ABSTRACT

An Evaluation of Stocking Rate and Economic Outcomes for
East Wildlife Foundation Cattle Operation

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The East Wildlife Foundation (EWF) includes over 215,000 acres of native south Texas rangeland. The extremely variable climate in south Texas creates a difficulty in effectively managing natural resources, while trying to achieve financial success through cattle production. To aid in the management of rangeland health and achieve profitable long-term beef production, an in-depth evaluation of stocking rate and financial outcomes will benefit EWF. Therefore, the objectives of this project were to: 1) Determine a long term stocking rate to minimize destocking under drought conditions on EWF ranches that is compatible with typical variation in forage production; 2) Determine the EWF cattle enterprise total cost from 2,000 to 8,000 cows for comparison with current animal operating budget; and 3) Project net income based on a herd size of 2,000 to 8,000 cows to estimate break-even stocking level. To accomplish these objectives, historical precipitation was analyzed and used in conjunction with forage production data from sites across the ranch to estimate the appropriate animal units that allow for proper forage utilization during drought. Using the current EWF projected budget, costs were categorized into direct and indirect costs and entered into a dynamic Excel model. Financial outcomes for the gradient stocking rate of 2,000 to 8,000 cows were used to project the number of cows needed to break-even. The model output revealed 2,718 animal units as an appropriate stocking rate for severe drought similar to 2011 through 2012. Under the current management system, this equates to approximately 1,720 brood cows with associated bulls, heifers and retained calves. Current

projections indicate break-even will be achieved at approximately 3,500 brood cows. The difference in appropriate stocking rate during drought and breakeven presents a challenge for management. A target of 3,500 cows may be reasonable long-term to allow profitable production most years while sustaining or improving rangeland health. However, maintaining 3,500 cows will most likely require animal unit reductions at times. These findings should be considered with the understanding true range management is a balancing act between science and art. As science guides management the art allows for the flexibility that is necessary in a highly variable environment.

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To my two lovely daughters, they are my inspiration and driving force in pursuing a better life.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The East Wildlife Foundation (EWF) includes over 215,000 acres of native south Texas rangeland. This land is operated as six separate ranches in Jim Hogg, Starr, Willacy, and Kenedy Counties. The Foundation's ranch headquarters is the historic San Antonio Viejo Ranch, a 148,000-acre property that lies across southern Jim Hogg and northern Starr Counties. The extremely variable climate in south Texas creates a difficult environment to efficiently manage natural resources, while at the same time, trying to achieve financial success. To aid in the management of rangeland health and achieve profitable long-term beef production, an in-depth evaluation of stocking rate and financial outcomes will benefit the EWF. . Leadership of the EWF has requested a study to assist in the development of long-term cattle operation planning. The objectives of this project were to: 1) determine a long term stocking rate to minimize destocking under drought conditions of EWF ranches that is compatible with typical variation in forage production; 2) determine the EWF cattle enterprise total cost based on a herd size of 2,000 to 8,000 cows for comparison with current annual operating budget; and 3) project net income from 2,000 to 8,000 cows to estimate the break-even stocking level. To accomplish these objectives, historical precipitation was analyzed and used in conjunction with forage production data from sites on the ranch. Financial reports from EWF were used in projecting revenue, cost, and break-evens. By comparing these factors and performing a complete analysis, a recommended stocking rate and projected break-even was produced.

LITERATURE REVIEW

Determining long-term sustainability for a cattle ranch includes two components: 1) business; and 2) stocking rate. For a cattle ranch to succeed over time, attention to business details and an understanding of business principles is essential (Hanselka et al., 2010; Hohlt et al., 2009; Lyons and Machen, 2001). Stocking rate also plays a vital role in maintaining or increasing range production. A healthy ecological environment is dependent on a correct stocking rate. Accomplishing this requires a cleverness of integrating science and experiential knowledge into the management plan (Pratt and Rasmussen, 2001; Redfearn and Bidwell, 2000). This literature review will cover business principals necessary for projecting break-evens and factors used to calculate a sustainable stocking rate.

ECONOMIC PROJECTION FACTORS

This section of the literature review will discuss the importance of understanding cost behavior and knowing how to classify costs, the comprehension of depreciation, and computing and deciphering break-evens. Along with examining the different types of accounting systems, specifically financial accounting and managerial accounting, a comparison of cash verses accrual accounting will also be evaluated (Bevers, 2013).

Cost Behavior and Classification

A cost behavior is the way in which a cost changes as a related activity changes. The behavior of costs is useful to managers for a variety of reasons. For example, knowing how costs behave allows managers to predict profits as sales and production volumes change, and is useful for estimating costs when preforming financial projections. Understanding the behavior of a cost depends on two factors: 1) activity bases, which is identifying the activities causing the cost to change; and 2) relevant range, which is specifying the range of activity where changes in the cost are of interest (Warren et al., 2011). Costs are normally categorized by their behavior in three ways: 1) variable costs; 2) fixed costs; or 3) mixed costs (Siegel and Shim, 2006). Each of these categories can be further sorted into direct and indirect costs.

Variable, Fixed and Mixed Costs. Any cost that is not a consistent dollar amount over time is considered a variable cost. Variable cost may or may not have a direct correlation with the activity bases (Warren et al., 2011). Fixed costs are costs that remain the same in total dollar amount over a period of time regardless of the activity bases (Warren et al., 2011). A per acre pasture lease is an example of a fixed cost. Mixed costs are a combination of variable and fixed costs. They may have a predetermined cost for a predetermined number of productions, combined with an additional variable cost with additional production (Warren et al., 2011).

Direct and Indirect Costs. All variable, fixed, and mixed costs are further classified into direct and indirect costs. It is necessary for managers to understand cost behavior to assist in their decision making. Costs are often classified by their relationship to a particular segment of operations, called a cost object. A cost object may be a product, a department, or an activity. Expenses associated with cost objects are either direct costs or indirect costs (Warren et al., 2011).

Direct costs are expenses completely attributed and connected to a cost object (Goodrich, 2013). The two characteristics of direct costs are: 1) the cost/unit remains the same regardless of changes in the production; and 2) total cost changes in proportion with the changes in production. These direct costs are usually variable costs; however, there are a few exceptions where a fixed cost may be considered a direct cost, such as depreciation of a cow.

Indirect costs are expenses affecting the company as a whole and not just the product. Advertising and marketing, office supplies, building and equipment depreciation are examples of indirect costs. These constitute the overhead of maintaining the entire company and not just costs associated with creating a product (Goodrich, 2013). Warren et al. (2011) defines indirect costs as costs that cannot be identified with, or traced to, a cost object.

Once indirect or overhead costs are identified, allocations of these costs need to be performed to find the true cost of production. By the nature of business, indirect costs are usually more affluent than direct costs; therefore, the allocation process is a vital part of establishing a true cost. The frequently unbalanced ratio of indirect to direct cost also allows for manipulation of the true cost of production, if not grouped correctly. To accurately determine unit cost of production there are different methods to allocate overhead or indirect costs. Because of the different methods to allocate overhead, it is critical to be transparent with which method is used when discussing unit cost of production. The type of business usually determines the accepted method of allocating overhead. Once an allocation method is chosen, consistency is essential to establish accurate trends in costs. Knowing the cost trends allows for better understanding and interpreting of costs behaviors and permits managers to accurately project break-evens (Bevers, 2013).

Depreciation

Fixed assets are long-term or relatively permanent assets such as equipment, machinery, buildings, and land which can be commonly referred to as property, plant, and equipment. Fixed assets have three distinct characteristics: 1) they exist physically and therefore are tangible; 2) they are owned and are used by the company in its normal operations; and 3) they are not offered for sale as part of normal operations (Warren et al., 2011). However, over time fixed assets, with the exception of land, lose their ability to provide services. A physical asset may wear out or become obsolete. Because this loss of value will eventually need to be replaced, it is considered an expense. The recording of the loss in value of fixed assets as an expense is called depreciation (Bevers, 2013).

Three factors determine the depreciation expenses for a fixed asset are: 1) initial cost; 2) expected useful life; and 3) estimated residual value, often referred to as salvage value. The asset's initial cost includes the purchase price as well as all cost incurred to prepare the asset for use. The expected useful life may be determined in various ways. The Internal Revenue Service (IRS) publishes guidelines for useful lives that are essential in tax preparation (Warren et al., 2011). However, a manager may want to use many forms of expected useful life for different types of assets. This is due to the differences in financial accounting and managerial accounting. An asset that will wear out or lose functionality quickly has a short useful life. Conversely, an asset that will last for a long period of time has a long expected useful life. The residual value of an asset at the end of its useful life is estimated at the time the asset is placed into service (Albrecht et al., 2002).

