Mapping the social landscape of grazing management in the Corn Belt: A review of research and stakeholder perceptions of the multifunctionality of Iowa grazing systems

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Mapping the social landscape of grazing management in the Corn Belt: A review of research and stakeholder perceptions of the multifunctionality of Iowa grazing systems

by

Mae Rose Petrehn

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Sustainable Agriculture

Program of Study Committee:
John C. Tyndall and J. Gordon Arbuckle Jr., Co-Chairs
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ABSTRACT

Agricultural systems that incorporate perennials in the form of grassland pasture have consistently been lauded for the balance of ecological and economic performance they provide, both at the farm and landscape level. The multiple functions grazing systems provide are being explored in increasing detail as ways to mitigate negative externalities associated with expanding commodity crop production. This thesis work provides two distinct contributions to the development of performance indicators within perennial systems that utilize grazing as a tool to provision multiple benefits. The first being a comprehensive review of literature, primarily research-based, pertaining to the grazing as a form of agricultural production, as well as its role as a tool to maintain ecological functionality in grasslands. This review, as Chapter 2, is designed to serve as an information hub regarding the resources for grazing systems in the context of Iowa’s farming landscape, and discusses possibilities for developing incentives for grazing management that provisions economic and ecological benefits.

The second endeavor explains the rationale for and outcomes of a case study based upon qualitative data relevant to an Iowa Bird Conservation Area in a working agricultural landscape. This exploratory research project provides a real world scenario for how stakeholders view the role of grazing systems in both conservation and production contexts. Chapter 3 provides an overview of this work, including factors that facilitate and inhibit the development of grazing systems that provision multiple benefits. Chapter 4 focuses on the preferred formats for communication and education regarding grazing systems that model a ‘balance’ of ecological and economic considerations. Results indicate livestock producers as well as natural resource professionals see key challenges to developing these systems as an issue of access to knowledge and venues to share knowledge appropriate for the specificity of grazing systems. Concomitantly, the Bird Conservation Area model was identified as holding much promise in terms of its flexibility and scale, in terms of targeting outreach and incentives to livestock producers and natural resource professionals who wish to form partnerships that manage grasslands for ‘beef and birds.’
CHAPTER 1: INTRODUCTION

In December of 2008, leaders in the cattle industry from seven counties sat down to talk with professionals from Iowa State University Extension, and the Iowa Beef Center (IBC). One of the most identified concerns related to the societal perception of beef production in Iowa. Participants felt ‘besieged’ by regulations, bad press and activists concerned about the environment, and expressed a need for more education of the public about cattle production today. Based on this, the IBC’s sees the necessity to partner with organizations that address these concerns, and work with them to provide research that evaluates the costs and benefits of alternative policies or market actions.

Conflicts surrounding livestock production, the scale at which it takes place, and the externalities of these types of production systems have continued to loom large in Iowa. Forages and pasturelands in Iowa were once relied upon for a substantial portion of a beef animals’ life cycle, as recently as the 1970’s and early 1980’s (Hinrichs and Welsh 2003). In addition to the livestock community, ecologists interested in provisioning habitat for wildlife and biodiversity increasingly view grazing as an integral part in the maintenance of perennial systems needed by these organisms. Environmental concerns such as water quality, habitat loss, and declines in biodiversity can all be addressed and potentially enhanced by grazing systems (Sanderson et al. 2004; Boody et al. 2005). Partnerships are emerging between the livestock community and the conservation community to address these needs, though the awareness of and broad support for these systems has been marginal in the Midwest to date (Jordan and Warner 2010). Under comparative conditions, perennial forage systems provide more ecosystem services than annual cropping systems, namely pastures with native warm-season grasses (Doll and Jackson 2009; Entz 2002). However, Iowa’s pastures are relatively low in diversity, with mostly introduced cool-season grasses (Sheaffer et al. 2009).

It is widely recognized that the fate of conserving and increasing biodiversity lies mostly in the management of privately held farmland, especially in Iowa’s highly altered landscape (Wiltshire et al. 2010; Rosenzweig 2003). Grazing by domestic livestock has historically been regarded as a general contradiction to conservation goals, dismissed as purely as an anthropogenic, or ‘unnatural’ practice (WallisDeVries 1998). Opportunities
for pastures to contribute to native habitat diversity in Iowa are mediated by the need for
additional educational and programmatic support to appropriately match site conditions
with management (Mayer and Mensching 2002; Wiltshire et al. 2010).

This study will characterize how livestock producers, landowners and natural resource
professionals define and negotiate the ‘best’ practices for grazing management through
two main works. A literature review of grazing management research pertinent to the
production of both profitable enterprise as well as ecological services demonstrates the
broader scientific perspectives, and gaps therein, of grassland management in Iowa. To
hone in on the issue of provisioning multiple benefits from grazing systems, a case study
was conducted within a socially constructed working agricultural landscape designated as
a Bird Conservation Area for co-management of grassland birds and agricultural
commodities. This combined perspective allows for a more holistic depiction of the
’social landscape’ of grazing as a multifunctional land management tool. This depiction
can serve as a basic map for organizations and institutions interested in expanding
grazing management for multiple benefits in Iowa to focus their efforts, serving as a
stepping stone to more comprehensive projects such as feasibility assessments for
targeted utilization of perennials in row-crop dominated landscapes (Hummel and Freet
1999; Schulte et al. 2008).

These combined accounts may reveal that a tension or disparities exist between livestock
producers and landowners who manage livestock at the farm scale, and the natural
resource management professionals from state, federal and non-profit entities due to the
complexity of negotiating the management of habitat provision (typically requiring a
landscape perspective) and livestock production (focused on the farm scale).
Incongruence between the understanding, implications and practices associated with
grazing management that produces multiple environmental and economic benefits can be
prohibitive when attempting to design appropriate collaborative partnerships, research
agendas and outreach.

Creating or re-creating a more multifunctional agriculture that would include pasture
based livestock production involves cooperation of a large number of institutional and
social groups that do not neatly fit into the agricultural sphere, requiring political,
economic, technical and social actions to be “…negotiated within the territory in question (Dufour et al. 2007: 316).” The territory in question in Iowa, are remaining grasslands that have not been converted to row crop production. In the study, this territory is remaining grasslands and pasture in the study area, the Raccoon River Bird Conservation Area (RRSBCA).

Grassland and pasture is valued differently by different people at different scales of the landscape. Figure 3.4 illustrates the social scales influencing the management of the study area. Partnerships between these stakeholders have been described as necessary to achieve multiple benefits from grasslands in Iowa. To quote the Iowa Department of Natural Resources (IA DNR), “If we are to be successful managing landscapes for Iowa's birds (and other wildlife), there will need to be strong cooperation between agencies, private conservation organizations, and private landowners (IA DNRA).” An important way of understanding the potential for change to occur in complex systems, such as grazing management that produces multiple benefits, is to closely observe synergies or inconsistencies among components in that system existent at various spatial, temporal and social scales (Atwell et al. 2009). A comprehensive literature review, in combination with interview data and focus group data from key stakeholders in the study area RRSBCA provide a window into the social processes and civic structure that comprise the complexity of co-management of grazing systems for wildlife and livestock production. These processes are catalysts to shifts in management practices in agricultural landscapes (Carolan 2006).

For the majority of social research involving human use of natural resources, scale is often defined simply by the household and community level, or is ignored altogether (Vogt et al. 2002). One way to organize the complexity inherent in a study such as this that wishes to collect data from these various social scales rooted in a landscape, is to create a case study with nested hierarchies. Hierarchies exist spatially within this overall case and data collected from actors at each scale must be compared, beginning at the level of the grazing manager all the way to a state and federal organizations such as the Nature Conservancy, Partners in Flight or the IADNR. An illustration of the overall case study process is in Figure 1.1.
The central questions this thesis will address are:

- Do disparities and tensions exist within the spectrum of stakeholders in grassland management in a conservation area prevent these groups from cohesively sharing information to expand grazing systems that produce multiple benefits? If so, how can they be addressed?
- How do these stakeholders view the environmental benefits of grazing systems?
- What is their vision for creating a more unified front from which to increase opportunities for grazing systems that produce multiple benefits?

In this project, there are ‘cases’ or units of social cohesion within each level of the management of RRSBCA lands. In this sense, the RRSBCA lands are physical boundaries from which to ‘ground’ the human scales related to those physiographic limits, but do not limit those social scales, that exists in relation to but potentially outside and removed from that space (Figure 3.4). Each case, or social group positioning within the hierarchy, will require an exploration “…over time, through detailed, in-depth data collection involving multiple sources of information rich in context (Creswell 1998:61).” The cases, anchored within the RRSBCA, will be used instrumentally to explore the issue of how stakeholders perceive the use of grazing management to produce multiple private goods and public services.
Figure 1.1 Case study research design, adapted from Bohnet et al. (2007).

**LEARNING FROM CASE STUDY**
- Identify resources for grazing that producers and landowners in RRSBCA use
- Identify resources for grazing information used by NRM professionals who are connected to the RRSBCA

**PLANNING AND BUILDING PARTNERSHIPS**
- Set and Review project goals
- Literature review
- Determine the multiple social, economic, political, and ecological scales via RRSBCA
- Collect data at the social scales identified

**REFLECTION, SYNTHESIS AND COMMUNICATION**
Informing strategies in collaboration with NRM professionals, organizations and graziers to use data and analyses conducted via RRSBCA case study to inform future planning and land-use decisions.


CHAPTER 2: LITERATURE REVIEW OF RESEARCH PERTINENT TO GRAZING MANAGEMENT IN IOWA: LIVESTOCK PRODUCTION AND ECOLOGICAL SERVICE PROVISION

A paper to be submitted to Leopold Center for Sustainable Agriculture’s Grass Based Livestock Working Group

The Identity of Grass-Farming in Iowa

This document provides information and resources to the grass-based livestock community that wishes to advance profitability and sustainability through management and practices in grass farming. Cherney and Kallenbach (2007) identify two distinct trends in animal agriculture in the Upper Midwest: large farms utilizing imported feeds, and smaller farms with “…homegrown forages and grazing systems (p 288).” Livestock management decisions will continue to be affected and potentially limited by manure management concerns, as well as others (US GAO 2008). Forage production is part of the solution to many of these issues, specifically grass-based livestock systems, as they can mimic functions of naturally occurring ecosystems through effective nutrient cycling, hydrology and water management, and biodiversity on the landscape (Boody et al. 2009; Keeney and Sanderson 2008; Mitsch et al. 2001). In general, livestock production in the Northern Great Plains depend on exogenous sources of energy, primarily fossil fuels, to sustain production; forage and grazing management offer strategies to reduce this dependence and increase the overall ecological efficiency of production (Heitschmidt et al. 1996).

The most common way to graze livestock in Iowa is to set stock, or have a set number of animals access the entirety of a given land area for an entire season, typically utilizing supplemental feed in the winter months. The simplicity and low capital investment of this model can come with other costs associated with highly variable forage supply, as well as increased weed pressure and soil erosion (Barnhart et al.1998). Continuous grazing can be profitable with a moderate stocking rate and grazing tolerant forages, and may fit the goals and land base of some managers. This guide is designed for those wish to evaluate and advance strategies that rely on perennial systems as a primary feed source for livestock.
The audience that will find this work most useful are producers who wish to transition from supplementing animals who are on pasture primarily or exclusively, as well as those already familiar with a grass finishing program who are looking for resources to develop and refine their practices. Landowners who own land for agricultural or recreational purposes interested in or currently leasing acreages to graziers will find information to improve sustainability and productivity of their physical resource for multiple benefits.

Professionals in the education and extension community, even those well versed in the technical aspects of grazing and grassland management, will find information to enhance outreach. The juxtaposition of highly technical information to more colloquial information commonly referenced by the grazing community will provide a real-world picture of what we know and need to know about the business of grazing.

Research on working grasslands is increasingly being driven by the management concerns that producers articulate. Controlled manipulations in experimental designs must relate to the reality of management in an agricultural context. This dialogue between graziers and scientists provides an important type of practical validity to research (Jackson et al. 2007). As will be discussed, research is reflecting shifting attitudes about the possibility, or to some, the necessity of a more grass-based livestock production.

What’s a grass farmer do, and why is it important?: As the field of grass-fed livestock production continues to grow and evolve in the Midwest, you sparingly hear the words ‘farmer’ or ‘rancher’ in reference to these producers. In grass-fed dairies, many do identify themselves as a dairy ‘farmer’, but with meat production, it seems that many operations are so small in land area and scale (and east of the Missouri River), so we don’t call ourselves ranchers. Those who only raise meat animals often don’t manage crop acreages, typically synonymous with ‘farmers’. So who are these people? Many names in grazing have deemed themselves ‘grass farmers’. This is likely why the Stockman Grass Farmer, a popular and seemingly universal publication in the national grazing community, is named as such.

A grazing system, most generally defined, is an ecological system manipulated by human management of livestock; a low-cost, high-value way to produce animals on land
unsuitable for crop production. As noted by Hobbs et al. (2009), the primary driver of most of the world’s ecosystems is human decision making and management. In Iowa, most grassland ecosystems are novel products of human management, via machinery, chemicals, and introduced species. Allen et al. (2007) calls these ecosystems ‘imposed.’ Of the myriad of ecosystems in North America, the tallgrass prairie has been the most thoroughly altered and removed (Samson and Knopf 1994).

Throughout the whole US Midwest less than one percent of the original tallgrass prairie remains; making it one of most endangered ecosystems in Iowa let alone North America (Fletcher and Koford 2002). Iowa’s grazing lands, when looked at as a resource base for all Iowans, has a unique and fragmented nature. Excepting southern and northeast Iowa, many grassland areas exist as patches within a matrix of lands both forested and agricultural (Giglierano 1999). Most grazing systems in Iowa are part of what Vallentine (2001) deems ‘medium term’ grazing lands whose tenure as grazing lands is highly variable; these include both arable and non-arable lands.

According to the Natural Resources Inventory, Iowa has roughly 3.5 million acres of pasturelands (NRCS 2007). The lack of many true rangelands in Iowa has kept pasture and grasslands in constant transition throughout the state over time. If demand continues to increase for corn and biofuel crops, the opportunity cost for pasture lands will also increase (ISU CA 2006). Grazing livestock can provide ecological services, and support the diversification of crop-livestock farms to increase animal agriculture, which the Iowa State University College of Agriculture claims is the key to economic development in rural Iowa (2006). This ability to provision multiple services positions grass-based livestock production industry well to adapt to future challenges.

The unique and constantly changing character and practices of Iowa’s graziers is reflected in the multitude of sources of information used to craft this publication. The art and science of balancing the need to produce animal products as well as stewardship to the land through sustainable grazing practices is a work in progress for all involved. Our sincere hope is this resource guide will assist in that work.
PART 1: LIVESTOCK PRODUCTION

This document is designed to give research-based, practical information to producers, landowners, educators and professionals interested in grazing livestock. This section will discuss decision-making tools designed to assist in understanding grazing management as a multi-faceted land management tool that fits within diverse crop and livestock enterprises. These tools will be discussed as strategies to implement and manage cost effective grazing systems. Practices to leverage the profitability and productivity of grazing systems such as the maximization of forage production, strategies to minimize energy inputs, and incorporating multifunctional uses and benefits of pastures in Iowa will be reviewed.

Overview

Section I: Grazing Management discusses general concepts and principles in grazing management systems, reviewing resources to identify and collaboratively work towards defined goals.

Section II: Decision Making Aids briefly identifies and discusses research and resources that offer decision-making assistance in grass-based agriculture.

Section III: Grazing Systems characterizes grazing systems in Iowa, and reviews principles and information relevant to making a grazing plan.

Section IV: Grazing Methods reviews grazing methods common and known in Iowa, and offers approaches to avoid degradation by livestock in a pasture, and concludes with a discussion on pitfalls in grazing method terminology.

Section V and VI: Tools to Manage Grazing System, and Physical Infrastructure for Low-Cost Grazing Systems provides a few notable insights into the social, physical, and biological infrastructure that supports grazing systems.

Section VII: The Economics of Grass-Based Livestock Systems offers examples of economic studies in grazing systems and enterprises.

Section VIII: Grazing in Perspective: Scales in Management and Environment contextualizes grazing systems within broader ecological and environmental scales.

Interest in grazing systems among meat and dairy producers in Iowa has been growing
largely in response to: 1) broadening market demand for “grass-fed” or “pasture raised” animal products (Burros 2006; Pirog 2004); 2) producer interest in lowering input costs (Iowa Beef Center Survey 2007); and 3) public and private interest in the environmental benefits of pasture-based systems (Conner et al. 2007; NRCSa). High crop prices and land values have placed enormous pressure on lands enrolled in programs such as the Conservation Reserve Program, as well as existing pasture systems in Iowa (Secchi et al. 2008). Producers who wish to lease or own these lands for grazing and forage production need comprehensive assistance and knowledge to make these enterprises profitable and competitive in a landscape dominated by row-crop production. Grazing is an important part of the re-integration of crop and livestock systems, and can be economically competitive and more environmentally compatible than more specialized systems (Keeney and Sanderson 2008; Sulc and Tracy 2007). This is in part due to the ability of grazing systems to integrate into a broader suite of agricultural practices defined as low-external input or LEI systems (Liebman and Davis 1999).

The diversity of opinions, however, as to the most appropriate grazing option for varying farm situations has been problematic for those looking for more site and landscape specific information about either enhancing their exiting pasture based enterprises or getting into the business. Interpretations and practices associated with various grazing systems (ranging from continuous grazing to the various forms of rotational grazing) will be addressed in full in this chapter. The essential understanding of grazing is the need for vegetative recovery after the grazing period. Adequate recovery contributes to the long-term sustainability of pasture production and soil cover.

Producers or graziers, as described here, are charged to deal with and capitalize upon a great deal of complex relationships and interactions to ensure production of healthy livestock and the persistence of the forages that maintain that health. In general, the information gathered for this section of the literature review points to the need for graziers to be flexible in their management strategy to account for this complexity. The more adaptable a grazing system implemented, the more likely an operation is to maintain stability and security if complications arise.

The decision to integrate grazing management onto a production system is a complex one
and involves many factors involving personal, social, financial, agronomic and ecological aspects. As organic farming is commonly likened to, transition to a new or different type of management can be information intensive. One of the initial considerations is the overall “appropriateness” of grazing and grazing style (or practices) for interested producers. The appropriateness of a particular grazing system for an individual producer is dependent upon at least three factors:

- Personal vision and goals for quality of life and land health
- Available physical, financial and social resources
- Overall management style

If grazing is deemed appropriate for a particular farming system, at this point producer decisions might then shift to the details of the production system itself. From a production standpoint, one of the key concepts to explore in production of grass-based livestock is the grazing system, or method, being used. For example in the upper Midwest, where the dairy industry is more pronounced, use of rotational grazing has increased dramatically (Jackson et al. 2007; Paine et al. 1999). The concept of “Management intensive Grazing” (MiG), popularized by Jim Gerrish (2004b) has come to describe the use of rotational grazing by managers who apply knowledge of plants, animals, fencing and inputs to everyday decision-making. This term emphasizes that to obtain benefits from this grazing method, you must invest a higher level of management. That is why Allan Nation, editor of the periodical The Stockman Grass Farmer (http://www.stockmangrassfarmer.net/), calls this type of grazing “the ultimate skill” (1998: p 201).

This chapter will review literature that compares the productivity benefits between different types of rotational grazing management in ecosystems analogous to those found in Iowa. Although that sounds like a fairly straightforward exercise, heated controversy persists within the range and pasture management research community about the benefits of these systems. Grazing management characterizes an entirely human manipulation of a grass based ecosystem with the tool of grazing animals and related technology. This chapter will also detail some case studies of profitability in grass-based systems highlighting key elements that keep costs at a minimum in representative grazing systems.
in the US Cornbelt. Resources that will provide frameworks for evaluating current management and contemplating modifications to their grazing program will be offered. It is worth noting that Barnhart et al. (1998) published the *Pasture Management Guide for Livestock Producers*, a guide with a wealth of information and recommendations for livestock producers at all stages of grass-based livestock management. This publication will review and expound upon the topics presented in that work, emphasizing the need for good management and a thorough understanding of the fundamental concepts of grazing. Profitability and sustainability are primarily determined by management, not chance or conditions out of our control (Briske at al. 2008). The primary input into any grazing system is management, which leverages the tools of frequency of grazing, intensity, and timing or duration of grazing, hereafter referred to as grazing FIT (Frequency, Intensity and Timing) (Schacht and Reece 2008).

**SECTION I: GRAZING MANAGEMENT AND FORAGE PRODUCTION**

_A vision without a task is but a dream._
_A task without a vision is drudgery._
_A vision and a task is the hope of the world._

-Etching found on wall of church in Essex, England

**Farm Management and Goal Setting:** This section reviews a variety of viewpoints that have a ‘big picture’ perspective on grazing systems. For anyone familiar with the grazing community, there are a number of divergent perspectives on the best way to manage a grazing system. Having an adaptive grazing system as described previously, by no means implies management should be completely _ad hoc_. Grazing consultant Jim Gerrish (http://www.americangrazinglands.com) has remarked that many producers “…start with their production system in place and try to build their goals around an existing white elephant (2004: p12)”. As the old adage goes, if you don’t know where you are going, any road will get you there. Many resources recommend that practices should always be evaluated within the context of ‘farm goals’, but usually fail to follow through on what that process entails. Goals are real tools that guide our decisions toward a desirable future (Hofstrand 2009). This section will provide some resources to facilitate that
process from the perspective of grass based livestock production.

Planning is the key to managing any business (Marrison 2007). In the context of this document, planning means articulating a vision, setting goals, and determining what steps are appropriate to reach these goals, and how to determine early warning signs that the plan is off track. The degree to which a producer wants to plan and evaluate decisions into the future, may determine which type of process works best for the operation.

When characterizing an overall farm vision, producers often start with broad farming goals from which specific action oriented objectives are to be developed. Rayburn et al. (2006) outlines several dimensions of operating a pasture-based livestock system that should be considered during such a process:

Producers need a specific “big-picture” framework within which management decisions are made. Within this big picture, overall vision/goals, available resources and markets are explicitly considered.

The overall resource availability and ecological context of production needs to be assessed. Land is generally the chief limiting factor in agriculture, therefore land availability and the ecological capability of this land to produce the array of desired goods and services needs to be understood. In the context of grazing, forage production, utilization, and animal response are all based on ecological processes.

The long term sustainability of these systems needs to be contextualized in order for producers to have adequate indicators to assess. Sustainability has (at minimum) social, economic and environmental qualities.

Socially: Morton and Miller (2007) discuss general community and farm level benefits of grass-based livestock production. Grazing systems, especially relative to dairying, have been shown to reduce labor needs of farms that were primarily family operated. These families and small to mid-size operations reported an improved quality of life due to this (Loeffler 1995; Petrucci 1995).

Economically: Profitability in grazing systems is contingent on management, markets and environmental factors. Studies assessing the profitability of different grazing systems often have mixed results (i.e., May et al. 2003). All studies comparing the economics of different grazing programs and markets must estimate costs; producers must do their own evaluations. The end of section II as well as all of section IV will discuss the economics of grazing systems.

Environmentally: When compared to any other agronomic practice, well managed
grazing systems are typically superior in their environmental benefits, such as carbon sequestration (Boody et al. 2003; Follett et al. 2001).

Once a producer has a good understanding of “what” the farm management plan is about, they need to consider the key “who’s” of the system; for example, who is designated to make day-to-day as well as major decisions about management practices? One way to decide who is a ‘decision maker’ is to decide who should be involved in the process. Decision makers make up what we will refer to throughout this text as the management team. The Ag Decision Maker website from Iowa State University Extension (www.extension.iastate.edu/agdm) offers a worksheet that helps management teams assess their individual values by asking simple questions about what is important to them in the context of their overall professional and social lives (Schnittjer 2007). This process could facilitate the formation of a collective vision for the farm and livestock operation. According to Rayburn et al. (2006), “visioning” should hold all day-to-day activities (including non-farm activities) accountable to the overall vision of the farm. For example, Zepeda et al. (1997) in a study examining the way husbands and wives in Wisconsin make decisions in pasture-based operations, found that extra farm issues such as non-farm income and career needs of wives played a strong role in decisions regarding rotational grazing methods that were labor saving.

Holden and Grusenmeyer (2006) give a more detailed map to the process. When writing a mission statement analogous to a vision, they would encourage producers to ask themselves three main questions: 1) What am I in business to do - What is my purpose/role?; 2) How is my business unique from others who are doing similar things?; and 3) What do I/we value in a farm business?

As an exercise to get the management team started in a more inclusive process of setting goals, the answers to these three questions will be broad and general. Goals can be specifically addressed via, targeted action oriented objectives. The acronym SMART is used to guide the process of setting goals and objectives: i goals and complimentary objectives need to be Specific; goal progress or attainment needs to be Measureable; goals and objectives must be realistically scaled so as to be Attainable; the process and product of goals reached should be Rewarding, and goals are useful when current,
therefore goals and objectives should be time bound (Gastier 2007; Holden and Grunsenmeyer 2006).

In slight contrast to the SMART concept, Butterfield et al. (1999) advocate Holistic Management with the forming of a ‘holistic goal’, a process that requires managers to first define exactly what they are managing and who is managing it before forming specific goals. “Holistic Management” is an organization originally founded by Allan Savory that uses a whole systems approach to land and organizational management. Explicitly defining the whole under management, or the social, economic and ecological units being managed by a group of people, helps decision makers determine what aspects their resource base is comprised of (White 2008). Knowing these assets, managers are more aware of what they have to work with when making decisions. There are three parts to an agricultural holistic goal, which all build on each other (Savory and Butterfield 1999):

• Recognizing the importance of “Quality of Life” in what one does for a living: How do you want your life to be?
• Understanding viable forms of production: What actions or products need to be produced to make it happen?
• Sustaining a resource base: Recognizing the temporal context of agricultural production by understanding and describing the condition that land and community need to be in to sustain the quality of life and forms of production defined long into the future.

The contrast between this process and other goal setting processes is that Savory advocates for avoiding very specific landmarks and rather focuses on a description of what is desired in general. Specifics, in this model, must be assessed using testing questions to filter and discuss decisions about the exact quantity and quality of something that is being produced (Sullivan 2001). Testing questions are questions that guide typically unstructured and sometimes tense discussions about changes in or additions to management. For example, because you described ‘profit from livestock’ in your forms of production, to produce the value of ‘profit’, you might want to test the decision of ‘profit from dairy cattle’ or even ‘profit from Holsteins’ or ‘profit from milking goats’. This process is designed to explore every potential impact of a decision. Howell (2008)
describes case studies from around the globe of livestock producers implementing this approach to management.

Winter et al. (1996) noted that managing resources requires six types of decisions: Setting priorities, dealing with unexpected events, assessing resources, planning, implementing the plan, and evaluating the outcomes all encapsulate the process of making decisions. When this idea is merged within the context of a holistic goal described above, planning can be seen as an infinite process. Just as there are feedback loops in natural systems, the process of planning, monitoring the plan, controlling or adjusting if things don’t go according to plan as indicated by monitoring, and re-planning if necessary (Savory and Butterfield 1999). The process is iterative.

Although it is tempting to get overwhelmed by the prospect of perpetually planning, realistically, managing any kind of business dependent on functioning, productive and healthy land needs to be adaptive to change. Biological systems are dynamic systems. The discipline of natural resource management has an entire body of literature reflective of this, typically coined ‘adaptive management’ (Holling 1978; Janssen et al., 2000; Walters 1986).’

**Resource Base: Manage What You Have to Get What You Want:** As part of the overall decision-making and goal-setting process, grass farmers need to access information and knowledge about the natural and physical resources existing on the land available to them (Emmick et al. 2006). Conceptual models described above are useful tools in visioning and in assessing existing systems, but often assume that there are few constraints to implementing new or additional practices. The next step after identifying and articulating shared values and goals is to identify problems or concerns that may stand in the way of achieving them. To properly address these concerns, the management team need to be aware of the full array of natural, social, and economic resources available (or obtainable) to do so. The feasibility of grazing management can at times decrease in proportion with farm size (Cherney and Kallenbach 2008), nevertheless, smaller operations relying less on stored feeds and more on grazing for livestock fodder
can be just as profitable as larger entities, especially in the case of dairies (Gloy et al. 2002). Knowledge of what resources are available to support a profitable grazing operation will optimize how those resources are leveraged for profitability and sustainability.

As noted, key resources in a grazing operation can be seen as physical, financial or social. Emmick et al. (2006) outlines a format for accounting for key farm resources, a process needed to create a plan that accounts for the whole farm unit:

**Physical Resources**

**Soil and Land:** Aerial maps are an important part of inventorying land resources. Soil maps, topographic maps, floodplain areas, stream classification, as well as state and federal wetland maps can all be obtained from the Natural Resource Conservation Service, Farm Service Agency, or local Soil and Water Conservation District offices. Physically marking these maps using an overhead projector sheet and an erasable marker will allow for some imagination when planning grazing sites and infrastructure.

**Livestock:** Ball et al. (2010) claim that the first step to any profitable forage program is to know your animal (various types and classes) and their nutritional needs. Know their attributes and limitations, as well as their food preferences, digestive morphology, and agility. Awareness of both the animals’ physical requirements as well as production attributes is key.

**Forage base:** This would include the type and yield potential of key species. Identification of forbs, grasses, legumes and woody species is important to synchronizing nutritional planes of livestock with forage quality and quantity (Emmick and Provenza 2007). In the ecological and climactic context of Iowa, cool-season grasses account for a smaller proportion of growth rates in summer and early autumn than warm season grasses (Baron and Belanger 2007).

**Water Supply and Access:** General considerations regarding water supply include quality, volume and demand, and delivery system. During the inventory, it is also an appropriate time to determine potential future sites for development of a water access point and various technologies available to facilitate water delivery. Water quality implications of location of watering sites will be discussed in Ch. 2.
**Air and Prevailing Winds:** Though this resource may seem arbitrary, knowing where winds prevail throughout the season can help you plan the needs of animals through the seasons. Dealing with harsh winter weather, knowing where wind chills may be lowest can influence where facilities should be located, or where animals should be placed for protection. Livestock performance improvements from the integration of windbreaks has been reported to provide positive economic returns in several parts of the Great Plains (Brandle et al 2004). Windbreaks have the ability to manage snowfall and snow drifts as well (Bilbro and Fryrear 1988). In warmer seasons, taking advantage of spring and summer winds can help reduce heat stress concerns and insect issues.

**Livestock Access Routes:** Walk the routes that livestock would have to follow to travel between pastures and to and from handling facilities. Would they be adequate in all weather conditions? Are they in environmentally acceptable locations?

**Infrastructure and Machinery:** Buildings, facilities, lanes, fencing and water systems all need to be accounted for and assessed. Evaluate the condition of implements and infrastructure relative to the function they are needed for. This will assist with situations where downsizing may be appropriate.

**Financial Resources**

**Financial:** Financial resources include income, cash on hand, investments, lines of credit, and even monies available from friends and family. Financial resources will be explored in detail in section 6.

**Social Resources**

**Human and Cultural Resources:** The management team, or anyone that will play a role in setting or implementing farm goals, each bring strengths and weaknesses to the table. For example, related questions may include: What does everyone contribute? What are appropriate actions for them given their talents? More broadly speaking, society values the preservation of biodiversity and cultural traditions. How does your operation contribute to the values of Iowans?

Well-expressed objectives, goals, holistic goals, or whatever process works best for needs and values, should add precision and consistency to management so that resources, time and other vital resources are allocated efficiently. Few other businesses besides farming and ranching produce so much product volume with
so little management (Gerrish 2006). If this is true, then the amount of time and energy devoted to planning and decision-making is essential to staying on course towards the desirable future described in a goal. Remember that educators and experts in grazing systems (particularly land grant universities and Cooperative Extension Service), agriculture, natural resources and conservation are all potential supporters of your operation, and can be a viable part of a ‘social resource base.

Section II: Decision Making Aids

“What is needed is the development of systems that provide alternatives to traditional livestock production. These systems should be team-developed to encompass efficient animal production...social acceptability, and ecological compatibility.” - M. Vavra, 1996

Many scientific studies have relied on various amalgamations of modeling to illustrate plausible future scenarios with different land use practices. These ‘plausible futures’ allow stakeholder groups to make informed decisions. At the farm and landscape level, models related to livestock production have tended to focus on manure and nutrient management and different iterations of cropping systems, and their impacts on farm economics and environmental systems. There are models for many specific aspects of land management and agricultural systems, but only recently have scientists been able to get many of these models to reflect the true human and natural dynamics at hand (e.g., the National Science Foundation’s Coupled Human and Natural Systems initiatives http://www.chans-net.org/default.aspx). There is an entire branch of science deemed “futures studies” which uses the tools of envisioning and scenario building (Garrett 1993; Slaughter 1993)

An example of this type of work pertinent to grazing systems at the watershed scale was published by Boody et al. (2005). They evaluated possible changes to contemporary farming practices in two Central Minnesota watersheds that are predominantly cultivated and cropped annually. Their model, combined with information from focus-group discussions, indicated that an increase in grassland and MIRG (management intensive rotational grazing) would play a strong role in measurably improving social, environmental, and economic well-being for residents and farmers in these watersheds.
These types of scenario based modeling studies can serve as reference points to help groups of citizens in a watershed or landscape scale work together to understand the impacts of different types of agricultural land use.

