wt.**	**Unit**	**Price**	**Quantity**		**$/Head**
Stockers	550	Lbs.	$119.50	1	Hd.	$657.25
Pasture		Head	$ -	1		$ -
Hay		Head	$ -	1		$ -
Grain		Head	$ -	1		$ -
Protein Supplement		Head	$ -	1		$ -
Salt		Head	$0.12	1		$0.12
Minerals		Head	$0.14	1		$0.14
Other Feed Additives		Head	$ -	1		$ -
Vet Services/Medicine		Head	$3.88	1		$3.88
Vet Supplies		Head	$0.71	1		$0.71
Marketing		Head	$4.80	1		$4.80
Mach/Equip Fuel, Lube, Repairs		Head	$12.19	1		$12.19
Machinery/Equipment Labor		Hrs.	$9.25	0.00		$ -
Other Labor		Hrs.	$9.25	0.00		$ -
Other Expenses		Head	$ -	1		$ -
Annual Operating Capital		Dollars	0.00%	323.03		$ -
Total Operating Costs						**$679.09**
Returns Above Total Operating Costs			**$ 128.42**			**$159.57**
FIXED COSTS		**Unit**	**Rate**			**$/Head**
Machinery/Equipment		$/value				
Interest at		Dollars	9.00%			$2.09
Taxes at		Dollars	1.00%			$0.41
Insurance		Dollars	0.60%			$0.14
Depreciation		Dollars				$3.53
Land		$/Acres	$ -			
Interest at		Dollars	0.00%			$ -
Taxes at		Dollars	0.00%			$ -
					Total Fixed Costs	**$6.17**
					Total Costs (Operating +Fixed)	**$685.26**

Returns Above all Specified Costs	**$122.25**
Leflore County - Southeast Oklahoma	
Stocker phase - 182 days	
Average daily gain - 2 lbs., 2% death loss	
Used machinery complement	
Primary forage - Small Grain,	

Appendix G -- Livestock Enterprise Budget for Extensively Managed Breeding Goats Excluding Labor, Capital and Pasture Costs

Goat Enterprise Budget - 50 Doe Unit Size							
Kidding percentage - 125%, kid death loss - 10%							
PRODUCTION	**Wt.**	**Unit**	**Price/Cwt**	**Quantity**		**Total**	**$/Head**
Male Kids	70.0	Lbs.	$100.38	40.50	Hd.	$2,846	$56.92
Female Kids	70.0	Lbs.	$100.38	30.50	Hd.	$2,143	$42.86
Cull Does	85.0	Lbs.	$65.00	7.00	Hd.	$387	$7.74
Cull Replacement Doe Kids	70.0	Lbs.	$125.00	0.00	Hd.	$ -	$ -
Cull Bucks	135.0	Lbs.	$78.39	0.00	Hd.	$ -	$ -
Other Income		Head	$ -	1.00		$ -	$ -
				Total Receipts		**$5,376**	**$107.51**
OPERATING INPUTS		**Unit**	**Price**	**Quantity**		**Total**	**$/Head**
Pasture		Head	$ -	1		$ -	$ -
Hay		Head	$ -	1		$ -	$ -
Grain		Head	$ -	1		$ -	$ -
Protein Supplement		Head	$ -	1		$ -	$ -
Salt/Minerals		Head	$1.90	1		$95	$1.90
Vet Services/Medicine		Head	$2.09	1		$105	$2.09
Vet Supplies		Head	$3.25	1		$163	$3.25
Marketing		Head	$8.50	1		$425	$8.50
Mach/Equip Fuel, Lube, Repairs		Head	$6.33	1		$317	$6.33
Machinery/Equipment Labor		Hrs.	$9.25	0.00		$ -	$ -
Other Labor		Hrs.	$9.25	0.00		$ -	$ -
Other Expenses		Head	$-	1		$ -	$ -
Annual Operating Capital		Dollars	9.25%	0.00		$ -	$ -
				Total Operating Costs		**$1,104**	**$22.07**
Returns Above Total Operating Costs						**$4,272**	**$85.44**
FIXED COSTS		**Unit**	**Rate**			**Total**	**$/Head**
Machinery/Equipment							
Interest at		Dollars	9.00%			$98	$1.96
Taxes at		Dollars	1.00%			$18	$0.36
Insurance		Dollars	0.60%			$7	$0.13
Depreciation		Dollars				$163	$3.25
Livestock							
Interest at		Dollars	9.00%			$442	$8.83
Taxes at		Dollars	1.00%			$69	$1.37
Insurance		Dollars	0.60%			$30	$ 0.59
Depreciation		Dollars				$78	$1.56

	Land		\$/Acre	\$ -				
	Interest at		Dollars	0.00%			\$ -	\$ -
	Taxes at		Dollars	0.00%			\$ -	\$ -
						Total Fixed Costs	**\$903**	**\$18.05**
						Total Costs (Operating +Fixed)	**\$2,006**	**\$40.12**
						Returns Above all Specified Costs	**\$3,370**	**\$67.39**
Leflore County - Southeast Oklahoma								
Used machinery complement								
20% Female kid replacement rate								
Primary forages - Native,								

Appendix H -- Livestock Enterprise Budget for June-October 50# Goat Stockers Excluding Labor, Capital and Pasture Costs