The depreciable cost of an asset is the difference between the initial cost and the residual value. The formula states that the initial cost minus the estimated residual value is divided by the estimated useful life. The amount of depreciable cost that is allocated over the useful life is depreciation expense (Collier, 2009). If an asset has no residual value then the total initial cost would be allocated as depreciation. For the purpose of trying to match the depreciation expense with the revenue generated by that asset, several methods are used in computing depreciation expense. The three most popular methods are: 1) straight-line; 2) units-of-production; and 3) double-declining.

The straight-line method allows for equal amount of depreciation expense to be allocated over the asset's useful life, this is the simplest and most common used method. The units-of-production method allows for the same amount of depreciation expense to be allocated for each unit of production. Depending on the asset, the units of production can be expressed in terms of hours, mile driven, or quantity produced (Warren et al., 2011). The formula for units-of-production states that the initial cost minus the estimated residual value is divided by total units of production. The units-of-production method is often used when a fixed asset's use may vary from year-to-year. The double-declining method is classified as accelerated depreciation. By accelerating depreciation early in an asset's useful life, it may match with the revenue generated by that asset. If a manager knows an asset may have high repair and maintenance costs later in an asset's useful life, an accelerated depreciation method may be used. Utilizing this method early in the assets useful life when the repair and maintenance costs are low, the depreciation expense will be high and later in the assets useful life when the repair and maintenance cost are high the depreciation expense will be low. Therefore, an assets expense may be manipulated to match the revenue generated by that asset (Spiceland et al., 2009).

To totally understand the concept of depreciation, knowing the difference between book value and market value is vital. Market value is the worth of an asset if sold at that particular point of time on the private market. Simply stated, what you can sell it for. Book value is the initial cost minus the accumulated depreciation for that particular point in time plus the residual value. This is what an asset is worth according to the financial records. The difference between market value and book value may be positive or negative. When the asset is sold and that difference is positive, it is recorded as additional income. If the difference is negative, it is recorded as a capital loss (Bevers, 2013).

Break-evens

According to Warren, et al. (2011), the break-even point is the level of operations at which a company's revenues and expenses are equal. At break-even, a company reports neither an income nor a loss from operations. Arguably, understanding and knowing a company's break-even is the most important information for a manager to acquire. Making critical decisions without knowing the break-even could be detrimental to any company. Even though the formula for a break-even is simple (revenues equal expenses), computing an accurate break-even may be difficult. The accuracy of a break-even is directly dependent on the accuracy of the information used for calculation. For this reason, it is essential to know all direct and indirect costs to produce a good or service (Warren, et al., 2011).

A break-even can be used in various ways, including determining how many units needed to be produced and sold, establishing a price point for a product or service, or using it to institute cost control. For example, how many units of a product does a company need to sell in order to break-even? The formula to calculate this reads: total indirect cost divided by the contribution margin. Where the contribution margin is defined as the unit sell price minus the direct cost/unit.

Combining cost behavior with break-evens is also a critical component in financial analysis. Knowing the results of a break-even when a certain type of cost increases or decreases, can be beneficial to a manager (Warren et al., 2011). Table 1 demonstrates the relationship and direction of change to a break-even depending on the direction of a change to a type of cost and selling price.

Table 1. Effects of change in cost and selling price on break-even

Types of Change	Direction of Change	Effect on Break-Even
Indirect Cost	Increase	Increase
	Decrease	Decrease
Direct Cost	Increase	Increase
	Decrease	Decrease
Selling Price	Increase	Decrease
	Decrease	Increase

(Adapted from Warren et al., 2011)

Break-evens can also be used to establish the number of units that need to be sold to attain target profits. This can be accomplished by modifying the break-even equation to include the target profit. The equation now indicates the total indirect cost plus the target profit is divided by the contribution margin.

Using Break-Even Charts. To help understand the relationship between sales, cost and operating profit and loss, charts are commonly used. This gives a visual assessment to those relationships and can display their complexities in a simple form (Warren et al., 2011). Figure 1 exhibits a break-even chart that displays the number of units sold where total cost equal total revenue from sales. This break-even was calculated from total indirect cost, unit direct cost and unit selling price.

Figure 2 is an example of a profit-volume chart that also may be used to express break-evens. Using the same calculations as the above chart, from the same total indirect cost, unit direct cost and unit selling price, a profit-volume chart is derived. Setting the break-even at zero on the y-axis, a profit-volume chart displays the net profit or loss amount in correlation to units sold.

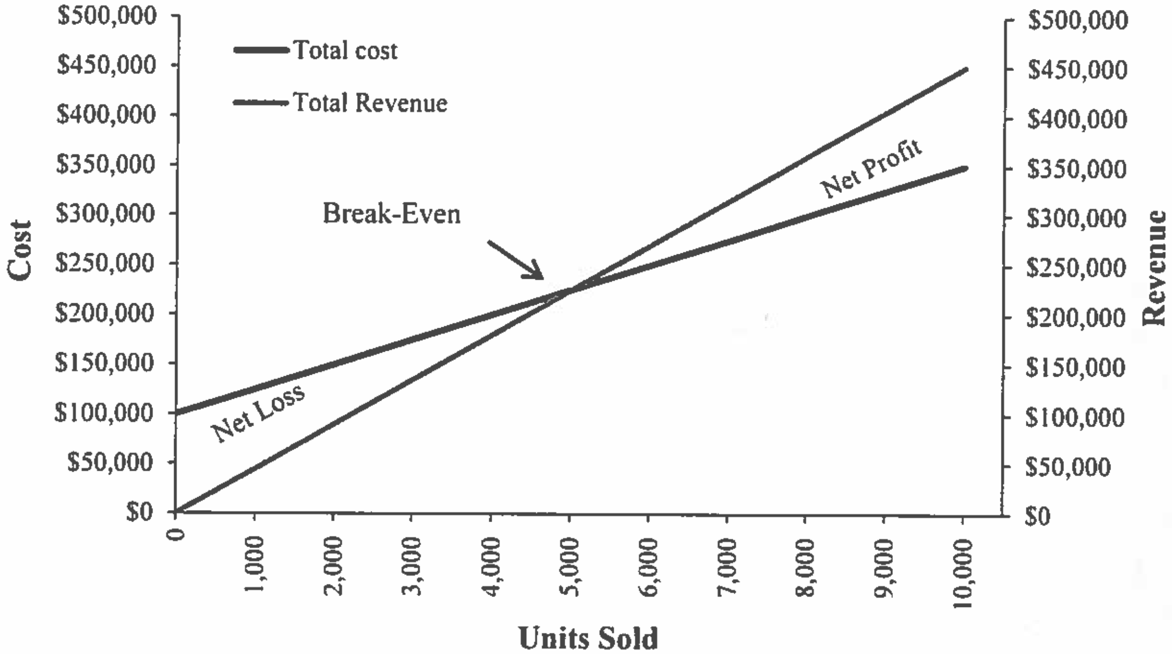

Figure 1. Demonstrates the number of units needed to be sold to achieve break-even (Adapted from Warren et al., 2011)