At the farm level, a team of researchers in Iowa have been working to create a more user-friendly computer based modeling in this regard. The goal of the project is to identify, promote and assist farmers in adopting integrated crop and livestock farming systems that reduce costs, minimize negative environmental impacts, increase market opportunities and increase profits for small and mid-size family farms. Part of fulfilling this goal led to the development of I-FARM, an integrated crop, livestock production and biomass planning tool. Training is available to utilize this modeling tool (see: www.ifarmtools.org). Of particular interest is an evaluation of potential changes in land use, and therefore livestock feed availabilities and types. The significant alteration of the ratios of beef cattle fed on grain vs. grass, for instance, could have significant impact on local economic development and potentially on national markets and prices (van Ouwerkerk et al. 2003).

Likely due to the past integration of crop and livestock production in Iowa, computer based decision based software relative to agriculture tends to be focused on either “rangeland systems” or cropping systems (Hanson et al. 1999), though many of those tools can be just as useful in Iowa. In the book Grazing Management, Vallentine (2001) discusses the merits of two computer based decision support systems: The Grazingland Alternative Analysis Tool (GAAT) which aides in examining the economic efficiency of a wide range of grazing systems and the Grazing Lands Application (GLA), a model used by the NRCS which provides users with information on the forage capacity, the optimum livestock-wildlife mix, grazing schedules, a financial analysis and energy balance (Stuth et al., 1990).
Section III: Grazing Systems

“The grazing animal is of the plants’ environment and the plant a part of the animals’. So long as the two live together, the welfare of each is dependent upon the other.”
- Stoddart et al. (1975)

Grazing Systems in Iowa: A grazing system defines periods of grazing and non-grazing for a given unit of land (Society for Range Management 1998). Two general concepts shape the way this publication will refer to grazing systems. Allen and Collins (2003) classify a continuum of grazing management from one extreme of intensive management to the other of extensive management. Intensive management systems are characterized as using additional inputs of imported resources, labor, and capital to increase production per unit of animal or land. Management-intensive grazing – MiG - systems are often used as an example of an intensive system because the approach benefits from inputs of outside resources, labor and capital on a relatively small amount of land. This is likely the reason that MiG became popular in regions of the United States that already had intensive cropping systems. A smaller farm size requires that each acre is highly productive; making off-farm inputs a common thread to most modern agricultural operations in the Midwest (Chavas 2008).

Extensive management, on the other hand, refers to low or no input systems, commonly associated with the Western US range country, where inputs for a larger land base are more costly. European literature refers to cropping systems as well as grazing systems that are diverse and use minimal inputs as extensive (e.g., Wolff et al. 2001). The idea that rangelands place limitations on producers because of their expanse and more xeric ecology can and should translate to a conservative approach to managing Iowa’s grasslands. Understanding how the ecological aspects of grasslands work, we can leverage natural functions to facilitate services such as soil fertility.

Regardless of the grazing management perspective (intensive/extensive) that is deemed most appropriate for a particular grower and farm situation, the first key to profitable pastures, healthy land and a good quality of life is a grazing plan (NRCS a). Grazing
plans help managers adjust the length of grazing and resting periods to match land, life and livestock needs. Seasons change and augment the speed at which pastures recover, adding to the number of complexities that need to be accounted for. Imagine grazing as harvesting a crop, in this case grasses, forbs and legumes, every day. The mechanism with which these crops are harvested are animals. Row-crop farmers spend much time and energy thinking and planning for harvest, as should graziers.

**Resources for Developing a “Grazing Plan”:** The benefits of having a grazing plan are both immediate and long term. The immediate benefits of a grazing plan are the peace of mind that comes not having to make decisions ‘on the fly’ because the plan is a reference point. The long-term benefit is that you will be able to see changes, positive or negative, from year to year if monitored, and adjusting accordingly. Many find the resources provided by their local NRCS or Extension office helpful when creating a grazing plan. Especially when planning for new infrastructure for producers getting started with a grazing system, the one-on-one assistance given by specialists can make the process much smoother. Some key publications of particular relevance to planning a grazing system are provided in the appendix.

The importance of planning the grazing season goes beyond farm gates; it can impact the reputation of a growing industry. For example, if developing markets for grass-fed and/or grass-finished beef are to expand beyond a niche industry, eaters must experience superior quality and taste. Although weather and other uncontrollable forces can determine how the grazing season unfolds, foresight and planning can help managers react appropriately to challenging situations. Without planning, shortfalls in forage production are common outcomes yet often come as a ‘surprise’ to producers. As quoted by Gwin (2009), Jim Gerrish (2005) comments that this situation often results in hands being thrown up in the air, exclaiming “we’re out of grass, let’s kill these cattle.” The quality of animals not yet fattened often results in unfamiliar or undesirable flavor, and contributes to the common complaint that grass-fed animals are often inconsistent in texture, flavor and appearance, or otherwise ‘gamey’ (Gwin 2009). Planning your grazing not only provides a reference point for daily management actions, for producers
interested in alternative marketing channels such as grass-fed, it can influence the perceptions of an entire segment of livestock producers and consumers.

Section IV: Grazing Methods

“Well-meaning technical people can urge ranchers to adapt new grazing programs without considering the capabilities or management objectives of an operator. This can lead to failure because the grazing system didn’t fit the operator and as a result everyone lost and a good grazing practice was discredited.” - Nebraska rancher Sid Salzman, 1983

Commonly Used Grazing Methods: What makes a grazing method cost effective isn’t the method itself. It is the scaling of the needs and goals of the manager to the capability of the system. As such, management strategies in grazing systems tend to be defined by three things, referred to in this publication as Grazing FIT (Frequency, Intensity and Timing) (adapted from Vallentine 2001). These concepts are represented on a continuum in Figure 2.1:

Grazing Frequency: A grazing method usually describes or implies the frequency that livestock are moved. A particular method sometimes refers also to the type and intensity of management. This reflects how animals move over the land base over a season and how often, temporally. Stocking rate is the relationship between the number of animals and the unit of land to be grazed over a specific period of time. Stocking rate does not imply how often or how densely animals are moved and grouped.

Grazing Intensity: Intensity typically refers to the effects of stock density. Stock density describes where animals are on a given part of land, spatially. It quantifies the relationship between the space they are allowed to move in and the size of the animal group in volume.

Timing and Season of Grazing/ Grazing Deferment: Timing of grazing, or how long an animal has access to a given area of land at which part of a season, can influence many production variables. Like grazing and fire, the use of rest or recovery time through the season can also be considered a land management tool. Grazing deferment refers to a specific type of nongrazing. For example, deferring grazing from the ‘breaking’ of plant dormancy until after maturity or seed-setting is used to increase seed production, thereby enhancing establishment (Vallentine 2001).

Of 29,690 farms in Iowa that have cattle, a little over 10,000 claim to do “Rotational or
Management Intensive Grazing”, defined as “…the practice of subdividing pasture into smaller sections and grazing different sections at different times (USDA Census 2009).” This definition is extremely broad and therefore does not tell us much about the variety of grazing perspectives and systems in Iowa, and therefore the consequences of those systems are difficult to define and replicate.

High density of livestock over short time period (> 3 days)
One defoliation every three years
One or two defoliations throughout the year
Three or more defoliations on one area through season
Occasional Fire
Low stocking rate over growing season

Figure 2.1 The grazing F.I.T. continuum: A visual representation of practices that are associated with ‘light’ grazing (on the left side in green) as a gradation towards ‘heavy or ‘chronic’ overgrazing (on the right side in red) as utilized in literature reviewed in this chapter.

Allen and Collins (2003) are slightly more specific, because they qualify that periods of grazing occur among two or more paddocks with periods of rest and regrowth between defoliation. The benefits of rotational grazing commonly cited are largely due to this allowance of time for plants to regrow and recover before being grazed again. Recovery of a pasture is commonly judged by height of a few desirable species (Blanchet et al. 2003). Height is largely correlated with the number of leaves of a grass. Rotational grazing allows for control of grazing FIT with fencing and paddock design (Gibson 2009).

Barnhart et al. (1998) describe four commonly used grazing methods in Iowa. These are continuous, rotational, intensive rotational and strip grazing. These different methods are to a large degree characterized by the number of paddocks in the system and how often livestock are moved among them, with continuous grazing having no divisions and paddocks, and strip grazing having many. Fences and paddock size influence animal density, in essence herding animals into groups.

• *Continuous grazing* is a low-cost method relative to capital investment, and livestock are not deliberately moved to new pastures; they are not ‘rotated’ by human management, but only by their own preferences (Allen and Collins 2003).
A variation of continuous grazing is to stock an area for the growing season only (Gibson 2009).

- **Intensive rotational grazing** uses more rotations to increase utilization, forage quality, regrowth and recovery rates (Barnhart et al. 1998).

- **Strip grazing** utilizes permanent fences to create temporary ‘strips’ of typically electrified temporary fence. Diet quality has been shown to be higher for shorter durations of grazing periods, and strip grazing can take advantage of this (Olson et al., 1989). Taller swards tend to increase bite size and intake (Forbes, 1988). Strip grazing has its roots in ‘rational grazing’, described in Andre Voisins’ famous 1959 text *Grass Productivity*. Wedin (1976) estimated efficiency of grazing animals on tall, productive pastures in Iowa, and found that strip grazing when compared to continuous grazing could add up to 89 AU’s per acre, mostly by an increase in utilization.

- Using the tool of stock density, ‘mob’ grazing has attracted interest in recent years (i.e. Kidwell 2010). “Mob” refers to the ultra-high stock densities obtained from frequent moves (1-3 times daily) and small paddocks. It is generally characterized by the high amounts of liveweight for short periods of time; between 100,000 and 1,000,000 lbs of liveweight on a given acre is an approximate range (Kidwell 2010; Salatin 2008). Overall productivity may be raised due to the ‘suppression’ of herd behavior, in the sense that the choosiness of the group is minimized and they behave more as an aggregate (Launchbaugh and Dougherty 2007). Many practitioners of ‘mob’ grazing allow animals to graze swards when they are taller than many other rotational-type systems. There is some research demonstrating that when herbage mass increases, intake may as well; herbage intake rate is a major factor in liveweight change, lactation and performance (Ungar and Noy-Meir, 1988)

None of these methods have strict guidelines for the duration of grazing or grazing period, thus allowing overgrazing as a possibility to most methods, excepting those who have a high number of paddocks. This is mostly due to the fact that fluctuations in growth
rate in the growing season predicate how quickly plants recover from grazing.

The number of paddocks associated with the livestock enterprise is detailed in Figure 1.1. Yet, the number of paddocks is relevant only when one considers the maximum amount of time you will allow animals to graze that area; as noted in Briske et al. (2008: 5), “Rest and deferment to promote plant growth is the most fundamental and long-standing corollary of the unifying principles and it represents a central assumption of all grazing systems.”

**Approaches to Avoid Overgrazing:** All grazing methods involve a mix of explicitly linked spatial and temporal activities. Overgrazing is a temporal activity, in the sense that it is continued grazing prior to the recovery of a plant or paddock (Valentine, 2001). In this sense, overgrazing is commonly a function of time that plants were exposed to animals, and not livestock numbers in and of themselves (Savory et al. 2006). This is reflected in the finding of Brougham (1956) that as long as one intact lamina (leaf) remains after defoliation, it has no significant effect on re-growth, or the rate of plant growth as it recovers from defoliation. A study on the digestibility of orchardgrass under differing defoliation treatments demonstrated that severe defoliation (not repeated defoliation) enables the digestibility of the following regrowth to improve by influencing the sheath length of the grass to be shorter (Duru and Ducrocq 2002). The intensity of grazing has substantially less effect of pasture health over time when adequate rest and recovery is allowed, than the *frequency and timing* of grazing.

<table>
<thead>
<tr>
<th>Paddock 1</th>
<th>90 days grazing</th>
<th>90 days recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddock 2</td>
<td>90 days recovery</td>
<td>90 days grazing</td>
</tr>
</tbody>
</table>

*With a growing season of 180 days, a 2 paddock system can be designed to give 90 days of grazing and have 90 days of recovery for each paddock.*
With a growing season of 180 days, a 4 paddock system would allow for 30 days grazing followed by 90 days recovery. Paddock 1 and 2 may potentially be grazed again before the season is over depending on regrowth rates.

<table>
<thead>
<tr>
<th>Paddock 2</th>
<th>30 days grazing</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddock 3</td>
<td>30 days grazing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paddock 4</td>
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</table>

With a growing season of 180 days, a 4 paddock system would allow for 30 days grazing followed by 90 days recovery. Paddock 1 and 2 may potentially be grazed again before the season is over depending on regrowth rates.

Each paddock in a 16 paddock system is allotted 6 days of grazing followed by 90 days of recovery, with some able to have a 6 day grazing again.

Table 2.1 The relationship of paddock numbers to rest periods represented with three systems.
As displayed above Table 2.1, the more paddocks that can be used in any given land base, the more time for recovery will be allowed through the growing season; it does not increase the total amount of ADA’s, but each paddock’s share is rationed out in a shorter time. Note that ‘divisions of land’ noted by black lines for ‘paddocks’ in the tables do not necessarily imply that permanent fencing is required.

**Measures of Grazing:** This section touches on the common management variables in grazing systems and defines how these variables are measured. The utility of these calculations is to provide a better understanding of the balance between livestock demand for forage with supply (Laca 2009). Livestock grazing may have an effect on pasture composition and productivity over time, but in the short term, forage resources must match livestock needs. The first element of a grazing system that must be estimated is the amount and quality of feed available.

### Figure 2.2 Pasture Condition Score Indicators

The NRCS (2004) outlines how to do a visual evaluation of a pasture based on ten indicators. Each indicator is given a score from lowest (1) to highest (10). Documenting these indicators on an annual basis will show important trends over time (NRCS 2004). These indicators are also used in pasture assessments as a part of the recent Conservation Security Program, and are listed in Figure 2.2.

- Percent desirable plants
- Plant cover
- Plant residues
- Plant diversity
- Plant vigor
- Livestock concentration areas
- Erosion
- Wind
- Percent Legume
- Soil Compaction
A measure of grazing helpful when planning grazing that makes a direct connection between the demand of livestock according to their type and class, and the available forage is Animal Unit Months (AUM). An Animal Unit (AU) is how much dry matter a given animal consumes in one day. An Animal Unit Month, then, is the amount of forage an animal unit, standardized as a 1000 lb. dry cow or with calf up to 6 months old requiring 26 lbs or dry matter/day, will need in one month. One AUM will consume 780 lbs dry matter.

Using this standard unit, a mature sheep will be the AU equivalent of .2; it will eat only 20% of what a 1000 lb dry cow would eat in a month (Pratt, 2001). Animal unit equivalencies are helpful to make initial stocking estimates, however, the amount, type and nutritional plane of the vegetation must be the primary determinant of proper animal types, classes and numbers. There are resources that provide extensive tables describing different types and classes of livestock and their concomitant consumption of dry matter/day (Barnhart et al. 1998; Vallentine 2001).

Butterfield et al. uses the term AD’s or Animal Day to describe the same unit, encouraging managers to calculating the amount of AD’s from an acre in a single grazing period. This is the same metric with which they recommend estimating the amount of forage available in an acre or paddock.

The same idea is expressed in carrying capacity, which is the stocking rate that a particular grazing unit is able to sustain throughout the grazing season (Gerrish and Morrow 1999). This is a crucial measure of grazing management (Walker 1995).

Carrying capacity takes into account general estimates of four factors and can be calculated for the whole grazing season the grazing period:

- **Total Annual Forage Production** (expressed in pounds of dry matter per acre)
  - Barnhart et al. (1998) and Butterfield et al. (2006) give worksheets and step-by-step instructions on how to calculate all of these measures. This is usually in pounds per acre or hectare.

- **Seasonal Utilization Rate** (what percent of the total annual forage production is actually harvested by animals)
A utilization rate higher than 50% generally needs to allow for a greater recovery period than a utilization rate less than 50%.

*Average Daily Intake* (expressed as pounds of forage per pound of liveweight) This value is estimated, and should err on the side of overestimating. This will be set at the level of desired animal performance. For example, the average 1,200 lb. lactating cow of medium milking ability would consume roughly 36 lbs. of dry matter in one day. So, it would be .03 lb forage/ per lb liveweight.

*Length of Grazing Season* (number of days animals will be grazing through the year)

Example adapted from Iowa NRCS (2008):

\[
\text{Carrying Capacity} = \frac{\text{Total Annual Forage Production} \times 2 \times \text{Seasonal Utilization Rate}}{3 \times \text{Average Daily Intake} \times 4 \times \text{Length of Grazing Season}}
\]

Carrying capacity is typically expressed as the amount of liveweight per acre that an acre can support.

*Stocking rate* is a common measure employed in grazing research, and is therefore necessary to understand as a way of interpreting the results and recommendations of scientists. Pratt and Rasmussen (2001) provide a simple and thorough discussion of the pros and cons of using this measure. Stocking rate refers to the number of animals/animal units/total liveweight relative to the entire land base that will be grazed, typically on a per acre basis. This measure is recommended for managers who have a long-term understanding of trends in the productivity of the land being grazed.

*Stock density* typically refers to the concentration of animals on a given space (such as a paddock). This can be expressed as a description of animal presence on a unit of space: “The animals are at a high density”, expressed by the lbs. of liveweight on a paddock or per acre (Butterfield et al. 2006). It is also used to describe the animal demand per unit area, such as the AU’s per acre needed to feed the amount of livestock present (Vallentine, 2001).

**Grazing Methods: Schools of Thought and Terminological Pitfalls:** Grazing methods as explained by those who adhere to specific ‘schools of thought’ discussed in reference to MiG, or mob grazing, or other iterations of what is generally referred to as a type of
rotational grazing, allow for discussions to imply that choosing a specific type of grazing is somehow a panacea to success. A grazing method is one part of the grazing system, and does not offer a silver bullet to profitability or attainment of other desired goals; all grazing methods can be badly managed and no method can compensate for poor planning and management (Briske et al. 2008).

Both rotational and continuous grazing methods are defined in such a broad manner in terms of the frequency and intensity of defoliation individual plant patches, they mesh easily with each other (Laca 2009). The seemingly infinite combinations of grazing FIT are difficult to reduce to two “named” options (Laca 2009). In this sense, ‘rotational’ grazing in Iowa has become a sort of catch-all term which broadly speaking encompasses ways of manipulating grazing FIT. The USDA Census of Agriculture defines rotational grazing as “…the practice of subdividing pasture into smaller sections and grazing different sections at different times (Census 2009).” Overgrazing, as discussed in this chapter, can easily occur within a system defined as such.

The scale, or level at which a given land base is stocked can explain why that the same values for measures such as stocking rate and density can create different outcomes. Traditional grazing management assumes that 10 cows on 10 acres for 200 days to give similar outcomes as 500 cows in 500 acres for 200 days; these situations would both be classified as ‘continuous grazing’, however the scale alters the types of results obtained (Laca 2009). This difference is primarily a phenomenon of herd behavior. For instance, Hickman et al. (2004) illustrated that relative to vegetative biodiversity, stocking method had no effect on plant diversity. However, stocking animal density was the management variable with the strongest influence on species diversity and vegetative composition (Hickman et al. 2004).

In his paper *New Approaches and Tools for Grazing Management*, Emilio Laca eloquently describes the relationship between the rate and density with which animal grazing is described: “By compensating stocking density with grazing time, various combinations of animal numbers and pasture sizes can be explored at a constant stocking
Section V. Tools to Manage Grazing Systems

Custom Grazing: Human Infrastructure for Low-Cost Grazing: The most common way to graze livestock with minimal capital investment is to custom graze. That is, to manage the grazing of animals owned by someone else. Custom grazing has a number of advantages for producers seeking stability in a volatile market. When marketing feeder cattle, having additional weight from forages is an adaptable strategy to price volatility (Reinhardt 2008). This arrangement typically involves a per day charge per head for feeding, grazing and sometimes care. In 2007, the Iowa Beef Center did a survey on managers who custom graze beef cattle. The common classes of beef cattle are cow/calf and stockers. The surveys show average prices for incentives or surcharges associated with the agreement. For example, incentives are used for live calves weaned from cows or first calf heifers. When negotiating leases, a few key points to consider were expressed by custom grazing operators from Iowa cattlemen:

- Know your client and their history.
- Know the condition of the cattle; no sale barn cattle.
- Have a written agreement to reference who does and pays for what and when.
- Match the carrying capacity of the pasture to the number and class of cattle, as well as the season.
- Communicate regularly to establish trust.
- Consider surcharges or incentive payment as reward for better management or extra labor.

Greg Judy, in his book No Risk Ranching (2002) provides some personal perspectives on successes with custom grazing on land owned by recreational landowners. The IBC surveys also mention “three-party management arrangements” where landowners interested in the wildlife and recreational benefits of land. The private landowner rents land to a caretaker who then manages cattle there who are owned by a third party. Judy gives key advice on how to establish a trusting relationship with landowners, and pointers on good communication, about both good and bad events in the grazing season. Another strategy is to have good knowledge of pasture management practices that will help them
meet their goals, as well as the goals of the producer. Judy also provides specific
guidance on how to write up a thorough lease agreement.

According to the Iowa Beef Center (2007), other potential opportunities for custom
grazing agreements to become more prevalent in Iowa are:
  • Grazing publicly owned lands using managed grazing
  • Stocker grazing and backgrounding during the growing season
  • Grass-fed beef; long-term grazing on high quality forage
  • Flexible payment arrangements for flexible livestock programs

Though it has declined in popularity in Iowa, stocker owners who would like to send
“hard yearlings” to the feedlot with an ability to take advantage of compensatory gain
have an advantage when charging a per-head per-day rate for grazing land (Rhinehart
2008).

Section VI: Physical Infrastructure for low-cost grazing systems

This section will briefly introduce resources that detail physical tools that allow for
flexibility and resourcefulness in grazing systems. Many readily available sources present
practical information and guidance on these tools, several of which are presented in the
appendix. This section will outline the basic principles of watering and fencing systems
and offer some innovative ideas with regards to allowing for more mobility in the use of
those tools. Planning infrastructure and fencing should almost always begin by drawing
in access to water on a physical map, since it can be the most complex to plan (Ruechel
2006).

Water Systems: When grazing many paddocks, especially on uneven terrain, water
systems need to be creative, functional, accessible and sometimes mobile. Field days are
often used to see the mechanics of others’ water systems. Water and shade are powerful
influences on where livestock move and spend their time. Reuchel (2006) manipulates
the way animals move with shade by keeping trees in his pastures from having many low
branches, thus ensuring they do not linger in one space as the sun moves.
Many sources give helpful explanations of commonly used water resources. The unique feature of portable watering systems is that they prevent an area from losing productivity, depending on how often they are moved. In the long-term this would be a cost savings measure. For example, research has shown that when cattle must travel over 900 feet to water that grazing uniformity is reduced (Gerrish and Davis 1999) Though there is some research describing the ecological benefits of creating variability or ‘heterogeneity’ in the ways that animals move and graze, the consistent trailing of cattle to distant water or shade sources will degrade the land.

The further away water is, the more “disruptive” it can be to the herd when one animal goes to drink; when water is supplied within the paddock being grazed, it is common to only see one or two animals go to drink while others graze undisturbed (Emmick and Provenza 2008).

Record how livestock in each division in the pasture will access water. If you are grazing in the winter, try to minimize labor by winterizing only the watering sites at all corners of the land base. Base your watering sites on the maximum number of animals you may have now or in the future; animals consume roughly three times as much water as they do dry matter (Barnhart et al 1998). All ruminants replace roughly 15-20% of their weight when the first drink (Turner et al. 2008). For example, a 1,000 lb. cow would drink roughly 10 gallons in one day. Heat stress or lactation can increase this significantly. There are many examples of low-cost stationary watering systems available online via Extension and the NRCS.

Mobile watering systems can require a bit more labor, however if a manager is moving fences in addition to water, it adds little time to a procedure already taking place. Aside from keeping more productivity in more areas, mobile watering systems discourage the kind of muddy situations that can occur when animals linger for long periods of time around water tanks. In a wetter climate like Iowa, this can contribute to health problems and calving issues (Reuchel 2006). There have been many types of mobile systems developed. Many of these have been
featured in periodicals such as *the Stockman Grass Farmer* or *Graze*.

**Fencing systems for low cost grazing:** Just as there are advantages with the flexibility offered by mobile water systems made with relatively simple designs and materials, there are real advantages to flexible and basic designs of fence. A good way to get started is to match the level of management, specifically how often livestock can be moved, with the number of paddocks. To determine the *minimum* number of paddocks needed, divide the desired amount of rest period (days) by the length of the grazing period (days) and add 1.

**Biological infrastructure for low-cost grazing: Forage Base:** In Iowa, our largest grazable forage base is row crop residue. The Iowa Beef Center offers numerous resources on how to use these acreages to lower feed costs in the winter. Of note is Leu et al. (2009), who provide a compact and specific presentation of different strategies to take advantage of corn acreages with minimal supplementation. Many farmers are rightfully nervous that soil compaction could take place, and recent research in soybean fields by Busby et al. (2004) suggests that if the ground is frozen, there will be no difference in yield. If livestock access no-till soybean fields before the ground is frozen, yield reductions are slight.

Forages that are persistent, high nutritive-value, and hardy under a variety of conditions are often sought after by graziers. Though seeking plant types that meet these goals can lend itself to lowering costs and creating a persistent stand, it is often the variety and diversity of forages that allow for forage availability to remain relatively steady though the season (Tracy and Faulkner 2006). Although species richness has not been shown to affect livestock performance, it has been shown to have an effect on pasture performance. Sanderson et al. (2004) assesses human and environmental factors in the context of the benefits of biodiversity in working pastures. More specifically, they highlight the complexity not only of the system, but in our evaluation of it. Many discussions of grazing management talk simply about the *number* of species, when the real critical features of pasturelands are:
• The proportional abundance of species
• The unique attributes of these species
• The spatial distribution of these species

When soils and topography are variable, plant diversity can be highly beneficial to maintaining adequate production (Sanderson et al. 2004). As stated earlier, the first step to managing for the desired plants is to work with what currently exists (Barnhart et al. 1998). A specific example of the inputs and outputs of a grazing system in terms of animal gains was in Jackson County, on the Andrew Jackson Demonstration Farm. Pitcher (1996) found that calf gains under a cool season/ legume mix in fertilized pastures yielded an ADG of 2.8 lbs. Interestingly, in the Adams county cow/ calf CRP grazing demonstration had comparable ADG’s over 13 years of collecting data (2.3 lbs ADG) with no fertilizer or herbicide inputs (Nelson et al. 2003; Peterson and Houck 1998).

Roberts and Gerrish (1999) review studies and information pertaining to the effective use of warm-season grasses to maintain a nutritional plane during what many call ‘summer slump’, or the time periods where cool-season grasses are no longer growing. Most published information relative to cost-effective use of warm-season use supplemental pastures use pastures that are managed separately from the rest of the land-base to maintain quality stands of these grasses. Barnhart (1994) discusses research in Castana, IA that shows comparable or superior gains from switchgrass in a smooth brome and switchgrass grazing system.

The quality of seed obtained for warm-season pastures is an important consideration. Mitchell et al. (2005) evaluated the forage quality of two improved big bluestem cultivars bred for increased in vitro dry matter digestibility increased livestock gains 26% when compared to commercially available cultivars. A formula for precision management and timing of warm-season pasture use has proven elusive to agronomists. For example, in a Michigan study warm-season pastures were generally ready to be grazed before they were ‘needed’, or before cool-season areas slowed or stopped growth (Hudson et al., 2010). Though research continues to address roadblocks to the establishment and management of warm-season/ native grass pastures, the ecological benefits and potential
restoration implications continue to motivate interested producers and ecologists (Doll, 2009) (Jackson, 1999).

**Animals for Low-Cost Systems:** As both part of a biological and economic system of a grazing operation, livestock need to be adapted to the management style, forage base and overall climate. For example, as a tool to increase forage production, cattle trampling has been associated with improved germination rates of both annual forbs and grasses (Jackson et al. 1999) A variety of livestock eat a variety of types and heights of forages and brush, which is why many producers choose to alternate the species they raise, or have a multi-species herd (Vallentine 2001).

Producer groups have been actively attempting to breed livestock for greater efficiency on grass, and are only beginning to see success (Gwin 2009). Heitschmidt et al. (1996) echoes the barriers to developing livestock that are efficient at converting grazable forage and low-quality roughage into desirable meat. This is primarily due to the fact that little energy has been expended towards developing this type of ruminant production technology (Heitschmidt et al. 1996).

Though it can take many generations of livestock breeding to create what researcher Jan Bonsma calls “functional efficiency (Bonsma 1965).” His perspective is useful due to the emphasis placed on livestock ecology, or the study of domestic livestock and their ability to adapt to local environmental conditions and variability. In his written works Bonsma details methods to judge animal efficiency through the measurement of physiological characteristics.

The influence that animal types and behaviors have on pasture productivity and sustainability will be discussed in the section VII.

**VIII. The Economics of Grass-Based Livestock Systems**

The general conclusion researchers studying the economics of grazing when compared to confinement feeding livestock production is that, although production levels on the
animal side can drop (e.g. lower overall milk production or less average daily gains) other costs in the operation are generally reduced and therefore can potentially compensate for any declines in production (Taylor 2009). The costs of producing each unit of milk or meat drop enough to buffer against drops in marketable product production.

Beef and dairy production with cattle comprise the lion share of production and therefore research relative to the economics of grass-based production in Iowa and the Upper Midwest. Most of the studies accounting for costs in grazing enterprises specifically relevant to an Iowa context are with cattle, and are reviewed below.

**Principles for planning and monitoring finances for a grazing enterprise:** Financial planning should take precedence over excuses of any kind, and include all decision makers (Butterfield et al. 1999). Though graziers are certainly an intelligent bunch, nobody can be expected to track all of the types and amounts of expenses and communicate them to decision makers without creating and monitoring a plan.

Additionally, just as monitoring and keeping records of pasture production can help when planning improvements and management, so can monitoring expenditures enable a view of what expenses can be reduced over time. This serves as an indicator of management strengths and weaknesses (Strohbehn 1995).

Another important reason to track finances in the context of custom grazing is that when approaching landowners, especially absentee, showing them that diligence will influence their approach to the partnership. Any additional assets you can offer are helpful in a competitive market. Just as Judy (2002) shows landowners what his management has done for the health of his land, showing potential partners that you possess the discipline to track and plan your finances demonstrates reliability.

Land cost and availability, whether renting or owning, is often the deal-maker or breaker for graziers. The Iowa Beef Center’s survey of custom grazing operators shows that many are looking to expand but find a serious limitation to doing so is a lack of pasture for rent. Seventy-six percent of those interviewed were at capacity and about half of those would
expand if land was available (IBC 2007a). The issue likely compounded through a combination of two land use pressures: row crop acreages continue to go up (Secchi et al. 2009) as well as urban areas expanding outward (Cosner 2001). Many graziers in central Iowa are feeling this pinch (Gordon et al. 2009). Gwinn (2009) echoes this limitation in other regions of America.

As a reference point for those who have a cow-calf enterprise, Miller and Knipe (2003) summarize the average returns and costs for 30 commercial and purebred herds in Iowa, Illinois, Kentucky, and Michigan. They provide details on a number of economic aspects of the operation, from labor to livestock and land.

**The Overall Plan:** Use the units that make sense for the goals of the operation to track expenditures; most cattle producers use costs per head, average daily gain (ADG) per head or per hundredweight (Moore 1999). Barnhart et al (1998) suggest using a cost per Animal Unit (AU) and provide worksheets for doing so. Many suggest tracking expenses and profit per acre; this gives a better indicator of how the land is performing (Moore 1999).

Ag Decision Maker (2009) offers a guide to variable and fixed costs with improved summer pasture for yearling steers and cow-calf operations in Iowa. Walter (2009) presented unpublished USDA data on net returns over variable costs per head under new the new grass-fed standard. This data showed that although there is promise and potential for grass-fed beef to become a profitable venture it is extremely risky. This is likely why some producers market only a portion of their meat as grass-fed and sell or fatten the rest on supplement (e.g. Larson et al. 2004).

