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A board game simulator for promoting system thinking for sustainable pastoralism among Maasai in Southern Kenya

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A BOARD GAME SIMULATOR FOR PROMOTING SYSTEM THINKING FOR
SUSTAINABLE PASTORALISM AMONG MAASAI IN SOUTHERN KENYA

Jacob Loorimir Mayiani

A thesis submitted to the Graduate Faculty of

JAMES MADISON UNIVERSITY

In

Partial Fulfillment of the Requirements

for the degree of

Master of Science in Integrated Science and Technology

College of Integrated Science and Engineering

May 2013

TO MY LATE UNCLE
JONATHAN TARAYIA LEKANAYIA

*“Life has no smooth road for any of us; and in the bracing atmosphere of a high aim
the very roughness stimulates the climber to steadier steps, till the legend, over steep
ways to the stars, fulfills itself. “*

W. C. Doane

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ACRONYMS AND ABBREVIATIONS

ALARMP	Arid Land Resource Management Project
ANP	Amboseli National Park
ANR	Amboseli National Reserve
ASALs	Arid and Semi-Arid Lands
CABGS	Culturally-Anchored Board Game Simulator
CLD	Causal Loop Diagram
C-ROADS	Climate Rapid Overview and Decision Support
DSG	District Steering Groups
EPZ	Export Processing Zone
EWS	Early Warning Systems
FAO	Food and Agriculture Organization of United Nation
GAE	Greater Amboseli Ecosystem
GR	Group Ranches
I = PAT	Human Impact equals the product of Population, Affluence and Technology
IBLI	Index-Based Livestock Insurance
IPCC	Intergovernmental Panel on Climate Change
KJD	Kajiado
KSH	Kenya Shillings
MCF	Malignant catarrhal Fever
OP	Office of the President
SD	System Dynamics
SFD	Stock and Flow Diagram
USAID	United States Agency for International Development
WFP	World Food Programme

ABSTRACT

Jacob L. Mayiani

A Board Game Simulator for Promoting Systems Thinking for Sustainable Pastoralism among Maasai in Southern Kenya

A culturally-anchored board game simulator named ERAMAT! was created in cooperation with faculty members and members of the Maasai community and then piloted with US students and members of Maasai communities in southern Kenya during the summer of 2012. The game provides an alternative to a computer-based simulator, and hence provides a culturally credible simulation of the system dynamics associated with an accelerating boom/bust cycle of drought and hunger in the region. Factors driving the phenomena include greatly increased population densities, pastoralist cultural values, evolving pastoral practices, the ebb and flow of the semi-arid environment in which Maasai pastoralists live, and political and ecological pressures. The game encourages deeper understanding of these dynamics for pastoralists and non-pastoralists alike, and can generate conversations leading to insights on effective strategies for reducing the impact of the inevitable periods of low rainfall. This thesis reports on the underlying dynamics, the game design, and the results of the pilot. ERAMAT's rules, symbols and language attuned to Maasai core values and pastoral praxis allowed players to engage in conversations about past experiences and outcomes, as well as explore alternative strategies for livestock and livelihood survival.

Keywords: Pastoralism, System Dynamics, Board game simulator, ERAMAT!

Chapter One

Problem Addressed in this thesis

1.1 Introduction and Thesis Statement

The purpose of this thesis is to describe the development, piloting, and post-play analyses of a board game simulator that serves as a system-based learning environment to explore in “fast-forward time” the dynamics contributing to the recurrent boom-bust cycle of drought and hunger in southern Kenya’s Maasai pastoralist communities. The hope is that a deeper understanding of these dynamics can provide insights to Maasai pastoralists from which they can form more effective strategies for reducing the impact of the inevitable periods of low rainfall.

The study also explores the possibilities of using such a game as a learning tool for non-Maasai students to experience and learn about Maasai culture and the sustainability issues that Maasai pastoralists face. The use of games for learning is not entirely new. For instance in article by O’Hollaran et al, the use of games in the college classroom is a collaborative technique when the games involve structured tasks monitored by instructors as a way to improve learning and social interactions (Rau & Heyl, 1990). In addition, the use of computerized simulators to provide insights to decision makers is relatively common, although obviously dependent on the availability of computers and appropriate software.

The System Dynamics (SD) literature provides numerous examples of game simulators applied in fields as diverse as health care (Royston et al. 1999), business

supply chain management (Forrester Industrial Dynamics Akkermans et al. 2005), and national security (Minami et al. 2009). In a project to develop and implement policies and programs in healthcare in England, a SD approach was used in assessing public health risks, screening for diseases, managing waiting for hospital treatment, planning healthcare workforce and developing emergency health and social care (Royston et al, 1999).

There are a variety of SD applications to environmental problems. Huerta (2004) used system dynamics to examine the impact of climate change in Guanajuato in Mexico. This study documents a system dynamics model named “ProEstado/MAUA/Clima®” that utilizes and inputs meteorological data to explore climate change impacts in each of the 13 watersheds in the State of Guanajuato. Other SD climate models include the Climate Rapid Overview and Decision Support (C-ROADS) climate policy model, now used by U.N. policy makers to evaluate options for greenhouse gas emissions policy (Sterman et al. 2012).

What is unique about this thesis is the idea of adapting SD modeling methodology to aid decision making in a culture where abstract representations typical of a computer-based model are replaced with more concrete and culturally relevant representations through a medium that is a common part of that culture – a board game. This enables decision makers to experience at visceral level the consequences of their actions and immediately see the connections between those actions and important problems they face.

The specific objectives of this research are therefore to:

1. Develop and pilot a culturally-targeted board game that mimics the boom-bust dynamics associated with recurrent cycles of drought, livestock loss, and hunger in southern Kenya.
2. Use the game with decision makers in the target communities to evaluate
 - the cultural validity of the game
 - the validity of the game for modeling the dynamics associated with the recurrent boom/bust cycle in the region
 - the utility of the game for facilitating discussion and problem solving toward more sustainable pastoralist practices
3. Evaluate the potential of the game to help students understand the interactions between cultural values, the physical environment, and the economic realities in important environmental issue involving the Maasai of Southern Kenya.

1.2 Context and Background

1.2.1 Pastoralism Defined

Oxfam International (2008) defines pastoralism as a “finely-honed symbiotic relationship between local ecology, domesticated livestock and people in resource-scarce, climatically marginal and highly variable conditions. It represents a complex form of natural resource management, involving a continuous ecological balance between pastures, livestock and people.” *The League for Pastoral People*, a non-profit research and resource organization for holistic and people-centered livestock development states, “pastoralists are people who primarily depend on their

livestock for living. They inhabit those parts of the world where the potential for crop cultivation is limited due to lack of rainfall, steep terrain or extreme temperatures” (Kohler-Rollefson, 2005).

According to (Hesse and MacGregor 2006) pastoral systems in East Africa are complex, diverse, and extremely dynamic as pastoralists seek to adapt to evolving social, political and economic conditions at local, national and regional levels. They include the relatively sedentary Maasai in southern Kenya that manage highly diversified livelihood strategies only partly dependent on livestock, mobile Samburu in the north, agro-pastoral Karamojong in north-eastern Uganda, highly mobile Turkana, predominantly camel-rearing Somali, Rendile, Gabra and Borana in arid north and north-eastern Kenya, and the highland agro-pastoral Maasai in Ngorongoro, Tanzania (Hesse and MacGregor 2006). Blench (2001) asserts, “Exclusive pastoralists are livestock producers who grow no crops and simply depend on the sale or exchange of animals and their products to obtain foodstuffs. Such producers are most likely to be ‘nomads,’ i.e., their movements are opportunistic and follow pasture resources in a pattern that varies from year to year.”

Maasai communities in our study area (Lenkiseem and Melepo), exhibit varying levels of sedentarization due to differences in land tenure systems. The land in the Melepo area is subdivided and people live permanently on their own property. Hence, Maasai in this community exhibit less mobility. There is some sedentarization in Lenkiseem due to semi-permanent settlements around water

points, schools, and hospitals. However, the land there is still communally owned, and mobility is relatively high, compared to Melepo. In addition, during dry seasons, Lenkischem pastoralists move their cattle over significant distances in order to feed cattle on commonly held drought refuge land.

1.2.2 The Importance of Livestock in Kenya

Studies have shown that pastoralism has proven to be one of the most efficient options of utilizing arid regions, comparable in productivity to commercial ranching, but better adapted to the semi-arid lands due to the resiliency of the livestock breeds and seasonal movements of the herds (Western et al. 2009, Western, 1982; Ellis and Swift, 1988). Pastoralism in Africa is believed to play a fundamental role in sustaining livelihoods of most people living in arid and semi-arid lands (ASALs). A study aimed at examining drought situation for Maasai pastoralist of northern Kenya argues that economies of most of Africa countries “depends on the climate-sensitive sector of rain-fed agriculture with about 70 percent of the continent's population depending on agriculture for their livelihood. Rain-fed agriculture in ASALs of Africa involves crop farming and pastoralism for subsistence. Pastoral areas occupy 40 percent of Africa's land mass where over 70 percent of the land in pastoral areas lacks potential for crop farming, making livestock production the most viable economic option. Thus, pastoralism offers a viable production system that enables huge arid and semi-arid areas to be used productively” Huho, et al. (2010:779).

Pastoralist livestock production in Kenya plays a very significant role to improve performance of the country's economy. It is estimated that, within Kenya, "...over 60 percent of the national herd is held by pastoralists and it produces about 10 percent of the domestic GDP and 50 percent of agricultural GDP" (Huho, et. al., 2009; USAID, 2010). In arid and semi-arid lands (ASALs) of Kenya, pastoral production accounts for 90 percent of employment opportunities and 95 percent of family incomes and livelihood security (Huho, et. al. 2009; USAID, 2010). Other studies indicate that the livestock sector "supplies the domestic requirements of meat, milk, dairy products and other livestock products, and accounts for about 30% of all marketed agricultural output" (Alila and Atieno 2006). Other than immediate products of livestock husbandry, the sector also contributes to the national economy through the export of by products such as hides and skins, dairy products and processed meat products.

1.2.3 The Unique Importance of Livestock among Maasai Pastoralists

While the case studies on which this thesis draws are set in southern Kenya, the modeling and problem-solving paradigm described herein has potential application to all pastoralists in the region. Maasai are one of many pastoral or nomadic groups that primarily rely on livestock for their livelihood. Depending on the local conditions, some Maasai have diversified to other means of livelihood, including crop farming and/or a wide variety of wage labor.

Livestock play an important role in Maasai culture as the main source of food and wealth, and thus are integral to many cultural practices. Cattle particularly are

wealth on the hoof, providing dairy products and blood, symbolizing status, and serving significant social and ritual functions through exchange as bridewealth, inheritance and/or gifts (Coffman 2007). Among pastoral Maasai, cattle are the most valued of livestock, as indicated by the common Maasai greetings of “Kesidan nkera o nkishu” (“How are your children and cattle?”). While smaller livestock, such as sheep and goats, are regular sources of meat, cattle are rarely slaughtered. Important traditional ceremonies and rituals, such as coming of age ceremonies, circumcisions, marriages, or formation of an age-group, may require the slaughter of cattle, and the animals are selected according to particular characteristics relevant to the event.

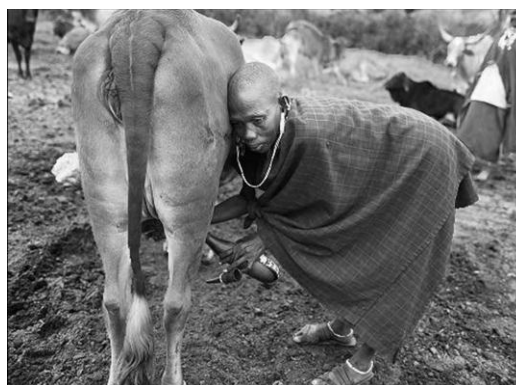


Figure 1 A Maasai woman milking. Photo courtesy of <http://mikewadejournalist.blogspot.com/>



Figure 2: Maasai men collecting blood from a live cow. Photo courtesy of Doranne Jacobson

Large herds of cattle also act as a symbol of social status among most pastoral communities and certainly among Maasai. For instance, if one family is fortunate to own a large herd of cattle, the owner is afforded a high level of respect from the rest of the community and carries greater weight in community decision making. Part of

this status is attributable to the fact that the “affluent” can afford to contribute resources (cattle, small stock, other support) to cultural functions without hardship. In addition, individuals with large livestock holdings may create employment opportunities for those who do not have large herds by hiring them as shepherds. The shepherd is often compensated in cash and/or livestock after tending cattle for a certain period of time.

Cultural practices rooted in traditional beliefs and values help explain Maasai attachment to cattle. According to an old Maasai folk tale, all cattle in the world belong to the Maasai and are a sacred gift from God, along with the grass and trees. This view is often symbolically represented during various cultural functions. For instance, it is customary for a Maasai to place a handful of grass between the roots of a fig tree, as homage to the source of their herds. Other myths associated with Maasai love for cattle include a famous myth, as presented by Sankan (1971:67-69) and reproduced by Rutten et al. (1992:129):

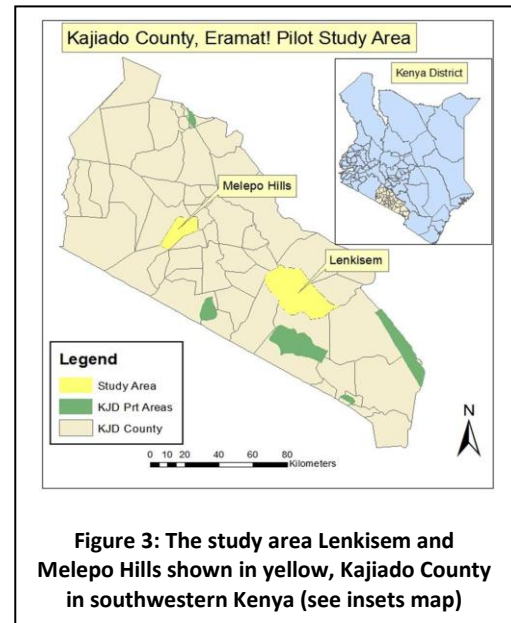
“All Maa-people found themselves in a low, dry land, suffering from famine and drought. One day the people discovered green grass that had been dropped by a bird. Scouts were sent to follow this bird, and look for fresh pastures. So they did. Upon reaching an escarpment (Kerio) a bridge was built to let all the people and domestic animals pass. When half the people had reached the other side the bridge collapsed. Those who had reached the rich pastures became the Maasai pastoralists, while those who failed became *Ilmeek*, the non-Maasai agriculturalists”

There are many of these myths about Maasai relationships with cattle, and they are embellished and made relevant through storytelling, songs, riddles, proverbs, and general conversation.

1.2.4 The Study Region: Kajiado County

Kenya

Kajiado County falls under the ASALs part of southwestern Kenya, an area totaling 21,105 km² (Boone et al. 2005). Our pilot study, as depicted in Figure 1, was conducted in two



parts of the county. Lenkitem area located at the southern part bordering the world-renowned Amboseli National Reserve (shown in green shading and represented at the legend as Kajiado (KJD) protected areas), and the near Melepo hills to the west. The interesting distinguishing characteristic of the two locations is that Melepo area is subdivided and people live on their own pieces of land (properties), while in Lenkitem area, people still live on communally shared land.

The Greater Amboseli Ecosystem (GAE) lies in southern Kenya, approximately between longitudes 37°15' East and 2°37' South. The elevation ranges between 1500 and 3000m above sea level (Okello et al. 2008; Smith, 1997; Thresher, 1981). The climate of the Greater Amboseli Ecosystem is characterized by bimodal rainfall with the "short rains" typically occurring from October through December, followed by a short dry period from January to February, and "long rains" in March through May,

followed by a long dry season from June to September. While the overall precipitation in the district ranges between 400 and 800mm annually (Boone et al., 2005), precipitation in most areas around the GAE where Lenkiseem lies, receive much less with an average annual rainfall of 240 mm, with 160mm during the heavy rains season (March–May) and 88mm during the short rains from (October–December) (Okello et al. 2008).

Lenkiseem's landscape is characterized by bushy shrubs, grassland, and multiple species of *Acacia* trees with *Commiphora africana* as the dominant species. Soil types range widely from mainly red clay, sandy clay and black cotton soil. The region is home to Amboseli National Reserve, a world famous tourist destination that includes a variety of wildlife species such as elephants, lions, zebras, wildebeest and buffaloes. Melepo Hills encompasses the border between two Maasai sections: Ildamat and Iloodokilani. The plant community in the region includes wooded grassland and bushland with a variety of both *Acacia* and *Commiphora* species, as well. Soil type includes sandy clay and rocky grounds. The Melepo region is also well known for wildlife such as elands, Grant's and Thomson's gazelles, zebras, giraffes, dik dik, hyenas, and more.

1.3 The Problem of Accelerating Boom/Bust Cycles in Study Area

Despite the critical role played by pastoralism in the ASALs of Kenya, pastoralists live with the threat of inadequate rainfall and therefore drought, during which they can suffer catastrophic losses of livestock, which contributes to poverty, and food insecurity. Recent trends of increasing drought severity have raised concerns about

the viability of the pastoralist lifestyle in the region. Pastoral landholdings are shrinking and the climate is changing, thereby eroding opportunities for pastoral people to make a viable living (Hesse and MacGregor 2006).

A study of rainfall records and herd-history data from 56 pastoral households in southern Ethiopia, found that cattle population dynamics resembled a “boom and bust” pattern where periods of gradual herd growth are punctuated by sharp crashes (Anderson and Broch Due 2000; Rutten 1992;). This dynamic is analogous to the one in southern Kenya that also exhibits an accelerating boom-bust drought and famine cycle. Desta (2001) concluded that high stocking rates predispose the system to crash when a dry or drought year occurs (see Table 1). According to the study the higher the stocking rate and the larger the annual rainfall deficit, the larger the crash. In some cases a high stocking rate only needs a slightly dry year to cause a crash (Desta 2001). The tendency for pastoralists to overstock their herds following a drought is especially likely in a culture such as Maasai, where livestock play such a prominent role. Hence the dynamics observed in Ethiopia are present among the Maasai communities and environment of southern Kenya.

Desta (2006) calculated that cattle herd crashes occur in many parts of eastern Africa once every 5 to 6 years, corresponding to the time required for the regional herd to grow to over 20 head per square kilometer. These boom-bust cycles in Kenya are occurring more frequently. While droughts significant enough to cause a major loss of livestock happened only once in the 1970s, they occurred twice in the 1980s, and every 2-3 years in the 1990s, and that has been the norm since 2000

(Howden 2009; Huho et al. 2011). In fact, the Kenyan government declared five national disasters due to drought in the past two decades alone: 1992-1993, 1995-1996, 1999-2001, 2004-2006 and 2008-2009 (Huho et al. 2011).

It is estimated that about 2 billion US dollars' worth of livestock is lost annually to mortality, poor quarantines, diseases and missed trade opportunities, resulting in increased food insecurity in drought-prone arid and semi-arid lands (USAID, 2010). Table 1 below shows the effects of livestock mortality across a number of countries in Africa from the 1980s to 2010. This is confirmed by the effects the 2008/2009 drought had on livestock in southern Kenya, where most herders including those in my community in Lenkiseem lost up to 95% of their cattle herds.