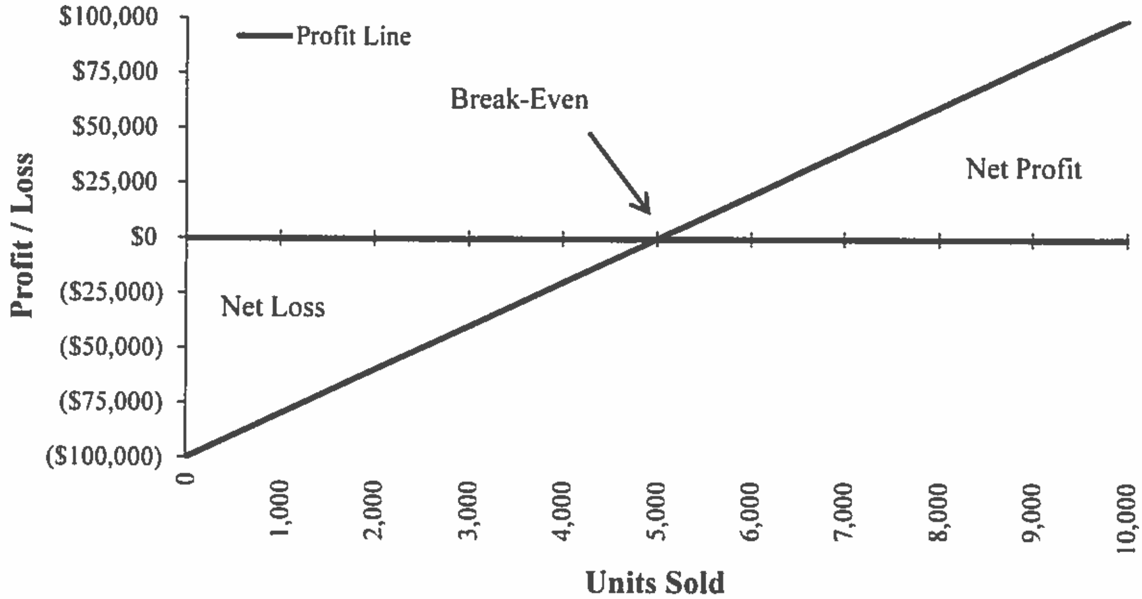

Figure 2. The profit volume exhibits the relationship between units sold and profit/loss

Accounting Systems

Accounting systems have two distinct methods in which transactions are recorded, cash or accrual. While both methods are used, they are used independently of one another. Each method has its advantages and disadvantages; however, the choice to use one or the other has limitations due to regulation of allowance by regulatory authorities.

Cash verses Accrual Accounting. Cash accounting or cash basis accounting, is based on cash flow and recognizes revenues when cash is received and records expenses when cash is paid (Larson, 2005). This is accounting method in the simplest form. Cash accounting is simple because transactions match up with the cash flow. Managers can maintain a clear understanding of a company's cash position. However, it may offer a misleading picture of profitability, because of the time lag between cash transactions and services rendered.

Accrual accounting or accrual basis accounting is based on transaction timing, as opposed to when the cash is transferred. The accrual method shows the flow of business income and debts more accurately, but it may be misleading to a cash position. Accrual accounting is more complex due to recording the flow of funds that have not yet been transferred. This method also complicates the adjusting entry period. However, because of the ability to illustrate a more accurate cost of production, the accrual method is highly recommended for more complex businesses.

Financial verses Managerial Accounting. The purpose of accounting is to provide quantitative financial information about economic entities useful for making sound economic decisions (Albrecht et al., 2002). Accounting also records, summarizes, and reports the transactions of a business to provide an accurate picture of financial position and performance. The two types of accounting systems are financial and managerial.

Financial accounting is mainly concerned with external reporting, providing financial information to outside parties such as investors, creditors, and governments (Warren et al., 2011). To protect those outside parties from being misled and to keep uniformity in financial statements, financial accounting is governed by Generally Accepted Accounting Principles (GAAP; Siegel and Shim, 2006). Because financial accounting is restricted to GAAP's guidelines, managers are constrained to customize their company's accounting system to provide specific information. The necessity to customize the accounting system led to the development of managerial accounting.

Managerial accounting is described by Solomon (2004) as "the process of collecting, measuring, processing, and communicating both quantitative and qualitative information for the internal use of management in planning and controlling activities." Managerial accounting measures and reports information only for internal use, so GAAP governance does not apply. Although managerial accounting uses the same financial statements and the same accounting principles as financial accounting, the flexibility to customize record-keeping plus analyzation is pervasive (Siegel and Shim, 2006; Larson et al., 2005).

The time and detail an organization wants to invest into their accounting system, beyond legal requirement, is purely up to them. However, as with most aspects of business, greater input equals greater output. This principle also applies to accounting systems. Accrual managerial accounting requires more time, and possibly more costs with an opportunity for greater benefit. The benefits from having an accurate understanding of how a business performed, is performing, or potentially will perform as well as the current financial position is likely worth the additional cost and effort. The knowledge derived from precise and accurate accounting combined with the intellect and ability to read cost behaviors will give managers a competitive advantage in business.

STOCKING RATES

Determining Stocking Rates

"As each animal grazes, it reduces available herbage both in quantity and in quality, thereby changing the habitat for itself and altering its future response" (Heady, 1975). Heady (1975) and Hanselka et al. (2010) agree that controlling animal numbers is one of the most important tools available to the rangeland manager. Grazing pressure is a driving factor controlling species composition and forage production, therefore the effect of grazing decisions over time has a tremendous impact on rangeland health. Maintaining healthy rangeland is a combination of art and science. Plant and ecosystem response to grazing is based on science, but applying science to achieve objectives is an art (Hanselka et al., 2010). The ultimate objective is matching a long term sustainable carrying capacity with a stocking rate that achieves the highest economical return. To attain this objective, carrying capacity and stocking rate must first be defined. Hanselka et al. (2010) defines carrying capacity as "the optimum number of animals units an area can sustain over time." Stocking rate is defined as "the actual number of animals on a given amount of land over a certain period of time (Redfearn and Bidwel, 2000)." To obtain a recommended stocking rate, the carrying capacity must first be established. The two primary factors that influence carrying capacity are herbage production and intake demand. Herbage production is determined by forage type and species, soil type, annual rainfall, and grazeable acres. Intake demand is primarily determined by the class of animal.

Forage Type. The types of forage in an ecological site largely dictate the amount of forage that will be produced. Forages, as a group, are made up of many different types of plants including grasses, legumes, forbs, and shrubs. The different groups into which grasses can be categorized are: 1) annual or perennial life cycles; 2) tall or short statures; 3) jointed or non-jointed regrowth mechanisms; 4) sod or bunch growth habits; 5) warm or cool-season responses to climates; and 6) requirements or no requirements for vernalization (Hannaway, 2008). Because a cow's diet can consist of other herbaceous species, measuring the forbs and shrubs is a consideration when calculating stocking rates. Identifying forage types assures the stocking rate is calculated on selected palatable forage.

Soil Type. Ogle and Brazee (2009) suggest the texture, depth and fertility of the soil is another critical component to forage production. Herren (2007) claims the physical properties or characteristics of the soil determine soil productivity. The speed of water penetration, water retention, root penetration, and the aeration of the soil are all influenced by the physical characteristics of the soil. These characteristics of texture, structure and consistency determine the kind and amount of forage produced and the type of management that is possible. Soils are composed of sand, silt, and clay. The physical characteristic and classification of the soil is defined by the percent mixture of the three components (Herren, 2007). The chemical and physical characteristics of a soil determine the ability to furnish plant nutrients, the rate and depth of water penetration, and the amount of water the soil can hold as well as the availability to plants. Fine-textured soils, especially without plant or residue cover, tend to reduce water infiltration. Coarse-textured soils may have high infiltration rates but dry-to-deeper depths than do the fine-textured soils. The desired soil has a perfect mixture of sand, silt and clay allowing the plant to receive all available water and nutrients. However, the exact combination of the components that is optimal for plant growth varies between plant types.

Soil pH also affects the types, concentrations, and activities of soil microorganisms. Soil microbes play critically important roles in the recycling of soil nutrients through mineralization of organic matter and nitrogen fixation (Redmon and McFarland, 2013). As the soil pH decreases the microbial population also decreases and creating an unhealthy environment for plant life.

Annual Rainfall. Rainfall is one of the most important determinants of forage production. However, the complexity of variables related with rainfall makes it impossible to predict an exact correlation between annual rainfall and forage production. This complexity creates an accepted practice of using average annual rainfall as a comparison. Because of the variation in annual rainfall, relying on average rainfall as a benchmark has proven to be risky and deceptive. For example, one big rain over a short period of time can increase total rainfall for the year with minimal effect on soil moisture and forage production (Lyons and Machen, 2001).

Grazeable Acres. Several factors play a significant role in determining grazeable acres, including brush density, slope, rock cover, water, forage, and accessibility (Hohlt et al., 2009). Hohlt et al. (2009) also referenced the brush density scoring system, Grazing Land Stewardship, where 1 represents no trees or brush and 5 represents brush so thick that mobility through it is nearly impossible. Hohlt et al. (2009) found that only 25% of areas with a brush density score of 3 were visited by cattle, and that cattle completely avoided areas with scores of 4 or 5. Ground displaying 30% or more of rock cover has been found to discourage grazing (Hanselka et al., 2010). Slope has an inverse relationship with grazeable acres. As the percent of the slope increases, the percent of grazeable acres decreases (Table 2).