Butterfield et al (1999) describes gross profit analysis as a simple tool to compare the financial profitability of two or more enterprises that separates fixed costs (costs present regardless of what or how much is produced) from the costs linked directly to production. Ruechel (2006) offers worksheets for tracking expenses.
<table>
<thead>
<tr>
<th>Livestock Enterprise</th>
<th>Response to High Levels of Grazing Management</th>
<th>Suggested Level of Paddocks for Rotation</th>
</tr>
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<tbody>
<tr>
<td>Seasonal Dairying</td>
<td>Very High</td>
<td>50-60</td>
</tr>
<tr>
<td>Year-Round Grazing</td>
<td>High</td>
<td>50-60</td>
</tr>
<tr>
<td>Stocker Calves</td>
<td>High, subj. to price fluctuation</td>
<td>25-40</td>
</tr>
<tr>
<td>Developing Dairy Heifers</td>
<td>Moderate to High</td>
<td>15-30</td>
</tr>
<tr>
<td>Ewes; sale of weaned lambs</td>
<td>Moderate to High</td>
<td>6-20</td>
</tr>
<tr>
<td>Cow/ Calf; sale of weaned calves</td>
<td>Moderate</td>
<td>4-20</td>
</tr>
</tbody>
</table>

Table 2.2. The general responsiveness of specific grazing animal enterprises by species and class to investment management resources. Adapted from Barnhart et al. (1998).

When evaluating the utility of these approaches, it is important to remember that economic decision making, at the farm level, is not just a calibration of inputs and outputs; it is necessary to choose between alternative grazing systems and articulate a strategy (Dillon and Burley 1961).

**Enterprise Profitability in Grass-Based Systems: Dairying:** Grass-based dairies have become a poster child for the potential economic benefits of grazing system in Iowa.
(Tranel 2008). Foltz and Lang (2003) illustrate that dairy farms in the Northeast who fully adopt MiG had more profitability overall than their counterparts who only partially adopted the practices. A study in Wisconsin showed that net farm income of the average grazing operation was double that of the average confinement system (Center for Dairy Profitability 2004; LSP 2004). This profitability factor has contributed to a 15% increase in the number of Wisconsin dairies using pasture as a predominant feed source (LSP 2004). See Hanson et al. (1998a; 1998b), Emmick and Toomer (1991), and Elbehri et al. (1995) for more specifics on the potential economic advantages of grazing dairies.

Organic dairies have on average, tended to be more profitable due to higher milk prices, but can also have higher expenses. For example, Digiacomo et al. (2007) details the economics of two grass-based dairy operations in Central Minnesota, one organic and one not. For a smaller scale, family-managed operation, organic dairy grazing proved to be a financially stable operation. Not only are the economics of these operations of similar structure evaluated and compared, but they are also compared with regards to environmental performance.

Schuster et al. (2001) present enterprise budgets for stocker enterprises in grass-based systems with a focus on both beef and dairy steers. With their assumptions, beef steers, grazed for 170 days on 100 acres, needed to gain 2.25 lbs/day to break even. Holstein calves, purchased at a lighter weight, break even at just over 1.75 lb/day.

**Approaches to season-extension and winterfeeding in beef production systems:** Due to the high costs of winterfeeding for the average cow-calf operation in the northern United States different strategies for storing harvested forage have been explored. Baron and Belanger (2008) provide a thorough overview of forages and winter hardiness. Practices like snow fencing, windrowing at various stubble heights and leaving residues on fields are all ways to buffer against the effects of low-temperature injury (Baron and Belanger 2008). Nayugihuugu et al. (2007) determined that windrowing forage tends to increase production costs without a concomitant increase in animal performance. Production costs in this study took into account quality of forage, animal performance and feeding methods. Snow accumulation on top of windrows can become a factor influencing performance as well.
Annual cool season crops can also allow for greater amounts of production early and late in the growing season, and McCartney et al. (2008) provide an overview of the performance of annual cereals, annual and fall ryegrass, and oat. Specifically, they review studies (predominantly Canadian) starting from as far back as seven decades that account for management, yield, animal gains. However, they cite that the economic viability of these systems in the context of actual operations is poorly researched.

Janovick et al. (2004) assessed the hay needs for a year-round grazing (YRG) system when compared to a conventional winter-feeding and summer grazing (minimal land) system over 3 years. In general, the research found that YRG that include grazing of stocker cattle to utilize excess forage decreases stored feed needs while maintaining growing animal production. Overall gains of calves and grazing stockers were 12 kg/ha less than those on supplement, but cows in the YRG system gained 27 kg more overall than those in the minimal land system. Additionally, body condition scores evaluated for August-calving and April-calving cows, showing that the increased efficiency of energy reserves contributed to the reduction of supplemental hay requirements for August-calving cows when compared to April-calving. Synchronizing calving date with forage resources can have significant economic implications; studies of grazing systems in Nebraska’s Sandhills showed that the most profitable systems took advantage of matching cow nutrient needs with nutritional value of native grasses (Adams et al. 1996). Reuchel (2006) echoes the efficiency of fall-calving cows, specifically for enterprises selling grass-fed cattle.

May et al. (2003) utilized data from the McNay research farm near Chariton, IA to understand potential cost savings year-round grazing systems may obtain over systems that require importing supplemental feed to a drylot. On average, when modeled over a nine-year period, the economic costs for both systems were roughly equal. However, at times when the cattle cycle contracted, the year-round grazing strategy was more profitable.

Many producers in the Upper Midwest use tall fescue as a forage to stockpile through the winter, and research shows that the success of this strategy depends on other plant species available and management factors. Meyer et al. (2009) examined the specific value of
stockpiled fescue pasture vs. tall fescue based hay in Northern Missouri for feeding during winter. Stockpiled fescue pastures had more nutritive value than the hay in this instance, maintaining higher amounts of backfat. Allen et al. (1992) demonstrated that average daily gains on stockers were 47% higher on fescue pastures stockpiled with alfalfa as opposed to N-fertilized fescue, though yield was reduced slightly. Stockers on the pastures stockpiled with alfalfa also required half the stored feed required by calves fed only orchardgrass-alfalfa hay. The results of applying late season N on fescue show that as N increases, so does crude protein and in vitro dry matter digestibility, yet neutral detergent fiber drops (Singer et al. 2003). High levels of soil N have been shown to decrease cold-hardiness in all grasses (Baron and Belanger 2008).

**Whole-farm cost accounting case studies:** Although the study took place in California’s Marin and Sonoma counties, Larson et al. (2004) detail all costs and sales for a 200 head cowherd that sells 30 cattle as grass-finished animals directly to customers. This study serves as a valuable reference point for how to track costs and even offers a column to write in expenses for an individual operation when presenting data for the operation in question. Scenarios of possible marketing channels and their costs and returns are presented. The cattle fattened on grass are kept an additional year to come to a weight of 1,100 lbs, and fetched a price of $0.78/ lb (Larson et al. 2004). Relative to Iowa graziers, Denise Schwab, ISU Extension Beef Specialist, is currently tracking expenses on multiple grass-based livestock operations, and a report of this information will be available in the spring of 2011.

Digiacomo et al. (2001) profiled a young, beginning part-time beef cow-calf grazing operation as it began expanding into finished beef and local sales. The grazing enterprise covered 145 acres of ground formerly enrolled in the CRP, and grazed between 40 and 70 head of cattle depending on the season. An analysis of whole farm economics including liquidity, profitability, efficiency, solvency and debt repayment capacity were reviewed and compared with West Central Minnesota farm businesses of similar age and size. A low-stockling rate, high corn supplementation and overwintering steers significantly impacted profitability for the 3 years of the study, however other overhead costs were well below similar operations. To remain competitive, the authors conclude, this farm
would need to reduce feed costs through a combination of increased stocking rates, reduced supplementation and fewer soil amendments are recommended.

One thing to keep in mind when exploring the economics of grazing are the other aspects of the choices producers make in grazing management is placing the numbers in the context of the quality of life that these practices are associated with. Specifically, studies on dairy farms report that the primary benefit and motivator for producers to switch to grazing as their primary feed source was a quality of life factor (Loeffler 1995). Pasture based livestock operations are a key ingredient for economic and social sustainability in rural communities (Conner et al., 2008; Morton and Miller 2007). Michigan farmers interviewed by Conner et al. (2007) associate the largest value in doing pasture-based farming with the opportunity to farm as a family, do enjoyable work, and contribute to the well being of a community.

Section VIII: Grazing in Perspective: Scales in Management and Environment

Pastures are essentially a manipulated ecosystem before they are human or economic systems. Coleman and Sollenberger (2007) note there are various ecological scales in our understanding of grazing. At the landscape level, the system is divided into plant communities, then patches, then feeding stations, and at the finest scale, individual plants. An understanding of the gradient of these scales, places management decisions in context. A ‘feeding station’ may become seriously overgrazed if livestock stay too long, and this may disrupt the seeding and propagation of the plants that he livestock were so desirous of; a manager might take note of this in the context of the whole land base available and ensure that the animals either are moved from this area after a short period of time, or that the area is given adequate recovery time. The management of the overall landscape markedly influences the rate at which change occurs at the plant community level within a pasture (Coleman and Sollenburger 2007). In other words, each scale is connected in space and time. Former land uses and adjacent land uses in the landscape scale can greatly influence what kinds of plants and forage production occur. Managing animals with the tool of grazing can greatly influence plant
and animal communities, even patches of plants (Daines 2006).

**Looking Forward: Livestock Production Can Serve Multiple Functions**

Several venues currently exist today that provide an opportunity to manage grazing lands for multiple services. Forage crops show promise as a tool to diversify farming systems. Grazing in conjunction with the incorporation of forage crops into a 6 year grain rotation has been shown in Canadian studies to reduce income variability or risk, more so than crop insurance (Zentner et al. 1986). Grazing animals learn and respond to several scales of resource heterogeneity (e.g. variable resources of forage, shelter and water), as influenced by human management (Laca 1999). One resource that is certainly heterogeneous in its vegetative composition and function are lands currently or formerly in the Conservation Reserve Program. In the words of University of Nebraska forage specialist Bruce Anderson in reference to the forage resources in these lands, “CRP ain’t just CRP (Anderson 2009).” Grazing Conservation Reserve Program lands has been a topic of renewed interest in the past few years, due to the large number of acres due to be released from the program (Secchi and Babcock 2007). A case study featuring grazier Kurtis Hall of Decatur County grazes lands in CRP very third year and takes a payment reduction for doing so. Using these acres as ‘insurance’ against running out of forage on his other pastures, and also provides ecological benefits and habitat for wildlife (Betts 2009). Local NRCS, DNR and Extension personnel are encouraging landowners with CRP to partner with local livestock producers to realize these benefits. While Hall and his family see using CRP lands as ‘insurance’ to provide additional forage for livestock on their farm, as we will investigate in the next section, it may be the insurance as part of a strategy to maintain and enhance ecological services in Iowa.
PART 2. ECOLOGICAL SERVICES PROVISIONED BY VARIOUS GRAZING MANAGEMENT SYSTEMS IN IOWA

This section will provide a basic overview of research and information regarding the impacts various grazing practices have on Iowa’s pasture ecosystems. Different grazing practices can lend themselves to positive or negative results for ecosystem functioning at multiple scales (i.e., Asner et al. 2004; Collins et al. 1998; Guretzky et al. 2005). Specifically, the Grass Based Livestock Working Group, for whom this document was initially conceived, seeks a better understanding of how certain types of grazing alter, enhance or degrade these systems, and what the potential value or value-added characteristics of those enhancements are to the economy and to society. Concomitantly, this information also informs ways to mitigate potential land-based tradeoffs. All in all, connections between Iowa’s ecosystem functions in grazed pastures and grasslands and the production of ecosystem services using the tool of grazing livestock is explored.

Overview

Section I of this chapter will outline relevant distinctions in Iowa’s grasslands in terms of the types of vegetation that tend to comprise Iowa’s grasslands today, as well as the original nature of those lands. A discussion of the climactic and botanical variations in these areas and the implications for management will ensue.

Section II briefly reviews evidence and examples of the joint production of livestock and the forages needed to sustain their production, as well as the enhancement of ecological functionality. Studies that synthesize research on physical systems, scenarios, and models to demonstrate this possibility will be presented. Following this will be a discussion of the essential elements necessary for optimizing the joint production of these services.

Section III breaks down these essential components in the joint production of economic and ecological services in grasslands into their concomitant functions in human and natural economies. The specific ecological services these functions provide will then be reviewed.

Section IV synthesizes this information to recommend some general management practices that provision both ecologic and economic services.

Section V concludes the chapter with a discussion of what potential markets for payments for ecosystem services exist, and how they pertain to stakeholders in grassland management in Iowa.

Agricultural landscapes are multifunctional landscapes that jointly produce an array of socially vital market and non-market goods and services (Wilson 2007; Boody et al. 2005). The capability of an agricultural landscape to sustainably provide goods and
services is the sum result of complex interactions between biotic and abiotic components of ecosystems that mediate the driving forces of matter and energy (de Groot et al. 2002). In short, the quantity, quality, timing, and compliment of goods and ecosystem services are dependent upon the ecological functionality of a landscape, regardless of service type (e.g., provisioning, regulating, supporting, or cultural.)

Agricultural landscapes are simultaneously characterized as being highly complex, socially constructed mosaics of land-use constrained by ecological capacity. Row-crop agriculture underscores this notion perfectly (Nassauer et al. 2002). Row-crop agriculture, particularly in the US Corn Belt region, has evolved in ways that attempt to reduce land based constraints and, ironically, increase productive capacity by reducing ecological complexity through landscape and managerial modification/simplification. It is clear, however, that such an approach while highly productive in terms of tradable crop commodities is also known to have strong, negative impacts on ecosystem patterns and processes that are essential to ecosystem function (Robertson and Swinton 2005). Many of the consequences of ecosystem impairment are subsequently passed on to society as negative externalities that are increasingly being experienced at multiple spatial and temporal scales (Tegtmeier and Duffy, 2004). In contrast, remnant high-diversity perennial prairie systems are noteworthy because of their long-term net soil carbon sequestration and because of their high diversity are thought to be more stable than lower diversity systems to environmental perturbations (Tilman et al. 2006). It is becoming understood that high diversity systems are capable of providing a wide range of critical ecosystem services (Hector and Bagchi 2007).

To create a sustainable and profitable synergy between the joint production of livestock, forages and ecological services, frameworks used to make decisions on these lands must be reoriented to practices suitable to producers on the ground (Kemp and Michalk 2005). This is a sizeable task given the fundamental complexity of managing pastures for even one function, the production of livestock.

A proliferation of literature exists regarding in-field practices for cropping systems designed to reduce inputs and conserve soil and water resources. However, information
and research pertaining to grazing systems has not been as prolific or specific. One reason may be due to the overall complexity of managing pastures to grow and finish livestock and simultaneously manage complex (native or introduced) plant communities. For example, because of nutritional differences in forage, regionality and seasonal variability of grass systems, the effects of grazing on animal weight gain and concomitant impact on carcass and meat quality show mixed results (e.g., French et al. 2001).

Regarding grass systems, pastures with two or more species have long been characterized as being difficult to manage and ultimately unpredictable (Doll et al. 2009a). Grazing can have either negative or positive consequences on habitat structure (for a variety of species), ecosystem functionality and overall forage productivity, and all of these potentialities are contingent on management (Briske et al 2006; Butterfield et al. 2006; Heitschmidt and Taylor 1991). What we do know about pasture systems, in general, is that they produce significant ecological benefits as well as supplement the overall productive performance in forage and grain rotations. For example, benefits of integrating pastures into cropping rotations include higher grain yields for up to thirteen years following forages, changes in weed populations away from species that heavily compete with crops, as well as overall improved soil quality (Entz, 2002). Though it is vital to recognize the value of pasture and forages to enhance row-crop agriculture, this chapter will focus solely on the mechanics of grazing on the ecological systems of Iowa.

The literature and research of the environmental benefits produced specifically by grazing has more recently been referenced as ‘ecosystem services’, a modern way of describing an old concept that humans rely and benefit from ecosystem function for survival (Mooney and Ehrlich 1997). The concept of ecosystem services gives value and weight to a large suite of essential functions in a given ecosystem in discussions of natural resource management. Iowa’s land use and cover reflects an anthropogenic system, or a human-constructed landscape, with ecosystems altered for high yield agricultural production. Nevertheless, managing for ecosystem services and production need not be competitive in practice. For instance, Gagnon et al. (2004) emphasizes that of all possibilities for land use strategies in Iowa’s ecoregions, those that integrate directly with agricultural practices are most likely to be effective. Agricultural practices
such as grazing livestock are often seen as a compromise between production agriculture, implying a loss of native biodiversity and complete ecological restoration, rendering it a more ‘multifunctional’ agricultural system (Boody et al. 2005; Jackson et al. 2010).

Grazing, as an agricultural practice, is poised to play a major role in managing ecological functionality (Doll et al. 2009a). Forages can be considered part of the solution to environmental problems associated with manure management, playing a key role in the nutrient balance on a farm and watershed scale (Cherney and Kallenbach 2007). Management of pasture offers a venue for the coexistence of grass-based and grain-based animal production in that manure from Confined Animal Feeding Operations (CAFOs) can be applied to grazed and harvested grasslands to minimize nutrient losses on a landscape scale (Sharpley and West 2008). Simultaneously as noted in Bakker (2006), the re-introduction of large grazers in remaining highly productive natural grasslands is likely crucial for the plant diversity on these areas.

The ability for gazing management to navigate between and negotiate the existence of two seemingly opposing functions such as the high-volume production of animals and native biodiversity will likely facilitate partnerships across disciplinary and political boundaries to meet societal demands for environmentally sound management (Hanson and Hendrickson 2009). Projects that promote the management of an agriculture that is multifunctional will be more likely to influence the development of policy and programming that compensate farmers to produce environmental services, as opposed to management geared towards the provision of a singular service, such as biodiversity (Goldman et al. 2008).

Ecological terminology used in this section is defined in the index (page **). Accessing the vocabulary of this discipline may occasionally arduous for readers who are unfamiliar with general principles of ecology. However, having more tools to describe and capture the ever-changing dynamics of grassland systems will ultimately make land managers better able to do the job.

Section I: Characteristics of Iowa’s Ecoregions: Understanding the Environments We Manage
“Prairie is a very complex community. In one’s early study it seems somewhat elusive...This vagueness of understanding can be overcome, once the species are known, by visiting the prairie several times through the growing season, examining it closely...and always with a definite purpose in mind.”

-Naturalist J.E. Weaver (1958), in reference to Guthrie County, Iowa’s remnant prairies.

Grazing is fundamentally a way to manage and harvest vegetation as forage, which is why many graziers refer to themselves as grass farmers. However, not all grasslands are physiologically the same in Iowa nor are their responses to management. Physiography, geology, climate, land use, hydrology, and vegetation are all integrated into the unique aspects of an ecoregion (Chapman et al. 2002). Becoming familiar with the biophysical context of a given pasture within a distinct region is a tool to describe an ecosystem’s potential to response to disturbance (Bryce et al. 1999). In this section ecoregions will be talked about mostly in terms of the endemic vegetative composition of those regions. Though there are distinctions between these regions, a common idea that connects all these regions is that they were structurally heterogeneous. Heterogeneity describes diversity in vegetative stature, composition, density and total biomass, and is the precursor to understanding biological diversity, and orienting ecosystem management (Christensen, 1997). Heterogeneity and complexity on multiple scales is critical to sustaining ecosystem function (Christensen 1997b). Fuhlendorf and Engle (2004) discuss a heterogeneity-based approach to management, using focal disturbances such as livestock grazing and fire, termed “patch-burn grazing”, to influence a shifting pattern of vegetation across the landscape (Fuhlendorf and Engle 2001).

Three major ecoregions in Iowa represent the largest variation in vegetative community composition (Olson et al 2001; Bailey 1978). Various mosaics of prairies, rolling woodlands, and wetlands comprised Iowa’s landscape; more specific descriptions are offered by Olson et al. 2001 in the index) Generally speaking, Iowa is part of the temperate humid zone, defined generally by the geography and climate unique to this area (Cherney 2007). Climate and specifically moisture gradients have a large influence on how grazed areas respond to the impacts of grazing (Milchunas and Laurenroth 1993). Climate is the abiotic aspect of the grassland ecosystems we cannot directly manage,
while the biotic components can be altered and are what produce valuable goods and services for humans; the integrity of these systems depend solely on the management of the flow of energy and efficient cycling of materials required to capture solar energy (Heitchmidt et al. 1996). Iowa’s climate allows for both warm and cool season species to thrive, such as big bluestem and smooth brome, which share what Baron (2007) calls an adaptation center.

**Iowa’s Grasslands and Pastures**

The vast majority of Iowa’s pastures utilize mostly introduced cool-season grasses that have higher nutrition in the early part of the growing season. These grasses, such as fescue, ryegrasses, orchardgrass, bromegrasses, Timothy, and Bluegrasses, tend to be used in monocultures on specialized production systems (Casler and Kallenbach 2007).

Bailey (1996) classified ecoregions for North America, which were then subdivided into domains and divisions; Iowa is part of a division that was added, called the prairie division, which is “…a transition from the dry temperate steppe grasslands to the north and more humid, forested and warm continental divisions to the south (Baron and Belanger 2007: 84). In Iowa’s fertile soils and non-limiting precipitation, dominant plants are tall plants, such as warm season grasses and woody species, to compete for a strong limiting resource, light (Burke et al. 1998; Olff and Ritchie 1998). This tendency is modified with disturbances like grazing, which opens the canopy to differing degrees depending on the type of animal and the grazing FIT (Gibson 2009). Two main environmental factors dictate what species comprise any given grassland sward, or a given portion of ground covered in grassland and pasture species, in order from factor with greatest influence to least (Peeters 2004): Type of management and the cycling of nutrients and animal waste.

**Type of Management:** Grassland community species diversity is influenced by the disturbance regime, i.e. the frequency and intensity of disturbances (Peeters 2004). Grazing ungulates affect grassland structure and function, as well as plant community composition (Knapp et al. 1999). In most of Iowa’s ecoregions, warm-season grasses
were the dominant species (Weaver 1958). The responses of different plants to grazing are highly variable, and dependent on the conditions they adapted to. A familiar example of how management determines the vegetation comprising a grassland sward, warm season, or C₄ grasses. These grasses are not tolerant of any grazing that allows for close and frequent defoliation because they developed under a system that had *intermittent* grazing as well as occasional fire (Anderson 2000; Fuhlendorf and Engle 2004). This supposed co-evolutionary relationship has been the topic of much debate and conjecture (Gibson 2009).

A recent study mimicked practices associated with Management Intensive Rotational Grazing (MIRG), or high-intensity, short duration grazing with bison, and found that warm-season species declined and were replaced by introduced cool-season species (Jackson et al., 2010). This was attributed in part to the finding by (Mousel, 2003) that Big bluestem persists in pasture mixes with less intense grazing (residual height of >10 cm) and/ or longer (>40 days) recovery times. Further evidence that warm-season grasses are not ideal in systems that have frequent defoliation is that older leaves do not remain photosynthetically productive as they age (Mehaffey et al. 2005). The general recommendation for maintaining stands of warm-season grasses is to never graze them below 6-8 inches (Roberts and Gerrish 1999). They also do not break down as quickly in litterbanks as cool-season grasses largely due to the differences in C:N ratio between cool and warm season grasses, occasionally necessitating the use of fire to catalyze the process for warm-season dominated stands (Vinton and Goergen 2006).

Carlassare and Karsten (2003) demonstrated that grazing regimes that keep swards at shorter heights tend to favor short, sod forming grasses and annual forbs. Shorter, here, is defined as grazing when the tallest grass was 20 cm before grazing and the residual height averaged 5 cm (Carlassare and Karsten 2003). A taller grazing regime, when the height of the tallest grass was at 27 cm prior to grazing and the residual height averages 7 cm, produced more total pasture and specifically orchardgrass on average each grazing period, and was more likely to limit less desirable species, defined by the authors as quackgrass and dandelion.

**Nutrient Availability:** In grazing systems, over 90% of the nutrients that are removed
from the soil via vegetation and foraging, are returned in differing facets by manure and urine (Barnhart et al. 1998). Yet, management significantly determines how much of those excretions are able to be cycle through the pasture ecosystem (Sharpley, 2008).

Wedin and Tilman (1996) describe how the addition of even small rates of N causes grasslands to shift to overall lower diversity, shift to cool-season grasses, and store low rates of C. Over 12 years of experimental addition of various rates of N, researchers found that as N rates increased, the percent of C₄ biomass declined sharply even with rates of less than 5 g m⁻² year⁻¹, or less than 45 lbs/ ac/ yr (Wedin and Tilman 1996). Additionally, the fields dominated by cool-season grasses (in this case mostly quackgrass and Kentucky bluegrass) retained “…essentially none of the added N at low-input rates (Wedin and Tilman 1996: 1721).” Grazing, when contrasted to burning, can accelerate the N cycle in grasslands (Johnson and Matchett 2001).

This confounds recent findings in S. Michigan, where researchers wanted to investigate the potential benefits of integrating big bluestem or switchgrass into cool season pastures (Hudson et al., 2010). The pastures used in this study, as well as a similar study by (Moore et al., 2004) to integrate and test the efficacy of switchgrass and big bluestem in grazed pasture were annually fertilized in spring for multiple years with higher rates than discussed above. This potentially affected the ability of these species to respond to grazing pressures or compete with cool-seasons. It is also worthy to note that none of these areas were burned during the study period, which has been shown to maintain forage quality and persistence in warm-season grasses (Vinton et al. 1993).

Low plant diversity of a sward can slow the rate of litter decomposition (Hector et al. 2000), ultimately slowing nutrient availability. In a humid environment like Iowa, nutrient availability tends to exert more influence on the composition of a sward than soil moisture or pH (Hector et al. 2000). White et al. (2004) concluded that local-scale ecological processes, mediated by nutrient availability, are seen as primary determinants of patterns of vegetative diversity in grasslands.
Section II: Evidence for Joint Production of Ecosystem Services and Anthropogenic Services: Bridging Conservation and Working Lands

The processes discussed previously that influence vegetative composition are a part of developing a better understanding how to build sustainable grazing practices (Kemp et al. 2000). Grazing has become a topic of interest in the ecological restoration community due to its utility as a tool to suppress undesirable species and promote plant species diversity in prairie restoration efforts (Jackson et al. 2010). Many studies in the ecology literature focus on vegetative diversity, mainly due to the dramatic loss of species that once comprised the tall-grass prairies that once blanketed most of Iowa (Kurtz, 2001). Though graziers are wary of using native species such as warm-season grasses due to unknowns relative to grazing practices that promote warm-season growth in mixed stands (Jackson et al., 2007; Jackson et al., 2010), these species have several advantages when it comes to ecological health (CIAS 2009).

Iowa consists of highly productive ecosystems, which has specific implications for how large and small herbivores affect grassland plant diversity (Bakker et al., 2006). Spatially-explicit models were developed by a team of researchers to explore the potential of different scenarios of farmland management in Iowa (Santellmann, 2004). One of their scenarios illustrated what types of farming practices would be desirable to improve water quality, endorsing those enterprises that reduce sediment delivery, erosion and nutrient runoff, and improve aquatic habitat. In this scenario, forage crop production and rotational grazing are “…widely adopted as profitable enterprises supported by federal policy to help meet water quality performance standards on erodible land…woodlands are retained for carefully-managed grazing (Santelmann, 2004).”

A similar assessment was done on the Walnut Creek watershed, but did not look at the role of grazing systems. However, the importance of hay and forage crops as key practices to enhance biodiversity and water quality are emphasized, and assessed with through valuations of the environmental and economic impacts of these systems (Coiner et al., 2001). Farber (2006) assessed some of the data generated from the Walnut Creek study, showing that the value of service changes per hectare were highest for the water
quality scenario, mostly due to the drastic increase in soil retention.

Brudvig (2007) and Karnitz and Asbjornsen (2006) discuss grazing as a having seriously degraded Iowa’s remaining oak-savannas over time. Mabry (2002) echoes this, describing it as one of the primary factors in Iowa forest declines. Specifically, heavy grazing over time has been shown to change the layers of woodlands, altering or removing the understory and the functions of soil protection and wildlife habitat (Mabry 2002). Mabry (2002) selected grazed (sites grazed at an undefined rate and intensity sometime in the past 15 years) and ungrazed sites to sample vegetation. Mabry’s conclusions that there are major and undesirable differences between grazed and ungrazed plots is difficult to qualify, since the characteristics of the grazing FIT as discussed previously are not known in the sites studies. More research on appropriate grazing of Iowa’s woodlands is needed.

**Woodlands Are…**

*Intentionally* combined with crops and/ or livestock; the system is *integrated.*

Reliant on *interactions* between trees, crops and forage

*Intensively* managed to achieve economic, environmental and social benefits

**Fig. 2.1 The four I’s of Managing Silvopasture Systems**

Sharrow (2002) discusses the aspects of grazing temperate forests, specifically those dominated by conifers. Of note in this review is that the older a tree is, the less likely it is to be affected by grazing or browsing. Silvopasture is a method by which livestock, forages, and trees are integrated into a single system. The USDA National Agroforestry Center (2008) suggests that because these systems produce multiple products that they reduce risk. To manage these systems, the “Four I’s” are reviewed in Figure 2.1.
Section III: Ecosystem Services in Grazed Grasslands

“You know how the text books say if you allow pastures to grow roots and maintain good ground cover, infiltration will increase and runoff decrease? Well, it’s true.” – Jim Gerrish, 2004

Ecosystem services are defined as “…the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life (1997).” The literature regarding ecosystem services cultivates a more neutral ground for conversations that allow the integration of conservation and working agricultural landscapes (DeFries et al. 2004). Globally, grasslands provide over 17 ecological services worth 2.5 times that of cropland (Costanza et al. 1997). Ecological services are vital, economically valuable functions of healthy ecosystems; healthy ecosystems can be simply defined as absence of ecosystem disease (Costanza et al. 1997). Primary indicators of ecosystem discord would be nutrient leaching from terrestrial systems and subsequent nutrient loading of aquatic systems. Ruminant animals play an integral role in sustainable agricultural systems through the conversion of renewable resources into human food; land that is not considered productive in an agricultural context can be made productive with grazing management (Heitschmidt et al. 1996). Doll et al. (2009) found that the majority of producers surveyed in Wisconsin wanted to use more native species in their pastures, but lacked knowledge and resources to do so. Although the research on the direct economic benefits of grazing native warm-season grasses with cattle is mixed, the producers surveyed valued environmental considerations as much if not more than financial/production factors (Doll et al. 2009).

Despite the wide variety of ecological services that could be discussed, this chapter will focus on those services that the literature pertains to, in that we have research-based information on some services in grazing system, but knowledge is inconclusive or incomplete in other areas. For the purposes of clarity, this chapter will describe five central services pastures and grasslands provision. These services and their functional components that the literature presents, and are relevant to Iowa, are presented in table 2.1 and reviewed below. Though many presentations of the potential ecosystem services from forage and grazing lands attempt to review a long list of benefits, there are still
serious knowledge gaps in the ways in which these services are provisioned at specific scales, as well as how scientists communicate them. Each of these services will be presented with the type of grazing practices (which are described at different levels of specificity in different projects) helped provision the service.

**Heterogeneity**

**General Biodiversity:** Biodiversity includes all level of the organization of life, from genetic makeup to entire landscapes, and is not simply the number of species (Hobbs, 1999). Grazing alters plant allocation, litter quality, microbial interactions and the availability of N and light in indeterminate grasslands like those in Iowa (Burke et al., 1998). Freemark discusses the necessity of having a diverse mosaic of habitats, including pastures, to preserve herbaceous and woody species diversity (1996). In their landscape level study of habitats both on and around farms, pastures and hay fields had the highest species richness of any sampling done in other agricultural land-use areas.

Grassland birds can serve as an indicator of how heterogeneous grasslands are. Due to the time of year that cool-season grasses are at their peak biomass before many grassland birds need cover for nesting season, typically in mid-to-late summer, most haying and grazing takes places just as birds are attempting to find and build suitable nests (Giuliano, 2002). Giuliano et al. (2002) compared use and nest success of birds in Pennsylvania between warm and cool season fields nested within working farms and also reviewed differences in management between these field types. Overall abundance of birds was 1.6 times greater, fledge rates were 1.8 times greater, and species richness was 1.6 times greater in warm-season fields when compared to cool-season fields (Giuliano, 2002). This is mostly attributable to the availability of cover, and not necessarily the species per se. Despite this potential incongruence, there is still a number of studies that find native species of grasses tend to support a greater number and diversity of grassland birds than areas comprised of non-native species (Askins et al. 2007).

**Habitat Heterogeneity:** When compared to totally ungrazed grasslands that are mowed, grazed pastures had significantly higher plant species richness regardless of duration, even when measured at different landscape scales (Guretzky et al. 2007). For some,
species richness, a measure of biodiversity defined as the sheer number of plant species in a delineated area, might mean the inclusion of some ‘undesirable’ species. Insects have more habitat with grazing practices that leave residual and have a diversity of heights in the forage on a farm level. For example, (Dennis et al. 2004) found that beetle diversity and abundance is correlated with sward height. Plant species diversity at the scale of local habitat has the greatest influence on insect guilds in tallgrass prairie systems (Stoner and Jolen 2004). Insects are one of the primary drivers of decomposition in grassland systems, as well as soil microbial communities (Bradford et al. 2002).

Large herbivores such as cattle have more consistent effects on plant species diversity and at lighter stocking rates can greatly increase overall landscape heterogeneity through selective grazing and patchy urine deposition, while at high densities over time, can greatly reduce soil quality and diversity (Olff and Ritchie, 1998).