Table 1. Effects of recent droughts on livestock in selected African countries

Drought	Country	Livestock lost
1981-84	Botswana	20% reduction in national herd
1982-84	Niger	62% loss of national cattle herd
1983-85	Ethiopia (Borana Plateau)	37% loss of cattle
1991-92	Northern Kenya	70% loss of livestock,
1991-93	Ethiopia (Borana Plateau)	42% loss of cattle
1993	Namibia	22% loss of cattle; 41% loss of shoats
1995-97	Greater horn of Africa	29% loss of cattle; 25% loss of shoats
1995-97	Southern Ethiopia	78% loss of cattle; 83% loss of shoats
1998-99	Ethiopia (Borana Plateau)	62% loss of cattle
1999-2001	Kenya	30% loss of cattle; 30% loss of shoats; 18% loss of camel
2002	Eritrea	10-20 % loss of livestock in some areas
2002	Ethiopia (Afar and Somali)	40% loss of cattle; 10-15% loss of shoats
2004-06	Kenya	70% loss of livestock in some pastoral communities
2005	Kenya (Mandera and Marsabit)	30-40% loss of cattle and shoats; 10-15% loss of camels
2009	Tanzania and Kenya	Maasai lost 70-90% of livestock
2010	Niger	75% livestock threatened
2010 (May)	Somalia	70-80% livestock lost

Source: Morton, 2006; Tearfund, 2010; Akilu and Wekesa, 2002;FAO, 2003;HPG, 2006 and Somaliland press, 2010

1.4 Overview of the methodology used in this thesis

This thesis adopts a 5-step System Dynamics problem solving methodology from Sternman (2000). This adapted methodology consists of five main activities:

1. Articulate the problem from a systems perspective
2. Formulate a dynamic hypothesis identifying the roots of the problem in terms of feedback dynamics
3. Create a game board simulator to test the dynamic hypothesis
4. Test the model with the target audience and modify until it is fit for its intended purpose
5. Use the game to gain insights about the nature of the problem and to evaluate strategies to improve upon the current state of affairs.

The rest of this thesis is organized around this methodology. This chapter provides the system-based problem articulation. The next chapter provides a brief overview of what system dynamic is and its relevance as an appropriate methodology applied in this thesis. Chapter 2 also outlines a dynamic hypothesis that describes how multiple factors interact to create the boom/bust cycle described above. These factors include population growth, changes in land use, pastoralist values for cattle as a source of both economic and social capital, as well as the effects of climate change. Chapter 3 describes the process used to develop the ERAMAT! game board simulator that embodies the dynamics described in chapter 2. Chapter 4 summarizes the pilot study conducted in Kenya in the summer of 2012. Chapter 5

provides final reflections about the potential of this type of simulator for addressing problems in the region that emerge from complex human/environment interactions.

Overall, this work has demonstrated that the concept of a culturally-anchored game board simulator like ERAMAT! has significant potential to empower people in developing nations to tackle and address problems like the one addressed in this pilot effort. This thesis offers a unique application of System Dynamics. While it draws on the language and systems representation tools in that discipline, it implements the dynamic hypothesis using a board game rather than a computer simulator. The use of a board game allows us to present the system dynamics in a culturally anchored way that is readily accessible to the target user audience – Maasai of Southern Kenya. The validation of this board game “model” was accomplished by “running” the simulator (i.e. playing the game) with members of that community in a pilot study and seeking their input about the validity of the game outcomes.

Chapter Two

A dynamic hypothesis for the boom/bust cycles in the study region

2.1 Chapter overview

This chapter uses the methodology of system dynamics to provide a description of the dynamics behind the boom/bust cycle in Kajiado. This is done by identifying the driving forces impacting this cycle and by describing the interactions of these forces to explain the roots of the problem. The system notation used in this chapter will be explained as it is used. The chapter concludes by identifying which of these dynamics are incorporated into the design of ERAMAT!

2.2 Using System Dynamics to Understand the Boom/Bust Cycles in Kajiado

System Dynamics (SD) is a method of modeling feedback systems. The System Dynamic Society (2012) defines SD as *“a computer-aided approach to policy analysis and design. It applies to dynamic problems arising in complex social, managerial, economic, or ecological systems -- literally any dynamic systems characterized by interdependence, mutual interaction, information feedback, and circular causality.”*

Causal Loop diagrams (CLDs) are a qualitative tool for describing the system structure (causal dependencies, feedback, and delays) believed to influence the behaviors we wish to understand and possibly change. For example, using a causal loop diagram, one can describe the interactions between livestock management practices, the livestock population, and the ecosystem (water, food sources, etc.). The description represents a *dynamic hypothesis* about how the system structure gives rise to the behavior of interest and it can be a source of potential insight about

ways to influence the future. “CLDs are useful in many situations. They are well suited to represent interdependencies and feedback processes. They are used effectively at the start of a modeling project to capture models-both those of client group and your own” (Sterman 2005).

An important feature in the causal structure in a complex system is the presence of multiple, often competing, feedback loops. These can be one of two types: (1) *goal seeking feedback* (also called *negative* or *balancing* feedback), and (2) reinforcing feedback (also called *positive* feedback). Balancing feedback loops represent dynamics that work to restore the system back to some “steady” or “goal” state. The “goal” is not necessarily chosen, but rather one that is determined by the overall nature of the system and that emerges from the complex dynamics that drive its behavior. In addition, the “goal” of any balancing feedback loop may evolve over time as the system adapts. Reinforcing feedback loops represent dynamics that can lead to “runaway” or “snow ball” effects. When reinforcing feedback dominates the behavior of a system, the system state can experience rapid, accelerating change. Such behavior is often referred to as a “vicious” or “virtuous” cycle (depending on the viewpoint of the analyst).

By describing the feedback structure behind system behavior, the analyst is effectively creating a hypothesis for why the system behaves the way it does. This *dynamic hypothesis* can be tested in several ways, one of which includes the development of a working simulator that embodies the hypothesized structure. By testing the simulator against a variety of criteria (including comparisons with

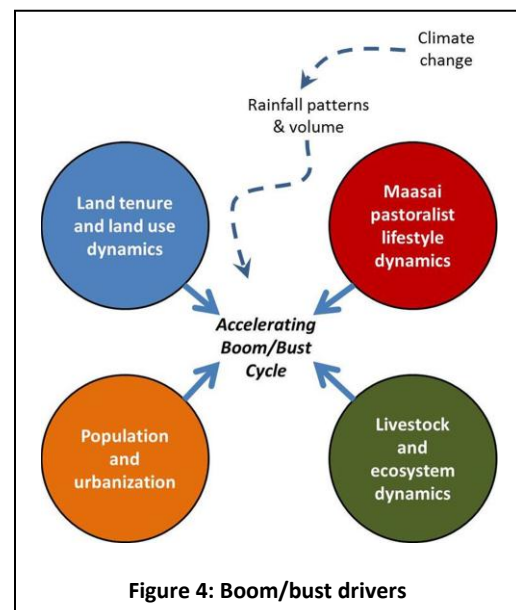
known behavior of the real-life system), the hypothesis can be tested. Hypotheses (and their corresponding simulators) that demonstrate sufficient explanatory power can then be used to explore ways to impact the system behavior in favorable ways. The rest of this chapter will use these concepts to develop a dynamic hypothesis for the boom/bust cattle cycles in the study region. The initial test of this hypothesis was performed through the development of the ERAMAT! game board simulator and subsequent testing during the summer, 2012 pilot in Kenya.

2.3 Complex Interactions among main boom/bust drivers

Livestock production systems in most so-called developing countries are changing rapidly in response to a variety of drivers (Thornton et al. 2007). In the purpose of this thesis, these drivers are classified into five broad categories:

- climate change and rainfall
- population and urbanization
- land tenure and land use dynamics
- Maasai lifestyle dynamics
- livestock and ecosystems dynamics

This overview of the elements in the dynamic hypothesis described here, are shown in Figure 4. Climate change and rainfall are treated as exogenous factors. The impact of climate is accounted for, but



primary attention in this thesis is on the other four areas because these provide a more complete picture of the roots of the problem.

The respective roles played by each driver in Figure 4 are not direct, but rather are the result of complex interactions among all of them. The rest of this chapter will provide a system's level description of these interactions in order to give the reader a deeper insight into the roots of the problem addressed in this thesis. This system description will frame the scope of system elements that are accounted for in the game ERAMAT! using stock and flow structures provided by Deaton (personal communication, March 23, 2013). Figure 5 shows the entire stock and flow diagram and highlights the sections that correspond to the four boom/bust drivers represented as circles in Figure 4. The rest of this chapter will explain the details in Figure 5 by gradually "building up" the complex dynamics represented there. Before discussing these, we begin by discussing the exogenous effect of climate change

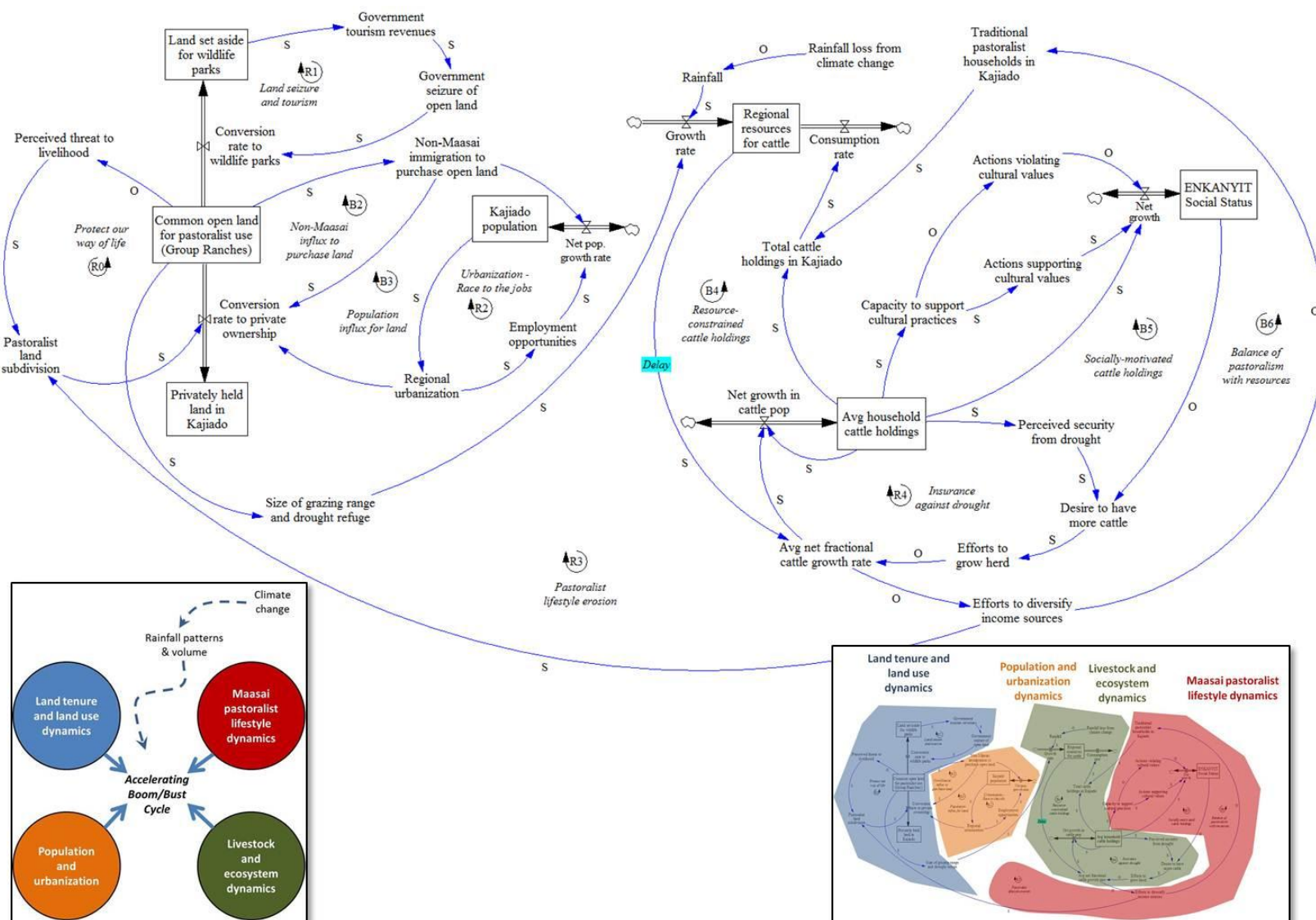


Figure 5: Overview of Stock and Flow Model with Four Boom/Bust drivers Highlighted

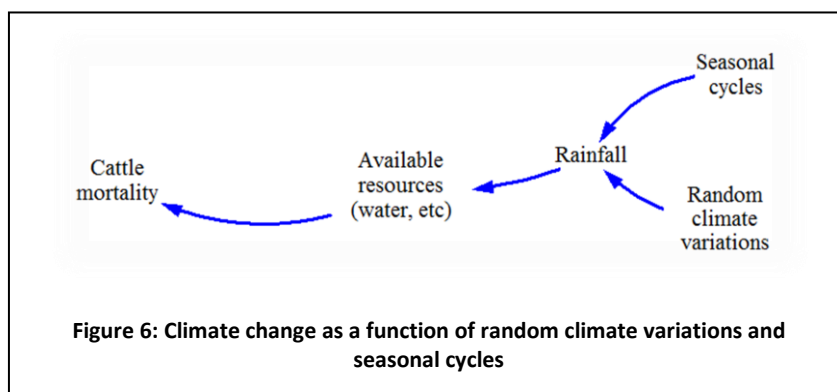
2.3.1 The role of climate change and the 2008/2009 drought

Though the problem with drought-related cattle mortality is not an entirely new phenomenon among pastoralist communities in East Africa, its severity has increased over the last few decades. Several studies attribute the increase in cattle mortality to worsening drought conditions that are largely driven by the effects of climate and climate change. Thornton et al. (2007) cites climate change as having major impacts on low-income livestock keepers and on the ecosystems goods and services on which they depend.

Evidence of changes to the Earth's physical, chemical and biological processes is evident on every continent and certainly among the pastoralists of southern Kenya. Rising temperatures and shifting precipitation patterns are affecting ways by which pastoralists interact with the environment. As mentioned earlier, the frequency of drought has increased from once in every 10 years in the 1970's to once in 5 years in the 1980's and now once in every 2-3 years since the 1990's, (Howden, (2009), and Huho et al. 2011). These changes can be attributed in part to random climate variations and the effects of climate change, as well as to anthropogenic processes.

Random climate variability occurs naturally and contributes to the unpredictability of weather from year to year, season to season, and day to day. However, the degree of climate variability can be exacerbated by climate change, which has been demonstrated by the IPCC to be exacerbated by human activities. Seasonal cycles provide the annual rhythms corresponding to wet and dry seasons in the Maasai calendar.

In Figure 6, both *seasonal cycles* and *random climate variations* determine the amount of rainfall to be

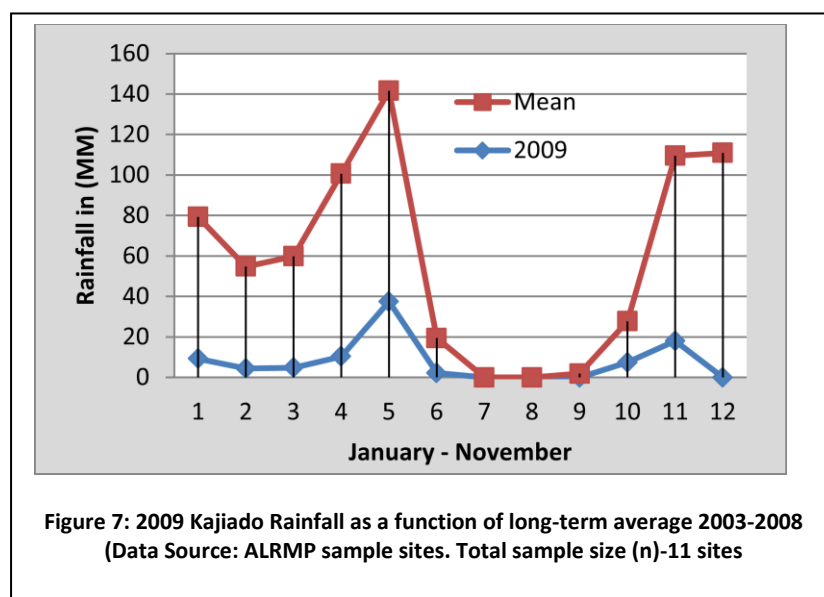


received. When **rainfall** is well below normal levels, **food and water resources for livestock** can be depleted, leading to a collapse of the regional cattle herd.

Reduced precipitation in the study region is one of the immediate effects of rising global temperatures. ASALs are experiencing prolonged draught periods and often sporadic precipitation, which increases competition for resources. This is illustrated during the drought of 2008/2009 in Kajiado County (what was then called Kajiado District). According to a 2008/2009 Kajiado District Annual Progress report, water sources were below their normal capacities. Vegetation growth is said to be poor in all areas largely because of prolonged drought periods. Grazing resources seldom lasted for more than one month in those areas that had received rains. Normally, those areas provide grazing for at least 5 months between rains (ALRM, 2009).

In other parts of the region, resident livestock would likely have otherwise survived the drought, but because of the influx of livestock and herders from other places seeking grazing and water resources, competition for resources increased leading to mortality of both resident and migratory livestock. Nkedianye et al. (2011) asserts, “immigration of animals from drought-stricken areas to the south caused a forage

and water shortage leading to the otherwise unexpected higher mortality rates in Kitengela.” The graph in Figure 7 represents the average rainfall received in the year 2009 for Kajiado County compared with the long-term average from the year 2003 to 2008 (ALRM, 2009). Rainfall records for 11 different locations within Kajiado



County were recorded from the year 2003 through 2009. The long-rain season (Nkokua) is from late March through May (months 3-5 in Figure 7). The figure shows that

during the 2009 Nkokua season, rainfall levels were less than 30% of the corresponding average rainfalls during the baseline period from 2003-2008. Overall most places appear to have received little to no precipitation especially during the short drought period of January through March as well as during the long dry season (Olameyu; June through September).

Due to this loss of precipitation during 2009, Maasai pastoralists suffered and many livestock were lost. This situation is not limited to Kenyan pastoralists alone. For example, Huho et al. (2011) claim, “Over 68% of India is vulnerable to drought with 33% being chronically drought-prone.” Given this considerable agreement on the role of climate change in escalating drought conditions, as well as the anthropogenic

contributions to accelerating this change, it is clear that pastoralist livestock holdings and livelihoods face considerable pressures.