George and Lile (2009) and Hohlt et al. (2009) agree that the distance from water plays a significant role in determining grazeable acres. Research using fitted collars with global positioning system devices that recorded the cattle's location every five minutes found that 73% of the cow locations were within a 1-mile radius of water (Hohlt et al. 2009). Additional findings from George and Lile (2009) show the relationship between the percent of useable land related to distance from water (Table 3). As the distance from water increases the grazing capacity decreases.

Table 2. The affect increasing land slope on percent utilization

% Slope	**% Reduction in Utilization**
0-10	0
10-30	30
31-60	60
>60	100

(Adapted from Hohlt et al., 2009)

Forage type, as it pertains to cow selectivity, is another consideration when calculating grazeable acres. Identifying palatable forages aids in knowing which areas cattle will avoid. Cattle will not graze areas with heavy concentrations of certain plants (George and Lile, 2009). In addition, some areas may have all of the desired traits for a grazing animal, but remain ungrazed, due to accessibility. If the area is inaccessible or difficult to access, it is deemed ungrazeable. Once a manager determines the factors that make land ungrazeable, he/she can decide if improving the land to be grazeable is worth the additional inputs. Most importantly, by knowing the total acres of ungrazeable land, the proper stocking rate can be calculated. The formula is simply total acreage less ungrazeable acres equal total grazeable acres.

Table 3. Effect of distance from water on grazing capacity

Miles from Water	% Reduction in Grazing Capacity
0-1	0
1-2	50
>2	100

(Adapted From George & Lile, 2009)

Calculating Stocking Rates

Calculating stocking rate requires estimation of forage supply and forage demand. To better understand how much forage will be harvested, diet selection and Animal Unit (AU) must be determined.

Diet Selection. A cow's dietary intake can be categorized into grasses, forbs, and browse. The majority of a cow's diet is grass; however, the percentage of intake changes according to the season (Hanselka et al., 2010). The annual percentage of a cow's diet between grass, forbs, and browse differs dramatically from region to region. Vallentine (1990) compiled fourteen studies from seven different states including, Arizona, California, Colorado, Louisiana, New Mexico, Texas, and Wyoming, and found that the annual percent of grass in a cow's diet ranged from 48% to 93%, with a mean of 70%. Everitt et al. (1981) found in Hidalgo County of south Texas that a cow's diet consisted of 73% grass.

Animal Units. Animal Unit (AU) is a standardized system established to project how much forage a cow or a class of cattle will harvest. An AU is defined as the amount of forage required to maintain a 1,000-pound cow with a calf (Thorne et al., 2007). The most widely accepted studies have established an AU requires an average 2.6% of the body weight or 26 pounds/day (1,000 x 0.26 = 26 lbs./day) of dry forage. Because all cattle are not the same, varying in requirements and forage demand, an Animal Unit Equivalent (AUE) is used (Pratt and

Rasmussen, 2001). Managers can use AUE to assist them in determining stocking rates. For example, a yearling steer weighing 600 pounds has an AUE of 0.6 (60% of an AU), or a cow that weighs 1,200 pounds has an AUE of 1.2 (120% of an AU; Ogle and Brazee, 2009). This allows standardization in forage consumption estimation and clarity of communication.

Conclusion

Developing a comprehensive managerial accounting system combined with understanding cost classifications, cost behavior, and the skills to calculate break-evens, allows for a valuable scenario analyses to be performed. Determining the long term carrying capacity and calculating the financial outcome of the various stocking rates for a carrying capacity is a complex and difficult process, but can be achieved with the recognition that production systems must be adaptable to a dynamic environment.

MATERIALS AND METHODS

Study Site

The EWF encompasses over 215,000 acres of native rangeland in south Texas and is comprised of six separate units in four counties. Headquarters for the ranch is located approximately 30 miles southwest of Hebbronville, Texas on the historical San Antonio Viejo ranch (148,980 acres) in Jim Hogg and Starr counties. The other divisions are: El Sauz (27,143 acres; Willacy and Kenedy counties); Santa Rosa (18,643 acres; Kenedy county); Buena Vista (15,106 acres; Jim Hogg county); Ranchito (5,218 acres; Jim Hogg county); and Gachupin (640 acres; Jim Hogg county). The six divisions embody four ecoregions, with the majority of the acreage in the Costal Sand Plain and Texas-Tamaulipan Thornscrub Ecoregions. The Lower Rio Grande Valley, Laguna Madre Barrier Islands and Coastal Marshes Ecoregions contain the remaining portion of the total acres. Soils on 200,000 acres of the ranch are classified in the complex of Sarita, Hebbronville, Randado, Delmita, Willamar, Mustang, and Zapata. The remaining 15,000 acres are spread over another six different soil complex types. Although relatively flat, the ranch's elevation ranges from sea level to 748 ft.

The EWF was founded in 2007 at the bequest of Robert Claude East to promote wildlife conservation, livestock management, ranching heritage, and private land stewardship. The mission statement reads, "The mission of the East Wildlife Foundation is to support wildlife conservation and other public benefits of ranching and private land stewardship. Our mission is achieved through research, education and outreach."

Calculating a Stocking Rate

Rainfall Data. Historical annual rainfall totals were obtained from the National Oceanic Atmosphere Administration (NOAA) station in Hebbronville, TX. There were 84 complete records out of 106 years between 1908 to 2011. Annual rainfall data was evaluated for normality using the skewedness function in Excel. Since rainfall data was determined to be skewed, annual rainfall totals were categorized into 5-inch groupings from zero to 45 inches. In addition, mean, median and mode of the rainfall data were calculated. In the interest of identifying appropriate stocking levels for drier years, the lowest ten and 20 percentile years were considered bench marks for establishing long-term stocking level.

Forage Production. Forage production data were collected from the Caesar Kleberg Wildlife Research Institute (Hines, unpublished; CKWRI data) and from the Texas A&M University Institute of Renewable Natural Resources (TAMU-IRNR). The CKWRI data included dry weights for grass and forb clippings from 300 enclosed plots on six study sites covering 6,178 acres. Data were recorded during 2012 and 2013 on four of the six EWF units (San Antonio Viejo, El Sauz, Santa Rosa, and Buena Vista). Forage clippings were collected in late fall after the growing season to ensure total growth was captured, and converted to lb/acre. The CKWRI data include precipitation records collected from the Texas A&M Agrilife Research Crop Weather Program (CWP) weather stations within a few miles of each study site.

To estimate forage production potential across all EWF ranchland, data was obtained from the TAMU-IRNR. The TAMU-IRNR data provide potential forage production range estimates by soil type. The average of the TAMU-IRNR soil type ranges were calculated and combined with USDA-NRCS soil maps to calculate total forage production potential by EWF unit. Total forage production potential was only used as a point of comparison against CKWRI data forage production for 2012 and 2013. Conveniently, the CKWRI data from 2012 and 2013 were very similar to the 10% and 20% rainfall years. Therefore, these empirical values were used to calculate forage production across the 200,000 acres of grazeable EWF land.

Determining Animal Units. Total available grass calculated from the CKWRI study was used to estimate average grass production (lbs /acre) across EWF ranchland. To account for brush canopy, 30% (Dr. Poncho Ortega, Jr. personal communications) of 200,000 acres was excluded. The remaining 140,000 acres was multiplied by average grass production determined in the CKWRI study. Once total available grass was established, it was divided by predicted annual grass intake/AU. Total forage intake/AU was assumed to consume 9,490 lbs dry forage annually, based on 1,000-pound cow consuming 2.6% of body weight daily for 365-day period (Redfearn and Bidwell, 2000). However, annual grass intake/AU was assumed to be 6,928 because the forage diet was assumed to be comprised of 73% grass (Everitt, 1981). Total available grass was divided by 6,928 lbs grass/AU to calculate total AU for the ranch.

Projecting a Break-Even

Determining Revenue and Cost. A projected cash flow budget from EWF's current fiscal period was the source of all cost data. Revenue was determined by multiplying production numbers and current prices. Current cattle market prices were collected from local livestock auction reports and Superior Livestock Auction video sales report.