Murphy et al. (2004) suggest that rotational grazing system as practiced on the high plains of North Dakota influence the density of vegetative cover in drier years, allowing species who nest in this type of vegetation to do so. Nest success was not influenced by management type in this study. Large accumulations of vegetation can be detrimental to waterfowl and wetland habitat; controlled grazing is one tool to address this (Holechek et al. 1982). Duck nesting success has been correlated with the presence of pastures when compared to other agricultural land uses in the prairie pothole region; this is especially true in pastures that have been rested for long periods between grazings (Ignatiuk and Duncan 2001; Stromsmoe 2005). Pyke (2004) illustrated that grazing maintains habitat that is hydrologically suitable for endangered brachiopods and other threatened animal species in ephemeral wetlands.

Species Richness

Wildlife: Wildlife are likely affected more by the type of grazing management than by grazing in and of itself (Boyd et al. 1997). All animals create disturbances that concomitantly enhance diversity of plant species, and different suites of plant species are plastic enough to adapt to a variety of animal disturbance, such as ant hills, gopher mounds, vole burros, bison wallows, and badger mounds (Baer et al. 2002). A sound
understanding of habitat requirements for all wildlife allows managers to create habitat for desired species, as well as minimize habitat for undesirable species. For example, European starlings are considered a nuisance in many farm operations, costing millions annually in damage (Center 2010; Wohleber 2010). However, preliminary research suggests that when the short, sparse vegetative structure they need to nest in is reduced by changing grazing practices to allow for recovery by rotating livestock, their populations decline (Wohleber 2010).

In the context of the effect of grazing on Iowa’s grasslands, waterfowl and grassland birds are the most well researched wildlife species. Certain intensities of grazing FIT can benefit grassland birds (Giuliano 2002), and some grassland bird species evolved to occupy niches created by heavy grazing, as well as lighter intensities (Knopf 1994). An Illinois study recommended a “…coarse-grained mosaic of burned, mowed, grazed and undisturbed habitats…” for endangered birds in that state (Walk 2000). Specifically, their study of how 3 ha management units (burned, mowed, hayed, grazed and undisturbed) within a 473 ha study area, and demonstrated how different species prefer different habitats; low-intensity and late season grazing was recommended for maintaining this favorable habitat (Walk 2000). This connects to the findings of a recent paper by Walk et al. (2009) that even small patches of grassland in an agricultural matrix are important and provide functional habitat for species of management concern (in this case Dickcissel and Eastern Meadowlark).

Grassland bird species of concern such as the savannah sparrow, eastern meadowlark and the bobolink density higher on rotational and continuous pastures, and rare or absent on ungrazed buffers (Renfrew and Ribic 2001). However, this study did not specify the stocking rates, grazing periods, or any aspects of practices of the two management types, and the designation of rotational was quite loose, with paddock sizes ranging from 2.5-35.5 ha. The authors mention that the continuously grazed pastures sampled likely represented only moderate grazing, as opposed to findings by Temple et al (1999) who found a greater incidence of birds on rotationally grazed vs. continuously grazed pastures. This discrepancy was likely due to the differences in vegetative structure and density in the continuous pastures sampled by Temple et al., which were grazed more heavily with
higher stocking rates, though neither of these studies specifically accounted for that measure. The incidence of birds was strongly correlated, in agreement with many other studies, with vegetative structure. This finding is illustrated in Figure 2.5.

Studies on the efficacy of CRP lands for grassland bird habitat echo this sentiment (Patterson and Best 1996). Vegetative structure and composition in Iowa’s grasslands, as discussed previously, requires periodic disturbance to maintain (Baer et al. 2002; Tremain 2006). For maximum benefit to birds, grazing deferment on a section of a given land base is recommended during nesting seasons (Holechek et al. 1982).

![Figure 2.4 Grassland bird species associated with management and subsequent vegetation height and density. Thanks to Helga Offenburger, Iowa DNR; Adapted from Herkert (1994)](image)

Best (1995) reviewed the suitability of different agroecological habitats in Iowa, and evaluated scenarios of land use for the success of nesting species. They found that if crop diversity expands to include pasture and alfalfa, the number of species increase by more than 40% (Best 1995). Paine et al. assess the impact of stocking density under conditions common in the Midwest, and found that a higher stocking density allows more land at
one time to remain undisturbed, and causes no more nest destruction than other grazing methods (1996).

**Botanical: Forage Diversity:** One of the most commonly discussed principles linking grazing with ecological services is the ability to create and take advantage of plant diversity. Fitzpatrick (2004) provides and updated and comprehensive review of research and issues in the restoration of native plant communities in the Midwest, paying specific attention to establishment of new seedlings. Figure 2.5 (below) illustrates a simple decision-tool that can aid in evaluating diverse forages in pasture ecosystems.

![Decision-tool to design, implement and assess diverse plant communities for multiple functions in pasture ecosystems. Adapted from Sanderson et al. (2009).](image)

A 6 year study by Hickman (2004) specifically looked at what kinds of management influences species diversity, finding the highest levels of species richness in pastures grazed at high stocking densities (1.8 ha/cow-calf pair in this study) in combination with a late season rest-rotation. They found that “…the stocking density influences the overall intensity of herbivory and physical impacts, and the grazing system determines the spatial and temporal patterns of grazing and their effects across the landscape (Hickman et al. 2004: 62).”
This study re-affirms the discussion in the previous section regarding the importance of distinguishing grazing density/intensity from grazing timing and frequency. In this instance, (Hickman 2004) saw no effect of grazing system, e.g. continuous vs. what they term ‘late-season rest-rotation’, and determined that the vegetative outcomes of any grazing system are over-ridden by the effects of stocking density. Thus, manipulating animal density has potentially greater consequences in the long term for grassland community stability and ecosystem function, in turn influencing the long-term ability of these systems to sustain plant and animal productivity (Hickman, 2004).

The results of this work were also dependent on annual burns. Burning in combination with grazing in alternate cycles tends to yield the greatest plant species richness in grasslands with a long evolutionary history of grazing (Fuhlendorf and Engle 2004).

The impacts of high stocking densities with long recovery periods in Hickman (2004):
- Decreased tall warm-season species and favored medium height warm-season species.
- Greatest diversity of plant ages and heights in general.
- No effect on the incidence of short warm season species.

**Nutrient Cycling**

The availability of nutrients is one of the primary determinants of vegetative structure; for instance, it has been shown that non-native species such as smooth brome (*Bromus inermis*) favor the N rich conditions created by the application of ammonia fertilizers, and native, warm season species such as switchgrass (*Panicum virgatum*) are not as competitive in those conditions (Vinton and Goergen 2006).

**Nutrients deposited by livestock:** Urine contains nitrogen, potassium, magnesium, and sulfur (available for plant absorption). Nader et al. (1998) reported that up to 80% of the nitrogen in urine may be lost by volatilization. Urine spots by cattle impact roughly 24 inches in diameter, and the N concentrations under these spots can equal a 1,500 lb/acre fertilizer application. Feces contains less inorganic compounds and contain more phosphorus than urine, and much of the nutrients must be mineralized by decomposers before they are available to plants, but was showed by Steward (1970) to lose 37.3% of the nitrogen present in fresh feces within one week to volatilization.
How grazing and animal waste influence structure and function: The way in which grazing livestock deposit urine and feces can contribute to overall landscape heterogeneity by depositing nutrients in patches (Steinauer and Collins 1995). Specifically, urine patches are also more likely to be grazed and utilized by insects, as well as increase abundance of late successional species like warm-season grasses (Steinauer and Collins 1995). Bison have demonstrated clear preferences for areas treated with urine, and those grasses are shown to have higher leaf N content (Knapp et al., 1999).

Human alteration of the N cycle plays a dominant role in the persistence of N-philic exotic plant species, further challenging those who wish to preserve and manage native ecosystems (Vitousek et al. 1997). For example, species composition of pastures in northern Europe have changed markedly due to chronic N loading from air pollution; this has also been observed in California (Sanderson et al. 2004; Weiss 1999). Native warm season grasses tend to be more efficient in their use of N than cool seasons (Anderson 1996). Warm-season grasses and prairies tend to have increased production under burning, which could be understood as a catalyst in the process of cycling nutrients (Johnson and Matchett 2001). The quantity and quality of roots in a grassland system impact ecosystem-level processes, such as C and N cycling (Johnson and Matchett 2001). A pasture ecosystem in southwestern Wisconsin showed adverse effects of nitrogen application on root growth, though the literature shows a variety of responses (Doll 2009b).

Grazing has been found to increase the rate of N cycling in tallgrass prairie when burned annually (Johnson, 2001). Johnson and Matchett (2001) also found that fire increased root growth by over 20%, and heavily grazed areas had 30% less root mass than more lightly grazed areas (precise grazing density and methods were not defined); essentially grazing and fire had opposite effects on belowground processes. This study, located in the Konza Prairie near Manhattan, KS, illustrated that herbivore effects on N cycling occur the distribution of N through plant litter and labile forms in dung and urine.
(Johnson, 2001). It is important to note that this study allowed heavy grazing via ‘grazing lawns’ created by repeated defoliations through the season by a herd of bison.

Detling (1988) found that vegetation in grazed systems had higher estimated nutrient concentrations, supporting the commonly held assumption that grazing can increase rates of nutrient cycling. Depending on the management system, increased rates of nutrient cycling may potentially support faster nutrient losses from the system as well (Woodmansee 1978, Floate 1981). In Iowa, phosphorus runoff from pasture systems has been an issue, and the general recommendation is to limit access that livestock have to streams (Russell et al. 2009). For pastures that accumulate a significant amount of manure over time, harrowing is a common practice to allow for quicker breakdown (Nash and Halliwell 1999)). However, when nutrients leach from pastures, soil movement is the primary mechanism transporting it to waterways (Moeller et al. 2006) and is also dependent on sward height (Boehm 2003).

Many smaller livestock operations, namely sheep and cow-calf producers, use crop residues as a supplement to winter feed. One concern with this practice is that it could impact crop yields due to changes in soil structure and function from compaction. An Iowa study in soybean fields found that when soils are grazed while frozen or disked before planting, any compaction resulting from livestock use is negligible (Clark et al. 2004)

**Carbon Sequestration**

Carbon sequestration is part of a dynamic system of feedbacks between the structure of swards, plant diversity, and soil qualities such as N availability and C storage (Burke et al., 1998). Carbon sequestration is ultimately a product of nutrient cycling and concomitant decomposition of nutrients; it occurs as a product of the balance between the rate of organic carbon input and decomposition over time (Schnabel, 2001). Burke et al. (1998) provides a thorough review of the soil-plant interactions that take place in intermediate dominance grasslands that influence processes linked to C sequestration.

Fire frequency and grazing management, in conjunction with characteristics of the
photosynthetic pathways of dominant plant species, are the dominant factors affecting ecosystem properties such as carbon in grasslands (Seastedt et al., 1994). At warmer temperatures, soils can lose carbon due to increased plant respiration; having warm season grasses intermixed into pastures can negate these losses (Seastedt et al., 1994). Warm seasons are generally associated with greater C: N ratios than cool seasons, thereby the sequestration of more C into soil; this increase is less significant in already fertile, C rich soils (Schnabel, 2001).

**Soil Organic Matter (SOM):** Greenwood (2001) provides a thorough literature review on the effects of grazing on soil physical properties. The composition and important functions of SOM is simply explained in a review by Arlene (2000). Soil becomes more resistant to compaction where SOM forms a surface mat (Greenwood and McKenzie 2001). The length of time a herd has access to a given area can also influence soil quality. A common concern in pasture management is what many call ‘pugging’, a term to describe what happens when the ground is too wet and soils begin to become compacted (Gerrish 2004).

The soil microbes that aid in the decomposition of manure require a C:N ratio of less than 15-20 to slowly release compounds sufficient for plant growth (Nader et al. 1998). Research demonstrates that defoliation increases C exudation, and this labile material is rapidly utilized and incorporated into a “…growing rhizospheric microbial population (Hamilton and Frank 2001).” Soils with clipped Kentucky bluegrass plants had double the percent soil carbon when compared to unclipped (Hamilton and Frank 2001). Ultimately, grazing that allows for a microenvironment that feeds soil fauna will facilitate the formation and cycling of SOM (Bradford et al. 2002).

**Carbon Sequestration:** Grazing warm-season grasses in the summer can increase organic C accumulation with no soil compaction, as is the concern for those incorporating grazing into crop rotations (Franzluebbers, 2001). It is implied that because of their higher belowground biomass (Wilsey and Polley 2006), native grass species will lead to increased carbon sequestration as they become more prevalent on the landscape (Doll 2009b; Sharpley 2008).
The intensity of grazing management may influence carbon sequestration as well; the adoption of MIRG has been associated with increases in SOC due to the breakdown of residue; this is especially true on lands that are of marginal fertility with adequate moisture (Schnabel 2001). This is qualified, however, by the notion that frequent defoliation of pasture swards requires plants to allocate C from roots to charge regrowth. Schnabel et al. (2001) is the most consistently cited authority to date on how grazing systems in both range and pasturelands sequester and store carbon.

**Water Quality**

**Flow Mitigation & Storage:** Stimulating infiltration of water in critical areas can restore multiple ecological functions (Gordon, 2007). Turbidity for streams at rotationally grazed sites has been shown to be lower, and to have less exposed streambank when compared to continuously grazed sites (Sovell, 2000).

**Mitigation of Nutrient and Sediment Flow:** It is widely accepted that vegetative cover is one of the main factors on the landscape that can be managed to minimize runoff and erosion (Sharpley, 2008). Results in a study of two Minnesota streams by Sovell et al. (2000) show that woody buffer strips are only effective when forest canopy cover is managed to allow ground cover and understory vegetation. In this instance, grass buffers removed 50-60% of sediment entering the buffer. Digiacomo (2001) found that a pasture-based system in the Sand Creek watershed in Southern Minnesota lost only 52 lbs of soil per acres during an intense rain event, while adjacent corn fields lost ten tons of soil per acre, and corn fields using conservation tillage lost five tons per acre.

The Iowa Department of Agriculture and Land Stewardship (2009) reviews the myriad of water quality projects undertaken by Iowa Soil and Water Conservation Districts, sixteen of which use improved grazing practices to improve water quality, on a total of over 7,766 acres. In a report to the USDA’s Sustainable Agriculture Research and Education program, Zaimes and Schultz (2005) assess the benefits of rotational grazing for stream health, specifically sediment reduction, in three different Iowa streams. Small order streams can transport sizeable amounts of sediment to larger rivers (Johnson, 2003). Although most ‘rotationally’, or ‘intensive rotationally’ grazed pastures had significantly
less erosion than continuously grazed or cropped sites, in the southeast region the rotational pastures had much higher losses than continuously grazed areas (Zaimes, 2005). The authors attribute these mixed results to broad and divergent definitions and interpretations of what ‘rotational’ grazing is, and also that only recently had some of the cooperating producers transitioned to allowing more rest in paddocks by rotating livestock. Ultimately, they emphasize a need to allow more recovery time to areas near waterways, and emphasize that the frequency and timing an area is grazed is more important than the type of grazing system (Zaimes, 2005). Case studies of three grass-based livestock operations in two Minnesota watersheds also demonstrated the direct link between management of grass cover and water quality (Digiacomo, 2001).

This sentiment was echoed by Russel et al. (2009), who researched the effects of pasture management on sediment and P loading of streams in two Iowa watersheds. They found that, after 2 years, bank erosion did not differ in streams of pastures with different stocking rates or systems. The measureable difference in stream bank condition was in restricting stream access or using rotational stocking with ample recovery, allowing an increase in sward height and density within 35.5 m of banks.

Nitrate leaching from grazed areas was shown to be correlated with the percent of pasture utilized by animals and whether or not pastures were fertilized with N or maintained fertility with white clover swards; pastures using supplemental N had double the leachate than pastures using legumes (Sharpley 2008). Boehm (2003) found that soil P losses on upland pastures in Iowa are correlated with sward height as well as soil moisture.

The Land Stewardship Project published a comprehensive annotated bibliography that specifically looked at literature regarding stream health, morphology, and the grazing practices that can benefit these systems that provides resources that discuss these issues more in depth than is appropriate here (Driscoll and Vondracek 2002). Riparian buffer strips, when periodically grazed, maintain appropriate stand density (Sharpley and West 2008).
Forage

**Quantity:** Forage quality is just as, if not more important, than persistence over time. Carrying capacity of cool-season pastures in Iowa is greatly reduced as the season progresses (Moore et al. 2004). Productive annual forages are useful for controlling weed invasions in pastures, though may not be sustainable in monoculture (Tracy 2004). Increasing the diversity of forages overall creates greater primary production, yield stability, and reduced pathogen infection (Tracy, 2004). For instance, including warm-season grasses can increase total production (Jackson et al. 2010). One strategy to do this is to have one or two paddocks planted to warm-seasons to graze when they are in a late-vegetative state (Barnhart et al. 1998; Barnhart 1994; Moore et al. 2004).

**Quality:** MIRG has been shown to increase forage quality at equal amounts of biomass when compared to totally unmanaged continuously grazed pastures; some aspects of forage quality may be addressed by grazing to vary the residual leaf area on plants, thereby keeping growth and senescence in flux with varieties of different plants at different stages, and ages (Hickman 2004). This enables livestock to choose what suits their nutritional needs, a constant balancing act (Provenza 2009). Younger leaves are typically preferentially harvested in older plants due to their higher rates of photosynthesis (Mehaffey et al. 2005). A study in Iowa County, Wisconsin showed that as the density of native warm-season grasses increased, there was no change in overall forage quality in spring and summer, with a slight decrease in fall (CIAS 2009). Cool-season pastures are typically revered for the protein content and are high in protein early in the summer, and then stabilize for the remainder of the season (Moore et al. 2004). Cattle grazing big bluestem in summer performed better overall, especially when grazed in a sequence including kura clover (Moore et al. 2004).
Figure 2.6 Summary of ecosystem services discussed in Section IV. Five main drivers of the physical environment and human management shape vegetative structure (height, density, age structure; what Rook et al. (2004) refers to as ‘sward structural heterogeneity’), the primary interface with which ecological services are provisioned in grazed grasslands in Iowa. Adapted from Havstad et al. (2007).

Section IV: Managing for the Provision of Ecosystem Services in Grazing Systems: What Guidelines and Practices Are Important?

Anthropogenic disturbance can now be incorporated into ecology in the same way as any natural disturbance, rather than being considered as distracting noise. The incorporation of human activities into ecological investigations is most obvious in the field of conservation biology, but one can predict that the ecology of agricultural systems will also undergo fresh growth in the coming years, as a result of hybrid vigor. -R.J. Hobbs and S.R. Morton 1999.

Reading Ecosystems: Scale Counts: Outcomes of sustainable grassland management with the tool of grazing will be more effective for conservation goals if we approach their management at a landscape rather than a paddock focus (Kemp and Michalk 2005). Studies in vegetative biodiversity affirm the efficacy of this approach (White et al. 2004; Freemark et al 2002).
For example, the objectives of international bird conservation groups such as Partners in Flight echo the need to link ecological scales to human management scales, in that the design of an optimal conservation strategy for grassland birds “…requires a shares conservation strategy among entire communities of partners (Will et al. 2005:6).” Both species and landscape diversity are important, yet agriculture proposes a decision; are we to increase diversity within farms, or can a similar outcome occur by diversifying ‘between’ blocks of land (Hobbs, 1999).

Long term ecological research in agriculturally dominated areas at the watershed-scale is lacking (Santelmann et al. 2004). Naugle et al. (1999) evaluated the influence of scale on how prairie wetland birds utilize habitat. Due to the unpredictable nature of the hydrologic cycle in the prairie pothole region, vegetation structure largely dictates wetland conditions and habitat suitability; research demonstrates that landscape scale impacts of human management are related to patch dynamics in wetlands (Naugle, 1999). Ducks Unlimited Canada developed several applied research projects regarding grazing management practices that benefited wetland and riparian areas, and also echoed the need to retain and manage grasslands at the landscape level (Stromsmoe, 2005).

**Animal Behavior, Selectivity and the Benefits of Plant Diversity:** The ways in which we define scales of management and landscape shape how we manage grazing systems. These definitions have consequences as to how livestock respond to the scales of resource heterogeneity we allow them to access. Resource heterogeneity, in this context, describes the locations in time and space where essential needs of livestock exist, and also recognizes the fact that they respond to these complexities just as much as we facilitate the response desired from livestock.

As discussed in the previous chapter, grazing frequency, intensity and timing are fundamental drivers of pasture composition and performance. Ecologically, the dynamics of stocking density are specifically relevant in terms of the ability to manage animal behavior and selectivity to create heterogeneity (Laca 2009).

Many agronomic studies of the incorporation of warm-season grasses into cool-season pastures do not discuss how livestock in the study may or may not be familiar with
grazing diverse mixtures of forages or warm-seasons. Hudson et al. (2010) imply that forage refusal is somehow an inherent reaction livestock have to lower quality forages, when in fact their decision to refuse may due to not learning to utilize it from their dam, as illustrated by Provenza (2003). It is precisely the choosiness of livestock that allows them to enhance what Rook (2004) terms ‘sward structural heterogeneity’, or a diversity of ages and types of plants and functions. Manipulating livestock to behave as a mower or baler would, i.e. utilizing all plants to precise amount and height, defeats the natural ecological and productive benefits allowing variability in their choices allows. This concept illustrates the fine balance between keeping a pasture system productive for livestock but also for sustained availability of habitat for diverse flora and fauna.

Plant biodiversity allows for animals to make choices between tannins, saponins and alkaloids; the sequences that plants with these compounds are consumed can increase intake an overall gains (Provenza 2009). For example, for those managers dealing with endophyte infected fescue, Provenza et al. (2009) suggests that making legumes that contain tannins (e.g. birdfoot trefoil) and saponins (e.g. alfalfa) available reduces toxicity and increase intake. This is an example of an ecosystem service (plant diversity) facilitating an economic service, in that fescue alkaloids cost over $600 million annually in the US in cattle losses annually (Ensley 2001). Additionally, Sellers (2005) reviews general recommendations for managing fescue by Dr. Craig Roberts.

Section V: Examples of Payments for Ecosystem Services: Approaches and Possibilities

“Who knows, with suitable prairie habitat once again available, the haunting, resonant call of the prairie chicken might once again be heard on Iowa booming grounds.”

-Ronnie George, Iowa Wildlife Research Biologist, 1974

When the leaflet ‘Native Grass Pastures’ was written by Ronnie George in the mid-1970’s, his optimism was apparent in the text. He seemed convinced that private landowners would accept the proven benefits of grass management, specifically by incorporating warm seasons for use by livestock and wildlife. In today’s economic climate, producers are squeezed from many angles, and are wary of adopting unfamiliar
practices that may decrease or alter profitability, if even for a short time. Though the research on managing pastures for ecological and economic outcomes has come a long way, there are still gaps in our understanding of the complex biotic systems that are grasslands.

Not only has the economic climate shifted from the 1970’s, but so has the political, in the context of the potential for increased regulation to protect environmental quality. In December of 2008, leaders in the cattle industry from seven counties sat down to talk with professionals from Iowa State University Extension, and the Iowa Beef Center (IBC). One of the most often identified concerns related to the societal perception of beef production in Iowa. Participants felt ‘besieged’ by regulations, bad press and activists concerned about the environment, and expressed a need for more education of the public about cattle production today. The IBC’s conclusion based on these discussions is to partner with organizations that address these concerns, and work with them to provide research that evaluates the costs and benefits of alternative policies or market actions (Lawrence 2009).

This conclusion is in alignment with a discussion of ecosystem services provisioned from agricultural systems by Swinton (2008), who reiterates that to move forward with developing Payments for Ecosystem Services (PES), research from multidisciplinary teams must be facilitated. None of this is to say that producers are not adaptable and privy to new markets. On the contrary, grass-based systems for livestock as well as for biofuels (e.g., Boody 2009; Sanderson 2008) has piqued the interest of farmers, and could result in the diversification of enterprises to accommodate these interests (Hanson and Hendrickson 2009).

A small example of the value or ‘land ethic’ so to speak that landowner’s hold was revealed in a survey done in Guthrie County, Iowa. Landowners surveyed in the Raccoon River Savanna Bird Conservation Area in Guthrie County show that these individuals value ecological systems very specifically; protecting wildlife habitat, enhancing prairies and grasslands, and reducing soil erosion were all ranked as very or extremely important (Regen et al. 2009). It is likely that Iowans desire the provision of more than a singular
ecological service. In a recent poll, 90% of Iowans said that protecting land, water and recreational opportunities is critical to the state’s economic vitality (IWLL 2009).

In Rhode Island, Swallow (2008) provides an insightful and accessible discussion of the methods used to explore market mechanisms at a local scale for the provision of ecosystem services desired by residents. Three market mechanisms relative to cultural and aesthetic values that residents place on wildlife in grassland areas were tested. All of these mechanisms to value the service of wildlife in these areas, namely bobolinks, incorporated a provision point, which corresponded to the minimal amount of funding needed to omit hay harvesting or grazing from these areas during the late-season nesting period for this species (Swallow 2008). The project ultimately inspired Jamestown producers to explore decisions to alter grass species, and to overall be mention better manage the joint production of grassland birds and livestock feed.

In 2006, Katherine Smith, Administrator of the Economic Research Service with the USDA, gave a presentation to the Agricultural and Applied Economics Association where she asked for her audience to “…turn our thinking about agri-environmental programs upside down.” She implored economists interested in designing programs for PES to account for consumer demand for environmental services from agriculture, and avoid focusing only on the details of farm-centric program eligibility. She suggests we link this demand for environmental services to those likely to be linked to services provisioned at the farm scale, as discussed in this chapter relative to grazing practices.

Using the language of ecosystem services provides a venue for negotiating the process of choosing how incentives to produce these services on the farm level might be designed. The concepts and information presented in this literature review can play a small part in this negotiation process as we begin to build links between managed farm ecosystems and the practices that facilitate the genesis of ecosystem services at the farm scale.
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CHAPTER 3. BEEF, BIRDS, OR BOTH? A CASE STUDY OF THE SOCIAL LANDSCAPE OF GRAZING MANAGEMENT IN AN IOWA BIRD CONSERVATION AREA

A manuscript to be submitted to the *Journal of Sustainable Agriculture*

"*Farmers know this innately, that perennial crops and range feeding of livestock are sustainable.*”

-Richard Leopold, Former Director of the Iowa Department of Natural Resources, 2010

Introduction

Beef production in the US Cornbelt in general and Iowa in particular is a complex and highly varied production system in both the scale of farm enterprises and their environmental impacts (Hinrichs and Welsh 2003). All of these systems come together to comprise an industry that contributes strongly to Iowa’s rural economies (Hogberg et al. 2005), cultural identity (Bogue 1994), and under certain management regimes, various environmental goals (Boody et al. 2005; Russelle et al. 2007).

Beef production in Iowa offers many possibilities for management practices that provide economic benefits to the farm level by adding value to feed crops grown on farm, as well as fertility (Entz et al. 2002). Additionally, ruminants have long served in a critical role in agricultural systems that are viewed to be sustainable (Heinrichs and Welsh 2002). They are highly efficient at converting renewable resources from pasture and marginal crop land into high protein meat and dairy products (Oltjen and Beckett 1996; Tilman et al. 2002). Of any livestock enterprise, beef production, specifically at the cow/calf (birth to weaning of young calves) phase, has remained consistently dependent on a pastureland and other perennial based farming systems (Cherney and Kallenbach 2007; Mathews and Johnson 2010). To decrease dependence on stored feeds, some producers in the US Cornbelt region manage forages harvested through grazing; this has been especially prevalent in dairy systems (Wedin and Fales 2009). Beef and dairy cattle production systems, when compared to any other type of livestock production today, has the highest potential to provision multiple public and private benefits (Heinrichs and Welsh 2002).
Livestock systems that rely primarily on grazing pastures can enhance functions of grassland ecosystems through facilitating effective nutrient cycling, hydrology and water management, and biodiversity on the landscape when compared to row crop systems (Boody et al. 2009; Keeney and Sanderson 2008; Mitsch et al. 2001). Forage production in pastures, when integrated within a mosaic of row-crop production, can facilitate patches and edges that contribute to landscape heterogeneity needed for wildlife habitat (Corry and Nassauer 2002; Ryszkowski and Jankowiak 2002). Specifically, grassland bird populations, which are of high priority due to their drastic declines resulting from habitat loss over the past two decades, can benefit from grazing management that diversifies canopy structure when incorporated with large patches of grassland (Helzer and Jelinski 1999).

Both private and public goods can be derived from privately managed grazing systems when integrated into landscapes predominantly under row crop production. To incentivize farm scale management to jointly produce public environmental services, an understanding of the social dynamics among diverse stakeholders that shape both farm and landscape scale management is needed to determine effective management opportunities and resource needs (Corry and Nassauer 2002; DeFries et al. 2007). Different stakeholder groups, depending on their experience and perceptions of grazing may have different perspectives on how these systems would best be implemented. Given that landscape patterns and land use are an expression of social dynamics, what social forces are shaping the implementation of this type of livestock management?

Specifically, are there divergent views on the specifics of this management? If so, does this incongruence inhibit the adoption of this type of agroecosystem management? Figure 3.1 illustrates the logic and context of the development of these research questions.
Figure 3.1: The development of research questions for this study

Land use in Iowa’s Grasslands Past and Present

Of the myriad of ecosystems in North America, the tallgrass prairie, once the majority of land cover over Iowa, has been the most thoroughly altered and removed (Acton 1992; Samson and Knopf 1994). Today throughout the whole US Midwest less than one percent of the original tallgrass prairie remains; making it one of most endangered ecosystems in Iowa let alone North America (Fletcher and Koford 2002).

Today, remaining Iowa grasslands are typically more simplified plant communities. Pastureland and lands enrolled in the Conservation Reserve Program (CRP) as well as remaining tallgrass prairie can all be classified as grassland when defined as any plant community in which grasses and/or legumes make up the dominant vegetation (Casler and Kallenbach 2007). Pastureland is defined as land managed for the production of introduced forage plants for livestock grazing managed with cultural treatments such as fertilization, grazing management, pasture renovation and weed control (Natural
Resources Inventory 2007). Comparatively, pastureland is generally relegated to marginal lands in Iowa, and has been for decades. Yet, pastureland has been steadily declining since 1982; USDA Census data shows that in 2007 Iowa farmers grazed approximately 32.9% fewer acres than in 1982, with an average decrease of 7.6% every 5 years, or 1.5% annually. Today, over 70% of Iowa’s total land surface is in row crops (Figure 3.2)(USDA Census 2009).

The majority of grazing by commercial beef producers in Iowa takes place on improved pastures largely comprised of non-native vegetation including cool season grasses and legumes (Sheaffer et al. 2009). The vast majority of Iowa’s pastures utilize mostly introduced cool-season grasses that have higher nutrition in the early and latter part of the growing season. These grasses, such as fescue, ryegrasses, orchardgrass, bromegrasses, Timothy, and Bluegrasses, tend to be used in monocultures in specialized production systems (Casler and Kallenbach 2007).

Grassland areas enrolled in the CRP account for an additional 1.8 million acres, the majority of which are in southern Iowa (Secchi et al. 2010). This program is currently designed to take sensitive lands out of production primarily to reduce sediment losses (C.
Das et al. 2004) and bird habitat (Haroldson et al. 2006). CRP promotes the use of native grasses and diverse species mixes for these purposes (Kindscher and Tiezen 1998). Policy stipulations included in CRP guidelines, however, impose limitations on grazing use. For instance, CRP lands are only accessible to grazing livestock once every three years, and with a 25 percent payment reduction to landowners (NRCS 2006).

**Grasslands, Grazing and Ecosystem Services**

The scale of row crop production in Iowa, while critical to commodity production and regional economies, is also known to have undesirable impacts on ecosystem processes essential to ecosystem function and therefore agricultural productivity (Tilman et al. 2002; Robertson and Swinton 2005). Furthermore, the overall fragmentation and alteration of remaining grasslands has had dramatic impacts on many wildlife species that require this habitat (Askins et al. 2007; Fletcher and Koford 2002). Grassland systems remaining in Iowa can be managed for substantial ecosystem service benefits using the tool of grazing. However, current applications of grazing systems does not typically emphasize the types of management practices that leverage these benefits.

This research attempts to characterize factors that encourage the development of and influence decision-making regarding pasture management systems that provision multiple benefits. Given that landscape patterns and land use are an expression of culture (Corry and Nassauer 2002), what social forces shape the implementation of this type of livestock management? Actors representing institutions whose primary goal is to conserve and create wildlife habitat may have divergent views about the utility of grazing to achieve this goal. Beef producers may or may not also see the value of modifying pasture management for ecosystem benefit. Do these two stakeholder groups, who exist in different social and ecological context, perceive the production of ecological services such as wildlife habitat as opposed to beef production, or as a potential to balance these two goals? If these goals are seen as disparate, does this incongruence prevent this type of agroecosystem management from being incentivized and implemented?