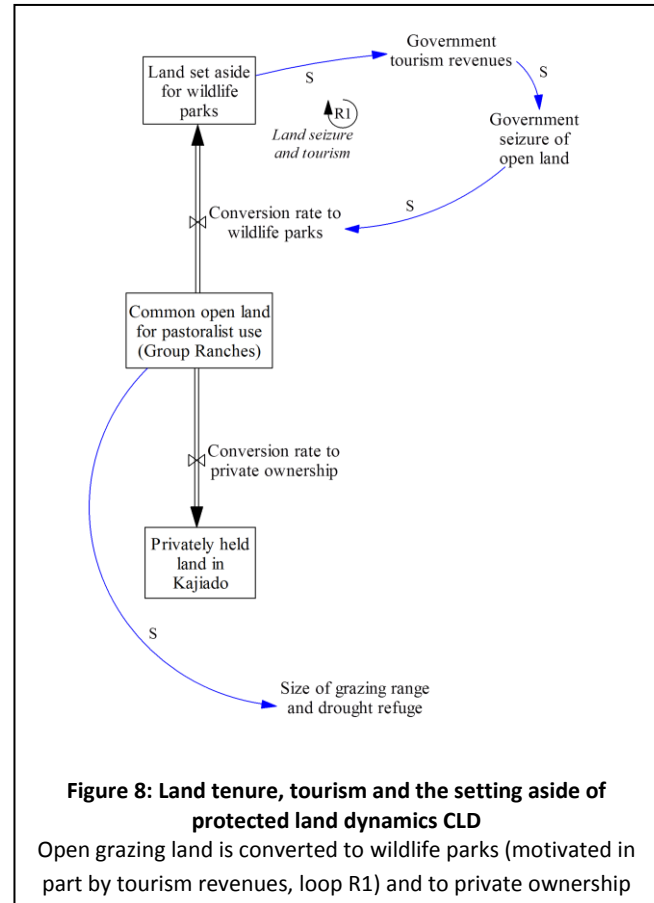
2.3.2 Land Tenure and land use dynamics

According to the Food and Agriculture Organization of the United Nations (FAO 1999), “land use is characterized by the arrangement, activities and inputs people undertake in a certain land cover type to produce, change or maintain it.” In Kenya, both colonial and current government land policies have led to detrimental effects on Maasai land use. The concern arises in large measure from the increasing support of policies aimed at diminishing the power of herding societies through restriction of key areas necessary for their survival. Both colonial and post-colonial land use policies encouraged expansion of cultivation, and demarcated areas for wildlife conservation (Campbell et al. 2000). Maasai land use via traditional pastoralism is characterized by “complex interactions between societal processes and the natural resources of the area” (Campbell et al. 2000), meaning the use of natural resources to meet both livestock and human needs while striking a continuous ecological balance. However, this traditional method of utilizing natural resources is gradually disappearing largely due to “driving forces of change that are both local and external, and have altered in the nature and intensity over time” (Campbell and Olson, 1991). These pressures emerged during the implementation of land policies that led to the setting aside of conservation and protected areas for wildlife. In this section, the changing land tenure system is explored to illustrate the

complexity of interactions among driving forces that contribute to the boom/bust dynamics of cattle mortality.

Figure 8 is a stock and flow diagram showing the conversion of open land to both private ownership and wildlife parks. Following Sterman (2000), a brief introduction to the notation used in stock and flow diagrams like Figure 8 is needed.

- Stocks are represented by rectangles (suggesting a container holding the contents of the stock). In this case there are three stocks. Each stock



- “contains” acreage of land in Kajiado County, classified according to whether that land is common land, land set aside for wildlife parks or reserves, or land held privately.
- Inflows and outflows are represented by directional pipes pointing into a stock (inflows) or leading out of a stock (outflows). The flows in Figure 8 represent the processes by which, land acreage is converted from common land to either land set aside for wildlife or privately held stocks.

- Causal connections are single-line arrows showing the direction of causal influence. Each connection is labeled with a polarity of “S” or “O” indicating the nature of the causal influence. For example, the arrow running from the stock of land set aside for wildlife parks to government tourism revenues indicates that the amount of land set aside impacts the level of revenue. In addition, the “S” polarity indicates that the “effect” (revenues) moves in the same direction (“S” = “same”) as the cause: i.e. as land set aside increases, revenues also will tend to increase.
- This diagram also shows a feedback loop (described earlier). The circular symbol labeled with an “R” indicates that this is a reinforcing feedback loop: a type of feedback that reinforces change or builds momentum faster in one direction – a kind of snowball effect. In Figure 8, the reinforcing feedback loop is named “*Land seizure and tourism.*” This loop represents the accelerating dynamic of converting land to protected areas, partly because of the benefits of tourism revenues.

2.3.2.1 The Impact of Conservation and Protected Areas

Many conservation policies in Kenya have improved the wellbeing of wildlife, but those same policies have also led to unexpected undesirable consequences. The creation of the then Amboseli National Park (ANP) in 1974 (now known as Amboseli National Reserve, or ANR) is one example of such policies. Like most wildlife protected areas in Africa, the creation of Amboseli National Reserve followed a model imported from the temperate grasslands and stable conditions of North America (Oxfam, 2008). This meant that pastoralists who co-existed with wildlife

had to be pushed out and settled near drilled water points to encourage clustering of communities around water sources (Oxfam, 2008), a model that would later lead to negative unintended consequences.

Due to tourism income associated with ANR, the Kenyan government, supported by both national and international lobby groups, moved to set aside exclusive wildlife sanctuaries (Rutten, 2002). It was fairly clear that both British and the later new government's interest were motivated at least in part by the tourism income that was realized through these reserves, since. "...two National Parks in the area (Amboseli and Tsavo West) account for about 15% of all visits to Kenya's parks and they are of great economic significance to the nation" (Campbell, et al. 2000). Maasai protested the decision but in vain, and by 1972, the boundaries of the new sanctuary were demarcated and the area gazetted as government land (Rutten, 2002).

Tourism income fueled a self-reinforcing feedback (Figure 8) where increased tourism dollars encourage the government and other conservation initiatives to set more land for wildlife. This of course reduces the land available for pastoral lifestyle. The causal connection pointing from the stock named "*Common open land...*" toward the "*size of grazing range...*" in Figure 8 has an S polarity. This means that the more common land there is in the region, the greater the grazing range to support pastoralist practices. However, the S polarity also means that if the amount of common land decreases (because of conversion to wildlife refuges or national parks), then the size of the grazing range for pastoralists is also reduced. One impact

of this is that the carrying capacity of the grazing range that supports cattle is effectively reduced by such policies.

It is important to note that, while the financial benefits that the government gains from wildlife tourism far way outweigh the revenues derived from private land owners and livestock, many species in the current communities of wildlife in that region would hardly survive in the absence of livestock. Studies show that the current grassland ecosystem that supports herbivores including charismatic megafauna, as well as predators and other species has co-evolved with livestock. As stated by (Hesse and MacGregor 2006) , tourism which contributes to about 11% of the country's GDP largely depends on the existence of pastoralism because many protected areas in E. Africa's dry land were originally pastoral dry season grazing areas. Worden (2007) argues practices of "human-induced dissection of habitat into spatially isolated parts and conversion of habitat to render it unsuitable for grazing for animals are disrupting patterns of movement by pastoral people and native ungulates worldwide." The paradox is that policies that sought to help Kenyan society through revenues from wildlife-based tourism end up harming the people adjacent to the parks who bear the direct cost from diseases, increased predation, competition for grazing, and personal safety as a result of those policies (Campbell et al, 2000; Norton-Griffiths, 1996; and Norton-Griffiths Southey, 1995). Ecological degradation accelerates when these natural patterns of wildlife and pastoral movement are disrupted due to soil cover losses. These result from overgrazing in some areas and under-grazing in others due to restrictions on movement of the animals. Both wild and domestic ungulates promote grassland reproduction

through their trampling of older vegetation and planting of new via manure and hoof prints. (Savory 1999)

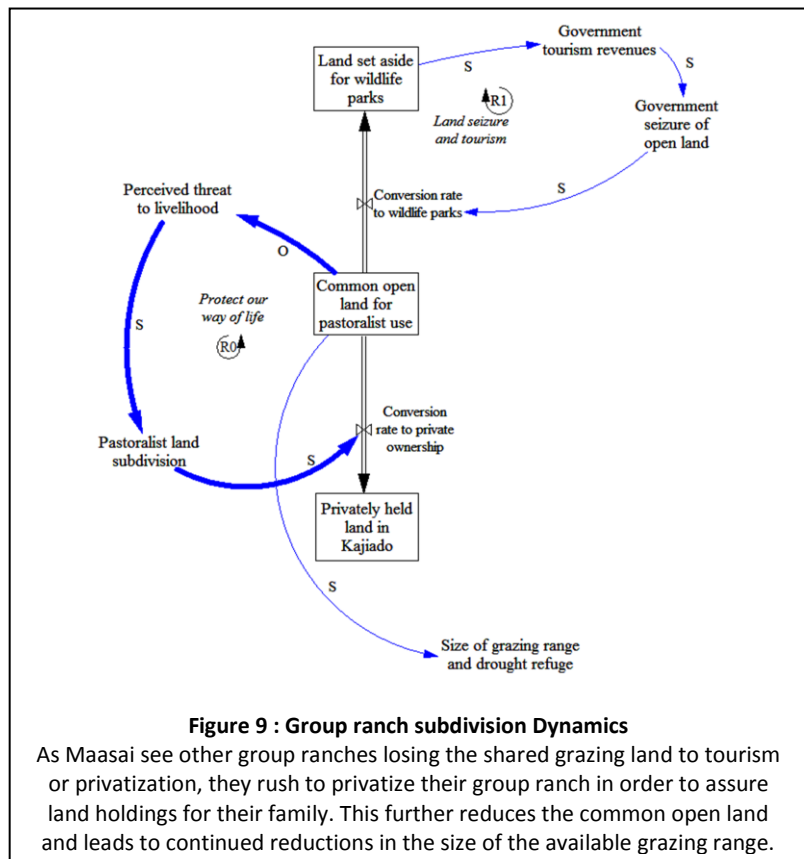
2.3.2.2 The Role of Group Ranches, Land Subdivision, and Land Privatization

Traditionally Maasai pastoralists lived and grazed their cattle herds within large sociocultural defined parcels of land known as sections. For instance there are eight Maasai sections in Kajiado County, averaging 2731 km² (Ole Katampoi et al. 1990; Boone et al. 2005). This sections include; Ilkisonko (Iloitokitoki), Ilmatapato, Ilkaputiei, Ilkangere, Ilpurko-lenkaroni, Ilkeek-onyokie, Ildamat and Iloodokilani. In the early 1970s, the Kenyan government in conjunction with international organizations began a process of organizing the land in Kajiado County into what were called group ranches (Kimani and Pickard 1998; Boone et al. 2005), with the intention of having their members “... gain collective group title to their land, improve livestock production, better match the capacity of ranches to support livestock (which individuals own), and encourage the development of infrastructure for both livestock (e.g., dipping tanks, water sources) and people (e.g., schools),” (Boone et al. 2005).

Further subdivision of group ranches began in the early 1980s (Rutten 2002), meaning that communally held land set aside for cattle production was broken down into private parcels owned by individual families. This was generally not supported among conservation organizations and the Kenya Wildlife Service (KWS), “...particularly in relation to those ranches surrounding Amboseli National Park” (Rutten 2002). Even so, group ranches continue to subdivide, with some group

ranch committee members “...voting to subdivide entire ranches into small parcels of 24 to 40 ha to be dispersed among ranch members” (Rutten 2002). While many Maasai foresaw a possible trend towards increased land fragmentation to the rangelands, pastoral households do continue to try to negotiate land access across sectional and group ranch boundaries, particularly in times of drought (Rutten 1992; BurnSilver, unpublished data; Worden, unpublished data; Boone et al. 2005). This is becoming increasingly difficult, however, as some land is fenced, mined, or otherwise made unfit for grazing, and some land is sold to non-Maasai who may not have much empathy for resource strapped pastoralists.

In response to the fear that communally held land would be further converted into wildlife protected areas or other kinds of land inaccessible to livestock, the idea of land privatization (ownership by individuals instead of communally-owned



and shared land) seemed to pastoralists in the region to be an appropriate response to address the perceived threat to their grazing range. By acquiring land for

themselves through subdivision, individual family groups could make sure that they had access to land for livestock. However, this move to private ownership also led to unintended consequences by fragmenting the land even further. Hence, as Maasai in Kajiado saw other group ranches subdividing, the perceived threat to their own grazing lands motivated them to pursue family-based ownership of land through land subdivision in their own group ranch. This further exacerbated the loss of common land for grazing. Reinforcing loop R0 in Figure 9 represents this behavior. This is a reinforcing feedback loop, because the rate of subdivision is eventually curbed to near-zero levels as the available open land is all eventually lost to either tourism or GR subdivision. Moreover, some individual title holders came to view their land as an as an easy way out of poverty. By selling their land to others, individuals could receive what seemed like a large sum of money. But in so doing, they forfeited the very assets that could help sustain their livelihood. Group ranches around Kitengela region in Kajiado East and Kimana GR in Kajiado South each serve as a case in point as described in Rutten's (1992) *Selling Wealth to Buy Poverty*. He described that much of the individually held land was sold to non-Maasai, further exacerbating the loss of land for livestock.

This trend is a major problem facing Maasai living in sub-divided lands. Land sale in Kajiado has not only led to the loss of grazing land in the county, but also the loss of wildlife dispersal areas while contributing to increased poverty in the region. Many Maasai lobby groups have been formed both on the ground and through social media to address the issue of land sale. David Melita, a Kajiado Congress Facebook® group member states, "*It saddens me to hear the current state of our land in Kajiado*

and especially 'ILODOKILANI' I kindly appeal to the members of the congress to come to the rescue of our land through sensitization of the ills on land sale to our people, my beloved community members" (Facebook, Nov. 2012). These are part of the efforts and campaigns being undertaken in efforts to save the remaining land, but in most place especially where the GRs have long been subdivided, it is already too late to reverse the trend as people have already settled and adopted different land uses.

2.3.3 Population and urbanization

There is a growing consensus that human population increase is posing a threat to Earth's ability to sustain it. This argument has received a lot of weight from a number of studies, most notably including Ehrlich and Holdren (1970), who went further to formulate a model that would assess the impact that human population exert on the environment, the IPAT model. The model argues that the environmental impact (I) is the product of the number of people living in an area (P), their affluence (A)

and the level of technology (T). This model has been adapted now to include an "S" variable, representing the sensitivity of land, thus making it IPATS.

Kajiado County has seen

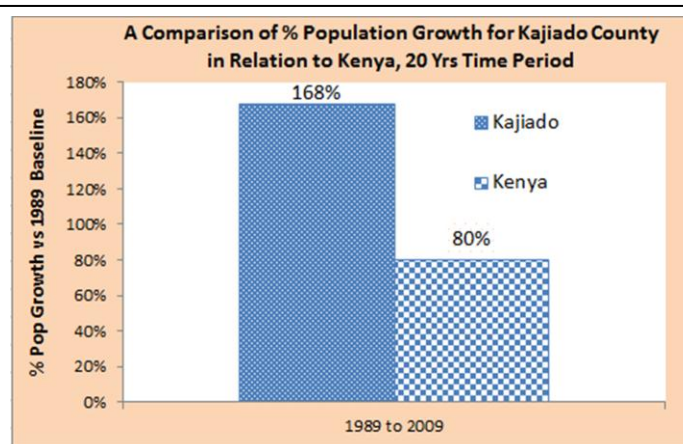


Figure 10: A comparison of population growth over the last 20 years, with Kajiado County to the right and the National average to the left respectively. Data Source: Kenya National Bureau of Statistics (KNBS) and Geohive <http://www.geohive.com/cntry/kenya.aspx>

The diagram illustrates the following causal relationships and feedback loops:

- Central Node:** Common open land for pastoralist use (Group Ranches)
- Top Path:**
 - Common open land for pastoralist use (Group Ranches) → Conversion rate to wildlife parks → Land set aside for wildlife parks
 - Land set aside for wildlife parks → Government tourism revenues → Government seizure of open land
 - Government seizure of open land → Non-Maasai immigration to purchase open land
- Bottom Path:**
 - Common open land for pastoralist use (Group Ranches) → Conversion rate to private ownership → Privately held land in Kajiado
 - Privately held land in Kajiado → Regional urbanization
 - Regional urbanization → Employment opportunities → Net pop. growth rate → Kajiado population
 - Kajiado population → Non-Maasai immigration to purchase open land
- Left Path:**
 - Common open land for pastoralist use (Group Ranches) → Perceived threat to livelihood → Pastoralist land subdivision
 - Pastoralist land subdivision → Size of grazing range and drought refuge
 - Size of grazing range and drought refuge → Common open land for pastoralist use (Group Ranches)
- Feedback Loops:**
 - R0:** Common open land for pastoralist use (Group Ranches) → Perceived threat to livelihood → Pastoralist land subdivision → Size of grazing range and drought refuge → Common open land for pastoralist use (Group Ranches) (S, O, S, S)
 - R1:** Land set aside for wildlife parks → Government tourism revenues → Government seizure of open land → Non-Maasai immigration to purchase open land → Conversion rate to wildlife parks → Land set aside for wildlife parks (S, S, S, S, S)
 - R2:** Kajiado population → Urbanization - Race to the jobs → Regional urbanization → Privately held land in Kajiado → Conversion rate to private ownership → Common open land for pastoralist use (Group Ranches) → Perceived threat to livelihood → Pastoralist land subdivision → Size of grazing range and drought refuge → Common open land for pastoralist use (Group Ranches) (S, S, S, S, S, S, S, S)
 - B2:** Common open land for pastoralist use (Group Ranches) → Conversion rate to wildlife parks → Land set aside for wildlife parks → Government tourism revenues → Government seizure of open land → Non-Maasai immigration to purchase open land → Conversion rate to wildlife parks (S, S, S, S, S, S)
 - B3:** Common open land for pastoralist use (Group Ranches) → Conversion rate to private ownership → Privately held land in Kajiado → Regional urbanization → Employment opportunities → Net pop. growth rate → Kajiado population → Non-Maasai immigration to purchase open land → Conversion rate to private ownership (S, S, S, S, S, S, S)

settling or purchase, while other parts of the country are experiencing greater and greater crowding. Further still, a new technology hub is being constructed in northern Kajiado County, and it will jumpstart sprawl of secondary businesses, housing, and more. Figure 11 represents the dynamics that emerges as a result of **population and urbanization.**

The increasing level of land privatization is driven in part by rapid population growth in the region. This growth is itself fueled by the fact that Kajiado County still contains significant tracts of land that are not privately owned or set aside for national parks. As a result, people (pastoralists and non-pastoralists) from regions where land is scarce are attracted to the region (loop B2). This loop is balancing, meaning that the immigration into the region will eventually level off as the land reserves are exhausted. The resulting dramatic increase in population in the region has also led to rapid growth in the cities, and an accompanying growth in job opportunities, further attracting more people into the area (loop R2). This is a reinforcing feedback: as more people move into the cities and economic activity builds, even more people are attracted to the area, leading to accelerating growth. This influx of pastoralists (for access to land) and non-pastoralists (to capitalize on economic opportunities in the cities) fuels the privatization of land in order to support urban growth in the region.