Design and Structure of Excel Model. To accurately project a break-even and a financial outcome for different stocking rates, a Microsoft Excel model was constructed. The goal of the dynamic model was to generate an income statement for each stocking rate that included cattle inventory, revenue, and expenses. Direct costs were assigned per head and changed in relation to inventory. Indirect costs were allocated/AU, meaning the total indirect cost does not change, but the cost/head changes as inventory changes. Categorizing costs in combination with revenue from production is the basis of the projected income statement. The model included seven worksheets: 1) AU's; 2) Cow Calf Production; 3) Yearling Production; 4) Cow Calf Direct Cost; 5) Bull Direct Cost; 6) Replacement Heifer Direct Cost; and 7) Yearling Direct Cost.

The AU's worksheet converted the cattle inventory to an adjusted total AU's using an Animal Unit Equivalent (AUE) and percent of year grazed. The adjusted total AU's was used to allocate indirect cost on the income statement. The cow calf production and yearling production worksheet generate the revenue for the income statement. These worksheets include input assumptions for determining production and prices. A complete list of assumptions used in the Excel model is available in Appendix A.

The direct cost worksheet displays the input assumptions for any direct costs that are associated with a specific classification of animal. These are: 1) breeding; 2) depreciation; 3) freight; 4) hay; 5) mineral; 6) pasture; 7) protein; and 8) veterinary and medical. Taken together, these categories comprise the total direct cost that is transferred to the income statement.

Current inventory, production and costs were entered into the Excel model to output total revenue, total direct cost, and total indirect cost. Each variable was divided by the number of current cows to calculate revenue/cow, direct cost/cow, and indirect cost/cow. These measures were multiplied by the number of projected cows from 2,000 to 8,000 at 1,000-head increments.

Primary model outputs aided in determining stocking level for harvesting no more than 25% of grass during drought; and aided in estimating a stocking rate for EWF ranches which minimizes liquidation risk with typical variation in forage production. The arrangement of costs into direct and indirect costs/cow, enabled a model projection of total cost and revenue from 2,000 to 8,000 cows, and a break-even stocking level determination.

RESULTS AND DISCUSSION

Stocking Rate

Estimating Rainfall. Figure 3 shows rainfall data from NOAA at a weather station in Hebbronville, TX, with horizontal lines indicating the bottom 10th, 20th, and 50th percentiles. The lowest annual rainfall was in 2011 (9.8 inches), and the highest in 1995 (42.7 inches). The median annual rainfall across all years was 21.2 inches. Annual rainfall for the lowest 20 percentile was less than 15.1 inches. There were two occasions between 1908 and 2011 when consecutive years rainfall were in the lowest 20 percentile. Alternatively, when the lowest 10 percentile years (less than 13.3 inches) were evaluated, there were no consecutive years in this category. Thus, precipitation for the lowest 10 percentile years was used to estimate forage production.

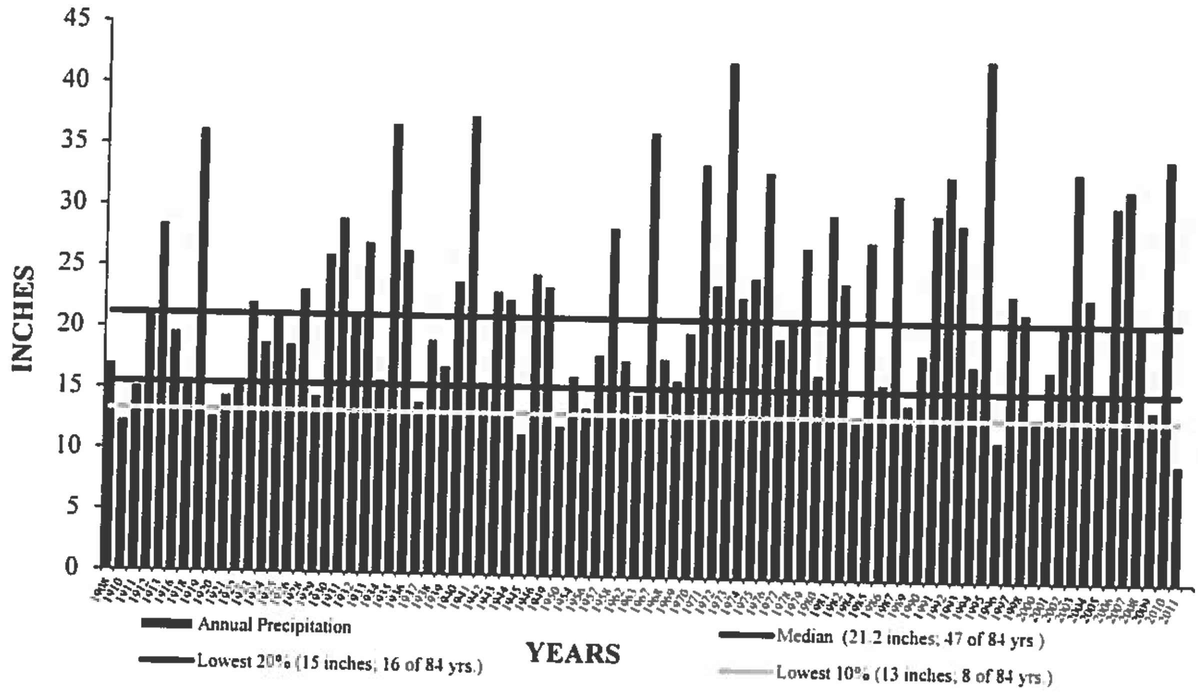

Figure 3. Historical annual rainfall at the NOAA Hebbronville, TX site

Historical rainfall data was grouped (i.e., 5-inch increments) based [redacted] total (Figure 4). The greatest frequency (29%) occurred between 15 and 20 inches. The chart demonstrates that the annual rainfall data for this location is skewed toward lower rainfall years. Together, these consecutive precipitation graphs (Figure 3 and 4) assist in understanding historical patterns and enable an evaluation of precipitation in a manner that helps interpret low precipitation risk to forage production.

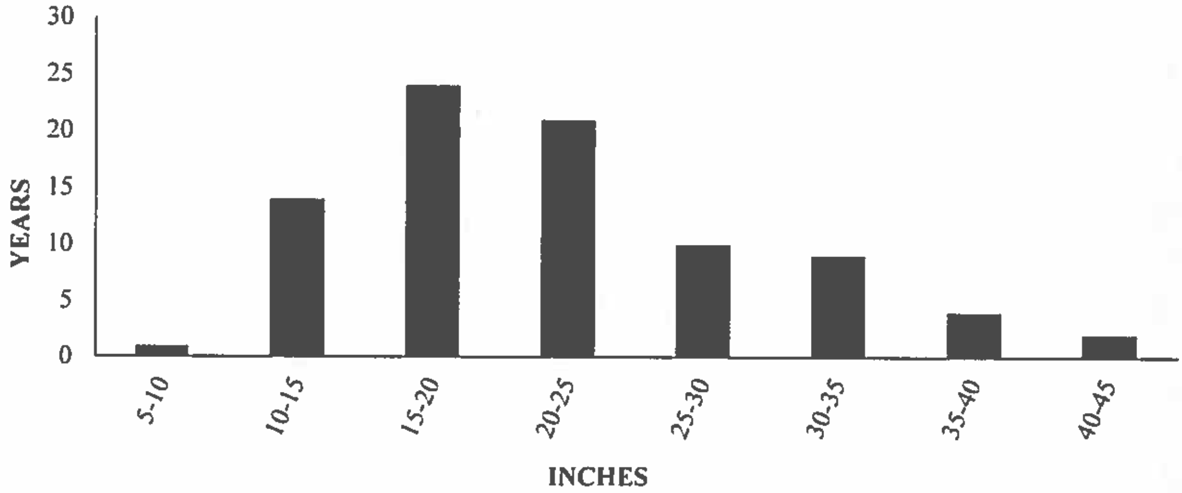

Figure 4. Eighty-four year frequency distribution by precipitation category at the NOAA's Hebbronville, TX weather station

Estimating Forage. Forage production data from the 2012 CKWRI data found that an average of 538 pounds of grass/acre was produced when annual rainfall was 13 inches (Table 4). This average forage production amount occurred within the lowest 10 percentile of rainfall years (<13.3 inches) and provided valuable empirical data for determining stocking rate during a severely dry year.