Stocker Goat Enterprise Budget - 100 Male Kids						
June purchase - 50 lbs., October sale - 80 lbs						
PRODUCTION:	**Wt.**	**Unit**	**Price/Cwt**	**Quantity**		**$/Head**
Stocker Goats	80	Lbs.	$93.30	0.970	Hd.	$71.98
Other Income		Head	$-	0.970	Hd.	$ -
				Total Receipts		**$71.98**
OPERATING INPUTS:	**Wt.**	**Unit**	**Price**	**Quantity**		**$/Head**
Stocker Goats	50	Lbs.	$106.00	1	Hd.	$53.00
Pasture		Head	$ -	1		$ -
Hay		Head	$ -	1		$ -
Grain		Head	$ -	1		$ -
Protein Supplement		Head	$ -	1		$ -
Salt/Minerals		Head	$0.15	1		$0.15
Vet Services/Medicine		Head	$ -	1		$ -
Vet Supplies		Head	$1.37	1		$1.37
Marketing		Head	$4.25	1		$4.25
Mach/Equip Fuel, Lube, Repairs		Head	$2.31	1		$2.31
Machinery/Equipment Labor		Hrs.	$9.25	0.00		$ -
Other Labor		Hrs.	$9.25	0.00		$ -
Other Expenses		Head	$ -	1		$ -
Annual Operating Capital		Dollars	0.00%	19.06		$ -
				Total Operating Costs		**$61.08**
Returns Above Total Operating Costs						**$10.90**
FIXED COSTS		**Unit**	**Rate**			**$/Head**
Machinery/Equipment		$/value				
Interest at		Dollars	9.00%			$0.60
Taxes at		Dollars	1.00%			$0.10
Insurance		Dollars	0.60%			$0.04
Depreciation		Dollars				$1.08
Land		$/Acres	$ -			
Interest at		Dollars	0.00%			$ -
Taxes at		Dollars	0.00%			$ -
				Total Fixed Costs		**$1.82**
				Total Costs (Operating +Fixed)		**$62.90**
				Returns Above all Specified Costs		**$9.08**
Leflore County - Southeast Oklahoma						

Average daily gain - .2 lbs., 3% death loss
Used machinery complement
Stocker phase - 160 days
Primary forage - Native,

Rajendra Ratala Joshi

Candidate for the Degree of

Masters of Science

Thesis: DETERMINING THE FINANCIAL AND RESOURCE MANAGEMENT IMPACT OF INTEGRATING MEAT GOAT AND BEEF CATTLE ENTERPRISES.

Major Field: Agricultural Economics

Biographical:

Personal Data**:** Born in Bajhang, Nepal, on June 24, 1981, the son of father Dhan Raj Ratala and mother Bhuji Ratala.

Education: Graduated from Maha Manjushree Secondary School, Kathmandu in 1993; received an Intermediate of Science degree in Agriculture from Institute of Agriculture and Animal Science (IAAS), Tribhvan University, July 1999; received a Bachelors of Science degree in Agriculture from the Institute of Agriculture and Animal Science, Tribhuvan University in 2004; completed the requirements for the Master of Science degree in Agricultural Economics at Oklahoma State University in May, 2007.

Experience: Graduate Research Assistant, Oklahoma State University Department of Agricultural Economics, October 2005 to December 2007;

Name: Rajendra Ratala Joshi Date of Degree: May, 2008

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: DETERMINING THE FINANCIAL AND RESOURCE MANAGEMENT IMPACTS OF INTEGRATING MEAT GOAT AND BEEF CATTLE ENTEPRISES

Pages in Study: 98 Candidate for the Degree of Master of Science

Major Field: Agricultural Economics

Scope and Method of Study: With the increasing ethnic population and the continuing increase in their household income, the US meat goat industry is growing. Despite the previous research showing the contributions of goats to livestock and forage production systems in multi-species grazing pastures, the economic aspects of adding a meat goat enterprise to an existing beef operation have not been fully studied and quantified. This study seeks to determine the profitability of integrating beef and meat goat enterprises, given a specified amount of land and capital plus assumptions concerning available farm resources and productivity levels. Since a whole farm approach is needed to understand the optimal allocation of resources, a Linear Programming model is used. The study focuses on three farm sizes, small, medium and large for Southeast and Northeast Oklahoma. Potential activities include the beef and goat enterprises, forages and crops. Potential constraints are labor, capital, hay and dry matter availability on the farm. The scenarios for the study include native pasture, native pasture with forest, native and improved pasture with forest, and native and improved pasture with forest and cropland.

Findings and Conclusions: Solutions for the base scenario with no livestock constraints include a mix of beef and goats. Results are similar for other land use scenarios (native pasture with forest land, native and improved pasture with forest land and native and improved pasture with forest and cropland) in that both beef and goats are included in the optimal solution. Dry matter availability from forage production together with the ability to purchase hay and supplements determines the stocking rate and the mix of livestock species. Capital and labor were not constraining in the specified scenarios. In the unrestricted solutions, breeding goats substitute for beef stockers, stocker goats are eliminated, and beef cow numbers increase on all farm sizes, which indicate that the beef cows and breeding goat enterprises are complementary. In every scenario and farm size, the inclusion of goats with beef enterprise results in an increase in net returns, lowers the capital required and improves forage and pasture utilization on the farm.

ADVISER'S APPROVAL: Damona G. Doye