Human population growth has added pressure and weakened the resilience of the ASALs. The differentials in land pressure have existed since colonial land alienation (Campbell et al. 2007), largely driven by socioeconomic factors such as

urbanization, the process of increase in the share of the national population living in urban areas (cities and towns of various sizes). It is usually associated with absolute growth in the urban population (Reese et al. 1999). The northern part of the county has seen increased in urbanization that has led to sprawling cities like Kitengela, Rongai, Ngong and Kiserian. Due to their close proximity to the capitol, cities such as Kitengela are home to some of the major cement industrial plants such as Bamburi and Blue Shield, and host the local textile industry Export Processing Zone (EPZ). These business centers create employment opportunities for both residents and internal immigrants living in close proximity to these industries all at the expense of grazing land for both livestock and wildlife. In northern Kajiado County for instance, the Kitengela wildlife dispersal area around Nairobi National Park has almost completely been occupied by farming, industrial, human and urban settlement activities in the last 10 years (Esikuri, 1998). The images in Figure 12 give a visual representation of the fast growing city of Kitengela and how it has expanded within a period of eight-year period from 2003 to 2011.

These changes in land use and land ownership in the region affect not only livestock but also wildlife and tourism. Western et al (2009), describes the impact of land fragmentation on migratory wildlife populations and pastoralists, and how that in turn affects the semi-arid and arid lands. A similar study in Southern Ethiopia also suggests that declines in the carrying capacity of the grazing lands are largely a result of loss of grazing reserves to cultivation, bush encroachment, insecurity, and over-population (Desta 2001). Pressure for land subdivision is attributed to the perceived need to protect the land from external pressures like farming by non-

Maasai people, and undesirable government interventions. People still recall with fear the annexation of Amboseli National Park (Campbell et al. 2007).



Figure 12: The City of Kitengela (2003- 2011) Images courtesy of Google Earth

These urban trends are also fueled by recent government policies that are in line with the country's 2030 vision, a "long-term development blue-print that aims to transform Kenya into a newly industrialized, middle-income country" (Kenya Vision 2030). As part of this plan, and as noted above, Konza Technology city located north east part of the County (see Figure 13) is expected to be a technology center and this will arguably bring tremendous change to people living adjacent to the city. Because of the loss of grazing land to the growing population centers, Maasai and their neighboring Kamba communities living in close proximity to those locations will have to alter their lifestyles, including the role of pastoralism as a source of food, income, and cultural practices. In a departure from traditional values Maasai in this region have already started to acquire alternative forms of income as an alternative to livestock. These changes are inevitable and as the value for education skyrockets, school fees need to be paid and pastoral communities are increasingly finding that access to cash reserves can assist households with drought-related calamities. However, few financial services are available to pastoral households. So, even as these communities seek to diversify their sources of income, stocking large herds of cattle are increasingly viewed less as a form of social capital and more as a kind of savings account, particularly when increasingly urbanized regions feed a growing demand for livestock products (Thornton et al., 2007; Nkedianye et al. 2011).

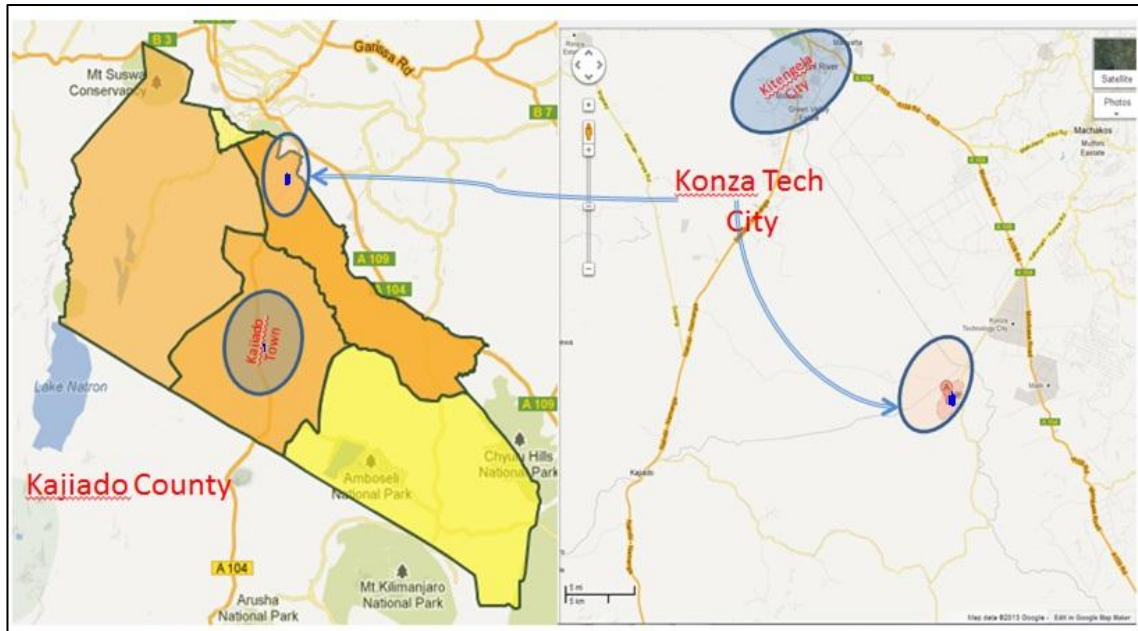


Figure 13: Location of Konza Technology City, in relation to major towns in Kajiado County

Images Courtesy of Google Maps and the Independent Electoral and Boundary Commission of Kenya (IEBC)

Lastly, internal migration is also driven by the need for cultivation especially in areas that have potential for agriculture such as rain fed agriculture in Loitokitok and irrigation swamps around Kimana and Rombo in the southern end of the county. Campbell et al. (2000) asserts, “With rapid population growth resulting from immigration from other parts of Kenya, rainfed areas have become settled, and today farming extends down into the wetter margins of the rangelands, along rivers and around swamps,”

2.3.4 Livestock and Ecosystem Dynamics

The cattle population in the region is dictated in part by the natural reproductive lifecycle of cattle, as well as the limits of the ecosystem in which those cattle participate. The collective cattle herd in the region can increase to the point where it exhausts the resources. At this point, mortality increases, and the population collapses to a low level. See loop B4 (*Resource-constrained cattle holdings*) in Figure 14. If the rate of growth of the cattle herd is too high, this process can repeat in an overshoot and decline mode where periods of gradual herd growth are punctuated by sharp crashes. This feedback dynamic has been described by Desta (2011) as a critical factor behind recurrent livestock mortality in Southern Ethiopia.

Studies suggest that the growing tendency to stock large herds is viewed by pastoralists as a long-term strategy for protection against drought as well as a way of enhancing social capital in the society (reinforcing feedback loop R4: *Insurance against drought* in Figure 14). Loops B4 and R4 in Figure 14 together create a vicious cycle of cattle herd buildup, followed by a collapse during drought (since the herd often grows beyond carrying capacity), leading to efforts to rebuild the herd, possibly to even higher levels in order to protect against future droughts. Maasai pastoralist practiced this strategy with the aim of cushioning themselves against loss of the entire herd during severe droughts. This dynamics is well explained by Hess and MacGregor (2006):

... the size of a herd represents the risk profile of a pastoral family. The greater the number of animals owned by a family the greater their chances of addressing risks and surviving adversity. This is for several reasons

- Households with larger herds are able to split them into smaller units each going in different directions. This spreads the risk of losing all ones animals in a drought.
- The larger the herd, the greater the ability of the family to share its animals among kin and friends, thereby spreading risk and investing in social capital.
- The more animals one has after a drought, the faster the herd as a whole will

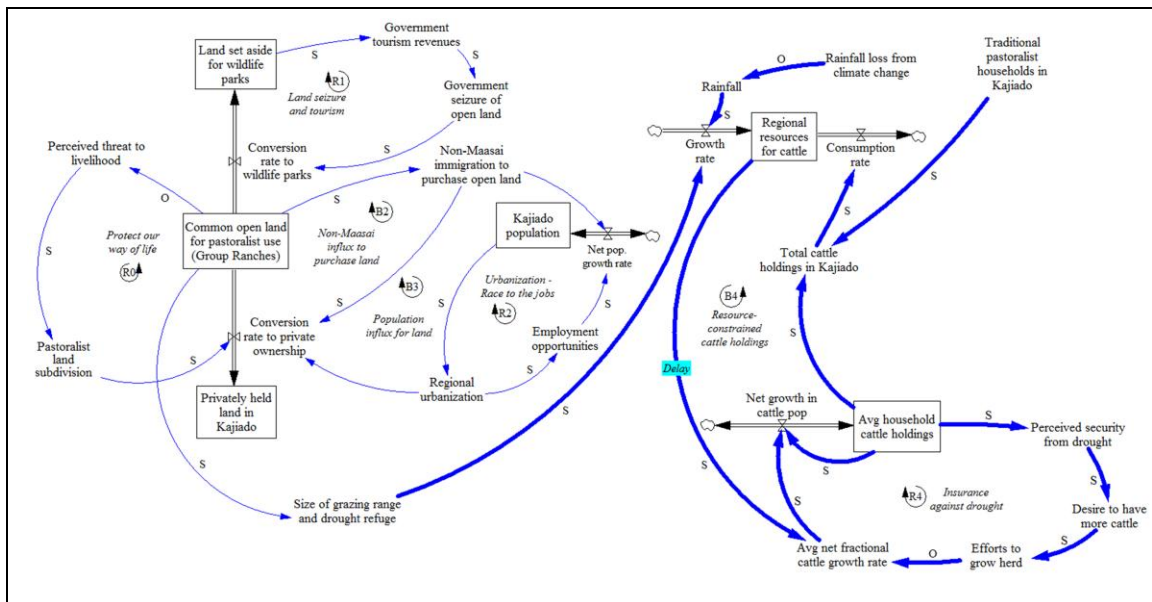


Figure 14: Livestock and Ecosystem Dynamics

While the population continues to grow, the resulting loss of land effectively reduces the carrying capacity of the region for supporting livestock herds. Loop B4 represents the balance between the resources available for cattle and the collective size of all the pastoralist cattle herds in the region. As the resources increase, the herds will grow, which will result in a more rapid consumption of the resources, leading to reduction in overall herd size...an ecological balance. This balance will not lead to a collapse unless the herds grow much larger than the ecosystem can support, or if the ecosystem (because of drought) fails to produce the expected forage and water for the livestock. Loop R4 is a reinforcing feedback loop that has been observed in pastoralist communities. If the cattle holding s drop significantly, this increases the sense of risk among the owners, leading to aggressive measures to restock the herd and “insure against drought.” This behavior can lead to an overstocking of the cattle herd and subsequent collapse during drought.

grow. The larger residual herd will also have a greater diversity of animals (species, age, sex) for the family to rely on.

Risk, however, is experienced on several scales. *Individual* risks include those associated with individual pastoral families such as accidents, predation, theft, and some diseases; *covariant* risks affect all households in a particular area at the same time, such as widespread drought and epizootic diseases. The larger herds place greater stress on an already fragile resource base, leading to significant losses of cattle during dry years. Insurance and identity are strongly linked (Hess et al. 2006). Huho et al, (2011: 788) and (Iro no date) states, “this adaptive strategy against droughts is very common among pastoralists in arid and semi-arid areas.”

2.3.5 Maasai Pastoralist Lifestyle

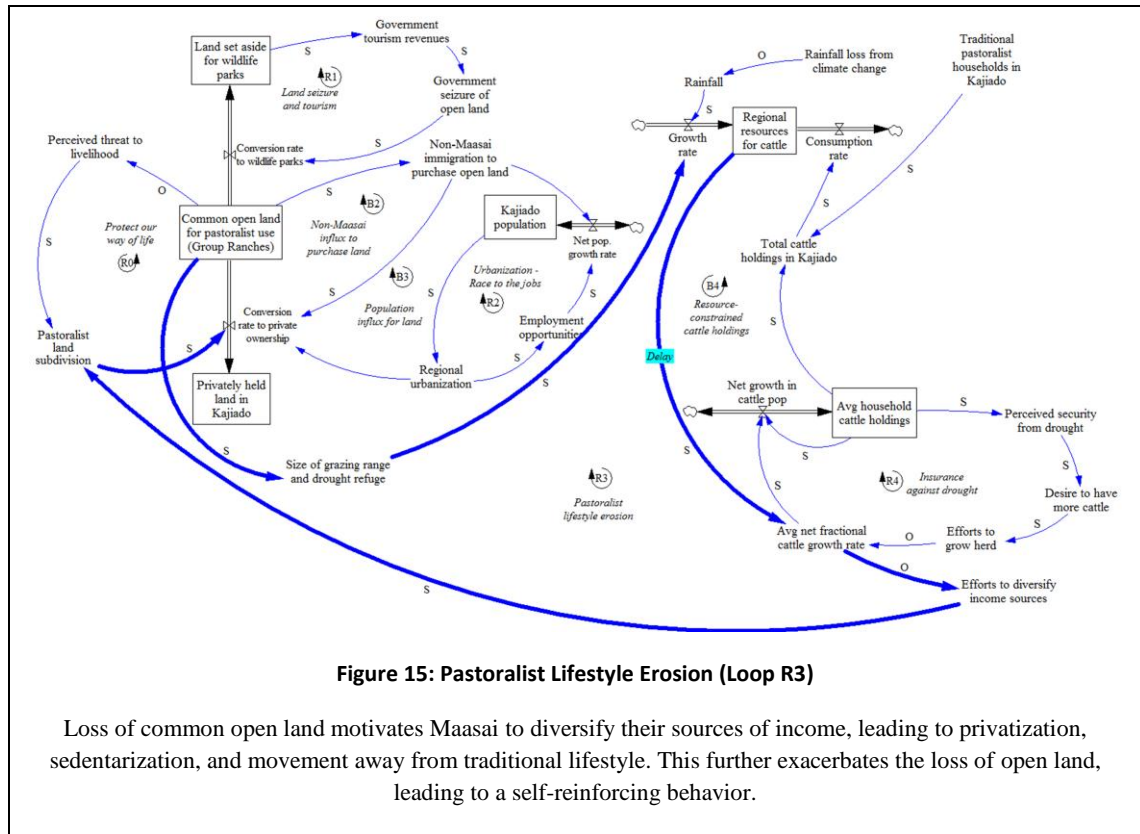
2.3.5.1 Interactions between Land Use and the Maasai Pastoralist Lifestyle

Effects of climate and climate change accompanied by changing land use dynamics has contributed to the change of Maasai pastoralist lifestyle which may further explain the declining resiliency of the land for grazing. This concern has been given weight by a number of studies including (Swift et al. 2002) who argue that growing links to the wider economy, and the development of local services (health and education) have led to various changes in the priorities of pastoral households and some pressure for sedentarization to allow access to these services. “Sedentarization from a formally semi-nomadic lifestyle, the associated land fragmentation and the intensification of the land-use further reduces resilience of

the pastoral system,” (Nkedianye et al. 2011). This dynamic is represented by reinforcing feedback *R3 Pastoralist lifestyle erosion* in Figure 15.

Because herding is a centuries-old practice, Maasai pastoralists had to devise methods of coping with the harsh realities of living in ASAL conditions. Reserving a portion of the land as drought refuge (*Nkaron*) to be settled only during drought seasons was one way. The traditional land use practice of moving with herds from one place to the other is another one. In the past, when there were far fewer people and the land was more sparsely settled, pastoralists had a wider range over which livestock could forage. An expanded grazing range enhances the landscape capacity to sustain livestock – an important principle of pastoral land use in the ASALs. These practices of relocating herds during drought periods to places with forage provides pastoralists the means to mitigate the risks from the spatial and temporal variability of the semi-arid ecosystems they live in (Western 1973; Worden 2007). It has also been observed that splitting up large herds into multiple smaller herds that graze over wide areas of land helps pastoralists further mitigate risks and maintain high stocking rates. This facilitates rapid herd recovery during wet years (Worden 2007; Scoones 1992). All of these coping strategies work only if pastoralists have access to expansive tracts of shared land. Numerous studies have illustrated the dire consequences that subdivision of the group ranch land and the changing land tenure system impose on pastoralists livelihoods. For instance when land subdivision forces people to move areas otherwise reserved for grazing during drought periods, the ability of the livestock to survive drought conditions will be jeopardized,

increasing risks of high mortality. Figure 15 represents the interaction of the Maasai pastoralists lifestyle dynamics with other boom/bust drivers.

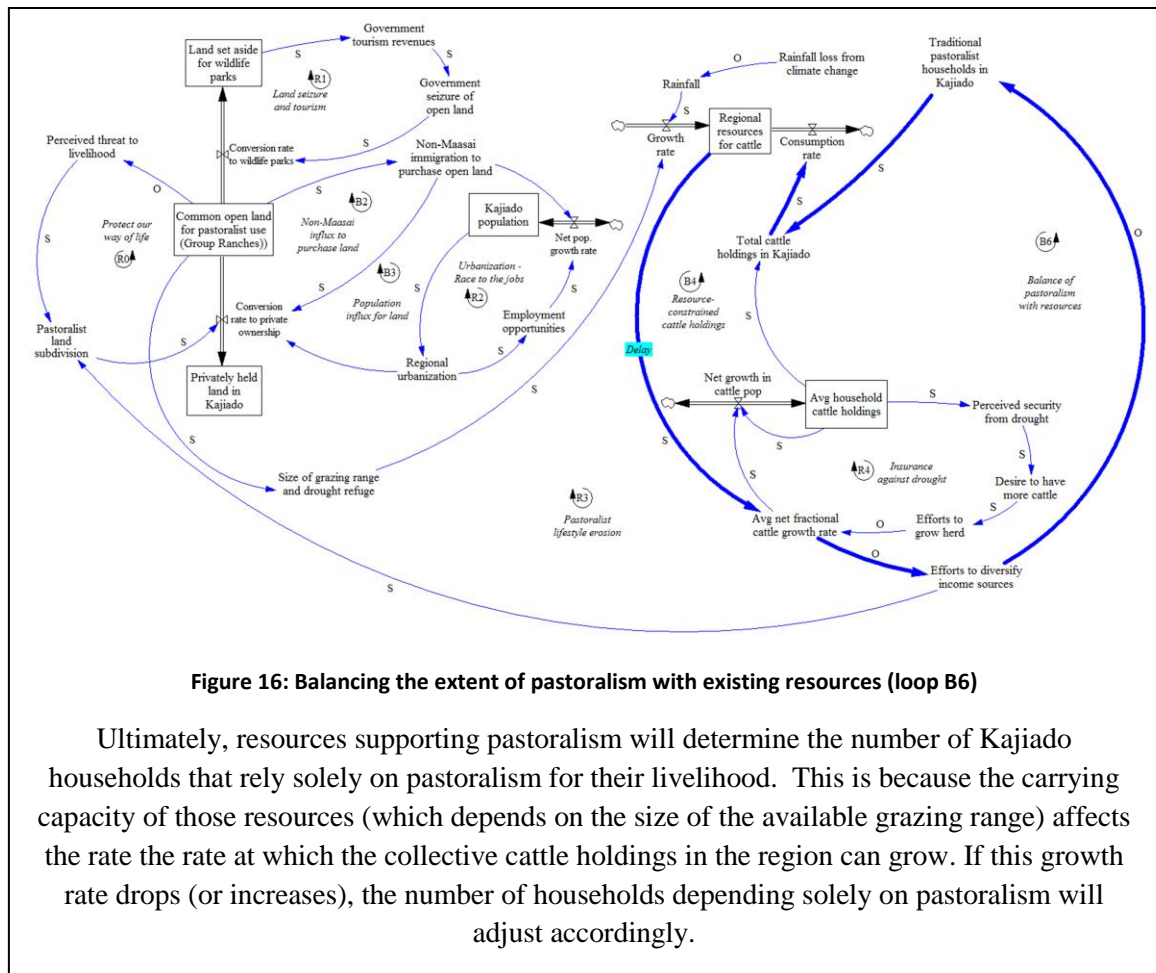


Here we see that, when pastoralists' values operate in an environment in which the land supporting the lifestyle is disappearing, two important dynamics emerge:

- Pastoralists see their land disappearing and see the threat to their livelihood. In response, many have opted to push for land subdivision in hopes of holding onto some resources that they can use for their livelihoods. Further conversion of this land to private ownership ultimately reduces open land available for pastoral use (loop R0).