Table 4. Averaged grass production related to rainfall from 300 plots at six different study sites covering 6,178 acres

Site	Grass (lbs./acre)	Rainfall (in)
Buena Vista	138	10
East El Sauz	783	13
Santa Rosa	352	12
SAV 1	740	14
SAV 2	207	14
SAV 3	1,010	15
Average	**538**	**13**

(Adapted from unpublished CKWRI data, 2012)

Since 1911, every year prior to a lowest 10 percentile year was above average. In this study, stocking rate was calculated using a 25 percent utilization of grasses in the lowest 10 percentile years. However, actual utilization might be less due to residual forage from above average rainfall the previous year. This increases the conservative nature of these findings since the precipitation basis used to estimate forage production and a corresponding stocking rate is already extremely conservative over the long-term.

Average potential forage production was calculated from NRCS data for each division based on soil types (Table 5). The estimated EWF ranch average forage production/acre was 2,951 lbs. The forage production estimate of 538 lbs./acre from the 2012 CKWRI data is only 18% of projected average forage production, and is a therefore a highly conservative estimate that will likely result in a low risk long-term stocking rate.

Table 5. Estimated average forage across EWF ranch divisions based on soil type

	Acres	Lbs. / Acre	Lbs. of Forage
San Antonio Viejo	148,979	3,081	459,073,500
Buena Vista	15,107	3,147	47,540,500
Ranchito	5,218	3,392	17,700,000
Gachupin	640	3,428	2,194,000
Santa Rosa	18,644	3,420	63,770,000
El Sauz	27,143	1,704	46,246,500
Ranch Total	215,731	**2,951**	636,524,500

Grass production of 538 lbs./acre was multiplied by the desired grass utilization rate of 25 percent, yielding the grass available for grazing. When calculating the total amount of grass available on the ranch, total acres (200,000 acres) was multiplied by the percent of grazeable acres (70%; Dr. Poncho Ortega Jr, personal communication), and then multiplied by pounds of available grass/acre. Once the total available grass on the ranch (37,660,000 lbs.) was established, it was divided by 18.9, the assumed AU daily intake of grass dry matter (Everitt et al., 1981; Redfearn and Bidwell, 2000), and then again divided by 365 days. This series of calculations yielded a total of 2,718 AU's, which is a stocking rate with a low risk of livestock liquidation during drought at the EWF. This stocking level equates to 74 acres/AU (Table 6).

Table 6. Calculated available AU's at the desired grass utilization[a]

	Estimate
Average grass production during drought (lbs./acre)[b]	538
Utilization percent	25%
Available grass (lbs./acre)	135
Percent grazeable acres	70%
Grazeable acres	140,000
Total available grass (lbs.)	18,830,000
Total animal units during drought	2,718
Acre/AU	74

[a] Based on 200,000 total acres
[b] CKWRI production data for 2012

The calculated AU's were based on utilization of grasses instead of utilization of total forage. To improve accuracy when calculating AU's, a diet of 73% grass (Everitt et al., 1981) was assumed with the remaining 27 percent of the 26 lb/day diet comprised of forbs and browse. Based on the desired current production system that included retention of all weaned calves for seven months post weaning (Gilly Riojas; personal communication), 2,718 AU would be totaled from 1,720 brood cows, with the associated 86 bulls, 258 replacement heifers and 1,010 weaned calves retained. However, if the production system allowed for liquidation or opting out of retained ownership of calves, the same amount of grass would be consumed by 1,976 brood cows, 99 bulls, and 296 replacement heifers. Furthermore, if both retained calves and replacement heifers were deemed flexible AU that could be sold or removed from pastures about 10% of the time in response to drought, then the number of brood cows and bulls comprising 2,718 AU would be 2,115 and 106, respectively (Table 7). The practical target number of AU for EWF to maintain is greater than 2,718, but higher numbers will necessitate destocking during severely dry years.

Table 7. Three cattle inventory alternatives for achieving 2,718 animal units

Cows	Bulls	Repl. Heifers	Retained Calves
1,720[a]	86	258	1,010
1,976	99	296	0
2,115	106	0	0

[a] Current management system including calf retention

Projected Financial Outcomes

Break-even. Figure 5 illustrates constant indirect cost and increasing direct cost, total cost, and revenue from 2,000 to 8,000 cows under the current management system. The model projected breakeven occurs at 3,550 cows where total cost and revenue intersect. Five key production assumptions in the model were: 1) 75% weaning rate; 2) 450 lb. and 425 lb. weaned steers and heifers, respectively; 3) 1.0-lb stocker average daily gain for 210 days; 4) 15% replacement heifers retained; and 5) all weaned calves retained and sold after seven months on pasture with a yearling average sale weight of 651 lbs. The assumed market value for sold yearlings was $160/cwt for a total of $1,041/head. Also a 2% death loss was assumed on the yearling cattle. The financial outcomes were highly sensitive to a number of these production and pricing assumptions. Sensitivity analyses were performed on variables which had the most significant impact on net income.

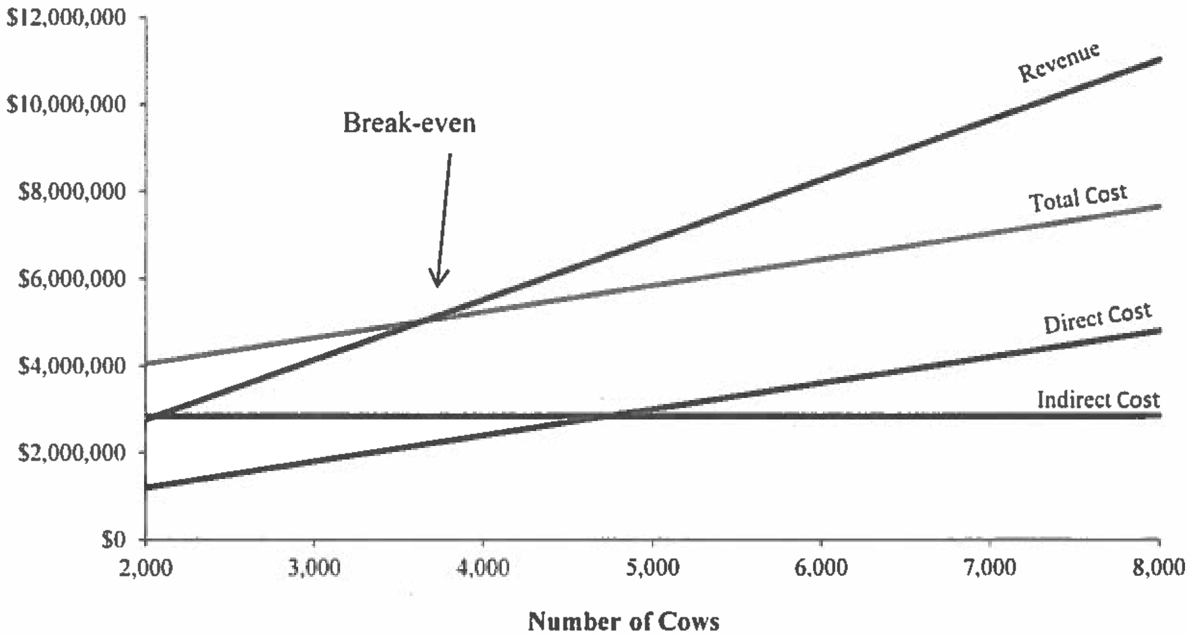

Figure 5. Projected break-even and associated revenue and costs from 2,000 to 8,000 cows

Sensitivity of Financial Variables

Revenue. A sensitivity analyses using current financials and cattle inventory (6486 AU) was performed on the impact of calf crop and yearling value on net income (See all sensitivity analyses in Appendix B). The two variables affecting net income the most were calf crop and yearling value. For every percentage unit increase in calf crop, net income rose by $40,395 (Table 8).

Table 8. Effect of change in calf crop on net income

Calf Crop	Net Income
90%	$ 992,588
85%	$ 790,613
80%	$ 588,637
75%[a]	$ 386,662
70%	$ 184,687
65%	$ (17,289)
60%	$ (219,264)

[a] Model uses 75% as the baseline

The value of a yearling stocker is a function of both weight and price. Regardless of which variable causes change in yearling sale value, net income changes by $24,973 for every 1% change in yearling value (Table 9).

Table 9. Effect of change in yearling value on net income

% Change in Yearling Value	Value ($/head)	Net Income
30%	$ 1,353	$ 1,135,851
20%	$ 1,249	$ 886,121
10%	$ 1,145	$ 636,392
0%[a]	$ 1,041[a]	$ 386,662
-10%	$ 937	$ 136,932
-20%	$ 833	$ (112,797)
-30%	$ 729	$ (362,527)

[a] Model uses an average of $1,041/head for yearling value; 651 lbs. @ $160.00/cwt.