This can be addressed in part by integrating perennial systems such as grazed grasslands in key points on the landscape (Boody et al. 2005). Besides food and fiber, goods
commonly associated with agricultural production, a more multifunctional agriculture produces other functions such as biodiversity preservation, and sustainable use of natural resources. Boody et al. (2005) developed alternative land use scenarios in two heavily row-cropped Minnesota watersheds that led them to recommend policy designed to support pasture and hay production so as to increase “…ruminant production on grass” due to the desirable environmental benefits of these systems when compared to row crop systems. These benefits include improved soil and water quality, as well as heterogeneous wildlife habitat.

Barnhart et al. (1998) describes four commonly used grazing methods in Iowa. Generalized definitions of these methods are: *continuous*- where livestock have unrestricted access to a given pasture; *rotational*- where periods of grazing occur among two or more paddocks with periods of rest and regrowth between defoliation; *intensive rotational*- uses more frequent rotations to increase utilization, forage quality, regrowth and recovery rates; *strip grazing*- when livestock are only allowed access to a paddock for less than 24 hours.

These different methods are to a large degree characterized by the number of paddocks in the system and how often livestock are moved among them, with continuous grazing having no divisions and paddocks, and strip grazing having many. Fences and paddock size influence animal density. Additionally, these methods differ on the length of time animals can access a given section of pasture. Ecological benefits derived from these systems are largely dependent on the methods implemented. Poorly managed grazing systems are often associated with high rates of erosion, detrimental nutrient flux, and damage to wildlife habitat (Krausman et al. 2009). However, grazing can also be managed as part of a strategy to mimic what we know of historic ecological disturbance regimes, which influence the diversity and resilience of grasslands (Fuhlendorf et al. 2009).

**Benefits of Grazing to Wildlife**

Wildlife in highly altered landscapes like Iowa depend on the management of patches in the landscape to maintain habitat (Walk et al. 2009). These ‘patches’ of perennial
grasslands are becoming increasingly more fragmented as row crop acreages continue to expand (Corry and Nassauer 2002). Avian species are the visible example of the potential benefits of pasturelands, and their populations are directly linked with the proportion of diverse perennial vegetation and pastures within a landscape (Soderstrom and Part 2000). Wildlife are likely highly affected by the type of grazing management than by grazing in and of itself (Boyd et al., 1997; Krausman et al. 2009). Grazing is an essential component of grassland management to create ideal habitat for a spectrum of grassland birds. This is the fastest declining suite of avian species in North America (Askins et al. 2007). Grassland bird “species of concern” (as designated by the international organization Partners in Flight) such as the savannah sparrow, eastern meadowlark and the bobolink were found to have higher densities on grazed pastures, and rare or absent on ungrazed buffers (Renfrew and Ribic 2001).

Certain intensities of grazing benefit certain grassland birds (Giuliano 2002), and some grassland bird species evolved to occupy niches created by heavy grazing, as well as lighter intensities (Knopf 1994). For example, Walk et al. (2000) demonstrated that low-intensity and late season grazing was recommended for maintaining favorable habitat for a host of grassland bird species; this effect was due to intensities of grazing which created heterogeneous vegetation structure at landscape scales and supported species with differing habitat requirements. However, Walk et al. (2009) also show that even small patches of grassland in an agricultural landscape are important and provide functional habitat for species of management concern (in this case the Dickcissel and Eastern Meadowlark).

**Grazing Management for Multiple Benefits: for Whom?**

There are clearly advantages to integrating grazing management as a tool in grassland ecosystem management for multiple benefits. These services are beneficial and manifest differently at multiple scales, both for private gain and public good. Therefore, this dynamic attracts interest from different stakeholder groups for a diversity of reasons that are potentially contrary to one another. In other words, these benefits may come to some with tradeoffs for others. Two main stakeholder groups with interests in grazing for
multiple benefits are 1) livestock producers and landowners and 2) natural resource/ ecosystem management institutions. These distinct stakeholder groups were dually represented in this study (Figure 3.1).

**Producer Interest**

Pastures in Iowa are predominantly under private ownership and managed for private use. Throughout Iowa, pasture are managed to meet a myriad of private land use goals. These include, conservation, recreation and agricultural production (Morton et al. 2010). In a management context, landowners have been shown to emphasize these goals in differing degrees. In the context of livestock production in Iowa, interest in grazing systems has grown largely in response to: 1) producer interest in lowering feed and input costs (Iowa Beef Center Survey 2007); and 2) broadening market demand for “grass-fed” or “pasture raised” animal products (Pirog 2004). Notably, prospective future markets and policy incentives for carbon sequestration resulting from grazing and grassland management could potentially become a factor in grassland management (Jarchow and Liebman 2010).

Livestock producers managing pasture take calculated advantage of what grasslands provide, and can make choices that will either enhance or degrade the long-term functionality of these systems, depending on farm goals. Managing for the maximum vigor of a pasture is often in the best interest of the stockman wanting to reduce the cost of feed (Barnhart et al. 1998). According to the Iowa Beef Center, cost of feed is one of the primary economic concerns on a livestock operation (Loy et al 2009). Grazing is increasingly acknowledged as a strategic way to address seasonal feed shortages (Jackson et al. 2007). Seasonality in Iowa requires stockpiled forages or the use of stored feeds to feed livestock through cold winters (Loy et al. 2009). Certain sectors of the beef industry have also purchased co-products such as dry distillers grains (DDGs) from corn ethanol production plants as an inexpensive alternative to purchasing corn grain (Loy et al. 2009). As a chosen alternative to alleviate feed costs, grazing requires a high level of technical knowledge necessitating subjective judgments on controlling risk, and an ability to leverage ecological processes in lieu of technological tools and inputs (Hassanein 1999).
As another impetus for producers to explore pasture management practices as a production strategy, alternative market channels have been influential. Beef producers utilizing alternative market channels for their product have increasingly touted the nutritional and ethical benefits of grass-fed and free ranging beef to human health. Producers have the option to tap into current and evolving markets for differentiated beef and dairy products, such as labeling to assure organic or natural production methods (Acevedo et al. 2006). These alternative market channels may encourage the diversification of grass-based livestock production, namely beef production, on pastures in the Midwest as production constraints are addressed (Acevedo et al. 2006).

**Natural Resource Management Institution Interest**

Although pastures in Iowa are predominantly under private ownership and managed for private gain, as noted above, there are multiple public benefits associated with grasslands managed with types of grazing previously discussed. Natural resource land management (NRM) institutions (e.g. Natural Resource Conservation Service, and state Departments of Natural Resources) across the United States are beginning to acknowledge the valuable ecosystem goods and services provisioned from grasslands that incorporate native species (Maczko and Hidinger 2008; Fox et al. 2009). Therefore, these organizations integrate ecosystem service management via public conservation areas, specific incentive programs designed for cooperation landowners, and land management outreach programming in general (USDA NRCS 1997). Iowa’s NRM institutions have attempted to adapt to this context by designing cost-share programs for implementation of conservation practices. For example, the Iowa Department of Agriculture and Land Stewardship reviews the myriad of water quality projects funded in part by Iowa Soil and Water Conservation Districts, sixteen of which use improved grazing practices to improve water quality, on a total of over 7,700 acres (IDALS 2009). In short, the future of conservation in Iowa depends on how private lands are managed.
The changing social landscape of grazing in the heart of the US Cornbelt

It is clear that grassland management in general and via grazing specifically is a socially constructed process. Many sociological investigations in livestock production and farm management that produce public and private goods examine what might be described as “the social landscape” of this type of farming, in the tradition of landscape ecology (i.e. Nassauer 1995). A social landscape comprises the interactions of stakeholders and the agro-ecosystem patterns on the ground (and concomitant array of ecosystems goods and services) that result from these social processes. The patterns of land use in any agricultural landscape are a function of complex interactions of individual preferences, farmer-to-farmer exchanges, farmer and nonfarmer connections, and the influence of third party change agents. Several models show that social behavior and interactions within community-level networks plays a critical role in the 1) guidance of farm practice implementation at the field level (Valbuena et al. 2010) and 2) how available research and information about farming practices such as grazing management for multiple benefits is obtained. Capturing these social processes provide insight into the broader process of how costs and benefits of this management are evaluated across farm and landscape scales (Morton 2008).

A number of studies have examined decision making in grazing management in order to better understand the complexities that influence individual utilization of certain production practices in their farm systems (e.g., rotational grazing versus continuous grazing versus confinement feeding). For example, Hassanein (1999) studied the development of grazing networks as a social movement in Southern Wisconsin, challenging power relations in agricultural knowledge by relying on members’ experiential knowledge. The notion of a collective knowledge community to filling gaps in technical assistance needs has been explored in the context of pasture management by Nerbonne and Lentz (2003). Several regional studies have shown the propensity of graziers to value land stewardship and biodiversity (Doll and Jackson 2009; Regen et al. 2009). In other livestock regions, social scientists have created typologies of grazier’s values and land management strategies to allow government and research agencies to see the diversity in these strategies to more effectively tailor extension and incentive
programs to meet those needs (Bohnet et al. 2007).

Nevertheless, our understanding of the social landscape of grazing in the US Cornbelt and Iowa in particular is limited in scope. Agro-environmental issues such as those in the study area and surrounding lands are complex phenomena that require an understanding of how ecological and social processes operate at various spatial scales. Social and landscape functions both operate at multiple-scales, therefore comprehensive social landscape analyses should also span realms of individual and/or social behavior at farm, neighborhood, community and watershed scales (Field et al. 2003).

Notably, a survey of landowners and community leaders in the study area was done by Regen et al. (2009). This survey gathered information about current land use practices, attitudes and values about native ecosystems, and knowledge of fire and grazing as management tools for recreational and agricultural lands. The survey revealed that, although these stakeholders value soil and water quality as well as birds on the landscape, there are knowledge gaps as to how to manage grassland and savanna ecosystems to maintain these environmental services.

**Models to Close the Knowledge Gap: The Bird Conservation Area System**

In order to address concerns regarding habitat for grassland birds in the tallgrass prairie region, the BCA system was designed on the principle that the most effective way to promote habitat for avian species in need of grassland habitat is at the landscape scale (Fitzgerald and Pashley 2000). Strategic partnerships formed as a result of the North American Bird Conservation Initiative, as a larger advocacy tool of which Partners in Flight is active in, helped lead to this system (Brennan and Kuvlesky 2005). Interestingly, researchers have acknowledged that among the diverse stakeholders, “...the organization and communication among many of these grassland bird stakeholders is relatively inchoate (Brennan and Kuvlesky 2005).” Applicable research to the BCA model is available as to what kinds of physical management configurations benefit grassland birds, yet we are only beginning to address the social configurations that can apply that kind of management.

A BCA is a relatively large working landscape dominated by private land use
(commodity production) bounded by a state department of natural resource policy
designation designed to enhance/protect a range of habitat services. The Iowa DNR has
established to date sixteen Bird Conservation Areas in across the state, with more
proposed (IADNRa, undated). These are areas designed to have a core of grassland and/or
woodland habitat. In addition to grassland birds, these BCAs also provide assurance of
habitat for wetland, savanna and woodland species as well (Fitzgerald and Pashley 2000).
To be designated as a BCA in the physiographic areas of the dissected till plains, 40% of
the total land must be in grassland (Jacobs et al. 2005). The suite of avian species that the
BCA model is designed to specifically target is grassland birds that require heterogeneous
structures of grasslands to breed, nest and protect young (Jacobs et al. 2005).

Although research on what types of habitat and management these species require is
fairly comprehensive, there are no specific practical recommendations given to
landowners or managers in BCAs as to what types of grazing management could be most
conducive to species of concern. This creates an ideal space to determine if tension and
apprehension exists between stakeholders interested in habitat management/resource
conservation, and those interested in the viability of agricultural enterprises like beef
production, without presupposing that any disparities exist a priori. The theoretical
approach to this case study explores current perspectives and practices in grazing
management in relation to grassland bird habitat and conservation. This approach
enables stakeholders involved in the management of lands in a Bird Conservation Area to
articulate, via the data collection techniques utilized, what an effective model for grazing
as a tool to create co-benefits of agricultural enterprise and conservation management
looks like in practice.

**Methodological Approach**

Given that research has shown grazing to be a valuable tool to capture producer benefits
and for broader public conservation/environmental benefits, this study seeks to
understand the social context of decision-making regarding the use of pastures for
multiple goals. We utilize a case study of the social landscape of livestock producers,
non-farmer stakeholders, and local and third-party change agents in relation to grassland
management within the Raccoon River Savanna Bird Conservation Area. Change agents,
in the context of agroecosystem management, are professionals who can serve as key communicators of natural resource management goals (Knoot et al. 2010). Case study research is empirical and (in this study) able to be situated in a physical environment, and thus integrates elements of ecology (Noro 2010).

Using a mix of qualitative methodologies involving key stakeholders (e.g., focus groups, semi-structured interviews), our case study sought to better understand: 1) what role stakeholders played in management activities in the BCA and surrounding landscape, or their social context 2), proximity and familiarity with grazing management and grassland ecosystems in regards to the biological community. Data collection also provided descriptions of 3) perceived access to and type of technical support for grazing systems in the study area as a way to characterize their knowledge and reference points for that information 4) views on the potential role of grazing systems for conservation and agricultural lands in Iowa, and what factors facilitate and inhibit that possibility. Finally, questions regarding a description of the stakeholders 5) vision for the role of grazing in a desirable agricultural landscape were discussed.

To observe the interactions and social connections relevant to developing the capacity of grazing systems toward production benefits as well as environmental services (particularly grassland bird habitat), this research utilized methods appropriate for a exploratory case study within the Raccoon River Savanna Bird Conservation Area (RRSBCA). The RRSBCA is a multi-landowner, mixed conservation/working land region in northwest Guthrie County, Iowa. This conservation area serves as an ideal place for an exploratory case study to characterize the perceptions of how grazing management can balance wildlife needs and livestock production due to the relatively balanced mixture of land uses in the area. (Figure 3.3)

**Physical and Social Context of the Study Area: the Raccoon River Bird Conservation Area**

The RRSBCA is a 54,000 acre area of land in Northwest Guthrie County consisting of rolling oak savannas, cropland and pastureland, representing an ecological transition area with critical habitat for approximately one-third of Iowa’s breeding bird species (Regen
et al. 2009). See Figure 3.3 for a land use/land cover map and boundary of the RRSBCA.

**Figure 3.3: The Raccoon River Savanna Bird Conservation Area with land use and topography. Map by Elizabeth C. Hill.**

The Middle Raccoon River cuts the RRSBCA into two landforms; to the north lies the Des Moines Lobe, famous for its wet, flat, and fertile soils. This ‘lobe’ as it is often referred to, has well-defined drainage systems and rolling topography, a common characteristic of the broader ecological region of the Eastern Tallgrass Prairie Region. Only 8,000 acres of this landscape are in a conservation easement or public ownership, the remainder being privately held (Regen et al. 2009). The southeast corner of the BCA holds Springbrook State Park, established in 1926, and the southwest corner is anchored by the Elk Grove Wildlife Management area, both of these areas primarily composed of timber (Ludvigson and Tassier-Surine 2000; IA DNR 2010). Whiterock Conservancy comprises roughly 5,400 acres of the 8,000 mentioned above. Whiterock is a non-profit land trust comprised of lands donated by the Garst family, who is part of a rich history of
the development of hybrid corn (Bogue 1983).

Guthrie County, Iowa has many farms with a balance of crop and livestock enterprises, and sizeable forage production, when compared to counties to the north. For example, 110 farms in Greene County (to the North and East of Guthrie) had 4,386 acres of pasture, while 225 farms in Guthrie managed almost 18,000 acres. Coon Rapids, Iowa is the largest population center resting on the Northwest edge of the RRSBCA, hosting just over 1,300 residents (US Census 2000). In Guthrie County, there are 415 people who listed farming as their primary occupation, out of a total population of 10,956 (Census of Agriculture 2007).

Stakeholders impacted by the grazing management decisions made in the RRSBCA are landowners who also raise livestock, the producers who pay rent for use of area pastureland, landowners who receive cash rent for adjacent cropland, and local businesses who operate and purchase cattle through breeding stock producers and sale barns that evaluate desirability of livestock raised in the RRSBCA and then market them, graziers and private landowners in other BCAs, and other public and/or conservation lands across Iowa and Missouri. Administrators involved with the conception and management of the BCA system in Iowa are also affected by the decisions private land managers make with their grazing management, as it has direct implications for birds of greatest conservation need that the BCA system wishes to address (Jacobs et al. 2002).

**Methods**

This case study was exploratory, in the sense that we sought to gather data that would reveal socially meaningful boundaries of a case to provide insight into our research question (Platt 2007). A case study is of particular utility when studying social phenomena (grazing management that produces multiple benefits) that span scales which operate within a broader, bounded social unit (Creswell 1998). Stakeholders with different degrees and types of involvement in RRSBCA lands represent multiple cases within a case, and their social context operates under different boundaries than the managerial boundary of the BCA (Crosthwaite et al. 1997). This case study is bounded by definition (it is one of many BCAs) and context (stakeholders that are decision makers
who influence land use in the RRSBCA) (Miles and Huberman 1994). Therefore our case study perspective involving key local and regional stakeholders can help characterize actors’ perceptions of and involvement in grazing for multiple benefits in RRSBCA lands.

**Data Collection and Sampling Technique**

Focus group and semi-structured, in-depth interviews were chosen as the primary methods of data collection for this study. Qualitative research techniques such as these are designed to build rapport with participants, thus allowing for an ‘insider’s view’ of the situation (Menzien-Dick et al. 2004). Focus groups are valuable in helping to initially frame complex issues through collective dialog (Denzin and Ryan 2007). Personal interviews, on the other hand, enable participants to more fully articulate their perceived roles in farm and resource management (e.g., Carolan 2006). Participants are also more likely to volunteer potentially controversial information or views about natural resource use in interviews, as opposed to focus groups (Kaplowitz and Hoehn 2001). Both data collection techniques have been shown in similar complex land use contexts to provide complimentary information with regard to how stakeholders perceive, use, and value natural resources (Kaplowitz and Hoehn 2001).

In order to gain appropriate multi-scale perspectives of land management in this region stakeholder participants of the focus group and those individuals selected for personal interview were: 1) livestock producers who actively manage land at the field and farm scale; 2) government field agents (NRCS, IADNR) who have broader, landscape level and political boundary perspectives on land use; and 3) University, and NGO stakeholders who are engaged in research and/or education on wildlife and bird habitat conservation (these individuals do not actively administer management of land but may provide guidance to those who do). These stakeholders represent social scales present within the study area as depicted in Figure 3.4.

Interviewees and focus group participants were selected using a purposive snowball sampling technique (Knight 2002), focusing on networks of individuals involved in managing grasslands within or in close proximity to the RRSBCA or who administer
management of programming directly related to the BCA system and were involved in the designation of the RRSBCA. Despite the recognized weakness of purposive sampling methodology (e.g., Carolan 2006), this approach was deemed appropriate given the specificity of the physical boundaries of our case study (the RRSBCA). These stakeholders were selected by reviewing relevant documents regarding the RRSBCA designation, as well as making contacts with the Whiterock Conservancy, which was a proponent of the BCA designation from the Iowa DNR (IDNRa). Key actors identified through these contacts in both the conservation and agricultural community in the NW Guthrie County were interviewed and subsequently asked to identify other willing participants. Participants were categorized into two distinct groups that each existed at a gradient in terms of their level of involvement in the RRSBCA and/or grazing systems: 1) various scales of grazing livestock production (i.e. herd size, number of employees, type of markets etc.), and 2) NRM professionals at various levels of organizational hierarchy involved in BCA management in Iowa and in the RRSBCA in specific.

Twenty total individuals participated in semi-structured, in-depth interviews lasting approximately one hour and thirty minutes in one-on-one or small groups (three or less) composed of co-workers/ family members. Nineteen of these individuals were interviewed on site (e.g., at their farm or place of work). Five additional individuals, all Department of Resources Private Lands Biologists, participated in a forty-five minute focus group discussion. All of the focus group participants are biologists employed with the Iowa Department of Natural Resources Private Lands Program and work regularly with livestock producers and landowners interested in implementing wildlife habitat in the RRSBCA and other areas of Iowa. As data was being collected and transcribed in the Spring and Summer of 2010, transcripts were reviewed for evidence of patterns and saturation (when participants begin to replicate concepts independently discussed by others) and an iterative thematic analysis (MacQuarrie 2010).
Stakeholders who participated in this study are from every social scale that has a role in managing lands in the RRSBCA. Numbers indicate number of participants from that scale, and solid vs. dashed lines and distance from BCA implies proximity to and perspective of the physical landscape.

Seven of the total participants interviewed currently work directly with beef cattle in or on lands directly adjacent to the RRSBCA (≤ 30 miles away). This distance was necessary as grazing livestock producers were distributed throughout the landscape, and not necessarily within the exact RRSBCA boundary, and obtaining a gradation of the types of and scale of operation was needed. Interviewees with farm/beef enterprises came from areas in/immediately surrounding the RRSBCA, including Guthrie, and adjacent Greene and Carroll counties. Four of those rely on a beef production enterprise for their primary income. Excepting two, all participants of interviews and focus groups have past or current experience with beef cattle management. Although only 7 of the participants currently manage livestock on pasture in some capacity, the fact that a majority of the participants had past experience managing livestock or have worked closely with those who do, was deliberately a part of the sampling process to provide a diversity of perspectives and experiences with grazing management. Two interviewees
work with a local NGO to promote sustainable natural resource management. Five interviewees work for state or federal institutions such as the Iowa DNR or the Natural Resource Conservation Service.

<table>
<thead>
<tr>
<th>Context</th>
<th>Livestock Producers/ Farmers</th>
<th>Natural Resource Managers/ Experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context</td>
<td>What is the history of your farming enterprises? How much do you rely on grazing pasture for these enterprises?</td>
<td>What is the scope of your position &amp; how are you involved with those who raise livestock on pasture?</td>
</tr>
<tr>
<td>Community/Place</td>
<td>What resources do you look to for support and advice when making decisions in this enterprise? Does the RRSBCA influence where you seek information?</td>
<td>What kinds of information and resources do livestock producers you work with and for when making grazing/ grassland management decisions? Do you think the RRSBCA designation influences this?</td>
</tr>
<tr>
<td>Characterizing Knowledge</td>
<td>What do you see as the benefits of grazing systems over other methods of livestock production? What kinds of indicators do you look for in a healthy pasture?</td>
<td>Do you see grazing as a viable land management practice? What kinds of management practices yield environmental benefits?</td>
</tr>
<tr>
<td>Characterizing barriers and facilitating</td>
<td>What is the future viability of this type of management in Iowa? How does that fit in with the RRSBCA? What are barriers to developing more grass-based livestock production systems in this area?</td>
<td>What is the future viability of grazing systems as a way to promote wildlife habitat and broader ecological health in Iowa? What are the barriers and facilitating factors to this viability?</td>
</tr>
<tr>
<td>Vision</td>
<td>What would the landscape in this area look like if it were up to you? What kind of farm management would there be?</td>
<td>If communication/ education is a barrier, how can we communicate the benefits of this management? What would that look like/ what are examples?</td>
</tr>
</tbody>
</table>

Table 3.1: Typology of Questions Asked in Focus Group and Semi-Structured In-Depth Interviews

An interview guide (Table 3.1) was used to ensure that every interviewee and focus group participant was asked questions that were of the same conceptual nature, but were executed differently in style and timing depending on the context of the participant(s). For example, interviews with those who managed livestock included questions about their specific management practices, such as herd(s) sizes and classes, as well as what kind of timing and recovery allowed in pastures. Follow up questions were used as needed to clarify terminology about management practices. Interviews with those who
work with an organization to manage the RRSBCA landscape were asked specific questions regarding their communication and outreach strategy when working with producers/landowners and agency personnel to implement conservation practices.

In addition to interview and focus group data, participant observation techniques were employed at various regional events held by farms and organizations within or in close proximity to the study area. Notes, handouts, informal interviews and photos from these events were reviewed as a way to better understand themes and common narratives that surfaced from the interview and focus group data (Bohnet et al. 2007; Hassanein 1999).

**Analysis**

All of these interviews were recorded and transcribed verbatim, reviewed manually for emergent themes, and subsequently coded and managed with NVivo 8 software (QSR 2008). Interviews were examined for data directly related to questions used from the interview guide, to categorize responses to consistent prompts used in each interview. Yet, due to the semi-structured nature of the data collection, data specific to prompts was limited, so open, axial and then selective coding was used to find relationships between responses across participants (Price 2010; Bryman and Burgess 1994). This process was used so emergent concepts could be identified that provide insight into the research question. These techniques are consistent with the tradition of grounded theory, in that there were no predefined themes that data was coded into, and throughout the coding process thematic concepts across stakeholders emerged (Bohnet et al. 2007; Corbin and Strauss 1998).

**Results**

Factors that either facilitate or hinder the development of “multiple benefit” grazing systems were articulated by participants at every stage of the interview and focus group process. Results are presented as two main elements: identified factors that are needed to support the development of grass-based livestock management systems for multiple benefits, and factors identified as challenges to the expansion of grazing for multiple benefits. To illustrate how these challenges and needs relate to the vision for grazing systems as a tool to provision co-benefits the data analysis revealed unifying ideas
advancing opportunities to utilize these systems.

Factors Identified as Necessary to Facilitate the Expansion of Grazing For Multiple Benefits

“They Work with Farmers”: Access, Knowledge Networks, Perceptions and Management Support

As previously discussed, the type of knowledge and technical support needed for grazing enterprises is highly contextual to manager goals and environment and requires different kinds of expertise than row crop production support. This section presents the concerns and needs identified by participants regarding characteristics of relevant and desirable vehicles for this assistance.

The kind of support available, as identified by participants, to assist producers to graze for multiple benefits exists at several scales locally, regionally and nationally. Consistent with many studies about farmer knowledge regarding farm management (see Hassanein 1999), producers consistently identified other producers locally and regionally and producer-based organizations as primary resources for learning about grazing management. Although there has been a fair amount of research done by public institutions such as Iowa State University on the economic and production concerns of grazing systems, producers either chose not to seek out and use this information or were unaware that this information existed. All farmers and livestock producers interviewed (n=7) reflected this general unawareness of science-based research on grazing systems that provision co-benefits for wildlife and production in Iowa or the immediate region. One producer commented that the research and development regarding grazing systems has generally not kept pace with other production oriented innovations, implying there may be a certain disadvantage to grazing managers as a result:

“...the science on the row crop side is unbelievable, talking about specific plant populations and the seed attachments and the agronomy side and everyone spraying the same chemicals and trying to hit the same application window, and then on the cow side you know vaccines have changed and the genetics have certainly changed but in some ways guys who talk about their management practices are kind of the same as they were 20 or 30 years ago.”

One producer who had experimented with grazing native prairie and implemented conservation practices was entirely unaware that any research on grazing ever occurred at
Iowa State. This producer had sold off a cowherd over 10 years ago yet was still interested in the ecological benefits of prairies and perennial pastures, claiming that “If I could, I would put this whole farm in grass and rotationally graze it, but...I am not sure I can make money doing that.” Interestingly this producer reiterated how much university research was trusted on the row crop side, but was tentative to do more grazing because of the perception of a lack of information and support:

Producer: If I can just look at ISU’s seed corn trials, they work out. The industry folks and feed folks. All you have to do is look at the research.

Interviewer: Do you think the research you are seeing has been helpful for you overall with grazing?

Producer: I haven’t seen that much...I don’t know, do they [Iowa State] have any research on grazing?

The role of state and federal institutions (non-university) in offering technical support for managers who wish to graze livestock for multiple benefits was described as being variable depending on geographic location (e.g., the proximity of a landowner property to a field office). For example, the knowledge base available regarding grazing management for multiple benefits from staff at USDA service centers was cited as highly dependent on the interests and experience of those individuals stationed at various centers. In these offices, employees represent the Farm Service Agency, the Natural Resource Conservation Service and various Rural Development organizations. Several producers expressed that much of the expertise available focused primarily on row crop production; one cattleman who manages a cow/calf enterprise on pasture, and a feedlot operation said specifically, “They [field staff] work with farmers...[emphasis theirs].”

In addition to livestock producers, participants employed in those offices readily confer that the knowledge base for grazing management expertise and experience as lacking in general around the state. One interviewee who works with the local Soil and Water Conservation District described the ‘foreign’ nature of knowledge and support available regarding grazing management for conservation: “...I can see that being very frustrating for a landowner [interested in grazing] who may go into an office and to them [staff] cows might be like [a foreign language]. So by that I mean, I can’t communicate the way you’re trying to communicate with me, you know that is the way it is.”
Thus there appears to be a knowledge divide between a producer seeking grazing information/assistance and agricultural field agents tasked with providing aid to "farmers," defined by the cattleman and the technical assistance provider as a separate audience needing separate assistance.

Another key issue brought out in the interviews was the role that broad stakeholder perception regarding grazing can play in land use situations. Stakeholders representing natural resource management organizations all referred to the common perception that grazing cattle was destructive to wildlife habitat. This perception was cited as a barrier when Private Lands Biologists wanted to encourage landowners interested in hunting game species to utilize grazing as a habitat management tool. Landowners often have a picture in their minds of grazed fields being devoid of useful habitat structure due to overgrazing. This condition is generally caused by too many animals for too long of a time period (Coleman and Sollenberger 2007): "If you talk to a landowner about integrating grazing, they look at you like ‘what?’ because they can’t envision what it looks like because all they see IS that golf course type stuff."

“Golf course” was a common metaphor used by NRM stakeholders when describing the effects of overgrazing. This perception was also described as a barrier when these stakeholders communicated with the broader public about the utility of grazing for ecological health. For example, a local land trust, the Whiterock Conservancy, struggles to communicate the benefits of using grazing management to maintain functional prairies to potential supporters:

“...we spend a lot of time painting a picture. We are talking about natural resources, we are talking about prairies, and they are starting to think about fluttering butterflies, and cute birds, and flowers, and you know then we put a COW there! And they are like ‘ahhh!’ So suddenly everything changes to mowed down bromegrass right? And it changes their perception... If suddenly we start putting cattle on restored prairie, suddenly they classify us from land trust that is doing the right thing for the environment to gritty pasture producing landowners. There is no transition.”

Experiences with and notions about the place and utility of grazing management, i.e. social perception, can clearly inhibit the ways that the potential benefits are understood and implemented. However, all participants referenced this same social process, direct
experience, as a way to convey the benefits of certain types of grazing management to wildlife. Participants from all backgrounds often referred to producers who they learned from as models of grazing for multiple benefits either existed locally, were met at a field day featuring a pasture tour, or read about in a popular press publication dedicated to beef producers. Both producers and NRM stakeholders gave positive examples in this way.

**Connecting Research and Demonstration “on the cow side”: Showcasing Private Grazing Lands Managed for Multiple Benefits**

In this case study, the willingness for grazing managers to implement practices that are beneficial to wildlife needs is a function of their past experience and level of trust with the technical assistance providers and NRM stakeholders interested in wildlife needs. All stakeholder groups discussed the value of a physical space to demonstrate the kinds of management necessary to manage grazing systems for multiple benefits. Producers all described learning experiences gained from field days and pasture walks they had attended.

There were mixed reactions to the types of field days and events hosted by institutions like the NRCS or Cooperative Extension, as opposed to field days initiated by farmers. Two producers had decided to completely disengage from outreach institutions due to a bad experience while seeking assistance, while the remaining five saw information and outreach institutions like Extension as valuable assets. Two producers mentioned the DNR as an desirable organization to work with when looking for assistance in grazing for multiple benefits. Nevertheless, these producers did view the IADNR as largely a regulatory body dealing with broader resource management issues, and not as an agency with the ability to provide landowners/ livestock producers interested in grazing for multiple benefits.

Stakeholders working with private land NRM institutions also saw the value in a designated demonstration area as a way to encourage producers to implement grazing for multiple benefits. The Private Lands Biologists with the DNR specifically discussed the need to allow producers to showcase the management they implemented voluntarily. One DNR employee echoed the effectiveness of this approach based on their own challenges influencing land management: “…showing farmers what can work. I mean, they are
cautious to try anything different. So we need to get a few people in each county to jump in, you know and have them sell it. Because we can’t sell it by ourselves [DNR Private Lands Biologists].”

This idea of getting “buy in” from landowners by showing successful adopters was a common topic raised by both NRM stakeholders and producers. Interestingly, which the DNR Private Lands Biologists explicitly emphasized this, as remaining NRM stakeholders from the research or NGO group were not as forthright in articulating this as a need. This variation in expression could be interpreted as distinguishing NRM professionals who regularly interface with landowners and livestock producers and those who do not have those interactions as a reference point.

All producers interviewed were interested in exploring and indeed trying new types of grazing management that would be beneficial to wildlife if they could be confident in the research and information available. One cattleman that relies on pastures to produce breeding stock sold all over the country talked openly about the importance of being a beef producer in having trustworthy knowledge:

“Yeah, he [extension agent] has his own operation and works cattle, that’s credibility. If you were going to have some guys my age who will say, ok, this is feasible, I might be willing to try things... until you can say I had to go hungry for a few days so I could pay my cow feed bill you know, then maybe I will listen to what you have to say.”