- Because vast tracts of land are required to support pastoralism in the ASALs, the privatization of land (whether through purchases by pastoralists, disintegration of group ranches, or purchases by non-pastoralists) effectively reduces the size of the grazing range to support cattle. This limits the resources for cattle and reduces the carrying capacity of the system. In a drought year, this inevitably leads to a partial or full collapse of the cattle herd.
- In response to all of this, many pastoralists are also purchasing land to diversify their source of income (either by starting a business or by growing crops). This further reduces the carrying capacity of the system, leading to even more stress on the cattle herd, more likelihood of collapse, even in years with less than severe drought, and hence greater movement away from the pastoralist lifestyle (loop R3 – pastoralist lifestyle erosion).

By further exploring the interaction of pastoralist with the land use and other ecosystem dynamics, we see other counterintuitive feedback such as B3 highlighted in Figure 16 below.

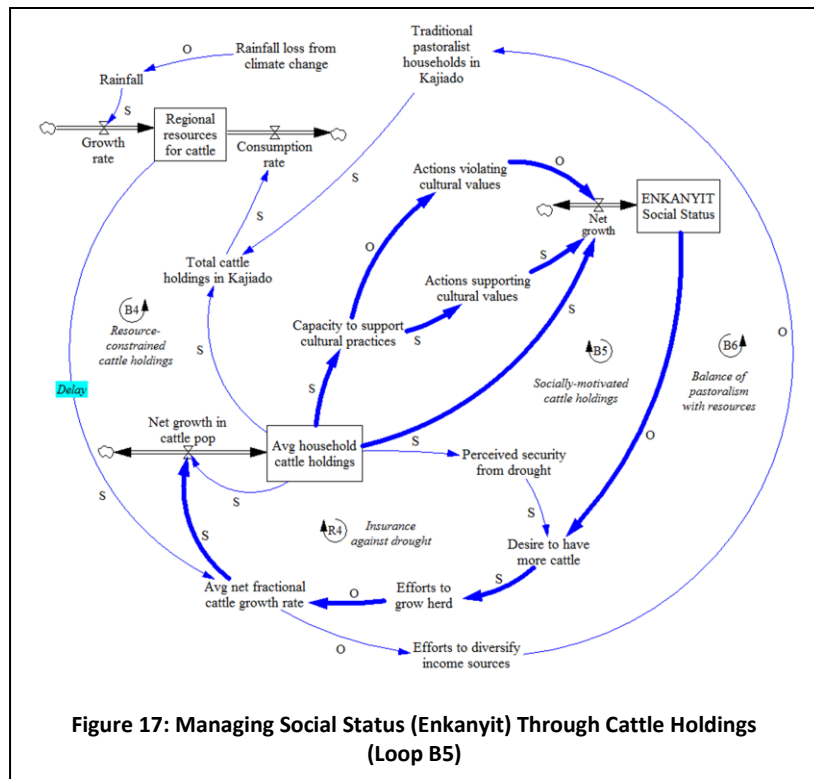


2.3.5.2 The Role of Social Status (Enkanyit) Associated with Cattle Holdings

Livestock represent much more than economic assets among pastoralists. Hesse and MacGregor (2006:19) assert, “livestock represent the means through which the continuity of pastoral institutions, traditions and cultural ties are assured and are the currency of building relationships (or social capital).” Though excessive stocking of cattle holdings stresses the ecosystem, the high cultural value placed on cattle can motivate Maasai pastoralists to increase their collective cattle herd to sizes beyond the regional carrying capacity in order to satisfy those cultural needs.

Based on the observations from the pilot study for ERAMAT! during 2012, players exhibited this behavior by aggressively growing their herds, even during drought conditions. In addition, players were highly reluctant to liquidate their herds for money under such conditions. Figure 17 represents this by incorporating a stock called “*Enkanyit*,” which is the Maasai word for respect. This stock is increased or decreased by a player’s actions that either support cultural values (such as paying cattle-based bride-wealth for a marriage) or by actions that violate those cultural values (such as failing to provide for your family or borrowing assets from another player in order to feed

family members). A player’s capacity to take actions that support cultural values is directly tied to his or her cattle holdings. In the updated version of ERAMAT! that will be used in the summer of



2013, we explicitly “hard wired” the *enkanyit* dynamics into the game by allowing players to advance a token along an *enkanyit* scale, based on strategic choices by players and by their capacity to fulfill cultural obligations. Each of these strategic

choices actions requires assets (cattle and money). At the end of the game, the player with the most “enkanyit” is the winner. .

Balancing Loop B5 in Figure 17 represents how traditional Maasai are motivated to build their cattle herd in part to achieve a desired level of respect. By having more cattle, they have the capacity to support cultural practices that are central to Maasai culture and values. Hence, by increasing cattle holdings, a traditional Maasai can play his role in the local community, earning the respect (enkanyit) of his peers. This loop is balancing because it builds the herd only to the level required to get the desired level of respect.

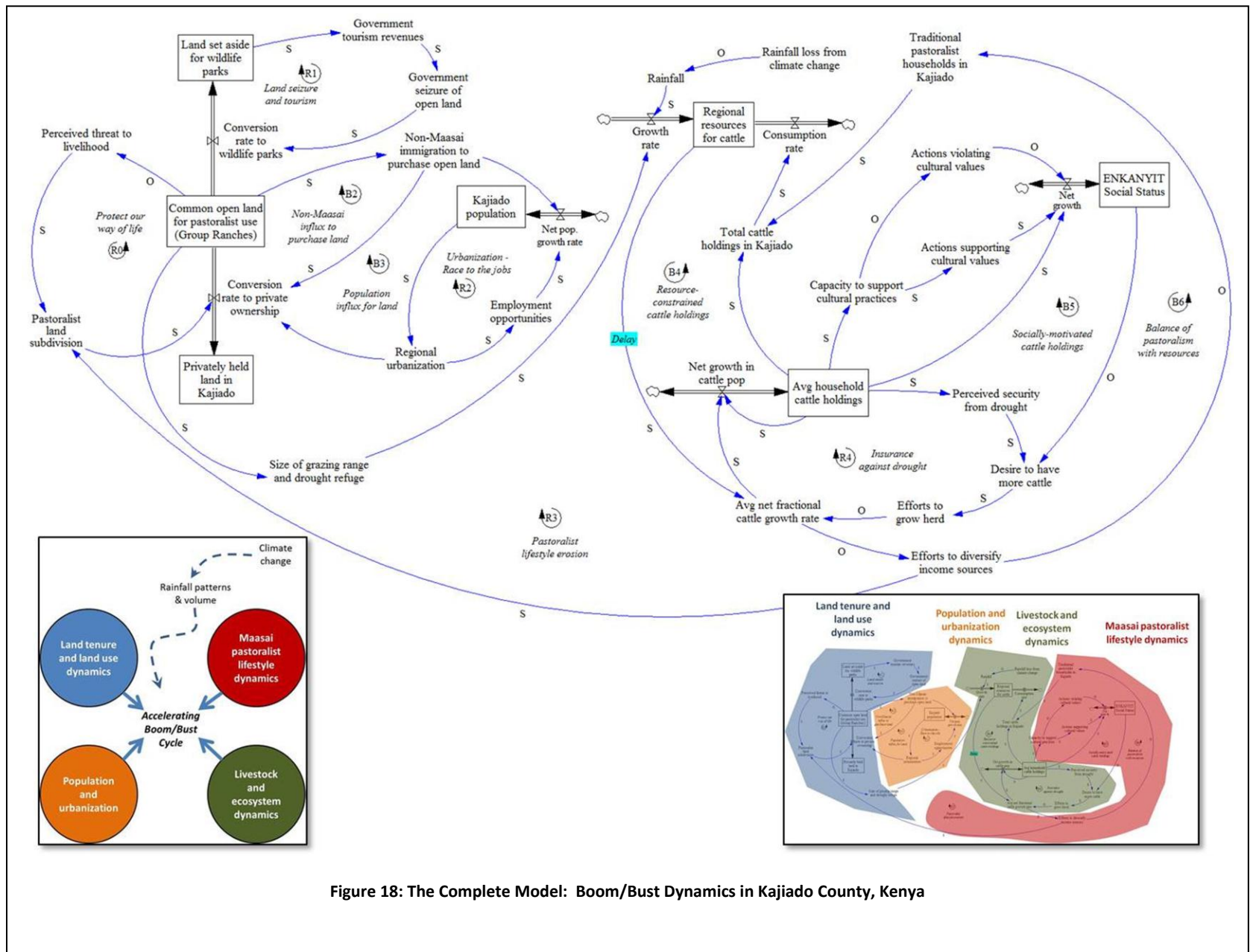
Loops B4 and B5 create the escalation dynamic which when combined with loop R4 can lead to an overshoot and collapse behavior in the collective cattle holdings across the region. However, these dynamics have always been present in Maasai culture. But because of the intensification of land use dynamics the pastoral landscape has lost resilience to sustain this pattern hence the boom/bust (overshoot and collapse) phenomenon seems to be much more prominent and frequent.

In the new version of ERAMAT!, a deck of action cards is used to represent strategic choices players can make to build their enkanyit stock. Each card represents a culturally valid action that can be taken, and each card has a “purchase price” that is paid in order to take the action. These actions represent important cultural practices and impact players’ enkanyit, cattle holdings and financial holdings. Large herds often mean that one has more capacity to support a cultural function. When someone is able to contribute in such ways it is considered an action that supports

the cultural values and therefore increases a player's social status and one gains respect. In ERAMAT! this dynamic is represented in such a way that players who are able maintain a good sized herd and still able to meet their family obligation gains respect points and that increase their *enkanyit* (respect) points.

In summary this dynamic shows that as cattle holdings increase, the capacity to support important cultural practices will also increase, which will lead to more ability to participate in actions supporting cultural values. This in turn increases a player's social status in the society, which means that the dynamic will be the same but moves in opposite direction if one owns a small herd.

Figure 18 represent how the boom/bust drivers interact with the broader system. The inserts show the original four broad sets of dynamics relevant to the boom/bust phenomenon and indicate where those dynamics appear in the full model. In the next chapter, more details about the game itself will further contextualize how *enkanyit* is incorporated into the game.



Chapter Three

Development of ERAMAT! A Culturally-Anchored Board Game Simulator (CABGS)

3.1 Personal Inspiration behind ERAMAT!

My interests that led to the development of ERAMAT!! were inspired by the drought of 2008/2009 where most families from my home region, including my own family, lost up to 95% of their cattle herds. Loss of livestock due to drought related conditions is considered one of the biggest challenges facing pastoralists in East Africa. Pastoralists face a number of challenges that hinder their way of life and stifle their ability to adapt to changes in their external environment (Oxfam, 2008). Taken together, these challenges account for poverty and lack of essential services. This has been the case as far as I can remember from my childhood growing up tending cattle myself. Though the cattle breeds raised by Maasai are very resilient in harsh conditions, the effects of climate change and poor land use practices have created a situation in which their survival, and the survival of the people who depend on them, is in constant jeopardy.

Because of the complexity of the problem, and because of my coursework in both my undergraduate and graduate programs, I wondered if there might be a way to use systems modeling to gain more insights about the problem and understand decision making among the people from my home region. I proposed an idea of creating a computer model about this problem to one of my professors, who later

became the advisor for this thesis. After lengthy discussions about the boom-bust dynamics, we concluded that a board game simulator might be more effective, simply because board game play remains common in Maasai culture. This was the genesis of the idea of a ***culturally-anchored board game simulator***.

3.2 A culturally-anchored board game simulator

We refer to ERAMAT! as a culturally-anchored board game simulator. It is system dynamics simulator of some of the important interactions behind the boom/bust cycle in the study region.

A board game format was used for the following reasons (Mayiani et al, 2013):

1. Target audiences among Maasai pastoralists were largely unfamiliar with computers and with the abstract representations that a computer simulator would use. Hence, a computer-based model or game would not have been credible.
2. The rules that govern the behavior of a computer-based simulator would be “hidden” from the users, thereby creating a “black box” feel to the output, further jeopardizing credibility.
3. A target audience is one of avid game players. Maasai pastoralist lifestyle includes significant periods of time during which games are played by adults and children alike.
4. The cattle management strategies employed by the users emerge out of deeply-held cultural beliefs, as well as the dynamic give-and-take between the environment and the people who live in it. In addition, the collective

actions of the people in the region are of interest, more than the actions of any one individual. Hence, we wanted to create a learning environment that would provoke discussion and self-reflection. A board game provides such an environment.

The word “*eramam*” is derived from a Maasai word “*eramatare*” which stands for management practices. Though the word *eramatare* may refer to the management of a variety of things, including people, livestock, and other resources, in this thesis *eramatare* specifically refers to the practice of livestock management. Hence, the chosen name for the board game ERAMAT! can be loosely translated to mean “Mind Your Cattle”.

ERAMAT! was created to simulate some of the dynamics described in chapter 2, while employing some of the advantages offered by the board game medium. The purpose of ERAMAT! is to promote active dialogue among participating Kenyan Maasai pastoralists, leading to insights about successful and sustainable livestock management strategies in the harsh and challenging semi-arid environments. ERAMAT! provides a culturally-anchored, engaging, and fun learning environment for members of the Maasai community to understand the consequences of their own livestock management practices in the presence of an arid climate, delicate ecosystem, and rapidly changing land use practices in the region. In this way, ERAMAT! is both a problem solving tool for Maasai pastoralists and it is also a teaching tool for non-Maasai players because it embodies an informed definition of

pastoralism and builds understanding of its deep-rooted complexity (Mayiani et al. 2013).

Because cattle management strategies employed by the Maasai pastoralists emerge out of deeply-held cultural beliefs, as well as the dynamic give-and-take between the environment and the people who live in it, ERAMAT!'s design had to be consistent with and evoke those management strategies. It is in this sense that ERAMAT! is **culturally-anchored** – it employs cultural symbols, rules, and scenarios that are consistent with the way of life of the target audience.

ERAMAT! is a **board game**, as opposed to a digital game or a group simulation. This design choice was deliberate. The collective actions of the people in the region are of interest, more than the actions of any one individual. Hence, we wanted to create a learning environment that would provoke discussion and self-reflection (Mayiani et al. 2013). A board game provides an ideal context for such interaction. In addition, board games of different forms are common among the Maasai. *Enkeshei*, a Maasai board game similar to Mankala is one such game (see Figure 19). Hence, we believed that simulating the boom bust dynamics with a board game would capitalize on the cultural position already held



Figure 19: Maasai elders playing Enkeshei. Picture courtesy of Michael L. Deaton.

by this medium. ERAMAT! is played on a game board with accompanying game elements. Players must play in a face-to-face setting and strategize both individually

and together to maintain a healthy cattle herd, provide for their family, and meet their social obligations.

ERAMAT! is a ***simulator*** because it mimics some of the important dynamics associated with Maasai pastoral use of livestock described in chapter 2. ERAMAT! therefore provides a conceptual framework where players can experience how their actions interact with the broader system to feed the boom/bust problem.

3.3 ERAMAT!'s position as an educational game?

A game is defined as any contest or play among adversaries or players operating under constraints or rules for an objective or goal (Coppard and Goodman 1977, p. 4; Gibbs 1974, p. 8; Ellington et al. 1982, p. 9; Livingston and Stoll 1973, p. 1; Seidner 1976, p. 220; Stadskev 1978a, pp. 5-8; Dorn 1989). Games are played as forms of entertainment. They may include games such as: checkers, poker, baseball, video games, etc. While well-designed games can provide player satisfaction, ERAMAT! was designed to also give insight to players about the boom-bust cycles in semi-arid pastoralist communities.

In addition, ERAMAT! is a *game simulator*, in that it incorporates some of the characteristics of both simulators and games (Dorn, 1989; Coppard and Goodman 1977, p. 4; Ellington et al. 1982, p. 12; Goodman 1973, p. 932; Heyman 1975, p. 11; Seidner 1976, p. 221; Stadskev 1978a, p. 8). ERAMAT! incorporates some elements of role playing games where players assume roles of characters and their responsibilities. Dorn (1989), however, distinguishes between role playing games and board game simulators: "In role playing, participants are assigned a role and

receive great latitude in interpretation and action; that is, they are instructed simply to act as they think the person whose role they are playing would act. In simulation games, however, explicit rules govern the actions that the players may or may not take, and usually forbid actions which would be impossible in the real world". In this sense, ERAMAT! is primarily a game simulator, and not a role-playing game.

The use of board games as learning and problem solving tools is not a new phenomenon. There is evidence of the use of board games and war games in Chinese warfare over 500 years ago (Jones, 2005). Board games as learning tools were not widely popular in the modern world until the late 1950's to early 1960's when business games started to surface (Jones, 2005). Even so, academic interest in board games has not fully caught on. The use of simulation games in education has been described as a "mature but rocky marriage" because the "interest in simulation gaming in education, as measured by the number of published articles and books on the topic, has been declining since the peak years of 1971-1975" (Dorn, 2011).

Even so, the use of games as learning tools has great potential, both inside the classroom and out. Games can be used in the college classroom to promote collaborative learning, insights, and social skills, provided that the games involve appropriate structured tasks monitored by instructors (O'Holloran et al, 2010; Rau & Heyl, 1990). The use of computer simulators, role-playing simulations, and board games as educational tools is well understood and documented (O'Halloran and Deale 2007). Scrabble®, the well-known vocabulary game, reached such popularity

in schools that School Scrabble Program was created in 1991, allowing students from across the country to compete against same-age peers (eHow, 2012).

ERAMAT! has also proven to be popular with those who participated in pilot studies. It has demonstrated its potential to provoke discussions among Maasai and non-Maasai players that were informed by deeper understandings of the dynamics simulated by the game. This shows promise in helping Maasai players find ways to mitigate risks from the boom-bust cycles, while also educating non-Maasai players about the very real concerns with respect to pastoralists' livelihoods. By playing ERAMAT!, players can develop and experiment with alternative strategies for maintaining a healthy herd through sound sustainable management practices.