Expenses. Sensitivity analyses were also performed on cost variables to evaluate their impact on net income. The two largest expenses were salaries and benefits and grazing lease, which are both indirect cost. The outcome revealed a $9,209 change in net income resulting from a 1% change in salary and benefits expense (Table 10). Similarly, for every 1% increase in grazing lease expense, net income increased by $7,516 (Table 11).

Table 10. Effect of change in salary and benefit expense on net income

% Change in Salary and Benefits Expense	Net Income
30%	$ 110,386
20%	$ 202,478
10%	$ 294,569
0%	$ 386,661
-10%	$ 478,753
-20%	$ 570,844
-30%	$ 662,936

With the stocking rate set on forage production at the lowest 10 percentile, additional forage is produced the majority of the time. Taking advantage of these opportunities may assist in long term financial success. A "what-if" analysis was performed to generate possible financial outcomes for purchasing stocker yearlings during years when forage supply supports additional AUs. Results show that for every 500 additional yearlings purchased, net income increases by $37,780 (Table 12).

Table 11. Effect of change in grazing lease expense on net income

% Change in Grazing Lease Expense	Net Income
30%	$ 161,164
20%	$ 236,330
10%	$ 311,495
0%	$ 386,661
-10%	$ 461,826
-20%	$ 536,992
-30%	$ 612,157

Table 11. Effect of purchasing additional yearlings on net income

Number of Purchased Yearlings	Net Income
0	$ 386,661
500	$ 424,441
1,000	$ 462,221
1,500	$ 500,001
2,000	$ 537,781
2,500	$ 575,561
3,000	$ 613,341
3,500	$ 651,121
4,000	$ 688,901
4,500	$ 726,681
5,000	$ 764,461

RECOMMENDATION

It is recommended that EWF consider 2,718 animal units as an appropriate stocking rate for severe drought similar to 2011 through 2012. Under the current management system, this equates to approximately 1,720 brood cows with associated bulls, heifers and retained calves. However, current projections indicate break-even will be achieved at approximately 3,500 brood cows. The difference in appropriate stocking rate during drought and breakeven presents a common challenge for management. Given that the vast majority of years in a given decade will likely far exceed forage production levels during severe drought, it is reasonable for EWF to maintain more animal units than 2,718 with the expectation of destocking to some degree during drier years. Such destocking risk is a normal component of ranch management. A target of 3,500 cows may be reasonable long-term to allow profitable production most years when additional stockers are purchased, while sustaining or improving rangeland health. However, maintaining 3,500 cows will most likely require animal unit reductions at times. Through excellent ranch management, the capacity of the land to maintain a higher stocking rate of EWF will likely increase over time. These recommendations are made with the understanding that true range management is a balancing act between science and art. As science guides management the art allows for the flexibility that is necessary in a highly variable environment.

LITERATURE CITED

Albrecht, S. W., J. D. Stice, E. E. Stice, K. F. Skousen, and M. R Swain. 2002. *Accounting Concepts And Applications*. Cincinnati, OH. South-Western College Publishing.

Collier, P. M. 2009. *Accounting for Managers*. (3rd ed.) John Wiley & Sons Ltd, West Sussex, England.

Dyckman, T. R., C. J. Davis, , and R. E. Dukes. 2001. *Intermediate Accounting*. New York, NY McGraw-Hill/Irwin.

Everitt, J. H., C. L. Gonzalez, G.Scott, and B.E. Dahl. 1981 Seasonal Food Preferences of Cattle on Native Range in the South Texas Plains. Journal of Range Management. 34(5):384-388

George, M., and D. Lile. 2009. Stocking Rate and Carrying Capacity. Ecololgy and Management of Grazing: An Online Course. http://www.plantsciences.ucdavis.edu/gmcourse . Accessed March 4, 2014.

Goodrich, R. 2013. Direct Costs vs. Indirect Costs: What is the Difference? Business News Daily. http://www.businessnewsdaily.com/5498-direct-cost-indirect-costs.html. Accessed Feb. 19, 2014.

Hannaway, D. 2008. National Forage & Grasslands Curriculum: Discuss the Basics of Grass Growth.http://forages.oregonstate.edu/nfgc/eo/onlineforagecurriculum/instructormaterials /availabletopics/management/growth. Accessed on March. 3, 2014

Hanselka, W., R. Lyons, and M. Mosely. 2010. *Grazing Land Stewardship: A Manual for Texas Landowners*. AgriLife Extension Texas A&M System.

Heady, H.F. 1975. *Rangeland Management*. New York, NY. McGraw-Hill, Inc.

Herren, R.V. 2007. *The Science of Agriculture: A Biological Approach* (3rd ed.) Clifton Park, NY. Thomson Delmar Learning.

Hohlt, J. C., R. K. Lyons, C. W. Hanselka, and D. McKown. 2009. Estimating Grazeable Acreage for Cattle. http : / /hdl .handle .net /1969 .1 /87615. Accessed on February 19, 2014

Larson, K. D., J. J. Wild, and B. Chiappeta. 2005. *Fundamental Accounting Principles* (17th ed.) New York, NY. McGraw-Hill/Irwin.

Lyons, R.K., and R. Machen. 2001. Stocking Rate: The Key Grazing Management Decision, Texas Cooperative Extension.

Ogle, D., and B. Brazee. 2009. *Estimating Initial Stocking Rates*. Boise, ID. USDA Natural Resources Conservation Service.

Pratt, J. 2006. *Financial Accounting In an Economic Context*. (6th ed.) Danvers, MA. John Wiley and Sons, Inc.

Pratt, M., and G. A. Rasmussen. 2001. Determining Your Stocking Rate. Utah State University Cooperative Extension.

Redfearn, D. D., and T. G. Bidwell. 2000. Stocking Rate: The Key to Successful Livestock Production. Oklahoma Cooperative Extension Service.

Redmon, L. A., and M. L. McFarland. 2013. Soil pH and Forage Production. AgriLife Extension Texas A&M System.

Siegel, J. G., and J. K. Shim. 2006. *Accounting Handbook*. Hauppauge, NY. Barron's Educational Series, Inc.

Solomon, P. 2004. *Financial Accounting: A New Perspective*. New York, NY. McGraw-Hill/Irwin.

Spiceland, D. J., J. F. Sepe, and L. A. Tomassini. 2007. *Intermediate Accounting.* (4th ed.) New York, NY. McGraw-Hill/Irwin.

Thorne, M. S., and M. H. Stevenson. 2007. Stocking Rate: The Most Important Tool in the Toolbox. Cooperative Extension Service.

Vallentine, J. F. 1990. *Grazing Management.* San Diego, CA. Academic Press, Inc.

Warren, C. S., J. M. Reeve, and J. Duchac. 2011. *Financial & Managerial Accounting.* Mason, OH. Cengage Learning.

APPENDIX A

Assumptions Used in the Dynamic Excel Model

A-1 Assumptions used for parts of production and pricing, all values are changeable.

Cow Calf Production		
Mature Animals		
	Brood Cows	4,153
	Bulls	160
	Calf Crop	75%
	Replacement Heifer Pregnancy Rate	75%
	Death Rate of Brood Cows	0.5%
	Death Rate of Breeding Bulls	0.5%
Replacement Animals		
	Replacement Heifers	15%
	Bull Age of Replacement (yrs.)	6
Weights (Lbs.)		
	Weaning Wt. Steers	450
	Weaning Wt. Heifers	425
	Open Heifers	750
	Cull Cows	1,000
	Cull Bulls	1,300
Transfer Value (Price/cwt)		
	Weaned Steers	205.25
	Weaned Heifers	195.50
Revenue (Price/cwt)		
	Cull Cows sold	70.00
	Cull Bulls sold	85.00
Retained Calves		
	Average Daily Gain (lbs.)	1.0
	Number of Days	210
	Death Loss Rate	2%
	End Weight	651
	Sell Price (cwt)	$ 160.00

A-2. Assumptions used for animal weights in calculating animal units.