Thus it appears that information needs to be conveyed by a trusted resource who has direct experiential knowledge. The value of producers seeing and learning from one another was reiterated as a manager of one of the largest cow/calf operations in the study area reflected on the value of pasturewalks: “…people stayed there til it was way past dark, cause they got a talking to other producers and they got a talking to the other people who were there and they were out in the pasture looking at a cow herd seeing about ideas that were challenging you.”

The Role of the Bird Conservation Area System

Bird Conservation Areas were implemented by the Iowa DNR. These BCAs created a physical and managerial boundary around the goal of influencing the management of
private lands within these boundaries for grassland and savanna birds. The goal of the DNR in this case is to maintain and enhance habitat for species of greatest conservation need (IA DNR 2005). With these parameters providing context for grassland management goals, we wanted to know to what degree the identity and definition of the BCA provided an impetus for specific management guidance in the form of outreach and / or management incentives for area producers (specifically regarding grazing).

Interestingly, producers (all 7 interviewed) and NRM s (all excepting two) are in many ways rather disconnected from or unclear about the goals of the BCA and its consequence in terms of incentives for certain types of land management. All producer interviewees could not articulate what the purpose of the BCA was, or even physically where it was located. Those interviewees were both NRM’s and producers who worked on or within 30 miles of the RRSBCA. This lack of knowledge about the BCA by producers led to the perception that there was little local involvement in its design and designation, which made them uncertain about its purpose and relevance to them. One of the seven producers interviewed referenced some skepticism in the community when the DNR first announced plans to establish the area:

“They [people who live within the BCA] were worried about it! I got emails when it was being established from groups that were concerned exactly what they were trying to pull...I think it was a hunters group. They thought it would limit their ability to hunt in the area, like no duck shooting or something.”

Further, although all NRM stakeholders were aware of the system and some even participated in the genesis of the RRSBCA, there were many instances of uncertainty when NRM stakeholders tried to communicate what incentives existed for landowners (individually or collectively) in the BCA to manage farm and/ or grasslands lands in any particular way. An educator and manager of a local NGO reflected on this uncertainty:

“You don’t read in the local paper, ‘the RRSBCA blah blah blah.’ There might have been something in the paper when it was first designated. [One local community leader], I remember she was pushing [the IA DNR] now we have this designation, what does that mean for us? And they [the IA DNR] didn’t have a really good answer for her.”

Nevertheless, despite uncertainties about the land management implications of the designation, the BCA system was discussed by NRM stakeholders locally and in other
areas as an *opportunity* for local leaders to partner with NRM stakeholders to both incentivize habitat management and conservation in general, and also providing a space to demonstrate to others throughout Iowa management practices such as grazing for multiple benefits. One DNR employee framed the issue in terms of the importance of local initiative and involvement: “*Because that’s the thing that people get heartburn about... What does a BCA DO? Well, it may not do anything. But it has potential to do a lot of things because you can focus energy, money...*”

The sentiment that the BCA system has a potential to serve as a kind of vector or medium to target state funds and human resources was explicitly recognized by seven interviewees and all focus group participants. The focus group participants of Private Lands Biologists in particular saw grazing as an underutilized and appropriate tool to manage grassland and pastures for functional wildlife habitat, contingent on management. These stakeholders all expressed optimism about the ability of the BCA designation to attract additional funds to do conservation projects and restoration. Two participants directly cited examples from other BCAs in the state where other state level conservation funds where leveraged to fund native habitat restoration projects within a BCA. These individuals also mentioned that landowners in these areas can get more ‘points’ signing up for state and federal programs that provide cost share for conservation work (e.g., Environmental Quality Enhancement Program and Wildlife Habitat Enhancement Program), though that ability was seen as dependent on the technical service provider a landowner may be working with. Four interviewees discussed a key value in the BCA system being the voluntary nature of the conservation work. For example, a retired leader of the DNR’s Wildlife Diversity program mentioned that when public information meetings are held before the establishment of a BCA, a common concern among local landowners is that the DNR is trying to purchase land:

> “Well one of the things we wanted to do before we designated all of these areas is we wanted to let the public know what we were doing because we thought that people might see this as an attempt by the state to make a so called land grab. That question has turned up at a few meetings.”

In lieu of purchasing lands to protect habitat, however, part of the BCA operating process there is a general goal of encouraging the voluntary implementation of conservation
practices by private landowners. In fact, one of five project objectives delineated by Jacobs et al. (2005) for BCAs established across Missouri and Iowa is to “…create a partnership with landowners and foster an understanding of the importance of and the need to conserve native grasslands and grassland birds...(p.79)”. Emphasizing the volunteer nature of the DNR’s process was seen as a way to address concerns regarding private property issues. Nevertheless, resources for desirable, voluntary models of grazing management in these lands that would fulfill the goals of both the agricultural community and the conservation community have been sparse.

NRM stakeholders in this study perceive that the BCA lacks a recognizable administrative process. This lack of standard, statewide process in BCA administration was seen as problematic in the context of the Iowa DNR attempting to communicate the potential benefits to landowners in BCAs around the state and make broad impacts regarding habitat. However, this was balanced by the view that NRM administrators could cater their outreach and work with the specific needs of local farmers and landowners. The characteristic of conservation programming being flexible and amenable to the local context was seen as a particular strength by an interviewee when offering technical assistance to those unfamiliar with grassland management practices that benefit wildlife:

“... other offices, I think that they may listen to someone who comes in and says “I want to break my pasture up”, and give them a cost share to do this or that and send them down the road, and then approach them with a plan. Here we try to understand why they want to do that with the understanding that we would offer alternatives to that as well. So, but I do know in other offices they will ask a landowner to bring a map in of what they would like to do and they will build their plan to build that, and here we are a bit more proactive, but it takes more time.”

The ability of technical assistance providers to be ‘proactive’ and adapt to the goals of local landowners translates to a broader interest expressed by ten interviewees and all focus group participants. There is the need for locally coordinated and managed demonstration areas (e.g., showing various grazing practices) to host field days and foster collaborative, participatory learning. Other interviewees emphasized the power of individual relationships and the ability for NRM stakeholders to work one-on-one with
private landowners.

**Identified Challenges to the Development of Grass-based Livestock Management Systems for Multiple Benefits**

Two main themes emerged from data that were pertinent to specific factors that are effectively beyond the control of the stakeholders and exist at multiple scales, and that in various ways inhibit increased management of livestock grazing for multiple benefits. Each stakeholder group had a set of themes that were distinctive to that group, and were reflective of their roles in managing BCA lands. Barriers described by producers were discussed in terms of limited physical access to remaining pasture and grassland as well as access to local and/or premium markets. Access to pastureland was further noted to be a combination of declining grasslands able to be grazed due to the past and present conversions of this land to row crop production, fewer beef grazing enterprises in the area, as well as the changing demographics of beef producers.

Challenges described by livestock producers and farmers that were evident after analysis are presented first as access to pasture and access to markets. Divergent landowners goals were discussed by both of these groups. Themes that emerged from an analysis of natural resource managers/experts are presented as the role of incentives and the appropriate scale of models designed to educate and communicate grazing for multiple benefits.

**Access to Pasture: Local and Regional Land Use**

A significant issue that limits the degree to which grazing of any kind can occur within the BCA as noted by all interviewed stakeholder groups was the lack of access to a somewhat shrinking base of available pastureland in the RRSBCA and surrounding counties. For the most part interviewees noted that lack of access to existing pastureland is related to changes in the demographics of area producers (e.g., overall gentrification of cattle producers) and the type and current degree to which cattle production occurs locally. Many farms in central Iowa comprised a patchwork of “farmer-feeders”, who essentially added value and harvested their grain through livestock (Krause 1991; Hinrichs and Welsh 2002). All in all, thirteen total participants attributed factors such as the ageing producer base, limited labor availability, the nature of labor required, and slim
profit margins as pushing many smaller producers who raised beef cattle to sell off their herds and making land available for uses other than grazing. Past land use decisions are also still affecting pastureland availability today. A farmer reflected on the amount of pastureland that was converted during hard economic times in the 1980’s: “In the middle 80’s there was a lot of pasture plowed up in Guthrie County, because people were under a lot of financial pressure, they had to make it through one more year. So they would sell the cows and plow up the pasture, it was really kind of sad to see.”

An older (relative to the other interviewees) cattleman who still manages well over 400 cows and grazes lands within the RRSBCA, shares experiences detailing that there are some lands converted to cropland each year, and perceives it is unlikely that many of those places would again be used for pastureland due to the length of time it takes to convert crop ground into viable pasture:

“...Its steep enough [the farmer] is actually having a difficulty getting a combine up there...there has been some land [conversions of land to row crops] I have heard about being tore up in the last 3 or 4 years since corn has gotten high, [and] for as many years as it takes to rebuild it and bring it back [into grassland] I guess its forever...I think we have to keep the ground covered in this country. We get such heavy rains...”

Another producer continues to discuss this limitation by highlighting the tremendous degree of competition for remaining pastureland – competition that limits a graziers access to grazable land:

“...just finding out that the ground is available, it is rented before it comes into the paper, it is very much a network deal, it is pretty interesting...in my opinion there is a lot of pasture ground that comes up for rent every year even with the liquidations (in area beef herds). A lot of times a guy might know who will be renting his ground before he liquidates his cows.”

The limitation, as discussed in the context this individual described, was largely caused by local increases in landowners buying and renting land for recreational use who were not interested in grazing for multiple benefits, or in allowing access for producers who may wish to do so.

The competing land use of row crop production combined with the perceptions and divergent goals of recreational landowners in the area generally limit access that
producers who want to graze for multiple benefits have of lands to do so on.

**Access to Markets: Income from Grazing for Multiple Benefits**

The changing demographic profile of beef producers in their age, as well as the lack of interest children of producers/young people have in continuing grazing systems creates a type of vicious circle in the limited access to remaining pastureland. One NRM technical assistance provider who works for the NRCS as well as raises cattle summarized how these factors combine to squeeze beef producers out of the business, and gave a compelling example of how the factors described previously have changed how farming is done in Guthrie County;

“Today’s market, you know, you got basically the livestock producers that are sitting there working probably 3 times, if not 4 times harder than the crop production guys. As far as time investment and labor involved, and making a third [of the income]...for example, right up here, 3 quarters of a mile there is an elderly gentlemen; he’s 82 years old with 2 sons and they run a 150 cow herd and it was from calf to finish for over 50 years, sold all their cows last year...the price of grain got up so dramatically it’s like why’d want to make little or nothing on the livestock end while we’re actually grazing and haying ground that we can raise $5 - $6 corn on ....That’s the downside of people; they go where the money is at.”

As the number of cattle producers declines, so does the diversification and size of the market. Market access, for remaining beef operations in the area, was discussed in term of consumer perceptions of and willingness to pay for beef production that incorporates grazing for multiple benefits. Another producer discussed how the perceptions by those concerned with animal welfare shaped urban consumers idea of their production practices, potentially limiting their access to local or premium markets:

“I have a first calf heifer who won’t take her calf, and I put her in the chute tight and if you took a video of that for 30 seconds, it would look like I am abusing her. But what I am doing is keeping her from kicking that calf in the head so he can learn how to nurse. Any 30-second video, you can make anything look terrible. And that is why a lot of ag people are getting a lot of distrust. Like I said, if the [local consumers] here don’t want to eat my beef I will send it to Japan. Well, I got friends who want local beef and want to know how good it is. The people in the city never had exposure to that.”

The lack of knowledge of production practices and familiarity with beef production, to
this producer, are associated with consumers’ ability to choose their product. The notion that consumer understanding of and willingness to pay for practices associated with grazing for multiple benefits could improve profitability was also reflected on by this female cattle producer: “...if they [consumers] were willing to pay a little bit more then maybe grass growers could afford to get some of that higher priced ground, and it could go full circle if you wanted it to.”

Full circle, in this conversation, was the ability for producers to stay in business and manage their grazing for multiple benefits based on consumer preference. Alternative markets for ecosystem services, carbon sequestration for example, exist only at the periphery of the beef industry and are predominantly at experimental phases, though more research is emerging (Bouressa et al. 2010; Follett and Reed 2010). Thus, other than consumer preferences for production practices such as humane treatment, meat quality, location or feed regimes, there are few current market incentives to graze for multiple benefits (Leonard 2010).

**Divergent Landowner Goals**

All producers and NRM stakeholders alike discussed issues in accessing areas where grazing livestock can still be utilized have competing uses because of the divergent goals of landowners. A producer quoted above about competition to accessing pastureland discussed recreational landownership and how it impacts their ability and the ability of other local cattlemen to access more acres to graze:

“What used to be pastureground had now become recreational property, like an overgrown yard or something. They had the ability to do that and enjoyed hunting and had their own little game preserves and didn’t need someone to come in and rent grass for 40 bucks an acre and could pay for it with their job in town or whatever. Some of it had no cropping history; we were just talking to a real estate agent who said it was up to 1600 dollars an acre, and to make it work on the cow calf side it is probably difficult, but that is cheap for folks in Des Moines who want to hunt or whatever. Farmers used to trade ground more than happens today.”

Concomitant increases in land price and rental rates due to this phenomenon were cited by several producers and NRM stakeholders as well. In the survey done by Regen et al. (2009) of landowners in the RRSBCA, approximately half of respondents live fifty or
more miles away from their land, and 22 percent cited recreational or wildlife reasons for owning the property. The perceptions that recreational landowners have of the potential value of grazing beef cattle for multiple benefits was also cited as playing a role in pastureland access. Private Lands Biologists working with the DNR expressed frustration with assisting landowners in the local and regional area who perceive cattle to be inherently destructive to wildlife because of past poor management; “I hear a lot of pride from landowners, that say ‘when I moved here it was that terrible situation’, and they say ‘we got them [beef cattle] off, we saved it, yet I have less quail and turkey’...”

The ‘terrible situation’ referred to was generally referred to as a result of overgrazing, and livestock accessing an area for too long. Overgrazing, or in this example cattle keeping vegetation too short for functional wildlife habitat, was cited as a common occurrence in the area. One farmer who raises a small number of beef cattle for local sale was blunt about the prevalence of this problem:

“...if you go to your spreadsheet, and you say, oh I want to make so much money and I need this many cows, I tended to thin my cow herd to the size of my financial goals rather than to [the size of] my pasture, so this was really overgrazed...almost everybody overgrazes in Iowa. [Previous landowner of farm] overgrazed too!”

Overgrazing was referred to jokingly by many NRM stakeholders with the metaphor of pastures looking like “pool tables” or “golf courses” that were described as resulting in poor wildlife habitat due to the lack of heterogeneous vegetative cover. To change or influence this problem, many of these stakeholders look to education and outreach for producers and landowners. However, a number of factors were identified that limit the amount of technical support available and applicability of what exists to do so, as discussed in the next section regarding the role of incentives and education.

The Role of Scale in Incentives and Education to Promote Grazing for Multiple Benefits

As seen by NRM stakeholders, outreach and education on regarding the potential value of grazing systems managed for multiple benefits was needed for landowners. These stakeholders often referred to the need for financial incentives attached to programs to encourage landowners in the RRSBCA to utilize grazing systems for habitat benefit.
These incentives were described as ideally administered by non-profit organizations interested in wildlife habitat, as well as state institutions.

One interviewee put a specific emphasis on the diversity of individual landowner preferences regarding potential conservation land management, and how smaller institutions, at local/landscape scales, exemplified here by Whiterock Conservancy, can help span the divide between state/federal level NRM organizations and individual landowners:

“...Certainly the goal [of the BCA system] is there are benefits to birds. But there should be some incentives to landowners or for...you know agencies that own land within an area to get together to coordinate. There is no big picture coordination within BCAs to what amounts to the big issue of land management. And that translates to how do you put that into action relative to the on the ground landowner. So landowners don’t get any real benefit out of that... Some people are interested enough to do it on their own, but they probably wouldn’t have the financial wherewithal unless they got help from Ducks Unlimited, or Pheasants Forever or the state or the feds. So even if they feel good about doing conservation... even if they say oh I am going to try and manage my pastures better... for the most part they will do it if there is a real incentive. Each individual landowner has ideas and priorities.

...[That is] the benefit of organizations like Whiterock. It’s not like what they do on the ground is really so unique, it’s that they energize people, small groups, but they are an example. They are like a BCA they have a small area they impact. They don’t have an impact on a state-wide basis. That’s not their goal, they aren’t the ... Nature Conservancy; they have a different constituency. The advantage of the impact of these organizations, when you visualize it, it is really probably in terms of getting information out and energizing people in the presence of a BCA or a number of BCAs.”

Catering to these unique ideas and priorities of individual landowners was discussed as a barrier, due to the lack of staff available to do so. A former administrator of the IA DNR’s Wildlife Diversity Program described the issue: “...we have a small staff in the state, not nearly enough to make all the contacts that are needed to make a dent in this, no we need a lot more staff for everything we do in wildlife. That goes without saying.”

The individuation and emphasis on personal preferences of landowners and livestock managers was connected to the identified need for more personal, one-on-one approaches for NRM stakeholders to provide technical assistance, and the overall ability to influence
management and land use changes in grasslands.

“Changing some minds”: Smaller, Adaptable Social Scales for Negotiating Grazing for Multiple Benefits

The need to bridge gaps between larger institutions and individual private landowners and producers, as discussed above, was cited as an effective way to support decision-making in farm management that incorporates grazing for multiple benefits warrants further exploration.

A USDA Soil Conservationist described the decision to raise cows and manage them for multiple benefits as, despite broader forces, distinctly individual: “Well it’s the economics and that some people…it is very complicated. Some people, it is economic, but then again, if you want to do it you’re going to do it. You’re going to have cows if you want them.”

The need to value the independence of landowners and their neighbors was integrated into the broader scales of the BCA landscape. The RRSBCA as well as Whiterock Conservancy were discussed as being the appropriate scales to influence private agricultural lands and landowner views surrounding those areas. One of those ways was described as being a ‘model’ for land management for multiple benefits, and a venue for demonstrating ‘what works’ and to get ‘buy in’ from landowners. The other aspect is that these institutions exist at a scale that is ideal for reaching both the local community as well as connecting with bigger change agents at the county and state level, and in the case of BCAs at the national and international level. BCAs were cited as priorities for staff to target resources, and, according to a retired employee of the DNR’s Wildlife Diversity program, “…those individuals [DNR Private Lands Program staff] are the people that really have the most opportunity to change some minds.”

Interviewees discussed the dichotomy of how institutions interested in wildlife conservation promote as well as punish agriculture and spoke towards the undesirability of regulation. As one interviewee remarked “…we are not going to have an impact on natural resources in the state of Iowa unless we have the incentives or the hammer to do it.” The perceived dichotomy of incentives or the hammer has impacted the way that beef
producers perceive or trust the human resources available to them. One DNR employee stated bluntly, “…the people who have grazed are generally not talking to us.” Yet, the data did not reflect stark differences and conflicts between livestock producers/farmers and NRM stakeholders in the study area. The impetus for cooperation exists; increasing collaboration and communication between producers and NRM institutions was desirable to both stakeholder groups, as one female cattle producer articulated:

“...we need to get all these groups together, the NRCS, and the naturalists and farmers and come to some conclusion where we are not grazing too short but the wildlife are still there...I mean, just to share ideas if nothing else, and stuff like that is being done, but if it can get more to a...bigger group of people.”

Discussion

Participants, despite the two distinct groups who participated and their diversity relative to their perspectives on the BCA, painted a consistent picture of where grazing management that yielded dual benefits of environmental and economic services fit in their vision of a farming landscape. These perspectives were essentially strategies for avoiding negative outcomes of ‘pool table’ pastures and expressions of what types of management promotes multiple benefits. Practices to provision multiple benefits such as reducing the amount of supplemental feeding throughout the year, and increasing the length of rest and re-growth on pastures and/or reducing stocking rates to increase vegetative cover were desirable to each stakeholder group. Relative to human management, NRM stakeholders as well as cattle managers saw advantages to better adapting to seasonal changes in the grassland ecosystem, specifically the importance of stockpiling forages when possible. These management and biophysical elements of grazing can, in the eyes of the study participants, provision dual production and ecosystem benefits.

Another clear example of a knowledge gap highlighted in the data is the marginal awareness of the RRSBCAs existence by producers, and a lack of clarity of its implications by all participants. This would lead us to believe that currently, livestock producers who graze pastures in the RRSBCA would not account for needs of grassland birds, as some concerned scientists have discussed (i.e. Jacobs et al. 2005). The question becomes, as grazing becomes increasingly recognized as a viable tool in the broader
scientific community to enhance the functionality of remaining pastures and grasslands, particularly for wildlife species of concern, what are the appropriate way(s) to encourage the application of that tool? Producers highlighted the power of farmer-to-farmer, on the ground demonstration areas combined with credible research and outreach from trusted experts familiar with day-to-day farm and beef management. Although this was discussed as well by the NRM stakeholders, most of these participants placed more emphasis on solutions via financial incentives through government programs, education and improved communication operating through established institutional channels.

Conclusion

Through our analysis of focus group and interview data, we identified key social mechanisms that support the expansion of grazing management for multiple benefits in lands with conservation needs, such as the RRSBCA. Our data illustrate that expanding access to integrated knowledge networks comprised of experiential knowledge (farmers/graziers) and scientific knowledge (technical assistance providers/ university researchers) within a scale appropriate to the specificity of grazing systems that provision multiple benefits can serve as a platform for the development of a more multifunctional grazing management. The scale with which a BCA exists was cited as appropriate to focus human and financial resources. This social and conceptual ‘space’ to negotiate grazing outcomes holds much promise for the future viability of wildlife species of concern as well as diversified farm enterprises. Based on this and other research, beef production at the initial phases where it is currently reliant on forages could be seen as a leverage point to promote the development of a more multifunctional agriculture. Organizations and management configurations can bridge the ‘gap’ between third-party change agents at the state and federal scale, and individuals and the communities they regularly associate with are seen as a way to facilitate an increase in grazing for multiple benefits in the case of the RRSBCA. Though people “get heartburn” regarding the fuzzy definition of what a BCA “does,” this flexibility allows for landowners, livestock producers and NRM agents to negotiate management needs that account for social and ecological specificity. Many scientists suggest that management objectives must be clearly defined in order to facilitate collaboration across perceived institutional and
cultural barriers (i.e. Ruth et al. 2003). However, this case study would suggest a certain degree of flexibility would provide an opportunity for stakeholders such as landowners and livestock producers interested in grazing for multiple benefits, who are typically excluded/ not involved from conservation planning, an outlet to inform the creation of conservation management objectives.

To create a sustainable and profitable synergy between the joint production of livestock, forages and ecological services in pastures, NRM institutions administering technical support to producers and landowners need to design outreach and programming suitable to the applied, ‘on the ground’ interests of these stakeholders (Kemp and Michalk 2005). Many approaches to developing these systems have highlighted the decision-making and management at the farm level, and the attitudes and willingness of individual producers to learn collaboratively through interpersonal exchange. The effectiveness of this strategy likely has roots in the notion that social pressure, which can take place in the context of civic institutions and in relation to others whose opinion is valued, is an effective tool to influence farm management decisions (Flora 1999). Trust is a product of a civic structure that allows questions and group learning to overcome negative perceptions (Morton 2008). The uncertainty and distrust livestock producers have of the IA DNR by was acknowledged clearly by those who work within the DNR in this study.

Many researchers who study land use and natural resource conservation discuss conflicts that arise when the interests of private landowners and NRM stakeholders diverge (Flora 1999; Heasley 2005). Yet, the outlook for multifunctional grazing systems is hopeful because of the willingness producers expressed to learn and collaborate not only with one another but also with NRM stakeholders. If barriers identified in this study are addressed we would anticipate that farmers and livestock producers, who articulated the desirable outcomes of grazing systems managed for multiple benefits, would readily implement practices associated with these outcomes.

Our findings contribute to the broader discussions of the value of informal social exchange coupled with opportunities for dialogue and relationships with researchers and NRM professionals for farmers and ranchers attempting to implement MFG systems.
The scale of the farm and the individual farmer has been studied extensively regarding factors influencing adoption and diffusion of alternative/organic/multifunctional agricultural practices (Kroma 2006; Jackson et al. 2007; Carolan 2006). In a study of the use of cow-calf pairs in reconstructing Iowa prairie systems, Wiltshire et al. (2010) conclude that local, community level support assists the expansion of pastures managed for multiple benefits in Iowa. This research enriches the notion that ‘grassroots’ and local action is needed (i.e. Meinzen Dick et al. 2004). One example of how social and civic infrastructure can facilitate multiple benefits from grazing systems is given by Schutz (2010), in reference to common-interest communities. The model of a common-interest community provides an example of formally organized collective action utilizing property law to negotiate provisioning and allocation issues, and applies to the institutional actions and scales identified as facilitating factors in this case study. Any institution, such as a legal common-interest community, that allows for the freedom and authority for landowners, farmers and livestock producers to make decisions regarding land management will be more likely to succeed than top-down agency driven decisions about ‘best practices’ (McCown 2005; Morton et al. 2010; Gadgil et al. 2003).

As part of an increasingly nuanced understanding of beef production, livestock sustainability, and multifunctionality, we can apply this information to help what Bell (2004) calls “...a process not of “adoption-diffusion,” but a process of adaption-diffusion”, occurring when those with experiential knowledge adapt information gleaned from exchanges described by study participants to their social context. This study supports the application of more flexible models of conservation management that are decentralized from a singular institution or regulatory body. The BCA model exemplifies this and can provides opportunities for local stakeholders who manage those lands to adapt conservation practices, such as grazing for multiple benefits, to their challenges and needs.


Denzin, C. and Ryan, K. (2007) Qualitative Methodology (Including Focus Groups). In:


In the US Cornbelt region, land use dynamics involves complex, multi-scale private and public tradeoffs. Rising commodity prices, higher costs of production and land values have created challenges to land use via perennial systems such as grassland pastures. In the Cornbelt context, grassland pasture use involves limited access to remaining pastureland, rising rental rates, and the navigation of somewhat specialized markets (Hinrichs and Welsh 2003). Furthermore, agriculture has become more specialized over the years – favoring either row crop production or large-scale livestock production, but no longer integrated in the same operation (Hogberg et al. 2005). Over eighty percent of farm operators surveyed by the Iowa Farm and Rural Life Poll cite pasture displacement by grain production as well as increasing rental rates as reasons for the decline in mixed livestock and grain farming (Arbuckle 2009). Forages have generally become a limiting resource for all stages of beef production in Iowa (Loy et al. 2009; Pers. Comm. Dr. John Lawrence).

The specialization and concentration of agricultural production, wherein farms increasingly produce fewer types, but large quantities of commodities has contributed to declines in ecosystem functionality (Schulte et al. 2006). Many of the consequences of ecosystem impairment are subsequently passed on to society as negative externalities, increasingly experienced at multiple spatial and temporal scales (Tegtmeier and Duffy 2004).

When compared to other agricultural land uses, pasture-based livestock production greatly contributes towards provisioning ecosystem services (Boody et al. 2005; Russelle et al. 2007). Given the ability of grazing systems to contribute multiple production and ecological benefits, in this paper grazing management that jointly produces and balances these benefits is referred to as multifunctional grazing (MFG) (i.e. Boody et al. 2005;
An operational definition of MFG would be any management of livestock that applies their grazing action as a tool to manage the harvesting of vegetation for the purposes of sustaining productivity and ecosystem functionality through effective nutrient cycling, habitat provision and vegetative biodiversity. In this way, MFG acts as a way to optimize and balance tradeoffs inherent in row-crop production systems through managing perennials as harvestable forage crops and as ecosystem service providers (Sanderson et al. 2004; 2009).

**Solving the Habitat Problem: The Role of Grazing for Grassland Bird Conservation**

It is increasingly recognized by conservation groups interested in environmental performance that well managed livestock grazing (which can mimic necessary disturbance for grassland health) can maintain heterogeneous habitat needed by wildlife populations (Askins et al. 2007). Of any suite of avian species globally, grassland bird populations are in the most rapid decline due the loss of habitat, partially due to the absence of it, and partially due to their specific requirements of a mosaic of habitats in varying stages of succession (Rohrbaugh et al. 1999).

For the goal of co-producing private farm profitability and public benefits from ecosystem services via multifunctional agricultural systems to be feasible, groups with these interests are increasingly attempting to collaborate for outcomes-based management of natural resources (Morton et al. 2010; Pretty and Ward 2001). The Bird Conservation Area (BCA) system, as will be discussed, is one model being utilized to increase the ‘outcome’ of avian habitat in working agricultural landscapes. Yet, creating a general policy that incentivizes management of a highly complex pasture agroecosystems for multiple benefits at a state or national level, (e.g. for carbon sequestration, water quality, and/or wildlife management) has proven difficult for several reasons. These include the divergent goals of private landowners and public natural resource management (NRM) organizations (Schultz 2010; Nassauer 1995) as well as the variability in the degree to which benefits are provisioned (Sanderson et al. 2004).

MFG is desirable not only from a farmer perspective (e.g. Doll and Jackson 2009), but also by NRM stakeholders in Iowa who require the partnership of livestock producers to provision ecological services such as wildlife habitat for recreational purposes (LCSA
2010). Therefore, to achieve a more widespread application of MFG, a firm understanding of user knowledge and perceptions is essential, and in this case users are farmers as well as NRM professionals on behalf of public and private NRM organizations (Raedeke et al. 2003).

**The Habitat Problem as Human Decision-making Problem: Where Do Outreach and Education Fit?**

Characterizing social dynamics among diverse stakeholders that shape both farm and landscape scale management is needed to jointly produce privately profitable enterprises and public environmental services (Corry and Nassauer 2002). Cultural conventions are embodied in how land is managed, especially in agricultural landscapes; human decision-making is a prerequisite to land use (Nassauer 1995). Highlighting these typically tacit understandings in how land users make decisions allows an assessment of how those management paradigms and practices can better contribute to the multiple public and private benefits we seek from the land. A general lack of research-based information exists regarding the specific factors influencing the use of MFG in a highly industrialized agricultural landscape such as Central Iowa.

To further understand the role of cultural forces shaping land use, this study was designed to assess the utility of current outreach paradigms through the eyes of the educators and the users of this outreach, in regards to pasture management. As such, this paper presents qualitative interview and focus group data collected from stakeholders representative of multiple scales of management of lands in a designated BCA. In order to gain appropriate multi-scale perspectives of land management in this region stakeholder participants of the focus group and those individuals selected for personal interview were more specifically (Figure 4.1): 1) livestock producers who actively manage land and livestock at the field and farm scale; 2)NRM professionals such as government field agents (NRCS, IA DNR) who have broader, landscape level and political boundary perspectives on land use, but still regularly interact with livestock producers and landowners and University and NGO stakeholders engaged in research and/or administration regarding wildlife and bird habitat conservation and policy. Given this diversity of social groups, a case study collecting data from and exploring the boundaries of each of these contexts will allow their unique
perspectives to connect to the whole of the particular landscape with which their decision-making collectively affects.

The analysis in this paper is regarding perspectives on what characterizes knowledge and information these groups identify as best suited to support the development of MFG systems that provision grassland bird habitat as well as other co-benefits. What are the similarities and differences between stakeholder groups as to how they express needs from information channels? If there are differences, are they a source of potential contention, or cooperation? What do stakeholders suggest as a ‘road map’ for communication and outreach suitable for increasing the viability of MFG systems?

**Taking Stock: Land Use in Iowa’s Grasslands**

Pastureland is defined as land managed for the production of introduced forage plants for livestock grazing utilizing cultural treatments such as fertilization, grazing management, pasture renovation and weed control (USDA Census 2009). Today, over 70% of Iowa’s total land surface is in row crops (USDA Census 2009). Remaining pastureland in Iowa has been in steady decline; in 2007, Iowa farmers grazed 32.9% fewer acres than in 1982 (USDA Census 2009). Between 2002 and 2007 alone, over half a million acres of grazable land was lost (USDA Census 2009).

The majority of livestock utilizing Iowa’s remaining pastures today are beef cows and their calves (Cherney and Kallenbach 2007; Loy et al. 2009). Typically, commercial beef producers in Iowa manage improved pastures largely comprised of non-native vegetation including cool season grasses and legumes (Sheaffer et al. 2009). A growing segment of these producers are interested in the benefits from well-managed diversified pastures that include native forbs and warm-season grasses as well (Wiltshire et al 2010).

**Grazing Management for Grassland Bird Conservation**

Grassland birds have experienced sharper and more widespread declines than any other behavioral or ecological guild of birds due to habitat loss and degradation in the Western Hemisphere (Vickery et al. 1995; Knopf 1994). Grassland birds are defined as any avian species that utilizes grasslands, whether for food, nesting, breeding or as a stopover site
during migration (Johnsgard 2001). Sixteen species of grassland birds are obligates of the tallgrass prairie region, as they require this vegetation to maintain stable populations (Vickery et al. 1999).