3.4 Design overview of ERAMAT!

ERAMAT! places each player in the role of a pastoralist head of household who must manage the cattle herd and other resources in the face of dynamics created through interactions between the arid climate, family needs, and other social constraints (Coffman et al. 2013). ERAMAT! consists of several elements. These are described in the following sections. The descriptions given here correspond to the game design used in the initial pilot in the summer of 2012. Since that time, significant changes have been incorporated into the game design. These changes are briefly described in the conclusion of the thesis.

3.4.1 How ERAMAT! Addresses the boom/bust dynamics

Figure 20 shows the connection of the stock and flow diagrams explored in chapter 2 with ERAMAT!. The top part of the SFD contains two sections; a highlighted part

which represents the internal system part that was model into ERAMAT! and the top left section which represent the external exogenous section that wasn't modeled into ERAMAT!.

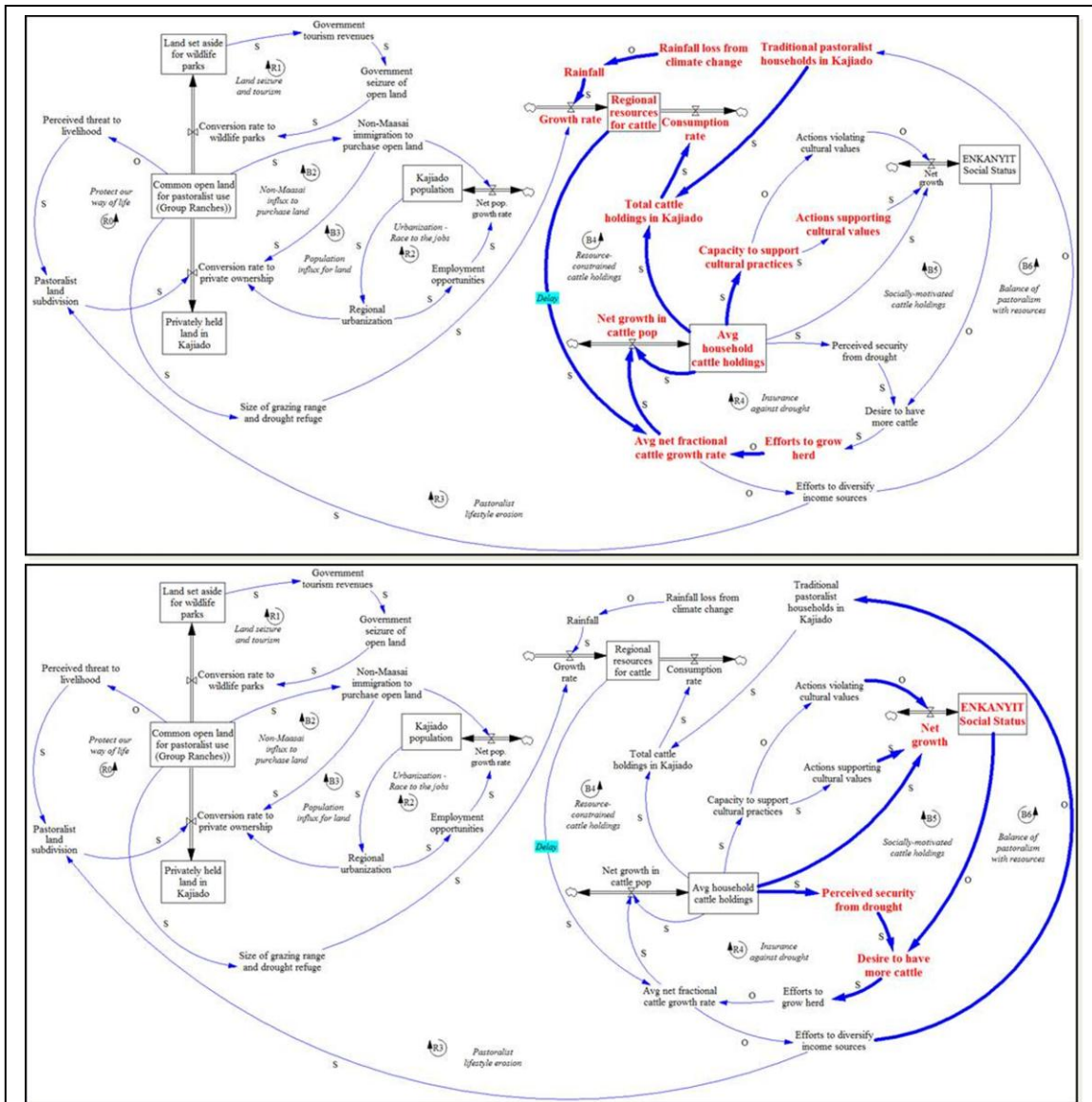


Figure 20: ERAMAT!'s approach to the boom/bust dynamics

The bolded sections in the top diagram identify the INTERNAL DYNAMICS from chapter 2 that are “hard-wired” into the rules of the pilot version of ERAMAT!. The bottom diagram highlights EXTERNAL DYNAMICS that were not “hard-wired” into the game, but were instead implicitly modeled during play as a result of the enkanyit value system on Maasai culture.

Internal game dynamics refer to those dynamics in Figure 20 that are highlighted in the top diagram in Figure 20. These dynamics were hard-wired” into the rules and structure of the game and would be experienced by all players, regardless of their cultural background. These represent the physical realities of the environment in which the Maasai live. These dynamics were modeled in the game as follows (Mayiani et al.2013):

1. The ebb and flow of the cattle holdings were modeled by player-managed herds. This was done through buy/sell decisions, natural reproduction, and by the availability of resources (water). The relationship between water supply and herd mortality was dictated by the rules of the game.
2. A single die was rolled in each wet season provide stochastic rainfall by season. This in turn determined the rate at which the water resources available for cattle were renewed.
3. Actions supporting or violating cultural values (and hence impacting enkanyit status) were modeled through randomly chosen life event cards and social obligations at the beginning of each year (Oladalu season). Each life event card represented a realistic event or scenario that could impact a player’s holdings and social status (lion attack on a player’s herd, a marriage alliance with another player, livestock disease, etc.). One important social obligation was built into the game through a seasonal school fee that had to be paid for each child in the player’s imaginary “family.”

4. The game rules defined a seasonal cattle market through which players could buy or sell cattle at seasonally appropriate prices. Players could also buy/sell/trade cattle with one another.

External game dynamics refer to those dynamics that emerge from the high cultural value that Maasai place on cattle, and the roles played by cattle in the culture. In the pilot version of the game, these dynamics were external to the game rules. That is, these dynamics were only visible and relevant to the game outcomes when Maasai played the game because they introduced the commonly understood enkanyit system that is central to Maasai culture. Because of the subtlety and potential complexity of those dynamics, the team elected to let the players demonstrate how those values impacted their decisions. Hence, these external dynamics were not experienced by non-Maasai players – including U.S. students who played the game. Later versions of the game have more explicitly incorporated those dynamics into the game rules with clear explanations so that non-Maasai players can easily adopt these practices in the game.

3.4.2 The ERAMAT! game board

The board displays four seasons (two rainy seasons and two dry seasons) consisting of a full year during which pastoralists experience a dynamic boom-bust cycle where “drought, livestock loss, and hunger” become very real factors for Maasai pastoralists (see Figure 21). Among the southern Maasai of Kajiado, these seasons correspond with the regular months of the year as follows:

- i. *Oladalu* (short dry season January - March),

- ii. *Nkokua* (long/heavy rain season April-May),
- iii. *Olameyu* (long drought seasons June - September)
- iv. *Ilkisirat* or *Oltumuren* (short rain season October - December).

At the beginning of each season, every player pays school fees for every child in his or her family, buys and sells cattle, and draws water from the water reserves. If insufficient water reserves are available, then dice are rolled by each player (according to the extent of water shortage and the size of each player's herd) to determine the cattle mortality.

In addition, during the two wet seasons, a single roll of a six-sided die determines the rainfall for that season for all the players.

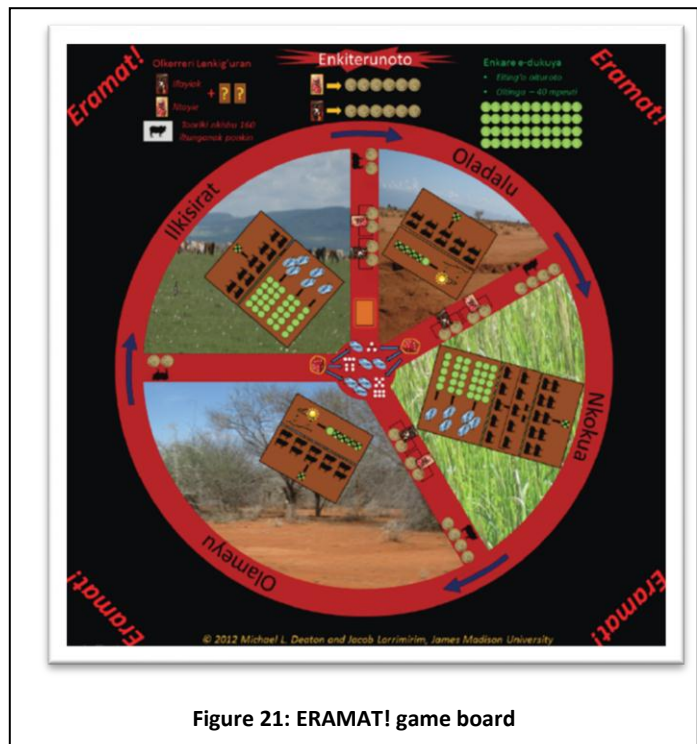


Figure 21: ERAMAT! game board

This in turn determines the amount of water that is added to the water reserves. Finally, during the Nkokua calving season, each player's herd grows according to a 40% reproduction rate (Teel, 2012). Game play can run through several annual cycles.

By cycling through the yearly seasons in this way, the game mimics the ecological dynamics and consequences of human/environment interactions that are observed

by pastoralists – and it does this on an accelerated time scale. Hence, the game provides opportunities for players to quickly see the consequences of their actions, to explore alternative strategies, and to engage in meaningful problem-solving conversations. These behaviors were observed during the pilot studies. Every session of the game resulted in at least one or more droughts, leading to a total collapse of the collective cattle holdings of all players. Players quickly began to think about what would happen in the next season and what happened in the previous season with respect to water resources and cattle herd size. Some players used these insights to their advantage by acting accordingly in the market in preparation for the next season. Other players, however, persisted in a short-term view, aggressively increasing their herds after a drought and selling cattle only if necessary to pay school fees.

3.4.2 Life Event Cards and Cattle Cards

The game includes a variety of cards representing different cultural aspects that play into Maasai pastoralist decision-making. A *life event card* is drawn by each player at the beginning of every year from a shuffled deck. Illustrations on each card represent a different scenario common to Maasai culture. Some impose a loss of cattle (predation, disease, marriage bridewealth costs, etc.), impose a financial cost (to pay for their children to go to the university, fix a broken borehole pump, etc), increased income, cattle holdings, or alliances to mitigate against drought risk (university card, special cattle market card, marriage alliance card), or larger family

obligations (birth of a child). See Figure 22 for the pictures and descriptions of the life event cards.

Cattle cards were used to represent the cattle holdings of each player. These were provided in denominations of 1, 5, 10, and 20 cattle per card (represented by the corresponding number of pictures of cows on the card). The denominations differed in color to distinguish the number on each card (see Figure 22). Cattle reproduce during the Nkokua season. A player's herd can increase through reproduction, through marriage (receipt of cattle for bridewealth), or through a cattle market. A player can lose cattle through mortality from drought, payment of bridewealth, selling of cattle in the market, predation, disease, or other life events. The need to maintain a healthy herd places pressures on each player and necessitates decisions at the market, the formation of alliances with other players, and managing risk based on the players predictions about the upcoming season.


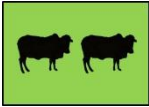
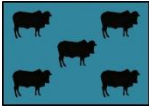
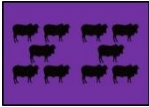
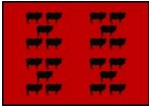
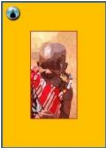
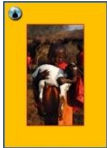
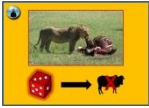
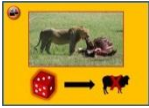
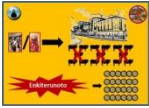










				
Cattle card: 1 cow	Cattle card: 2 cows	Cattle card: 5 cows	Cattle card: 10 cows	Cattle card: 20 cows
				
Life event card: birth of a daughter	Life event card: birth of a son	Life event card: Lion attack on a single player's herd	Life event card: Lion attack on all players' herds	Life event card: Send a son or daughter to college at a cost of 15 cows; gain additional income as a result
				
Life event card: Daughter marries; form marriage alliance and receive six cows bridewealth from groom's family	Life event card: Son marries; form marriage alliance and pay six cows bridewealth to bride's family	Market card – player to buy cattle at a reduced price from the market.	Market card – All players to buy cattle at a reduced price from the market.	Gift card: The player rolls one die to determine the number of cattle that will be gifted. Spreading risks
				
Ceremonial card: A visitor has come to the household or a ceremony is underway and one cow will be slaughtered in honor of the event.	Disease card: Disease has plagued the herd and the player must roll one die to determine how many cattle will be lost to its effects	Broken borehole card: Communally, all players must pay to have it maintained. Each player has the option to either pay by two coins or by one cow.	Hospital card: Illness has occurred within the player's household. The player has the choice to either give up one cow or two coins to the banker of the game.	Tourism card: The player has taken up another type of income and receives 24 extra coins annually (every round)

Figure 22: ERAMAT! Cattle and Life Event Cards, original version piloted in summer 2012 (alterations to cards have since been made)

3.4.3 Coins: Money and income

In the 2012 pilot studies of ERAMAT!, gold plastic coins (see Figure 23) were used to represent money and stand for values linked to the Kenyan currency (Kenyan shillings). Each individual used these coins to pay for various needs to meet family demands, including school fees and payment of consequences represented by life event cards. At the beginning of the game, each player received 23 coins (6 coins for every child). Each coin represented 5,000 Kenyan shillings (KSH). Therefore the 24 coins each player received at the beginning of the game meant a starting value of KSH 120,000 (roughly 1400-1500



Figure 23: Plastic coins used in the 2012 pilot study

USD at the time of the study). Coins were also exchanged in bargaining among players or with the banker at the cattle market. During gameplay, we observed different definitions of wealth across players based on their own value systems and how those personal values interconnected with larger cultural values. During play, participants had to determine whether to protect against or capitalize on life events with either cattle or currency. Ultimately, these decisions defined what players considered to be “wealth”—having a larger herd or having more money, although it was difficult in this particular version to accumulate money without cattle holdings. For example, one player drew a life card providing a form of income and beyond that available from the pastoral livelihood (tourism). He subsequently chose to use the extra income to build up his herd. However, another player with six children was required to pay school fees every season and thus repeatedly had to sell his cattle to obtain sufficient funds to make the school fee payments.

Some of these events resulted from strategic planning, and others from chance – much like life indeed. More of these game play dynamics are discussed in detail in the next chapter.

3.4.3 Water and food resources

The resources supporting cattle consist of the available water (both surface and ground water), and the amount of forage, which itself is highly dependent on water levels. ERAMAT!! Uses water as an aggregated surrogate for both of these resources (Mayiani et al. 2013). Drought-related cattle mortality in the region is primarily caused by a lack of adequate forage for all the wildlife and cattle. The amount of forage is directly tied to the rainfall. Moreover, the resilience of the foraging plants is so great as to provide an almost immediate increase in forage whenever the rains come. Hence, using water as a surrogate for both the water and forage resources in the area is reasonable. As the cattle herd grows, the demands on the water will increase (as does the demand on forage). In addition, low rains will result in low water reserves and low forage density, possibly leading to starvation. Hence, by using water only and by tying the water reserves to the rainfall and consumption by cattle, the game mimics the ebb and flow of cattle survival.

Water, represented in ERAMAT! by green plastic chips (see Figure 24), was stored as ground water and surface stocks managed by the facilitator. Water is given and/or



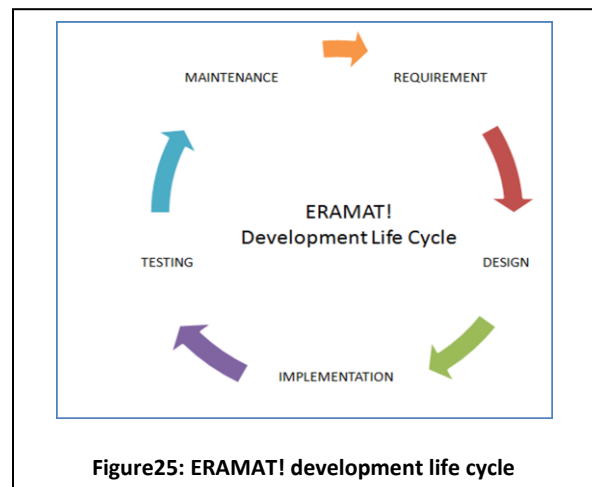
Figure 24: Water chips and corresponding clouds

taken throughout the seasons according to cattle holdings of each player. During drought, water reserves may be fully exhausted (if the cattle herds are too large). If this happens,

cattle are lost through dice rolls, a process described later. During the rainy seasons, water is replenished. Dice are rolled by one player in each wet season to determine the amount of rain for all the players (and hence the amount of water added to the surface and ground water stocks). When selecting a player to roll the dice, it was observed that sometimes the player considered to have the most “visible” wealth was chosen. Other times, the roller was chosen at random or a player whom others consider “lucky” in real life was selected. This seems to suggest an element of trust and application to connecting ideals found in the real world being represented in the game through player interaction.

3.5 Development Process of ERAMAT! (A Board Game Simulator)

The development of the ERAMAT! board game simulator followed the life cycle or waterfall model, primarily associated with software development (see Figure 25). Throughout the rest of this section, the steps in this cycle are described in the context of the ERAMAT! project. Dr. Deaton and I served as the development team, though we drew on the



expertise and experiences of other Maasai, and from JMU faculty members Dr. Wayne Teel and Dr. Jennifer Coffman. During the summer pilot, Dr. Coffman’s Kenya Field School students were also involved in playing and testing the game.

I served as the cultural bridge between the Maasai culture and Dr. Deaton. Dr. Coffman also provided cultural context, histories of socio-cultural change (livelihood, age, gender, etc.),

and a needed additional perspective on the ways in which self-identifying Maasai continue to seek economic diversification and rethink “family planning.” I provided cultural expertise and identified the important dynamics and forces that the game should account for. I also developed the initial causal structure and identified some of the important feedback dynamics that were eventually incorporated into the game. Dr. Deaton translated the cultural elements and dynamics into design concepts for the game. I was also the primary facilitator of the initial gaming sessions held in Maasai compounds in late May through early June, 2012. Together Dr. Deaton and I, and the Kenya Field School leaders, staff, and students tested the design in a variety of ways (described below).