Class	AU
1,200-lb. Cows	1.2
1,700-lb. Bulls	1.7
600-lb. Yearlings	0.6

A-3. Assumptions used in determining a stocking rate

Grass utilization	25%
Percent grazeable acres	70%

A-4. Diet selection used in determining animal units

	Percent of Diet	Lbs.
Dry Mater Intake/AU		26
Grass intake	73%	19
Forbs & browse intake	27%	7

A-5. Assumptions used to calculate cow calf direct costs

Cow Calf Feed Cost						
	Price/ton	Daily Consumption as fed (Lbs.)	Days Fed	$/hd	# of hd	Total Cost
Hay	$ 150.00	15	0	$ -	4,153	$ -
Protein	$ 600.00	2	30	$ 18.00	4,153	$ 74,754
Mineral	$ 900.00	0.25	120	$ 13.50	4,153	$ 56,066
Total Feed Cost				**$ 31.50**		**$ 130,820**

Veterinary and Medicine Cow Direct Cost						
Vaccine	Price/dose/ ML	Amount Administered (Dose/ML)	# of Times Administered	$/hd	# of hd	Total Cost
Clostridials	$ 0.90	0	0	$ -	4,153	$ -
BRD's	$ 3.72	1	1	$ 3.72	4,153	$ 15,449
Antibiotic	$ 0.26	10	2	$ 5.20	10	$ 52
Vitamins				$ -		$ -
Dewormer	$ 0.10	25	1	$ 2.50	4,153	$ 10,382
Implants				$ -		$ -
Veterinarian						$ -
Total Vet & Meds Cost				**$ 6.23**		**$ 25,883**

Veterinary and Medicine Calf Direct Cost						
Vaccine	Price/dose /ML	Amount Administered (Dose/ML)	# of Times Administered	$/hd	# of hd	Total Cost
Clostridials	$ 0.90	0	1	$ -	3,099	$ -
BRD's	$ 3.72	1	1	$ 3.72	3,099	$ 528
Antibiotic	$ 0.26	10	2	$ 5.20	10	$ 52
Vitamins				$ -		$ -
Dewormer	$ 0.10	25	1	$ 2.50	3,099	$ 7,747
Implants				$ -		$ -
Veterinarian						$ -
Total Vet & Meds Cost				**$ 6.24**		**$ 19,328**

A-6. Assumptions used to calculate Bull direct costs

Bull Feed Cost Matrix

	Price/ton		Daily Consumption as fed (Lbs.)	Days Fed	$/hd		# of hd	Total Cost
Hay	$	150.00	15	0	$	-	160	$ -
Protein	$	600.00	2	30	$	18.00	160	$ 2,880
Mineral	$	900.00	0.25	120	$	13.50	160	$ 2,160
Total Feed Cost					**$**	**31.50**		**$ 5,040**

Bull Veterinary and Medicine Expense

Vaccine	Price/dose/ML		Amount Administered (Dose/ML)	# of Times Administered	$/hd		# of hd	Total Cost
Clostridials	$	0.90	0	1	$	-		$ -
BRD's	$	3.72	1	1	$	3.72	160	$ 595
Antibiotic	$	0.26	10	2	$	5.20	1	$ 5
Vitamins					$	-		$ -
Dewormer	$	0.10	10	1	$	1.00	160	$ 160
Implants					$	-		$ -
Veterinarian								$ -
Total Vet & Meds Cost					**$**	**4.75**		**$ 760**

Bull Depreciation Expense Matrix

Number of Purchased Bulls	Original Cost	Salvage Value	Years Dep.	Annual Dep. Expense	Total Annual Dep. Expense
27	$2,500	$1,000	5	**$ 300.00**	$ 8,100.00

A-7. Assumptions used to calculate Replacement Heifer direct costs.

Replacement Heifer Feed Direct Cost Matrix								
	Price/ton		Daily Consumption as fed (Lbs.)	Days Fed	$/hd		# of hd	Total Cost
Hay	$	100.00	15	20	$	15.00	623	$ 9,344
Protein	$	600.00	2	40	$	24.00	623	$ 14,951
Mineral	$	900.00	0.25	120	$	13.50	623	$ 8,410
Total Feed Cost					**$**	**52.50**		**$ 32,705**

Replacement Heifer Veterinary and Medicine Direct Cost Matrix									
Vaccine	Price/dose/ ML		Amount Administered (Dose/ML)	# of Times Administered	$/hd		# of Head	Total Cost	
Clostridials	$	0.90	1	1	$	0.90	623	$	560
BRD's	$	3.72	1	1	$	3.72	623	$	2,317
Antibiotic	$	0.26	10	2	$	5.20	10	$	52
Vitamins					$	-		$	-
Dewormer	$	0.10	25	1	$	2.50	623	$	1,557
Implants					$	-		$	-
Veterinarian					$	2.00	0	$	-
Total Vet & Meds Cost					**$**	**9.60**		**$**	**4,487**

A-8. Assumptions used to calculate Yearling Stockers direct costs.

Stocker Feed Direct Cost Matrix

	Price/ton	Daily Consumption as fed (Lbs.)	Days Fed	$/hd	# of hd	Total Cost
Hay	$ 100.00	15	10	$ 7.50	2,448	$ 18,362
Protein	$ 600.00	2	20	$ 12.00	2,448	$ 29,379
Mineral	$ 900.00	0.25	120	$ 13.50	2,448	$ 33,051
Total Feed Cost				**$ 33.00**		**$ 80,791**

Stocker Veterinary and Medicine Direct Cost Matrix

Vaccine	Price/dose /ML	Amount Administered (Dose/ML)	# of Times Administered	$/hd	# of hd	Total Cost
Clostridials	$ 0.90	1	1	$ 0.90	2,448	$ 2,203
BRD's	$ 3.72	1	1	$ 3.72	2,448	$ 9,107
Antibiotic	$ 0.26	1	2	$ 0.52	100	$ 52
Vitamins				$ -		$ -
Dewormer	$ 0.10	1	1	$ 0.10	2,448	$ 244
Implants				$ -		$ -
Veterinarian						$ -
Total Vet & Meds Cost				**$ 4.74**		**$ 11,607**

Stocker Freight Direct Cost Matrix

Miles Hauled	Cost/Mile	Cost/Load	# Animals/ Load	$/hd	Total # of Animals	Total Cost
50	$ 4.00	$ 200	100	$ 2.00	2,448	$ 4,896

APPENDIX B

Sensitivity Analyses Preformed

B-1. Sensitivity analysis of revenue, for every 10% change in revenue, net income changes by $57,265

Revenue Sensitivity Values		
% Change	Revenue	Net Income
30%	$ 7,444,428	$ 2,104,607
20%	$ 6,871,779	$ 1,531,959
10%	$ 6,299,131	$ 959,310
0%	$ 5,726,483	$ 386,662
-10%	$ 5,153,835	$ (185,986)
-20%	$ 4,581,186	$ (758,634)
-30%	$ 4,008,538	$ (1,331,283)

B-2. Sensitivity analysis of total expenses, for every 10% change in total expenses, net income changes by $53,398

Total Expenses Sensitivity Values		
% Change	Expenses	Net Income
30%	$ 6,941,767	$ (1,215,284)
20%	$ 6,407,785	$ (681,302)
10%	$ 5,873,803	$ (147,320)
0%	$ 5,339,821	$ 386,662
-10%	$ 4,805,839	$ 920,644
-20%	$ 4,271,857	$ 1,454,626
-30%	$ 3,737,875	$ 1,988,608

B-3. Sensitivity analysis of direct costs, for every 10% change in direct costs, net income changes by $24,950

Direct Cost Sensitivity Values		
% Change	Expenses	Net Income
30%	$ 3,243,531	$ (361,845)
20%	$ 2,994,029	$ (112,343)
10%	$ 2,744,526	$ 137,160
0%	$ 2,495,024	$ 386,662
-10%	$ 2,245,522	$ 636,164
-20%	$ 1,996,019	$ 885,667
-30%	$ 1,746,517	$ 1,135,169

B-4. Sensitivity analysis of indirect costs, for every 10% change in indirect cost, net income changes by $28,448

Indirect Cost Sensitivity Values		
% Change	Expenses	Net Income
30%	$ 3,698,236	$ (466,777)
20%	$ 3,413,756	$ (182,297)
10%	$ 3,129,277	$ 102,182
0%	$ 2,844,797	$ 386,662
-10%	$ 2,560,317	$ 671,142
-20%	$ 2,275,837	$ 955,621
-30%	$ 1,991,358	$ 1,240,101

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