Studies have demonstrated declines in grassland birds is correlated with declines in agricultural grassland habitat like pastures, as well as management changes in timing and frequency of hayfield cutting (Herkert 1994; 1996). ‘Pro-bird’ models for balancing livestock needs with grassland bird needs have been developed, and are reflected in how the BCAs are established (Temple et al. 1995). Certain applications of grazing frequency, intensity and timing can benefit the entire suite of grassland birds, and some grassland bird species evolved to occupy niches created by heavy grazing, as well as lighter intensities (Knopf 1994; Renfrew and Ribic 2001). In other words, many approaches to grazing may be employed, but only some will yield the kinds of vegetation structures needed by the entire suite of grassland birds.

**The Problem: Communicating Co-Management Models that Benefit Beef and Birds in Designated Bird Conservation Areas**

In response to the rapid declines in grassland birds, an international coalition called Partners in Flight tasked regional partners to develop strategies to improve the status of priority species (Fitzgerald and Pashley 2000). The Bird Conservation Area (BCA) system in Iowa and beyond was established as a component of this broader strategy, and as a research-based method to increase habitat (Fitzgerald and Pashley 2000). BCAs are built upon models generated from research that advocates a core of ‘protected’ grassland amenable to breeding and nesting, surrounded by a matrix of agricultural land (e.g. Helzer and Jelinski 1999). Essentially, Iowa BCAs are an attempt to create models for habitat conservation that can achieve wildlife outcomes within privately owned working agricultural landscapes, without the need for strict regulatory oversight, mandatory conservation practices or land retirement.

BCA planners in Iowa and Missouri acknowledge the need to work with private landowners to achieve habitat goals (Jacobs et al. 2005). A central project objective for BCAs in Missouri and Iowa describes the need to create partnerships with landowners to foster an understanding of the urgency of grassland bird conservation (Jacobs et al.
Two surveys focused on landowner decision-making in BCAs illustrate a knowledge gap between how landowners value grasslands and wildlife, as opposed to the types of management practices they perceive to maintain the health of those systems (Regen et al. 2009; Morton et al. 2010). These surveys concluded that though landowners value wildlife and biodiversity in grasslands, these values are largely disconnected from the types of management practices landowners implement to benefit grassland ecosystems. In other words, agricultural practices such as MFG management are disconnected from distinctly ecological outcomes like grassland bird habitat.

Yet, communication models effective at engaging private landowners and their land use decisions remain sparse within the grassland bird conservation community. Several factors influence this communication issue. The nature of information needed to inform MFG systems is highly specific to local ecological context, where forage needs and availability are variable throughout the landscape and season (Sanderson et al. 2004). Farmers often struggle to appropriately express their multifunctional interests in ways that balance production goals and balance broader ecosystem goals. These struggles are in part due to limited understanding of the range and degree of effects associated with field and farm level conservation technology available, limited decision support tools, limited peer networking, lack of working demonstrations and lack of context appropriate conceptual and technical information (Prokopy et al. 2008; Lemke et al. 2010; Petrehn et al. 2011, in review).

The qualitative nature of what constitutes effective mediums for communicating the value of need for MFG allows the stakeholder descriptions of ‘what should be done’ to reveal tacit pedagogies. The pathways and directionality with which communication of technical information consists can be described from two distinct perspectives. Horizontal links between stakeholder groups refer to connections across similar stakeholder groups, for example from livestock producer to livestock producer or farmer. Vertical links, however, are characterized by connections between local groups and external agencies or organizations (Pretty and Ward 2001). As described previously, there are challenges for NRM scientists and conservation organizations to structure outreach communications both horizontally and vertically (Gunderson and Holling 2002).
The challenge in regards to communicating MFG systems centers largely around a difficulty in generalizing about the myriad of ecological situations and diverse social systems (Jordan et al. 2010; Briske et al. 2008). The persistence of communication inconsistencies between key resource professionals, applied scientists and land managers has led to calls for immediate attention to the development of strategies to remediate this situation (Ruth et al. 2003). Different types of communication strategies and knowledge sharing across stakeholder groups is not an issue per se. Yet, these strategies may be so divergent that progress, in this case an increase in the prevalence of MFG, is stymied.

The Place: Physical and Social Landscape of the Study Area: The Raccoon River Savanna Bird Conservation Area (RRSBCA)

The 54,000 acre RRSBCA is one of sixteen BCAs established by the Iowa DNR across the state, with more proposed (IADNRa, undated). The suite of avian species that the Iowa BCA system targets are grassland, wetland and savanna birds, with each area explicitly designed to have a large proportion of land in open perennial grassland (Jacobs et al. 2005). To be designated as a BCA in Iowa, 40% of the total land within a BCA must be in grassland (Jacobs et al. 2005). The Middle Raccoon River cuts the RRSBCA into two distinct Iowan landforms, and ultimately flows into the City of Des Moines. Des Moines Lobe lies to the north, famous for wet, flat, and fertile soils deposited by part of the Wisconsin ice sheet as recently as 13,000 years ago (Kurtz 1996). To the south is the Southern Iowa Drift Plain, with well-defined drainage systems and gently sloping topography, a common geographic characteristic defining Iowa’s endemic vegetative communities of a broader ecological region, the Eastern Tallgrass Prairie.

The RRSBCA is located in the rolling Northwest corner of Guthrie County, Iowa, which was once carpeted with mesic tallgrass prairie over a loess-mantled drift plain with deep black soils (Weaver 1958). Guthrie County, Iowa has many farms with a balance of crop and livestock enterprises, and sizeable forage production, when compared to counties to the north. For example, 110 farms in Greene County had 4,386 acres of pasture, while 225 farms in Guthrie managed almost 18,000 acres (USDA Census 2009). In Guthrie County, there are 415 people who listed farming as their primary occupation as of 2007, out of a total population of 10,833 (USDA Census 2007; US Census 2009).
8,000 acres of the RRSBCA landscape is ‘protected’ via conservation easement or public ownership, the remaining 46,000 being privately held (Regen et al. 2009). Whiterock Conservancy comprises roughly 5,400 acres of the 8,000 mentioned above. Whiterock is a non-profit land trust comprised of lands donated by the Garst family, who are part of a rich history of the development of hybrid corn (Bogue 1983).

Figure 4.1: The RRSBCA, with land uses. Below the map are categories of participants: The circles in green tones are referred to in the text as producers (7 total participants); the circles in red tones are stakeholders referred to as NRM Professionals (13 total participants). Map thanks to Elizabeth C. Hill, former Whiterock Conservancy Ecologist.
As the RRSBCA and surrounding lands are economically and socially based on agricultural production, these are ‘resource-dependent communities’ that rely on ecosystem functioning to sustain livelihoods. Stakeholders impacted by the pasture management decisions made in the RRSBCA are broadly defined as 1) landowners who also raise livestock or rent land to producers for the use of pastureland or cropland 2) local businesses who operate and purchase cattle through breeding stock producers and sale barns then market or slaughter them 3) graziers and private landowners in other BCAs and other public and/ or conservation lands across Iowa and Missouri. Administrators involved with the conception and management of the BCA system in Iowa are also affected by the decisions private land managers make with their grazing management, as grazing management has direct implications for birds of greatest conservation need that the BCA system wishes to address (Jacobs et al. 2002).

**Methods**

This case study was exploratory in the sense that this study sought identify socially constructed boundaries of a case to provide insight into the research question, or the question of whether or not stakeholder groups involved in the RRSBCA have divergent goals that would prevent the expansion of the use of MFG systems (Baxter and Jack 2008; Streb 2010). A case study is of particular utility when studying interconnected social scales that operate within a broader, bounded social unit; in this case, farms nested within and around the management unit that is the RRSBCA (Creswell 1998). Stakeholders with different degrees and types of involvement in RRSBCA lands represent multiple cases within a case, or a single case with embedded units (Yin 2003; Baxter and Jack 2008).

**Data Collection and Suitability of Sampling Technique**

Focus group and semi-structured, in-depth interviews were chosen as the primary methods of data collection for this study. Qualitative research techniques such as these are designed to build rapport with participants, thus allowing for an ‘insider’s view’ of the situation, which is necessary to gather perspectives on a type of land management
recognized for its contextual nature (Menzien-Dick et al. 2004). Focus groups are valuable in helping to initially frame complex issues through collective dialog (Denzin and Ryan 2007). Personal interviews, on the other hand, enable participants to more fully articulate their perceived roles in farm and resource management (e.g., Carolan 2006). Participants are also more likely to volunteer potentially controversial information or views about natural resource use in interviews, as opposed to focus groups (Kaplowitz and Hoehn 2001). Both methodologies have been shown in similar complex land use contexts to provide complimentary information with regard to how stakeholders perceive, use, and value natural resources (e.g., Bohnet et al. 2007).

Interviewees and focus group participants were selected using a purposive snowball sampling technique (Knight 2002), focusing on networks of individuals involved in managing lands within or in close proximity to the RRSBCA or administering management of programming directly related to the BCA system. Purposive sampling was deemed appropriate given the specificity of the physical boundaries of the case study (the RRSBCA). For example, key actors in beef and specifically beef cow production in the RRSBCA was interviewed, enabling a triangulation of producer perspectives on grazing and pasture use. These producers had a gradient of perspectives and practices about pasture management. Purposive sampling was essential to obtain this gradient of perspectives, scales and practices in grazing enterprises. For example, the smallest number of grazing livestock held by an interviewee was 3, who sold meat to friends; the largest was over 300, and sold them as fat cattle as well as breeding stock to buyers nationally.

**Process**

Twenty total individuals participated in this case study. Fifteen participated in semi-structured, in-depth interviews lasting approximately one hour and thirty minutes in one-on-one or small groups (≤3) comprised of co-workers/ family members. Fourteen of these individuals were interviewed on site (e.g., at their farm or place of work), and one was interviewed in the researcher’s office. Five additional individuals participated in a forty-five minute focus group. All of the focus group participants are biologists employed with the Iowa DNR Private Lands Program and work regularly with livestock producers and
landowners interested in implementing wildlife habitat in the RRSBCA and other areas of Iowa. This focus group was conducted at a recently constructed visitors center located at the Northwest corner of the BCA.

<table>
<thead>
<tr>
<th>Personal Context</th>
<th>Livestock Producers/ Farmers</th>
<th>Natural Resource Managers/ Experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community/ Place</td>
<td>How typical is your operation of others in the area? Has that changes in the past few decades? Does the RRSBCA designation influence how you manage pastures?</td>
<td>Do you work with livestock producers and landowners directly? If so, where are these producers located? If not, who do you work with in your organization? How does the RRSBCA/ other BCA’s influence where you or others you work with prioritize your duties?</td>
</tr>
<tr>
<td>Knowledge: Characteristics</td>
<td>How would you describe the kind of grazing management you do/ have done? Do you see environmental and wildlife benefit to grazing? What are some examples?</td>
<td>Do you see grazing as a viable management practice for wildlife needs, especially grassland birds? What are some examples of grazing management benefiting wildlife needs in Iowa?</td>
</tr>
<tr>
<td>Knowledge: Sources</td>
<td>What resources do you look to for support and advice when making decisions in your grazing enterprise? Why do you prefer the sources of support you described?</td>
<td>Do the organizations/ broader community of professionals you work with share your views on the benefits of grazing systems? If you work with producers and landowners, what is the most effective way to communicate grazing management that producers these benefits?</td>
</tr>
</tbody>
</table>

Table 4.1: Typology of Questions Asked in Focus Group and Semi-Structured In-Depth Interviews Regarding Communication and Educational Styles Suited for Advancing MFG

As data was being collected and transcribed in the Spring and Summer of 2010, transcripts were reviewed for evidence of saturation, identified when participants begin to replicate concepts independently discussed by others (Neuman 2003; MacQuarrie 2007). An iterative thematic analysis allowed for data to be reviewed and re-reviewed for emergent themes as it was collected (Lapadat 2010). Seven interviewees manage a beef production enterprise within 30 miles from the RRSBCA bounds, and will be referred to as beef producers. This geographic range is a result of the sampling technique, in that as participants would refer to other potential participants, they may or may not know someone directly within the BCA boundary. Also, because row-cropping enterprises predominate in the area, grazing livestock producers in total are a small group, especially
directly within the BCA. Excepting two, all participants of interviews and focus groups had some past or current experience with beef cattle management. Five interviewees work for state or federal institutions such as the Iowa DNR or the Natural Resource Conservation Service. All stakeholders within all sampling categories were chosen based on the fact they lived within or in close proximity to the BCA and managed land, were instrumental in the process of designating the RRSBCA as a BCA, or are part of an administrative organization that influences land use in the BCA. An interview guide (Table 1.1) was used to ensure that every interviewee and focus group participant was asked questions that were of the same conceptual nature, but were executed differently in style and timing depending on the context of the participant(s). For example, interviews with those who managed livestock included questions about their specific management practices, such as herd(s) sizes and classes, as well as what kind of timing and recovery allowed in pastures. Interviews with those who work with an organization to manage the RRSBCA landscape were asked specific questions regarding their communication strategy when working with producers and agency personnel to implement conservation practices. See Figure 4.1 for the categorization of study participants.

In addition to interview and focus group data, participant observation techniques were employed at various regional events held by farms and organizations within or in close proximity to the study area. Notes, handouts, informal interviews and photos from these events were reviewed as a way to better understand themes and common narratives that surfaced from the interview and focus group data (e.g. Bohnet et al. 2007; Hassanein 1999).

**Analysis and Results**

All of these interviews were recorded and transcribed verbatim, reviewed for emergent themes, and subsequently hand coded and later managed with NVivo 8 software (QSR 2008). Due to the semi-structured nature of the data collection, data specific to prompts was limited, so open, axial and then selective coding was used to find relationships between responses across participants (Price 2010; Bryman and Burgess 1994). This process was used so emergent concepts could be identified that provided insights into the research question (Maxwell and Miller 2008).
After a general analysis of all interview and focus group data, themes coded to concepts related to strategies appropriate to address challenges to implementing MFG were identified. These needs were identified as a result of a within case analysis of the two distinct stakeholder groups, an analysis between these two distinct groups, revealed specifics regarding stakeholder perceptions of the types of information and venues for knowledge exchange needed to support the development of MFG systems (Yin 2003). Three main themes regarding the preferred types of MFG communication and education are presented here.

**Natural Resource Management Professionals: The BCA as an Opportunity to Facilitate Organizational Consensus Regarding the use of MFG and Address Outreach Needs**

Stakeholders who conduct research and work in resource management and administration with institutions such as the Iowa DNR and the NRCS explicitly viewed conservation issues inherent to grazing systems as best approached with two types of activities. One was the need to catalyze changes in perceptions of MFG and create consensus within institutions and organizations involved in grassland and wildlife management in Iowa at the regional and state level. An additional theme that was expressed by NRM stakeholders was the value of working on a case-by-case basis with producers and landowners who they thought could benefit from MFG to improve communication. These NRM professionals saw the RRSBCA and the BCA model in Iowa as an appropriate venue to employ both of these activities.

The idea of changing perceptions within the NRM community was reflected predominantly in comments regarding the ineffectiveness of current incentive programs to create habitat in working agricultural landscapes, and that stakeholders discussed incongruent views across agencies and organizations regarding the role of grazing in creating functional habitat. Comments reflected frustration and ambiguity about the adequate course of action to create consensus across organizational boundaries in the RRSBCA and beyond. A NRCS employee and cattle producer echoes this when describing resources available from the NRCS for establishing MFG systems, namely via government cost-share programs such as EQIP [Environmental Quality Incentives Program]: “So I think the NRCS overall has the right idea, but...will vary
tremendously…they assume that everybody [in NRCS offices] is on the same happy page doing the same happy thing, at the same happy pace, and that is not the way it is.”

Not being on the “…same happy page…” as an organization about the role of MFG in environmental quality would imply, as this individual expressed, that this variability is detrimental to the ability to provide appropriate technical advice to land managers interested in MFG. Discrepancies in how NRM agencies define and implement grazing were discussed as well as how they administer technical assistance to landowners who wish to apply this management. The existence of and physical and informational variability in expert assistance for conservation grazing was discussed as limiting by all stakeholder groups (Petrehn et al. 2011 in review).

Addressing the variability in technical assistance was articulated as a medium to improve the ability of NRM organizations and professionals to connect on a more individual basis with landowners interested in habitat and livestock production. A manager at the Whiterock Conservancy echoed the limitation that even achieving consensus amongst NRM organizations regarding the use of MFG wouldn’t automatically translate into the language of livestock producers:

“Every cattle producer seems to be wildly independent, have their own…little quirks….we [Whiterock Conservancy] want clean water, we want real environmentalists to think we are doing the right thing… they [livestock producers] have their own ways of doing things. So, that’s why it’s hard to find that merge point, that model. I don’t know how you would do that except for talking…it is so highly localized to individual needs.”

The ability to find the ‘model’ to communicate and reach out to grazing managers is an apt way of describing the types of communication these stakeholders saw as appropriate when offering technical assistance. NRM stakeholders articulated the need to cater to the unique needs and character of individual landowners and livestock producers. Demonstration areas and individual, one-on-one assistance were identified as preferred strategies. These areas were described as a way to provide an experiential learning opportunity for landowners and livestock producers. Some, including this DNR biologist, were skeptical of the attention that these proposed areas would receive from locals. This interviewee also described the BCA system, as did the majority of NRM stakeholders, as
an appropriate venue for demonstrating MFG models:

“...it would be great to have a demonstration area in every county, but good luck. And even then you won't get everybody to actually look. Yeah, there are enough BCAs spread around... they would be close enough that the ones who wanted to know [about MFG systems] would travel.

These stakeholders viewed that communication and education regarding MFG should be framed around the individual circumstance of landowners/ livestock producers. NRM professionals who do outreach work readily identified the traditions and values associated with farm and livestock management as attributable to why ‘one-on-one’ is a desirable form of knowledge exchange for MFG.

Demonstration areas with characteristics of a BCA, in that they are designed to create quality habitat for a certain suite of birds as well as a viable livestock enterprises, are a means to convey the context specific aspects of MFG systems into a scale appropriate for local knowledge communities. As discussed in the next section, producers and those familiar with cattle production prefer the particular directionality of interfacing with others familiar with grazing systems as a way of learning MFG systems via model areas.

“Just spending time out there:” Trusted Social Networks and Local Knowledge Embodied in Demonstration Areas Key to MFG Implementation

Although the NRM stakeholders articulated the value of individual connections and increasing the visibility of MFG with demonstration areas, producers and those who regularly work with producers expressed a need to learn from and access knowledge and social networks consisting largely of livestock producers. This was expressed explicitly by one cattleman:

“Yeah, he [extension agent] has his own operation and works cattle, that’s credibility... until you can say I had to go hungry for a few days so I could pay my cow feed bill you know, then maybe I will listen to what you have to say.”

Though this is a somewhat extreme example, to this participant it appears that information needs to be conveyed by a trusted resource who demonstrates direct experiential knowledge. The value of producers seeing and learning from one another was reiterated as a manager of one the largest cow/calf operations in the study area reflected on the value of ‘pasturewalks’. These events are typically held on other farms with pastureland managed with livestock who share experiences with attendees. The
emphasis on who possesses the experience of grazing and the value of that was explicit and tacit. For instance, a majority of time during interviews consisted of stories and examples stakeholders experienced on their own farms or other farms of others. These stories and examples reveal the place-based nature of agricultural and specifically grazing and pasture management knowledge in the RRSBCA. A female cow/calf manager explained the value of a physical space to share ideas about the balance between production and ecological needs insinuated that a group of people from all of different reference points of producer, expert, conservationists can all share in the ‘meeting room’ of a pasture:

“We need to get all these groups together, the NRCS, naturalists, farmers, and come to some kind of conclusion where...the wildlife are still there...we need more people involved...get guys [livestock producers and others] together and they will exchange ideas themselves.”

**Discussion**

To stakeholders involved in this RRSBCA case study, the combination of demonstration areas that engage experiential learning while simultaneously serving opportunities for one-on-one outreach, such as the ‘meeting room’ described above, seem to address the concerns and needs held by livestock producers involved in this study. NRM professionals have many obstacles to overcome within and amongst their respective organizations and institutions, but will have greater effectiveness achieving wildlife and conservation goals knowing the appropriate engagement strategies to work with producers/landowners. This study reveals a pathway for NRM experts and institutions to follow knowing that their goals for wildlife conservation and MFG use are similar to those of landowners/ livestock producers; only the information about MFG needs to be conveyed in their terms. These results are consistent with other studies regarding the role of community in developing sustainable farming systems (Hassanein 1999; Oreszczyn et al. 2010). NRM stakeholders in this study understand their situated knowledge of serving an institution or organization from the perspective of scientific understanding, and the need to take extra steps to incorporate local experiential knowledge needed for advancing MFG systems, was also highlighted by Nerbonne and Lentz (2003). Thus, NRM stakeholders, of necessity, understand their role in the community of landowners and
livestock producers they would like to collaborate with to develop MFG systems, but are limited in the ability to do this by the expectations of their respective organization. Though demonstration areas and pasturewalks seem “common sense” as strategies to communicate models of MFG systems, and occur in the study area and in surrounding areas, these opportunities need coordination and substantial commitment from all stakeholder groups represented in this study. Getting “...more people involved” as quoted from a producer above, requires resources that have numerous other demands. Yet, it would seem the combination of benefits that can be provisioned by MFG systems would garner more attention from diverse supporters precisely because of this; this study has highlighted strategies for these diverse supporters to take these common sense strategies to the next level.

Conclusion

The data illustrates that local sources of ecological and experiential knowledge regarding MFG systems need recognition in the form of social engagement and group learning in the field. In this case study, entrepreneurial farmers and livestock producers all expressed a desire to collaborate with willing NRM experts and conservationists to manage MFG systems. This study reveals tensions between these two groups are real but do not impede the development of a knowledge community around the use of MFG in the RRSBCA, and that barriers to the development of these systems are largely based on economic and technical assistance limitations (Petrehn et al. 2011 in review). This investigation strengthens the notion that to drive implementation of MFG for grassland birds and other co-benefits, a more decentralized approach to conservation planning may facilitate the integration of local knowledge with scientific and expert knowledge.
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CHAPTER 5: GENERAL CONCLUSIONS

SUMMARY

This project used multiple strategies to approach the issue of a broad decline in working grasslands in Iowa utilized by farmers with grazing livestock, and the subsequent reduction in functional habitat. Mapping the landscape from which to view the possibilities for ecosystem services provisioned by grazing systems consisted of two distinct endeavors. The initial work, chapter two, was designed for the purposes of exploring gaps in the physical sciences occurring in the literature about the products of pasture systems in Iowa, both economic and ecological. This review indicated that there are still distinct research needs in how profitable livestock enterprises merge with ecologically beneficial grassland management. Regarding agronomic concerns of pastures, principles common within the literature on productivity and the mechanics of grazing practices and what is known about the consequences of various iterations of grazing were detailed. To add an ecological perspective regarding environmental services potentially provisioned by pastures in Iowa, pertinent research was surveyed and synthesized. This portion of the review revealed a need for more research that accounting for the enterprise profitability of certain grazing practices deemed more ecologically appropriate for service provision in the literature. Also highlighted was the importance of understanding heterogeneity, and the ways in which it manifests at different scales in a farm and the landscape in which a given grazing system embedded.

The case study was a tool to provide more specific insights into how stakeholders involved with managing lands in a Bird Conservation Area perceive grazing management as a tool to produce multifunctional products of livestock production with wildlife benefit. Factors that inhibit as well as support the development and implementation of grazing systems that are co-managed for production of livestock as well as wildlife habitat for this specific area were identified and synthesized.

Chapter four emphasized the pathways for communication that can enhance the types of education and technical assistance available to producers interested in grazing for multiple benefits, and demonstrated stakeholders’ value of partnerships created around
experiential and local knowledge of multifunctional grazing.

**LIMITATIONS**

A limitation of this research is that the participants’ views reflect a specific geographic space, rather than a focus on a specific issue. Many previous studies of farmer behavior and adoption of practices sample a group of farmers with a propensity towards and experience with the management or technology in question (i.e. Carolan 2006; Hassanein 1999). Incorporating farmers who have varying experiences with multifunctional grazing, technical assistance providers and independent business owners who deal with farmers and livestock producers in this landscape, as well as NRM experts who are largely interested in research and administrative responsibilities meant there was a considerable amount of data devoted just to telling stories and descriptions of the place. Although this certainly underscores the value of grounding sociological research in a definitive location, this also sacrificed a considerable amount of time that could have been expended on probing into issues that came up during the interview, instead of having to spend a portion of the interview simply trying to form a context or a common ground of what they did, and their role in the RRSBCA landscape. Roughly one-third of each in-depth interview was spent establishing the participants’ background and a description of their role in managing RRSBCA lands for public or private purposes. It may have been examples of their farm management, a description of previous professional experiences that led them to the position they hold today, or a story that come to mind during the conversation. Yet, it was these common descriptors of place that grounded the data and allowed for one interview to have some internal consistency with all other interviews, regardless of how divergent that data may have been conceptually. Every single participant in this study has at least once, walked on the land in the RRSBCA and contemplated its ecological and social functions.

The conclusions of the case study can allow an opportunity to assess the potential amount of extrapolation stakeholder views have to mirror multifunctional grassland management issues in the state or the Corn Belt region. However, this presents and interesting oxymoron; some of the most compelling findings that emerged from the case study were that grazing and information about pasture and grassland management that produces
multiple benefits is extremely contextual and place-based, and requires resources and support that account for this. To say that the case study, conducted within a small corner of central Iowa, is or should be broadly applicable to other situations and social groups in various geographic locations would be to potentially contradict the sincerity, and the specificity of the stories participants shared.

OPPORTUNITIES FOR FUTURE INVESTIGATIONS

The perspectives from this case study could be translated into a broader analysis that includes livestock producers and NRM professionals who manage grassland in BCAs all over Iowa. Specifically, the ability to test and explain causal linkages between the challenges faced by those who wish to expand the application of grazing systems for farm and conservation needs would provide clear action items for NRM institutions and conservation groups who wish to incentivize grazing systems amenable to grassland birds. The continuation of this case study would likely need to still focus on the relationships of grazing to grassland birds in specific, simply because the research between grazing as a habitat modulator and bird response is fairly comprehensive compared to other wildlife species in Corn Belt systems. Wetland and woodland obligate species in relation to grazing management have been researched as well, but in different ecological systems than those present in Iowa.

Additionally, an evaluative approach could be undertaken, to determine how amenable current incentive programming (i.e. Natural Resources Conservation Service and affiliated institutions that administer EQIP, CRP, WRP, WHIP, etc.) available to landowners in BCAs to manage grasslands with grazing in a fashion appropriate for grassland birds to the challenges and needs identified by participants in this work.

CONCLUSIONS

Literature regarding ‘sustainable’ or ‘alternative’ livestock production systems tends to focus on how we can change our approaches in the future for more ecologically amenable production. The way of life for livestock producers and farmers has, to some, come under siege by activists and eaters, as articulated by beef producers in a series of round-table discussions hosted by the Iowa Beef Center.
For example, author Michael Pollan, widely hailed as a leader in the movement towards a more sustainable agriculture and food consumption patterns, published what became a miniaturized and modern version of Upton Sinclair’s *The Jungle* in the New York Times entitled *Power Steer* (2002). *Power Steer* put into wry prose the sentiment of many the over 7 million vegetarians and vegans in the United States, and millions more concerned with the way meat is produced; an expression of shock, pessimism and total disconnection to production practices in the livestock industry (Vegetarian Times 2008). Indeed, an entire professional degree program has been devoted to ‘Beef Advocacy’; National Cattleman’s Beef Association check-off funds are devoted to training students to respond to the “…anti-animal agriculture advocacy” movement (National Cattlemans Beef Association).

Yet, the debate over the environmental and ethical consequences of large-scale livestock production begs us not to polarize the issue, but to explore more nuanced questions of the appropriate scale and the distribution of livestock on the landscape. Answering these questions requires the configuration of new social relationships and a recombination of rural resources (Marsden et al. 2009). This research provides a description of one piece as part of the bigger ‘landscape’ of that process. Regarding polarization and the configuration of new relationships for sustainable livestock production, as the case study participants that were grouped into two distinct categories, this was a decision made only for ease of data analysis. As referred to in chapters 3 and 4, all participants excepting two had some past or present experience with grazing management. This created a rather fuzzy line between what was categorized as NRM professionals and livestock producers. To add a further layer of context and transparency with how this research may translate into real world management scenarios, this distinction should be recognized as somewhat arbitrary. The purposive sampling methodology sought out resource managers that had this dual perspective, but because the past experiences of these individuals with grazing was highly variable (anything from “I grew up raising cows with dad” to “I have worked with landowners who utilize grazing in a past job”), so it would have been dangerous to generalize about weather or not this gave them some type of credible insights into the day-to-day issues present in a grazing livestock enterprise that must function for profit. Therefore it was appropriate to create a category that accounted for their role in an
natural resource management organization, as “[S]ociologists tend to classify people on
the basis of how they organize themselves (McDonough et al. 1999).”

This study may serve as a resource to improve the capacities of technical assistance
providers to work with a specific group of farmers and livestock producers interested in
grazing management for multiple benefits. However, the phrase ‘technical assistance’
implies that the relationship between NRM professionals and livestock producers/
grazing managers is somehow unidirectional; that somehow producers have nothing to
offer or provide in return for this assistance. On the contrary, these professionals who
participated in this study, whether they solely work with landowners or inform land
management at the broader, administrative scale, all recognized this potential pitfall. The
implication potentially being a recognition that their role is not only defined by their
respective institution, but the needs and goals of producers.

The challenge, which this study plays a role in articulating, to configure knowledge
sharing and education that promotes grazing that produces co-benefits in venues
appropriate for those implementing these systems, offers a fulcrum to address a common
dilemma in case study research. As referred to previously in these concluding remarks,
this dilemma is between the temptation to generalize results of a single case study such as
this one, and apply these perspectives to the broader issue of grazing and conservation
management in highly altered agricultural landscapes.

As an exploratory endeavor, no scientist would claim the applicability of this research to
other conservation contexts as an explanatory model. However, to add depth to the
metaphor of a social landscape, but also taking a bit of liberty with the idea; exploratory
case studies, as tools to make maps of undefined lands, are designed initially to create
contours and a key to certain physical, or in this case, sociological topographies. Where
roads, bridges and infrastructure are actually built is entirely up to the values and needs of
the users of that space. For this work, that infrastructure is based in locally based
knowledge communities that offer support and information to guide producers through
grazing systems that produce co-benefits. Yet, that infrastructure would arguably be
sounder into the future if it accounted for the composition of these landforms, or the
initial discoveries made when initially mapping. Or, in the context of this project, insights
gained directly from exploring the current social infrastructure of a given location that supports a specific type of land management.

Whereas some see the possibility for a “second Silent Spring (Krebs et al. 1999)” in regards to the potential for uncontrolled and ecologically damaging land use on private agricultural lands, this study exemplifies another layer in the “geography of hope (USDA NRCS 1997)” of landowners and NRM specialists willing to work cooperatively to balance ecosystem stewardship and profitable farm enterprise.

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ACKNOWLEDGEMENTS

Out beyond ideas of wrongdoing and rightdoing,
There is a field. I’ll meet you there.

When the soul lies down in that grass,
The world is too full to talk about.
Ideas, language, even the phrase each other
doesn’t make any sense.

-J. Rumi, as translated by Coleman Barks

And a highway shall be there, and it shall be called the Way of Holiness; the unclean shall not pass over it. It shall belong to those who walk on the way; even if they are fools, they shall not go astray.

-Isaiah 35:8, and motto of Northland College, my alma mater.

Over my desk in the basement of Science II I have always kept photos from my Great-Grandmother Rose’s farm and family. Digging my heels into the past and present experiences of my heritage, I’ve watched as they evolved from homesteaders to farmers, and into urbanites in the Midwest. These experiences have been a light that I have always looked towards, consistently holding the prism of my work up to, chiseling and shaping appropriately to ensure the continued viability of farming as both an occupation and enjoyable art. For this prism and that chisel, I thank my mother and father in their constant support of my wild dream to become an over-educated cowgirl.

This work would not have been possible without the financial support of the Department of Sociology, the Department of Natural Resource, Ecology and Management, the Grass Based Livestock Working Group and the Graduate Program in Sustainable Agriculture. I deeply appreciate everyone who had to put up with the occasional quandaries associated with my interdisciplinary and interdepartmental existence. Thanks much to Erica Romkema and Divinity B. O’Connor DeLosRios for helping me compile the mountain of resources that makes up the literature review in chapter two. Foremost for the purposes of my life and development as a master’s student learning the research process, I want to thank my entire committee for standing behind the big ideas I began crafting in the spring of 2009, and especially John Tyndall. John believed in my passion for the subject enough to ask me if I wanted to be his student after a phone call and since then has offered
continued support, plenty of comic relief, candy, creativity, coffee and constructive criticism whenever I needed it.