3.5.1 Requirement Phase – What ERAMAT! must do

Following Mayiani et al (2013), an important question to be answered in this project was whether a CABGS such as ERAMAT! had potential as a problem solving and learning tool with the target audience of Maasai pastoralists. This means that the game had to accomplish the following:

1. Provide a credible depiction of the relevant lifestyle, cultural values, physical environmental constraints, and decision-making options that pastoralists experience.
2. Adequately mimic the actual dynamics of the year-in and year-out ebbs and flows of cattle holdings in the region. These dynamics are described in chapter 2.
3. Provoke meaningful discussion about the role of human decision-making in the boom/bust cycles in the region.

In addition to the above criteria, those of us who have worked to develop and improve this game believed that ERAMAT! had potential as an educational tool to help American students learn about another culture and the difficult dilemmas faced by people in that culture. Hence, we also sought to determine if ERAMAT! could:

4. Provide a useful platform for educating American students about Maasai culture and pastoralism more generally.

3.5.2 Design Phase

Though ERAMAT! was developed at a location far from its target audience, we were fortunate to have access to several Maasai from the study region (including the author) who were currently living in or near Harrisonburg to attend school who are familiar with the problem that we wanted to address¹. This afforded us with individuals who could help us identify the cultural elements of the game and with whom we could test the game design for its validity and cultural authenticity.

Our first design (proposed by Dr. Deaton) was a linear rectangular board (Figure 25). This was eventually modified because our Maasai “focus group” asked, “What do you do when you get to the end of the year?” They pointed out that a circular layout made much more sense and were more consistent with how people in the target audience would envision the flow of time. We changed the board to a circular layout which now shows the connection of seasons from the beginning to the end. In addition, the original layout used blue to represent the wet seasons and red/orange/yellow to represent the dry seasons. This was

¹ Jacob Mayiani (from Kajiado), Dennis Sonkoi (from Narok), and Steven Kiruswa (from Loonkiito northern Tanzania, just south of Kajiado)

confusing to the Maasai who viewed the design. They explained that the wet season is associated with the color green (the time of dense forage for cattle), and the dry seasons are associated with the color brown (the time when the forage is sparse and the ground is bare). Changes were made accordingly to accommodate these ideas. Figure 26 below shows the original and final versions of the game board for comparison.



Figure26: The original prototype (left) and the game board used in 2012 pilot studies (right)

In addition to the changes to the game board design, the concept of the life event cards, the role of children, the pricing structure of the cattle market, and the kinds of decisions that players should make were all the results of interactions with our Maasai focus group.

3.5.2 Implementation

Figure 27 shows the game with all the playing pieces, as it was implemented during the summer 2012 pilot studies. Visible in the figure are the surface water reservoir (JMU cup), money, cattle cards, life event cards, playing board, and dice for determining rain and cattle mortality.



Figure27: ERAMAT! game, as implemented in the summer 2012 pilot studies.
Picture courtesy of Alexandra Hickling

3.5.3 Testing

Testing can be thought of as the process of performing a series of experiments with the new game to see how it works. The goal of conducting experiments is not just to find out how well a particular system operates, but also to gain insights to understand how to improve the systems' performance (Harrell et al. 1995). Hence, several gaming sessions were held with various groups as part of the testing process to identify issues before the game was taken to Kenya for piloting. Test gaming sessions were held with JMU faculty members, JMU students, and members of Maasai community in the Harrisonburg area. The game was also tested with families and friends around Harrisonburg. These early gaming



Figure28: ERAMAT! testing sessions prior to the pilot study

sessions provided us with invaluable feedback and comments that led to numerous, significant improvements to the initial design. With the American players, the input helped us identify elements of the design that opened doors for players to exploit the game and find an easy way to overcome what is in real life an exceedingly complex problem. With the Maasai players, their input led to changes that helped assure cultural authenticity to how the game progressed. All of this input helped us fine tune the game before it was piloted the following summer in Kenya. Figure 28 below gives pictures from some of the initial testing phase.

The initial pilot gaming sessions helped us greatly improve ERAMAT!'s *face validity*, meaning that while the earlier version did adequately represent the system and problem that it was intended to mimic, the subsequent alterations improved it significantly (Harrell et al. 1995).

Chapter Four

Pilot Study Results

4.1 Description of the Pilot

In 2012, a culturally anchored board game simulator (CABGS) was piloted with members of multiple Maasai communities in southern Kenya to explore the accelerating boom-bust drought and hunger cycle in the region. The pilot study was undertaken in two areas across Kajiado County's Maasailand (Refer to Chapter Figure 1). Maasai players from three villages in Lenkischem area (Lormomgi, Olepolos and Enchilishili) among the Ilkisonko Maasai and in two sites (Oltepesi and Melepo) in the Loodokilani location participated in six different gaming sessions. The gaming sessions that took place at Melepo (at Sirata Suruwa Camp, run by Mike and Judy Rainy) included players from Lldamat, Loodokilani, Samburu, as well as US students. All gaming sessions followed a protocol approved by JMU's Internal Review Board. A copy of the approved protocol is provided in the Appendix. During the sessions, both qualitative and quantitative data were collected by myself, Dr. Deaton, Dr. Coffman and students in the Kenya Field School. The data collection was somewhat informal, given the pilot nature of the study. However, we were careful to collect information to evaluate:

1. Players' reactions to the cultural validity of the game
2. Whether the game mimicked the kind of boom/bust dynamics that had been observed in the region

3. The extent to which the game evoked substantive problem-solving discussions among the players.

In accordance with the IRB protocol, all participants were given the opportunity to opt-out of the session and to sign an informed consent form. If participants were not literate, then verbal assent was accepted. Pictures and videos were also collected during most sessions.

The results of the pilot study are reported in this chapter. An important question to be answered in this project was whether a CABGS such as ERAMAT! had potential as a problem solving and learning tool with the target audience of Maasai pastoralists. As mentioned earlier, this means that the CABGS had to accomplish the following (Mayiani et al., 2013):

1. Provide a credible depiction of the relevant lifestyle, cultural values, physical environmental constraints, and decision-making options that pastoralists experience.
2. Adequately mimic the actual dynamics of the year-in and year-out ebbs and flows of cattle holdings in the region.
3. Provoke meaningful discussion about the role of human decision-making in the boom-bust cycles in the region.

In addition to the above criteria, the authors believed that ERAMAT! had potential as an educational tool to help American students learn about another culture and the difficult dilemmas faced by people in that culture. Hence, we also sought to determine if ERAMAT! could:

4. Provide a useful platform for educating American students about Maasai culture.

The pilot study provided the field experience through which we could evaluate ERAMAT! against these criteria. In the first few weeks of the study, ERAMAT! gaming sessions were held with approximately 60 different Maasai adults, each of whom had his own livestock holdings, from eight different homesteads or villages. The sessions were facilitated in the Maasai language by the author of this thesis. Each session lasted 1-3 hours, including one session played outdoors while we used flashlights until midnight. Sessions ended with some extended discussions in which feedback about the game was solicited from the participants and in which the implications of the game for cattle management practices were discussed (Mayiani et al., 2013).

ERAMAT's rules, symbols and language attuned to Maasai core values and pastoral praxis allowed players to engage in conversations about past experiences and outcomes, as well as explore alternative strategies for livestock and livelihood survival. Some players, who thought they had well-planned strategies for the year, were caught off guard by life cards that would require them to manage losses and reevaluate their plans for the next season. Given their conversations about these moments during game playing, it was clear to the observers that the depiction of Maasai cultural values and lifestyle in the game was relevant and meaningful to the players.

After several sessions of playing at Lenkischem, we often heard players interact among themselves expressing their feelings about the game and how they lost cattle due to drought. Feedback from Maasai participants about the game included comments such as, “Whoever made this game really understands our lives” (Anonymous elder, in Lenkischem, 2012). Further, many players used the gaming milieu to discuss real-life strategies. As one elder said, “This feels real. What should we do?” We turned the question back to them and pointed out that there are probably many different solutions, and that the game was designed to help them explore different ways of managing their cattle without the risk of losing real-life cattle and jeopardizing the well-being of their families.

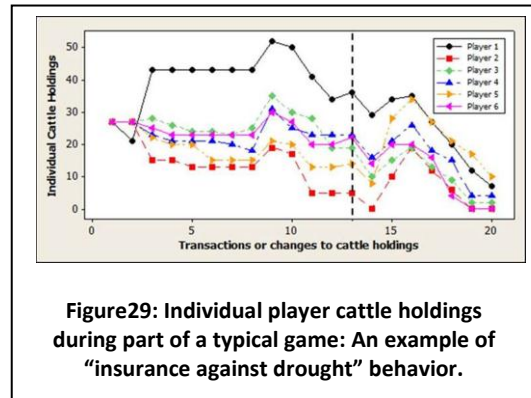
Another elder stated, “I need to play this game over and over to learn” (Anonymous elder, in Lenkischem, 2012). Part of the game’s success was that players built on the cultural content of the game to make it still more meaningful and relevant to their own experiences. For example, several Maasai players projected their own aesthetic ideals onto their otherwise generic cattle (represented via cards), courted other players for strategic alliances through marriage exchanges of offspring, and launched into historical and aspirational conversations about their herds.

4.2 Summary of Results

4.2.1 Gaming sessions with exclusively Maasai participants – Lenkischem area

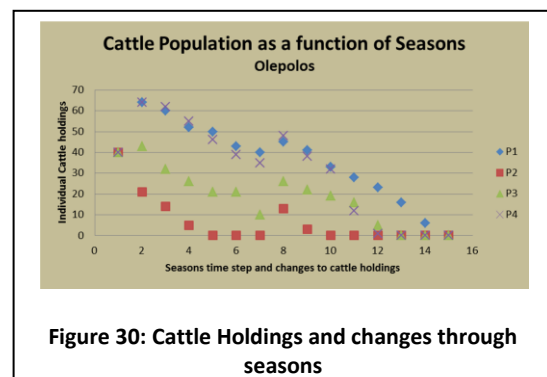
The following scatter plot and graphs reveal the outcome of few selected game sessions during the pilot study at Lenkischem in Kajiado south.

Game #1 in Figure 29 was inadvertently started with a total number of cattle that exceeded the carrying capacity of the system. Each time-step on the graph represents a round of transactions affecting cattle holdings (several transactions per



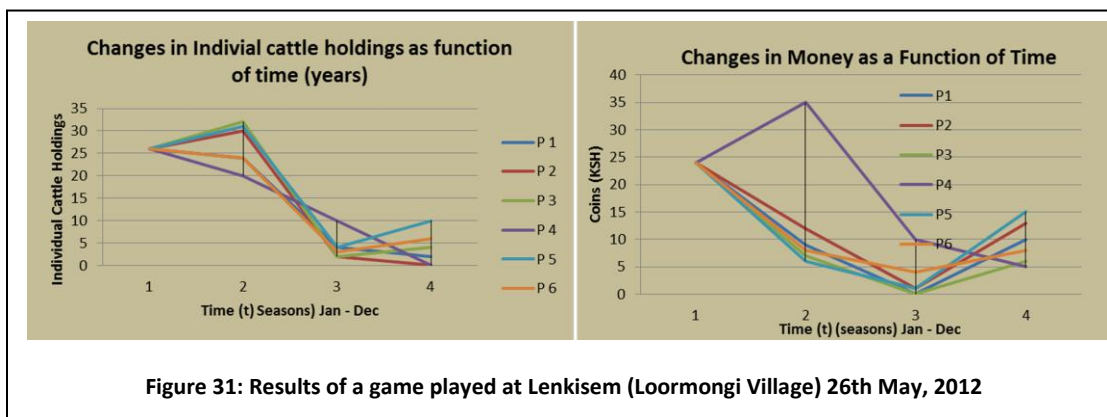
season). The vertical dashed line indicates the beginning of a drought (low rain). Prior to this, one player had aggressively built up his herd, hence depleting the water supply and resulting in a decline of the overall cattle holdings. At the dashed line, a low rainfall was realized, and yet players continued to expand their cattle holdings to recoup cattle losses and, as one player explained, “insure against the drought” (Mayiani et al. 2013).

Game #2 in Figure 30, all players started with a herd of 40 each, and the populations appear to have gradually declined to zero by the 4th round. Player 2 started losing his herd very early, while others, such as player 1, accumulated their herds but eventually all players’ holdings crashed. In this first version of CABGS, the major



constraint was water (absence of water meant absence of resources as well) and that marked the beginning of cattle dying. Water is indeed a major limiting factor in this semi-arid ecosystem. In the new version, though cattle still die once they run out of resources, there are other critical events and actions that affect individual

cattle holdings and all of them have a direct impact on an individual's status through respect (Enkanyit points), which ultimately determines the winner.



Game #3 in Figure 31 represents changes in both individual's cattle holdings and in the amount of money held by players (Kenya shillings) over a 1 year time cycle in the game (four seasons). *P1 through P6* represents the number of players. All players began playing with a herd of 26 cattle. These results in Figure 9 are based on one game, hence players are the same for the two graphs. An examination of all players' cattle and cash holdings reveals an interesting behavior, particularly in player 4. Changes in the *individual cattle holdings graph* reveals that all players except player 4 and player 6 appear to have immediately increased their herds, and it did not take long before they all crashed after running out of water (and thus food resources). This highlights the dynamics associated with pastoralists' quests for large herds, while often ignoring the reality that there is only so much to share. The next graph (b) represents the changes in the amount of money (24 coins) with which each player started. The graph provides a counterintuitive pattern, as most

players spent their money (e.g., in the market by buying cattle), except player 4 whose cash holdings were nearly as large as all other players combined. Player 4 was a relatively young man who did not view cattle the same way other elderly players did. He appears to have quickly sold his cattle and by the end of the second season, his herd was nearly completely gone due to selling or drought.

This illustrates the impact of liquidating most or his entire cattle herd in anticipation of drought. It is worth mentioning that P4 was a young player in his early twenties playing with elders mostly over fifty years of age. This dynamic will unlikely appear in the second piloting this summer as players will be penalized for not having enough cattle to feed their families; we have instituted a two cattle per family member minimum requirement, and if a player does not meet the minimum standard, then she or he must pay a cash “penalty” to represent a cash outlay that would be required to feed and clothe family members. There are even more severe penalties for over stocking herds.

Based on these playing sessions from Lenkischem, two things were very clear. First, ERAMAT! proved to be both an engaging and a fun game that made players feel as if they were trying to figure out a puzzle, meaning it provided players with opportunities to think strategically before they made a move in order to avoid losses due to drought, hence confirming the system validity of the game. Secondly, the comments and dialogue that ERAMAT! elicited, with players stating that the game really mimics their day to day life, support the game’s cultural validity and the potential to promote meaningful discussions.

4.2.2 Gaming sessions with U.S. students –Melepo Hills area

The Melepo Hills' games demonstrated the role of using alliances to protect against the uncertainties associated with weather, the cattle market, and life events. Even though the formation of alliances was not explicitly designed into the game, we observed that Maasai players actively sought such alliances, either through marriage or through informal agreements to help one another in times of hardship (an important practice in Maasai culture). The second version of the game which will be used in the summer of 2013 has explicitly provided strategic options for players to mitigate risks through alliances, income diversification, and other means.

We also observed Maasai players added cultural elements to the game by attaching aesthetic values to otherwise identical cattle cards. In some instances, players would remark on the physical beauty of a given cow in hopes of gaining a higher selling price when bargaining with other players. Examples of aesthetic characteristics placed on cattle but not represented in the game design, were related to age, sex, milk productivity, health, pregnancy status, and personality traits. This corresponds to the sentimental ties Maasai have with their cattle and also provided evidence that the game struck a "cultural chord" among the players. In one game, a player refused to sell one of her cattle because of her attachment to it, holding it until the end of the game.

American students participating in JMU's 2012 Kenya Field School also played the game, sometimes only with other Americans, and other times with a mix of Americans and Kenyans. The US students employed a set of values regarding cattle

ownership in which cattle were viewed as a more liquid asset that could be readily exchanged for money. As an experiment, and in order to counter the tendency of US students to quickly liquidate their herds, we tried playing games in which the winner was the player with the largest herd at the end of the game. This incentivizes players to build large herds (a common practice in the region), but also creates negative consequences if the total herd size across all players exceeded the carrying capacity of the system – resulting in an eventual collapse during a drought period. This approach compensated for the different values that US students brought to the game and who placed more importance on money than on livestock holdings – a value that ignores the social status role that cattle play in the Maasai culture. Meanwhile, the US students who played the game were overall less sentimental about livestock but would gladly enter into alliances with Maasai players, though more because the students were flattered by the invitation than because of specific proactive strategizing (Coffman et al. 2013).

4.2.3 How the game worked well

The pilot studies were overall very successful. The game was enthusiastically received and played by the original target audience of Maasai pastoralists and a secondary target audience of non-Maasai students. In addition, the game exhibited the same kind of rapid boom/bust behavior in cattle holdings that have plagued this region in recent decades. Sometimes the (randomly determined) rains were high, creating an environment for “health and wealth” for all the players, including increasingly larger cattle herds. However, if the game was played long enough, the

rains would eventually fail and the large cattle herds would rapidly deplete the water (and hence food) resources. This led to catastrophic cattle loss and animated discussions by the participants.

Because of the games cultural and systems authenticity, the players often engaged in lengthy, sometimes animated and even heated dialog about how to avoid such devastating losses. In many places, our team was asked to return the next day so that the player could experiment with different strategies for when to buy and when to liquidate their cattle. Players also talked openly about their attachment to their cattle, and how that attachment might be a factor in their tendency to overstock their herds beyond what the system could sustain.

4.2.4 Room for improvement: A need to “hard-wire” Maasai cultural values into the game

Based on the observations from the pilot study with U.S. students in JMU’s 2012 Kenya Field School, it was evident that the U.S. students were quick to liquidate their herds if it appeared that drought conditions were developing. While overall this did not overcome the boom-bust cycles, it did illustrate to us how the game changes character in fundamental ways when the players operate under a different set of values than were in mind when we developed the game. Moreover, this would minimize the value of the game as an educational tool for non-Maasai players. In short, there was little incentive for a non-Maasai player to maintain a herd of any size.

We observed that the game piloted in 2012 offered little opportunity for players to make strategic choices in order to hedge against drought risk or other hardships common to life in the region. The game also minimized the social and ecological role of children. In the initial pilot, children were primarily a source of income providing 6 coins per child per year (approximately Ksh 30,000) and also a cost (through school fees paid three times/year). The ecological cost of having children (because large families require more resources to survive) was not yet accounted for in the original design. Hence, the pilot identified several elements that were either missing from the game or that, if present, did not adequately represent reality. Hence several improvements were identified. These are discussed in the last chapter.

Chapter Five

Conclusion and Future Recommendations

5.1 Conclusions

This study explored and modeled the complex nature of pastoral livelihoods through internal and external drivers of boom/bust dynamics associated with Maasai cattle holdings. A Culturally-Anchored Board Game Simulator (CABGS) called ERAMAT! was created to help Maasai pastoralists understand and experience in “fast-forward time” the dynamics behind the recurrent boom-bust cycle of drought in that region and at the same time uncovering ways by which their actions contributes to the boom/bust problem. The goal is to provide a learning environment whereby Maasai pastoralists could gain a deeper understanding of these dynamics and thereby form more effective strategies for reducing the impact of these inevitable periods of drought and low rainfall.