The inspiration for this project was an accumulation of experiences working and living on farms during my undergraduate career, and several years thereafter. Yet, the real journey to understanding the positive role animal agriculture can play in grassland ecosystems began with the Lankister Family on a high desert ranch in Baggs, Wyoming. After almost two days on horseback herding cattle, Wendi Lankister encouraged me to pursue my dreams, even if it was ‘just to prove it to myself.’ Since that conversation in a dusty old diesel truck, I have drawn inspiration, wisdom (whether I asked for it or not!) and support from visionary livestock producers in from as far as Australia and South Africa, Texas to Canada, Kansas, Colorado, Nebraska, Missouri, Iowa, Minnesota, South Dakota, and of course, that beautiful corner of the Raccoon River. Another family in particular, the Petersons of Newport, Nebraska, as well as the entirety of the Holistic Management trainees, who created a space for me to learn the challenges and joys that are the balancing act of ranching for profit, and for land health. These families and their values of faith, and stewardship to land and community constantly served as a grounding force in how I designed this project, and it is my sincere hope in some way I’ve contributed to their perpetual struggle to make an honest living from the land. The experiences I have had as a result of these relationships has reinforced a notion I explored as an undergraduate studying philosophy, sociology and religion; the notion that God communicates through the complexity, beauty and mystery we call nature. Though science and religion offer us an important way of knowing both ecological and social systems, the fuzziness of the boundaries between the two also call us to define our personal experience in relation to the larger presence of these dynamic systems. I continue to discover this experience by working on ranches and with ranchers.

This work is dedicated to all the livestock producers and ecologists in Iowa who are willing to sit down at the proverbial kitchen table, scratch their heads, and take some creative risks to develop and realize the multiple functions of our grazing industry. Namely, for all of the participants who sat down at the ‘kitchen table’ of this research project, who willingly gave of their time to share valuable insights and stories. For people
like Elizabeth, who kept me sharp and kept me laughing, and always met me in the ‘middle’ of the Middle Raccoon River valley with a smile. And for Terry Gompert, the man with a radical vision; the vision that we are called to be stewards of the land. The man who lit a fire under me and so many others to become educated, but grounded, advocates for grassland agriculture and Holistic Management. Your legacy lives on in the work of everyone you touched, including this thesis and my work into the future. Complacency is no longer an option.
APPENDIX

ADDENDUM TO CHAPTER 2:

COMPILATION OF RESOURCES SUPPORTING GRAZING MANAGEMENT, MARKETING APPROACHES, AND PERSPECTIVES ON POLICY AND EDUCATION CONCERNS FOR IOWA GRAZIERS

By Mae Rose Petrehn, Erica Romkema, and Divinity B. O’Connor DeLosRios

RESOURCES FOR PLANNING A GRAZING SYSTEM

The USDA provides a list of useful links for graziers, as well as resources and research, on a web resource called Grazing Systems and Pasture Management relevant to beef and dairy cattle, poultry and swine:<http://afsic.nal.usda.gov/nal_display/index.php info_center=2&tax_level=2&tax_subject=295&topic_id=1408>

The Iowa Natural Resources Conservation Service’s Profitable Pastures provides general guidance when considering making infrastructure changes on pastures, and guides you through a process of planning grazing moves on the land. Available online at: http://www.ia.nrcs.usda.gov/news/brochures/Pasture/ProfitablePastures.html

The software package “Forage Planner” can be used in partnership with specialists through the Iowa Beef Center to gain foresight into the grazing season and be aware of potential forage shortfalls (www.iowabeefcenter.org).

Other resources available online for no cost:

Beetz and Rinehart (2006) offer Pastures: Sustainable Management as a free online download and offer some general principles of grassland and pasture management.

Another free online download is offered by Blanchet et al. (2003) called the Grazing Systems Planning Guide. This Minnesota publication includes many helpful ‘whole farm planning’ worksheets.

BIBLIOGRAPHY OF GUIDES FOR NATIVE AND NON-NATIVE FORAGE PLANT IDENTIFICATION IN IOWA


RESOURCES FOR MARKETING GRASS-BASED LIVESTOCK PRODUCTS


A case study of an Iowa meat producer (from a broader study focusing on three Iowa farmers who practice pasture-raised production systems and who market their products directly to consumers), Nan Bonfils and Don Adams of Full Circe Farm in Madrid, Iowa. The initial research utilized consumer surveys and focus groups to first determine which messages about pasture-raised meals were most convincing and compelling to the average consumer (findings indicted that a focus on taste, health, and nutrition, supported local farmers marketing about pasture-raised meats); and then conducted farm visits and interviews with the participating meat producers. A consultant (of the research group) developed marketing materials for each producers’ consumers market-focusing on the specific messages about pasture-raised meat that the consumer focus groups determined most effective and compelling (flavorful; easily prepared; nutrition; convenient; sustainable; humane; and local.)

Prior to the study, Don and Nan’s main method of advertisement was informal and local (word of mouth recommendation from satisfied customers); and at the beginning the study, the two indicted intentions to expand the market for their pasture raised beef. Following the findings of the focus groups from the study, the consultant for Full Circle Farms designed a specific brochure focusing the flavor and nutritional qualities (additionally, highlighting Don and Nan’s marketing goals to expand). A year later (after widely distributing the brochure), Don and Nan acknowledge the effectiveness of this as a marketing tool (i.e. reaching audiences outside their regulars); as well as discussing limitations and possible ongoing marketing consultation as beneficial to their operation.

Report presenting findings based on research conducted at three Michigan retail locations and a series of experimental auctions utilizing two methods: surveys and experimental auctions; the researcher’s intention were to address certain questions raised from a previous research (i.e., measure consumer awareness and beliefs about PR product; measure consumer’s likelihood of purchase and willingness to pay on PR products; and provide pricing and promotion information to producers and vendors, etc.). Findings from both methods indicted favorable consumer perceptions from participants. The authors very briefly discusses the implications of the results for what they call the “four P’s” of marketing.


A profile outline a brief overview and background of Cory’s Country Lamb farm located in Elkhart, Iowa, highlighting this family farm as a case opportunity to educate Iowans regarding producers, processors, and marketers of lamb products in Iowa (which is one of the top three producers in the nation and leader in world production). The story ends describing the future and opportunities regarding this family owned farm (i.e., using pelts of the sheep to create a business leather goods specialty items vs. taking pelts to landfill).

Iowa State University Extension. 2009. Find a meat processor near you or list your plant.


This site offers a list of meat processors by state, directs readers to a national listing created by NMPAN (Niche Meat Processor Assistance Network) and Local Harvest, offers directions on how to list your meat processing business, and how to search for a meat processor in your area.


This study looks at the CLA content of three muscles in raw and cooked states. Cattle were finished in one of four ways:

- Pasture
- Pasture with grain supplement
- Pasture with grain supplement containing soyoil
- Feedlot

The study involved 48 steers from Grassland Beef, Inc. The British x Continental cross was considered appropriate for pasture-based finishing and was background grazed on pasture to 363-385 kg., before moving to pastures for finishing at the University of
Missouri Forage Systems Research Center. The pasture used for the study was 80 acres divided into 24 permanent 3-acre pastures. Pastures consisted of cool season species including endophyte free tall fescue, orchardgrass, timothy, smooth bromegrass, red clover, and birdsfoot trefoil. Each group of cattle on pasture was grazed rotationally on four three-acre sections; these three-acre pastures were subdivided into strips in order to move the steers to fresh pasture every 2-3 days. The grazing period for the study was July 23, 2002-December 3, 2002.

Cattle finished on the feedlot were fatter than those finished on other treatments and had higher USDA yield and quality grade scores. Carcasses of pasture finished cattle were lighter but still had acceptable USDA meat quality grades. Cattle finished on the soyoil diet had meat highest in total CLA in the raw state as well as the cooked state. Results showed that the inclusion of pasture in the finishing diet can increase the amount of CLA in cooked meat, with or without grain supplementation.


Suggests read advantages of marketing pools and provides a sidebar highlighting questions to consider when determining whether prodders are potential members of a marketing pool. Chapter discusses how certain factors would affect the price of feeder cattle (1. Breed composition; 2. Grade; 3. Sex; 4. Weight; 5. Feed cost for finishing cattle; 6. Value of finished beef; and 7. Location/ delivery); and goes over how certain value-added factors that will often affect the price (1. Prescribed health program; 2. Genetics; 3. Reputation/ performance; 4. Volume; 5. Uniformity; and 6. Weight condition). Information is situated within some historical context/ statistical information in order to demonstrate author’s point how producers who utilize this information can succeed in the marketplace.


This article considers the significance of health benefits in marketing grass-fed beef products. Beginning with a history of the rise of grain-fed beef, and a definition of grass-fed beef: “beef from cattle that have been fed only on grasses rather than finished in a feedlot”—the piece goes on to consider the pros and cons from a consumer’s viewpoint. Three major consumer benefits are identified: health and nutrition, animal welfare, and ecosystem friendly farming practices.

The paper hones in on the health and nutrition benefits, specifically the fact that grass-fed beef contains much less saturated fat and offers high levels of omega-3 fatty acids. Using
an economic valuation-marketing, on site survey, the authors examine consumers’ preferences and the influence of these health benefits.

The authors are careful to use country-of-origin consistent products (as opposed to a previous study in which domestic corn-fed was compared with Argentine grass-fed). They also chose to use nutritional information as a marketing tool.

Surveys took place in four locations in Spokane, Washington: three conventional groceries and one natural foods grocery. 509 of the 603 respondents ate beef, 61% of respondents were female, average age was 42.6, and 79.4% lived in urban or suburban areas. 55.8% ate beef at least once a week and 76.1% felt it was safe. 55.4% were aware of the health-benefits of grass-fed beef.

Consumers were asked to choose from several different beef cuts:

- Option 1: Low fat and calories, Low omega-3 fatty-acids, Price $6/lb
- Option 2: Medium fat and calories, Low omega-3 fatty acids, Price $8/lb
- Option 3: High fat and calories, High omega-3 fatty acids, Price $4/lb

Price and fat calories negatively affected participants’ choice-making while omega-3 fatty acids positively affected it. The authors present a chart indicating demographic variables and affects on decision-making. In terms of importance of the three factors, price had most importance, then fat and calories, and lastly omega-3 fatty acids in terms of overall decision-making factors. Consumers did respond favorably to the U.S. grass-fed beef and it did play a role in their choice. The authors indicate that informing the consumer of such attributes will be an important and effective marketing tool.


Nation explains that his purpose for this book is to “offer an alternative path to wealth.” After a decade of studying the Mississippi prairie stocker operation of Gordon Hazard and considering how he managed to make money each year “regardless of the price of cattle,” Nation aimed to offer information to cattle producers, particularly beef cattle producers, on how to make a profit on grass. Chapter titles include, but are not limited to:

- People Make Calves Sick
- A Structure for Profit
- An End to the Crapshoot, Using the Cattle Cycle to Create Wealth Faster
- The Care and Feeding of Your Customers
- Manipulating Pasture Quality with Grazing
- Low Cost Grass Silage Production
- The Ultimate Skill—Management-Intensive Grazing

The book includes a glossary of terms, in addition to charts, graphs, and other data that offer clearer understanding of the economy and environment(s) at hand.

In this news piece, the reporter goes to the Fobords’ farm in Pope County, Minnesota, to purchase a Lowline Angus steer and follow it from the grass-based farm to the local meat locker. The article touches on some societal perceptions of organic farmers: “They called us tree-huggers” as well as the farmers’ methods: “we started cutting down all almost all the trees” – invasive species like Siberian elm and buckthorn that were interfering with grazing land. Neuzil also addresses the political challenges, such as the need for a USDA-certified slaughterhouse in order for the meat to be sold as meat, rather than as an animal, which a customer must buy from the Fobords and then pay the local meat locker to slaughter. Distance and cost come into play in such a situation, of course, as well as the fact that there are simply not enough USDA inspectors. Meanwhile, the Fobords’ farm in Pope County is getting more public notice, including interest from a new local mayor.


Paine outlines some of the history of and basis for increased interest in grass-fed products. Drawing the material more closely toward Wisconsin, where she is based, she considers how grass-fed products could be incorporated into the states dairy revitalization strategy.

Her case histories are meant to emulate three business structures, as described on p. 65:

A farmstead processing model where an individual farmer invests in equipment and facilities to process his/her own milk into unique products.

A farmer-initiated cooperative model where several farmers work together to pool their milk and partner or contract with existing processors to have products made.

Dairy processing companies that have sought to enter the market by developing a line of specialty grass-fed products in addition to their other brands.

Five grass-fed dairy artisans were interviewed using a set of 15 questions; information was also gathered through informal discussion and gathering of published materials on the topic. Paine considers the strategies, successes, and challenges facing these different structures; subtopics include, for example, “Mutually Beneficial Relationships,” “Harnessing Variability,” and “Milk Handling and Pooling.”

Paine concludes that “developing local artisan and grass-fed products could be a successful food-processing investment strategy and is the most likely to deliver broad benefits to rural communities and the environment. Several tools, including education,
technical assistance, and financial resources, need to be brought together to make this happen.”


Summary report of project based on a brief history; but mostly on the process of sustainable practices of agriculture at the Rosmann Family Farms (a 480 acre certified organic operation). Discusses changes in their market participation (due to family circumstances), effective marketing tools utilized; and consumer face to face interactions. A results/Discussion section briefly outline where “they are at” presently and outlines their objectives to achieving their goals; and state the importance of building a reputation in the Ames and Des Moines areas as a family operation (while growing in a cost effective and manageable way). They discuss their outreach methods; again, stating a focus on Iowa communities and identity.


Chapter 15: Market Options

Chapters centers on concept that profit margin is controlled by the three factors of volume, price and cost: volume x price – cost = profit margin (: 211). Briefly introduces the conventional commodity marketing system and process, and its influences to how products (i.e., animals, beef, etc). are marketing through commodity market channels; thus, how conventional practices and ideologies have influenced price and auction sales (describing this as the McDonaldization of beef: 212)–but his point is that this has been there are other marketing options available in order to increase profitability, such as the successful practices and strategies being practiced among markets in New Zealand and Australian producers. The author suggests, likewise, to take advantage of niche markets (i.e., capitalizing on what he describes as your unfair-advantage ) such as selling to the late-spring stocker market; keeping animals longer; grass-fed cattle, etc., and advises how to take advantage of this marketing process while being financially stable. Chapter briefly discusses how different communities (small, large and ethnic) and markets (i.e., restaurants, retail and those that utilizing by-products) can be potential (and economically fruitful) places to market, and how to utilize labeling strategies in order to market the uniqueness of one’s product. The latter part of the chapter centers on three case studies to illustrate how niche marketing opportunities were made specific to each example (1. Helena, Montana/ Grande Prairie, Alberta; 2. Seattle, Washington/ Vancouver, British Columbia; and 3. Lewistown, Montana/ Kindersley, Saskatchewan); thus, presenting as examples how a producer can tailor their production and marketing strategies to take advantage of opportunities discussed and illustrated.
Chapter 20: Helpful Business-Management Tools

Chapter explores valuable management tools to facilitate the organizing, planning, and decision making needed to successfully manage a business. Provides an example of some sample tasks (problems, or issues) are rated according to importance and urgency. Discusses how to maximize time management for the greatest financial return (“biggest bang for your buck); and how to weigh decisions, solve problems and handle crises (provides a worksheet to assist related situations/ events). Chapter ends with the author stating that there is no such thing as good or bad luck; and argues that every farm has an “unfair advantage” (i.e., things happen), but to remain positive and that wise choices/decision making skills and techniques that can be developed in order to avoid these potential shortcomings.


Document attempting to resolve common problems with selling meat halves, quarters, or bundles. Outlines 10 common reasons why people don’t buy meat in said above portions, and then offers suggestions on how to resolve these issues. Concludes by suggesting to utilize existing social and professional networks in establishing a customer base for these meat portions in areas including (but not limiting to) farmer’s markets such as natural food stores, CSA “veggie boxes” and other local buying clubs, churches ad public service groups.


The authors address the fact that profit/economic maximization has primarily been used as a guide for understanding, shaping, and changing land use policy, despite the fact that three decades of research indicate the other factors weigh more heavily in the ranch purchase decision. Such things as family, tradition, and desired lifestyle—including the fact that ranch buyers frequently “want an investment that they can touch, feel, and enjoy”—have shown to be influential to the point that buyers have consciously chosen to accept low returns on investment. The authors explore and suggest that market value for western ranches ought to include both livestock production income and desirable lifestyle attributes, and that this assessment would subsequently affect economic models and policy analysis.
USDA, Agriculture Marketing Service. 2007. United States standards for livestock and meat marketing claims, grass (forage) fed claim for ruminant livestock and the meat products derived from such livestock. Federal Register, 72.199, 58631-58637.

This notice explains the Agricultural Marketing Service’s establishment of a voluntary standard for grass (forage) fed livestock for marketing claim purposes. Establishing this standard will provide producers with the opportunity to have a grass (forage) fed claim verified by the USDA through an audit of the production process. The production process will be considered in accordance with procedures contained in Part 62 of Title 7 of the code of Federal Regulations.

Interested producers should contact Martin E.O’Connor, Martin.OConnor@usda.gov.


Research addresses what kinds of information and socio-demographic factors are most important in determining US consumers’ preference and willing to pay a premium for grass-fed beef. (versus grain fed beef) According to the authors, “[marketers] must understand the interrelationships and relative importance to consumer of the attributes inherent in grass-fed beef.” Page 604. Data from consumer surveys and experimental auctions, provided insight on product attributes (taste/ flavor, credence and nutritional characteristics) ; finding that labeling information and health related messages such as the absence of antibiotics, nutritional content and related production increased the probability that consumers were wiling to pay higher grass-fed beef . The demographic variables AGE and CHILDREN were particularly revealing significant predictors of consumers’ willingness to pay for premium grass fed beef. The authors argue that the research findings demonstrate that there is a potentially advantageous niche space in US markets (given that the US is currently Australia’s second largest beef export market...most Australian beef imported into the US is grass-finished beef: 604) and international agribusinesses’ target strategies for higher end beef distribution channels in countries such as the US (621).


The authors define grazing networks as “groups of farmers and ranchers who work together to increase their knowledge of forage management, pasture-based production, and farm economics” that “…promote a mutual self-help approach to learning, in which each member is both student and teacher.” The community and support that are cultivated in these environments may in fact be critical to maintaining family farms.
Such networks began in New Zealand around 40 years ago and led to the development of different grazing techniques, including management-intensive grazing (MIG). These networks began springing up in the U.S. and are now especially prevalent in the Midwest. The best way to get involved? Join a network. An extension agent can help you find one, or you can start one of your own. The authors go on to explain how to establish and sustain a grazing network, then offer a case study of the Grassroots Grazing Group in Hindsville, Arkansas, as a model of how an actual group might work. Some points include:

- Open vs. closed memberships
- Large vs. small size
- The role of the coordinator
- Incorporating pasture walks, guest lectures, field demonstrations, and holding meetings
- Identifying goals and aspirations; providing focus and direction
- Cultivating farmer-to-farmer learning
- Mentoring

Finally, the authors explain what might lead to a group breaking down and how to avoid it, or, if disbanding is inevitable, move forward in a positive way.


This article follows the rise and fall of the Tallgrass Prairie Producers Coop (1995-200). Ten ranch families came together to produce Tallgrass Beef and market it through the cooperative; their goal was to “produce and market meat products from livestock raised in a way to maximize conservation of natural resources and minimize use of fossil fuels and farm chemicals.” Annie Wilson, former business manager, explains the history of the organization, market successes, barriers and catch-22 situations, visions of success/profitability, and overall lessons learned. Key points include:

Fundamentals of success profitability depends on three elements:

Professional management of operations and marketing to establish and manage legal, safe operations, to penetrate the market and to navigate the complex food distribution system. This is essential for the business to succeed and to allow producers the time to do what they know how to do, which is to produce high quality products.

A successful business needs access to volume markets to reach breakeven (when gross profit on sales exceeds overheads). A business may be able to break the paradigm of huge scale production and survive on lower volume, but in so doing it must practice honest accounting for personal time and must reach a volume that covers these overheads.
Cost-effective operations are necessary to realistically price the product and reach the volume needed to be profitable.

Two keys necessary to obtaining these three elements include:

Supply: adequate supply = cost-efficient processing, ability to access volume markets, and a prerequisite to the ability to offer a fresh product

Capital: necessary to obtain the information and expertise in order to establish a strong business plan, capable management, and sufficient cash flow.

Supply + capital = Lower-cost processing + volume markets + professional management

RESOURCES FOR POLICY AND EDUCATION


With the use of in-depth interviews and photos, the authors attempt to ascertain the role that perennial cover crops play in shaping a “sense of place” as held by 33 Iowa inhabitants. Hamilton County, the study area selected, consists primarily of flat land that experiences relatively little erosion, so less land is planted in perennials through CRP or similar programs. Several watersheds were included in the studied region, as participants had strong family ties across them: the Squaw Creek, South Skunk, and Boone watersheds.

The selected participants identified strongly with Iowa’s farming lifestyle and considered the countryside to consist of interwoven social and biophysical networks. In regards to how perennial vegetation fit into this web of networks, the authors report: “While most interviewees approved of perennial farm practices on marginal agricultural land, implementation of these practices was neither a priority nor strongly assimilated into rural experience and ethics.”

The scale boundaries at work in this perception of place include: landscape-community, individual-community, and community-institution. The authors consider that working with social norms, within social networks, could move toward the possibility of creating swaths of perennial covers stretching across farms.

The authors explain that farming with grass can be a multifunctional endeavor offering benefits at once environmental, social, and financial. Further, they claim, the public will be willing to pay for such benefits “if markets and policies are appropriately aligned.”

They review the results of the Boody, et. al. 2005 study of Minnesota watershed areas, then move into a more recent study in the Rock Creek watershed in northern Ohio. The objectives of this study were:

To evaluate alternative agricultural land-uses that could reduce environmental impacts in tributaries to Lake Erie and provide new market opportunities to farmers

Assess economic impacts at a watershed scale, including policy drivers

The stream in question is a tributary flowing to Lake Erie and indicates effects of farming on larger bodies of water. The authors developed five scenarios with input from members of a steering committee of Ohio citizens, farmers, and natural resource agency staff. Scenario 1 starts off with conventional land use. Scenario 2 adopts BMPs and shifts to 75% conservation tillage. Scenario 3 includes a 25% increase in land planted in corn (primarily for ethanol), taken from soybean, and increase of N fertilization. Scenario 4 involves conversion of 20% of soybean cropland to pasture in support of grass-finished beef. Scenario 5 established cellulosic energy fields (assumed hay) along streams in soybean fields.

The simulations showed greater potential for reducing stream pollution with increased perennial cover through Scenario 4’s pasture-based beef production (including the greatest mitigation of nitrate-N transport) or Scenario 5’s cellulosic energy buffers (including up to 40% reduction in sediment transport). Other results reported address return for labor (highest for Scenario 5) and government payments (lowest for Scenario 4, highest for Scenario 3).

Boody, et.al., conclude from this work that “agroecological research needs to better understand grass-based production of livestock, as well as its impact on human health, bioenergy-related issues, selected ecological considerations, and social/cultural and economic considerations that could lead to wider adoption and sustainability of grass farming.” They go on to discuss these topics in detail, in addition to implications for future policy in this area.


The authors collaborated with residents of two Minnesota watersheds (Chippewa River and Wells Creek) to project potential future trends and outcomes in agriculture and the landscape of the area, if policy played a role in encouraging certain practices. Together,
the authors and residents developed four land use scenarios and came up with a list of likely environmental benefits, including healthier waterways, higher carbon sequestration, lower greenhouse gas emissions, the formation of social capital, better profitability of farms, and avoided costs.

Of particular interest to graziers will be scenarios C and D. Scenario C includes 5-year crop rotations, perennial crops, and managed intensive rotational grazing. Scenario D extends scenario C by replacing cultivated lands with even more perennial cover.

The authors claim that policy is critical for making change, and imply that smart policy makes better change. In particular, they encourage “redirecting farm payments by using alternative incentives” that will not only involve little if any cost to the taxpayer, but will also encourage and reward environmental restoration.

**Carolan, M.S. 2006. Do you see what I see? Examining the epistemic barriers to sustainable agriculture. Rural Sociology, 71 (2), 232-260.**

Carolan argues that epistemic barriers—that is, those elements of agriculture, particularly sustainable agriculture, that are invisible to the uninformed viewer—contribute to the tension and the debate between sustainable and conventional agriculture. The benefits of conventional agriculture (such as weed-free fields and high yields) are readily apparent, whereas the benefits of sustainable agriculture are less visible. Further, the costs of conventional agriculture are less apparent. These epistemic barriers subsequently affect human perceptions and conclusions, and from there can affect policy surrounding the issue. Carolan suggests that in order to overcome these barriers, we must nurture particular ways of seeing—“which can only be accomplished by institutional changes and new social network formations.” Education alone is not enough; he calls for “new institutional arrangements . . . which involve the integration of farming systems with diverse networks of people, institutions, and communities.”


Notice (November 15, 2007) providing information advising claim standards for the grass (forage) fed for individuals and companies that request verification for specific production practices that makes their products distinguishable in the marketplace. Provides a brief background history; supplemental information; comments and responses in the proposed marketing claim [grass (forage) percentage; clarification of language and definition relative to the exclusion of grains; stored and harvested forages and other supplements; related production issues including access to pasture, confinement, and antibiotics and hormones; verification, compliance, and labeling issues; perceptions
associated with grass (forage) fed claim; and additional issues that were raised]; U.S. standards for livestock and meat marketing claims, grass (forage) fed claim for ruminant livestock and the meat products derived from such livestock; and concludes with the claim and standard (summarizing the actual standard for “grass-forage-fed” claims).


Authors argue that a discussion is needed among animal scientist regarding the goal of current animal production systems, given current realities and social concerns i.e., pollution, environmental concerns, food prices, etc). Situates this need for said discussion within a historical perspective of the changes and consequences in animal agriculture during the past 50 years. Includes a discussion of ethics (i.e., changing values among farmers, farming practices, and society); animal agriculture and the environment (i.e., benefits of proper management practices in livestock production and how to achieve this); animal agriculture and rural communities (i.e. the interrelationships between animal agriculture and the social and economic vitality of rural community sustainability); and future implications, based on this study’s findings, on the decision making processes among animal scientists. Authors stress that “there is a need to evaluate, refine, and demonstrate these technologies and create business systems that minimize external costs and effects on society” (page E16).


Taking the UK as an example, the paper reviews the key development in grassland management (predominant form of land use in the UK and throughout the world) since the beginning and the end of the 20th century; mostly due to an increased understanding of soil and plant nutrition, plant physiology and cultivar improvement (while improved understanding of feed evaluation, rumination nutrition, grazing management and silage technology) have contributed to increased utilization of grassland under grazing and cutting. Recognition of the environmental implications of grassland management has increased since the 1980s (including, the need to reduce nutrient emissions in grassland agriculture, and role of grassland in biodiversity protections, carbon sequestration and landscape quality). While research is increasingly focused on addressing these issues and on integrating agricultural management with environmental protection, long term effects of population increase, competition for other land uses and the impact of climate change could impact on global food supplies and affect future grassland management in the temperate zones. Authors conclude by discussing some possible future developments in the role of grassland.
A program of the Natural Resources Conservation Service (NRCS), The Iowa Grassland Alliance emerged from the Grazing Land Conservation Initiative in 1996. It engages a variety of groups and individuals in cooperatively working to “promote the development, sustained productivity, and wise use of Iowa Grasslands in harmony with the environment.” A small team of conservationists works with over 425 IGA members in developing and implementing prescribed grazing plans on more than 43,000 acres of Iowa land.

**Offenburger, H. 2009.** Managed haying and grazing on Conservation Reserve Program lands in conjunction with Mid Contract Management creates diversity: Potential wildlife benefits.

Brochure advocating haying and grazing practices and benefits to landowners. Outlines MCM on CRP’s *Purpose*; (reasons) *Why*; and *How* for haying or grazing grassland. Provides illustrations and charts to support information.


Discusses the amount of grazing lands within harsh environments and climates that could be managed (i.e., tundra to near desert rangelands), and cost of achieving carbon sequestration in land-land soil in order to increase plant productivity (through water, nutrient management and grazing practices). Author states that management and grazing practices will be difficult to implement without offering incentives and policy changes (despite current political pressure and studies that demonstrate the benefits of these changing practices).


Report summarizes findings based on several educational projects conducted in 2002-2004 on managed grazing research and education. Lists key findings (report describes more comprehensive findings for each project): estimated 3,200 farmers were served directly through pasture walks, pasture meetings, classes, work shops and one and one consultations; involved 20 farms using managed grazing and two research stations as sites for experiments; tested 24 different lands of pastures in managed grazing systems. Overall, found that the success of these research and education projects can be measured quantitatively and qualitatively. Suggested the following themes as expressed by project leaders and participants as key to the future success of programs and activities that
support managed grazing: project are most successful when farmers shared knowledge, information and skills with other farmers; public events and media coverage of these projects increased awareness of managed grazing farms; more work is required to spread the word about managed grazing farms; while managed grazing farms continue to grow in Wisconsin, change in rural communities often takes place one farmer and one grazing plan at a time.


Authors investigate the relative importance of livestock production income and desirable lifestyle attributes in determining the market value of western ranches, and explore what this means for economic models and policy analysis. Review 30 years of research and observation demonstrate that family, tradition, and the desirable way of life are actually the most important factor in ranch purchase decisions (versus simply making a profit). Finally, authors evaluate what QOL (quality of life) values imply about policy analysis and impact assessment models. Regarding policy analysis implications, authors found that “QOL values explain much of the controversy and contradiction about grazing on public lands...neither side has recognized that, while ranchers have demonstrated their willingness to pay more than the current grazing fee, this willingness exists not because of the livestock that will be produced, but rather because of the desirable lifestyle that will be attained by purchasing the ranch and associated grazing permits” (no page number listed, but 7th age from first page); indicating that QOL will affect the type who purchase and live on ranches in the future. Authors conclude that traditional economic model can provide an incomplete assessment of land-use policies. Therefore, although motivates inevitably are guesses, “ranch investment and policy analysis require a great deal more thought than is offered by traditional cost-and-return studies about the economic value of livestock production.”


Paper identifies and quantifies interactions among landscape functions (i.e., indicate the capacity of a landscape to provide goods and services to a society—i.e., the benefits people obtain from landscape such as fresh water, food and recreational benefits) in the Gelderse Vallei in the Netherlands. Multifunctional areas are defined as the landscape’s potential for providing multiple goods and services. Seven landscape functions (residential, intensive livestock, cultural heritage, tourism, plant habitat, arable production, and leisure cycling) are quantified and mapped using landscape indicators. Utilizing landscape indictors and the quantified multifunctionality maps, the authors
analyze three different aspects of landscape functions interactions (1. Influence of landscape characteristics on function intersections; 2. Interrelations among landscape functions; and 3. effect of multifunctionality on the different landscape functions). Study explores the complex system of interacting landscape functions in relation to spatially heterogeneous multifunctional landscapes; and describes different aspects of landscape function interactions (through the use of their specific methodology on multifunctionality). Provides a table and landscape function maps—highlighting information, results on data collected. Authors conclude that an improved understanding of landscape interactions will help to design and evaluate spatial policies (for regional approaches versus sectoral focuses) related to the provision of multiple goods and services by the landscape. Overall, results demonstrate that at multifunctional locations, the total provided goods and services by the landscape are higher than at monofunctional locations; and that their particular research and approach, highlights interactions among landscape functions which hampers or stimulates the landscape to provide these multiple goods and services.


This book is a must have for those interested in issues surrounding grasslands. In part to commemorate the publication of the 1948 Yearbook of Agriculture classic that was devoted to the use of grass in working farms. It provides a detailed overview of the history, current issues and possible futures that grassland agriculture faces. Some of the biggest names in grassland agriculture and sustainable farming in general show up as authors of one of 14 chapters, many of whose past research was reviewed in this publication.

**Williams, P. and Beetz, A. Grazing networks for livestock producers.**


Discusses and advocates the benefits of grazing networks (centered in New Zealand). Provides a comprehensive and adequate description on the process for livestock producers to become a part of the grazing network; sustaining the network; and provides a case study example. Acknowledges potential downsides such as what to do when networks break down; and concludes that the rewards outweigh the challenges in grazing groups.

**Young R. 2009. The role of livestock in sustainable food systems: Soil Association briefing, Soil Association.**

<http://www.soilassociation.org/LinkClick.aspx?fileticket=qm0ueyxHQj1%3D&tab%20id=313> (Accessed January 2010).
Paper begins with an executive summary regarding policy issues concerning carbon sequestration on farming systems in the UK in order to reduce methane emissions, and by policy makers, politicians and campaigners call for people to reduce the consume of red meat (to combat climate change). Paper examines two important factors (1. extent to which soil carbon is lost to the atmosphere from some agricultural systems but has the potential to be sequestered from the atmosphere to the soil by others; and 2. the extent to which food productions stems which depend on nitrogen fertilizer are responsible for large emissions of GHGs—a third issue is explored in the appendix, the extent to which beef, lamb and other red meats from predominately grass-fed animals have a very different nutritional composition to that of grain fed animals) that has been left out of this debate and states that inclusion cold lead to different conclusions regarding the overall benefit.