ERAMAT! proved to be an enjoyable, portable board game that provided insights and self-awareness about decision-making in the presence of complex dynamics. This enabled Maasai pastoralist players to consider new strategies in an attempt to avoid the boom/bust problem. Overall, the ERAMAT! pilot study demonstrated that the concept of a culturally-anchored game board simulator has significant potential and viability to empower people in developing nations to tackle and address problems like those addressed in this thesis.

ERAMAT! has also allowed non-Maasai players to “virtually immerse” themselves in another culture’s experiences. Though it was difficult in the beginning for the US

students to comprehend some of the cultural dynamics incorporated in the game, they were able to quickly learn and understand ERAMAT!'s cultural validity and the role it played in provoking meaningful discussions among the players. ERAMAT! illustrated the potential of CABGS's as exceptional learning tools for understanding the complexity and challenges of pastoral livelihoods in harsh environments.

5.1.1 ERAMAT! Improvements

The piloting phase allowed the ERAMAT! team² to identify strengths and weaknesses of the game. Changes have been incorporated in the newest iteration of ERAMAT! and are set to be piloted during JMU's Kenya Field School in May – July 2013.

During the initial pilot study, we realized that US students did not play and make decisions under the same social constraints as Maasai players – the very constraints that were so important to the dynamics of the boom/bust phenomenon. The new edition of ERAMAT! explicitly “hard wires” the social status (*enkanyit*) dynamics into the game (see Figure 32) by incorporating *enkanyit score* for each player that can increase or decrease over time, based on strategic choices by players and by their capacity to fulfill cultural obligations, as well as respond to other events that occur during the game. In so doing, the game will serve not only as a useful for Maasai players but also as an educational tool for non-Maasai players. The *enkanyit score* is also used to determine the winner as the player with the highest amount of score at the end of the game. The revised version has already been played at JMU

² Jacob Loorimir Mayiani, Dr. Michael L Deaton, Dr. Jennifer Coffman, Alexandra Hickling

and at a community restaurant, and, after a few more tweaks, will be played in Kenya in the same communities that participated in 2012, as well as some new locales.

In addition to the introduction of enkanyit points, the newest ERAMAT! version employs both *life event cards* and *action cards*. The life event cards play the same role as in the first game: they represent chance events that affect a player's family, as well as his or her livestock and money holdings. Life event cards will be drawn randomly by players twice per year – once during each dry season (as opposed to drawing them once/year in the initial pilot). Eight action cards are always visible and can be purchased by players at any time during their turns, but only one card be purchased per player per turn. These cards allow players to make strategic choices

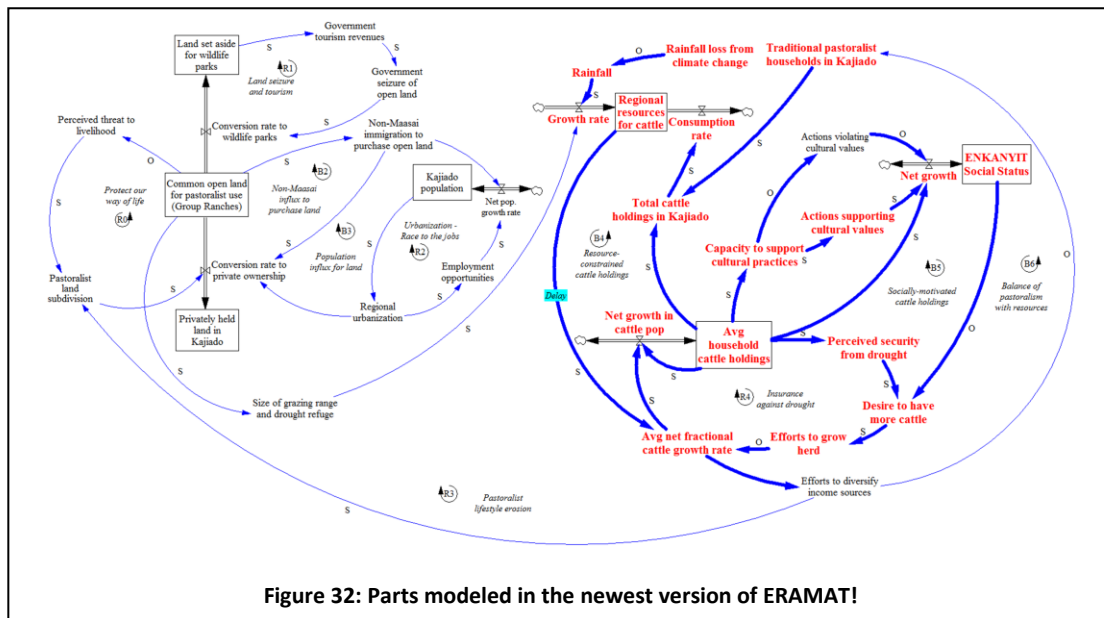


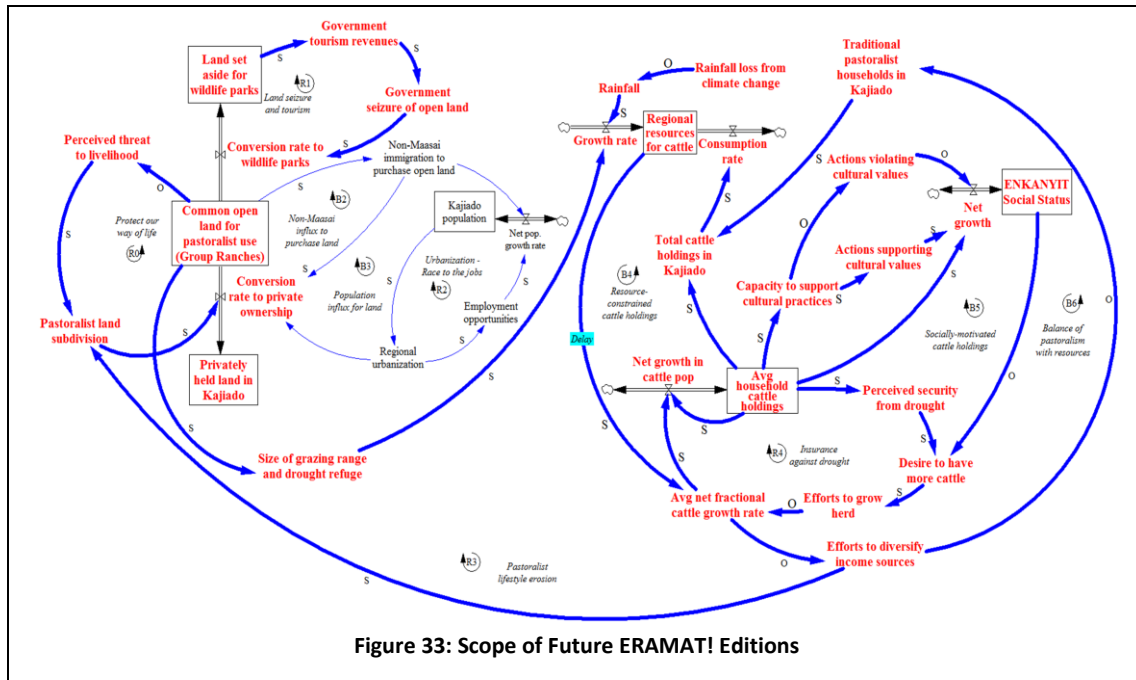
Figure 32: Parts modeled in the newest version of ERAMAT!

as to how they will seek to provide for their families and build *enkanyit* (respect) in the community. Each card represents a culturally legitimate action, and the number

of *enkanyit* points was assigned to each action in a way to represent the relative weights of those actions in Maasai culture.

The newest version of the game more explicitly mimics the benefits and consequences of having a large family. Children are a source of *enkanyit* and also income (as they can help care for livestock). However, large families require more resources (cattle and cash expenditures) to support them, and thereby impose greater stress on the ecosystem.

Finally, the game was modified to include incentives for forming alliances through marriage (a common and pragmatic practice). Families united by marriage can offer mutual support to one another during hard times. In addition, game rules indicate that resources can be loaned within an alliance without incurring a corresponding loss of *enkanyit*, although loans do have to be repaid. Future iterations for ERAMAT! will involve the inclusion of the external dynamics that are not currently represented, as shown in Figure 32. For example, the game could be modified to include some of the dynamics associated with land use, land tenure and population growth by including life event cards that remove land from the grazing range because of government land conservation or urban growth, thereby reducing the resources available. More actions cards could be introduced that incorporate more options for income diversification, and that also could reduce grazing range as players opt to purchase land. See Figure 33 to see the potential scope future editions of ERAMAT!



5.1.2 Future Work for CABGS

Little has been done in the area of systems thinking to help East African pastoralist communities address the complex problem that they now face. . The interactions between the people in these communities, their cultural values, their livestock practices, and the political and natural environment in which they live necessitate the kind of holistic analysis and problem solving that a systems approach can provide. The challenge, then, is how to make these concepts accessible and credible to these communities.

The cultural validity and initial success of using CABGS such as ERAMAT! for exploring the boom/bust drivers that are associated with livestock mortality in Kajiado County, Kenya, suggest one approach that is easily replicated and can be rapidly deployed at minimal cost. It is my long-term dream that governments, research agencies and non-profit organization working in ASALs of Kenya and

elsewhere in the horn of Africa provide strategic support and spearhead the development of culturally anchored board games like ERAMAT! to aid in development efforts and issues affecting pastoralist.

5.2 Recommendations for tackling the Boom/Bust Cycle

The following recommendations are offered from macro-level perspectives of how boom/bust drivers described in Chapter 2 can be addressed. Macro-level boom-bust drivers are those over which pastoralists have little or no control, while micro-level drivers refer to actions/behaviors that pastoralist themselves do and exacerbate or reduce the boom-bust problem.

5.2.1 Climate Change

Studies in the region suggest that drought is the most common hazard encountered by pastoralist living in ASALs of Kenya. Because of this, climate change for instance will always be a challenge as the global rise in temperatures is expected to increase. Low, unpredictable, scattered and variable rainfall from one season to the next and one year to the next is the defining feature of the dry lands of East Africa (Hesse and MacGregor 2006). These pressures have placed Maasai pastoralists at a cross roads between changing traditional practices and adapting to the socio-economic changes, or failing to adapt and hence trying to survive in an increasingly fragile environment. Rainfall in pastoral areas represents the single most important factor determining the quantity and quality of natural pastures and water on which the majority of livestock in pastoral and agro-pastoral systems depend for their survival ((Hesse and MacGregor 2006) et al. 2006). Due to these realities, pastoralists must

adopt the best way possible, and this means they must explore other ways of doing things in order to avoid the boom/bust problem. Change must be accepted in a way that would not compromise the livelihoods of people and the land's ability to provide food resources for both pastoralists and livestock. This reality is well represented in ERAMAT!, where loss of water due to evapo-transpiration and livestock over population repeatedly set the stage for a catastrophic crash. Pastoralists must therefore learn how to manage – and possibly diversify – their livelihoods through a variety of mechanisms. Some possibilities, as well as systems to negotiate, are summarized in the sub-sections that follow.

5.2.1.1 Rain Water Harvesting

Though prone to drought, most ASALs are also prone to flooding during the months of the rain. This often results in enormous erosion of top soil further exacerbating the lands ability to produce food resources for livestock. The idea of catching and storing strategically located waste water reservoirs has been adopted as a climate change mitigation measure. Rainfall in developing countries often result in uncontrolled discharges to rivers and lakes, causing rapidly increasing wastewater volumes going along with economic development (IPCC Section 6). If this water is captured, it can be stored for both domestic and small scale irrigation use. This reality is represented in ERAMAT! where water is used as an aggregated surrogate for both water and forage availability since drought-related cattle mortality in the region is often caused by a lack of adequate forage for all the wildlife and cattle.

5.2.1.2 Beekeeping

Though beekeeping may not appeal to most Maasai as a diversification option due to its traditional ties to *Ilitorrobo*, (a Maasai section that heavily relied on hunting and gathering), beekeeping may offer an alternative sustainable land use practice for pastoralists. This practiced is currently being implemented by Loita Maasai from Narok (Sonkoi, personal communication 2013) as a diversification option. However, in other parts of the country where beekeeping has been introduced as a means of diversification, it has been observed that diversifying into honey production does not always result in improved livelihoods but those successful beekeepers were able to sustain their families (Watson and van Binsbergen 2008).

5.2.2 Land Policies

Government land organs such as the Ministry of Land, land commissions and other land acts should take into account studies (land use, livelihoods and conservation) that have been done in pastoral lands to fully assess the impacts that some of the policies they initiate have on the local populations. Land use policies stipulated by these bodies need to be robust in addressing such issues as land tenure and land use change dynamics, especially among pastoral communities in Kenya. Studies indicate that, analytical frameworks that explicitly, address complexity, such as political ecology, can inform policy discussions (Campbell et al. 2000). Maasai group ranches subdivisions, a contentious issue, have resulted to enormous loss for both cattle grazing and wildlife dispersal. This matter can only be fairly addressed if members of the pastoralist communities are represented in these commissions to provide accounts from their own perspectives. Pastoralists have a deeper understanding of

their environment and can help stipulate appropriate land policies that are less detrimental to both their livelihoods and the natural resources instead of being constantly sidelined and changes imposed to them on a top down approach model.

5.2.3 Land tenure and land-use

Even though pastoral mobility may be the best way of utilizing ASALs, it will be difficult for this system to continue as a long term solution for pastoralists. In the past, rangelands were underutilized and competition for forage resources was less intense (Nkedianye et al. 2011). In recent times however, competition for resources are intensifying as demographic and other pressures as well as fragmentation and intensification of land use due to sedentarization progressively exclude pastoral livestock from their historical dry-season refuges (Nkedianye et al. 2011). As the GRs continue to be subdivided, as social pressures that encourages subdivision are too great to withstand (BurnSilver, unpublished data, Boone et al. 2000), ERAMAT! allows pastoralists to experiment with options for surviving and thriving without placing their families and livelihood at risk. In some areas, pastoralists who have repeatedly faced severe loss from droughts have adapted by liquidating a portion of their herds and purchasing commercial plots in urban areas – plots that they themselves have directly used or that they have rented to other people as an alternative source of income. By doing this, herds are reduced and resources will (over time) balance with the evolving ecosystem. In this way, economic loss and the boom/bust cycle can be averted.

Another approach to land subdivisions is given below (*Boone et al. 2000:524*):

“There are a number of ways in which group ranches can be subdivided, varying from a straightforward division based on the ratio of group ranch lands to the number of members, to arrangements under which members receive small parcels for permanent settlement but core areas remain open to communal grazing, to the use of grazing associations where multiple households, with either contiguous or separated parcels, band together for cooperative grazing”.

Both Mbirikani and Olgulului GRs around Amboseli, adopted this model by subdividing specific areas of the GR that had potential for irrigation while the rest of the GR was left open for communal use as well as a dispersal area for wildlife. However, debate whether the current un-subdivided GRs should be subdivided or not still continues between Maasai and conservation groups.

5.2.4 Conservation and Eco-tourism

Wildlife conservation agencies and tourism investors who continuously draw Maasai into agreements by setting aside protected areas for wildlife at the expense of their grazing land should ensure appropriate compensation to make up for the lost land. This can be through employment opportunities and tourism income from the ever emerging eco-tourism ventures within and outside Kajiado County, including those in the wildlife dispersal areas that occur on group ranches between Amboseli and Tsavo West (Okello, 2005 and Lichtenfeld, 1998). In this way, Maasai pastoralists can participate in ecotourism and benefit from wildlife that roams freely on their land and is part of their heritage (Okello, 2005).

5.2.5 Drought management

Drought management recommendation and drought early warning preparedness heavily derived from a *Drought Management Policy Guidelines for Kenya* (Swift et al. 2002). As stated by the authors, there is increasing concern about the social, economic and environmental cost of drought (food or famine) relief. Massive efforts both logistical and financial are required to prevent the loss of human life. This approach is often dependent upon bilateral donors and international organisations (WFP and others). While such aid can be effective in reducing loss of life, it can often lead to dependency and contribute little to the sustainability of pastoral livelihoods (Swift et al. 2002). External relief is now an expectation of many pastoral communities, and this expectation is contributing to increased sedentarization during periods of adequate rainfall in anticipation of aid during drought (Swift et al. 2002).

5.2.6 Drought Early Warning Preparedness

According to FAO there are many organizations throughout the world which provide early warning information. Majority of them are concerned with single types of hazards such as storms or floods, volcanoes or drought or follow individual organizational requirements and focus on specific user needs, i.e. food aid delivery. One thing that all early warning systems (EWS) have in common is that they are set up to monitor first signs of an emerging hazard. EWS is considered the first essential component of a drought management. This already exists in Kenya through the Drought Management Office in the office of the president (OP), the District Drought

Management Offices in ten arid districts, and the associated institutional structures such as the District Steering Groups (DSG) (Swift et al. 2002). The measures were undertaken after the realization that there is lack of information and reliable databases regarding pastoral systems (FAO, 2011)

5.2.7 Insurance for livestock

Matsaert, et al. proposed the potential role of *index-based livestock insurance* (IBLI) as a mechanism which pastoralist in northern Kenya can use to manage climate related risks. IBLI protects pastoralist against shared risks such as the disease outbreaks, price shocks and the boom/bust cattle mortality associated with dry years or low rainfall as opposed to individual risk (Matsaert, et al. 2011). This model can certainly be adopted in all ASALs counties including Kajiado.

5.3 Final Conclusions

Overall this thesis offers a unique application of System Dynamics in addressing such issues. While it draws on the language and systems representation tools in that discipline, it simulates those dynamics with a board game instead of a computer. The use of a board game allows us to present the system dynamics in a culturally anchored way that is readily accessible to the target user audience...the Maasai of Southern Kenya. The validation of this board game “model” was accomplished by “running” the simulator (i.e. playing the game) with members of that community in a pilot study and seeking their input about the validity of the game outcomes.

Appendix I

Giving of Consent

I have read or heard read this consent form and I understand what is being requested of me as a participant in this study. I freely consent to participate. I have been given satisfactory answers to my questions. The investigator provided me with a copy of this form. I certify that I am at least 15 years of age.

☐ I give consent to be photographed during the game. _____ (initials)

☐ I DO NOT give consent to be photographed during the game. _____ (initials)

Name of Participant (Printed)

Name of Participant (Signed)

Date

Name of Researcher (Signed)

Date

Appendix II

Interview questions for group discussion at the end of each gaming session

- What did you think of this game?
- What did you like about the game?
- What would you change about the game, if you could change one thing?
- In what ways did the game remind you of your experiences as a Maasai?
- How did you change the way you played the game after you played for a while? Why did you make that change?
- Was there anything that you would do differently if you played the game again?
- What would it take for every player to have a healthy herd of cattle during the game, even during dry years? Is this even possible?

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