Agrarian Frontiers: A Rural Studies Review

2013 • Volume 1 • Number 1

RSGSA

Rural Sociology Graduate Student Association

MU Department of Rural Sociology

Agrarian Frontiers

Editor: Anne M. Cafer

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Agrarian Frontiers is a peer-reviewed publication of the University of Missouri-Columbia Rural Sociology Graduate Student Association. It serves to disseminate student research in the areas of rural studies.

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Picture: Community development meeting among Ethiopian farmers © Anne Cafer, 2010

AGRARIAN FRONTIERS
A RURAL STUDIES REVIEW

VOLUME 1 JUNE 2013 NUMBER 1

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Water-Quality Watchdogs? –A Political, Environmental, and Socioeconomic Analysis of Oyster Farming in Alabama[*]

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ABSRACT *Once a common feature in Mobile Bay, oyster reefs and oyster harvest have seen a sharp decline. Overharvest, hurricanes, drought, dredging, and pollution have brought oyster populations in Mobile Bay and other oyster fisheries around the US to near collapse. Alabama responded to a poor 2008 harvest by creating stricter harvest policies and closed seasons, along with dive checks on reefs. The rules were meant to relieve the public reefs, but with degrading water quality and slumping species health oyster reefs were moved closer to the mouth of Mobile Bay in 2010. Evaluation of different strategic methods from six other states is done to compare superior and poor strategies for increasing environmental and social benefit. Use of private property rights, aquaculture, and simplifying permit processes were identified. Aquaculture in particular is examined. Oyster farming is not common in the Gulf of Mexico. Cost-benefit analysis of potential oyster aquaculture is done. No clear-cut permit exists for establishing an oyster farm in Alabama. Suggestions are put forth to aid politicians and industry in potential aquaculture permits.*

[**oyster, aquaculture, Gulf Coast, private property, coastal policy**].

ALABAMA OYSTERS

The Gulf Coast seafood industry is a key component to life on the southern water. Alabama has more than 600 miles of tidal shoreline that extends across coastal bays, rivers and bayous (Beck et al. 2011). Oysters were once a mainstay in these waters (Ritter 1895). In 2011, oystermen struggle to maintain a harvestable population (Rainer). In the 1960s and 1970s, standing oyster reefs were dredged to help make concrete that paved I-10 from Mobile to New Orleans. Three recent disasters sent the oyster population plummeting; Hurricane Ivan, Hurricane Katrina, followed by a warm weather drought conjuring ideal conditions for oyster predators (Rainer

[*] Thank you to the University of South Alabama economic department and Auburn Shellfish Lab for their contributions to this paper.

2011). The 2008 oyster harvest was the third worst harvest on record dating back to 1950 (NOAA 2013b).

Alabama oyster revenue took a plunge after the 2007 harvest (Figure 1). Drops in oyster production affect state seafood industry which sustains jobs and generates state revenue. The Gulf Coast is a vital part of the economy and ecology of the coastal cities that call it home (McGuire 2006; Turner et al. 2003). Even with Alabama's relatively small coastline, NOAA Fisheries Service (2013a) calculates the estimated seafood industry impact, shown in Table 1, at 8,292 jobs in 2009.

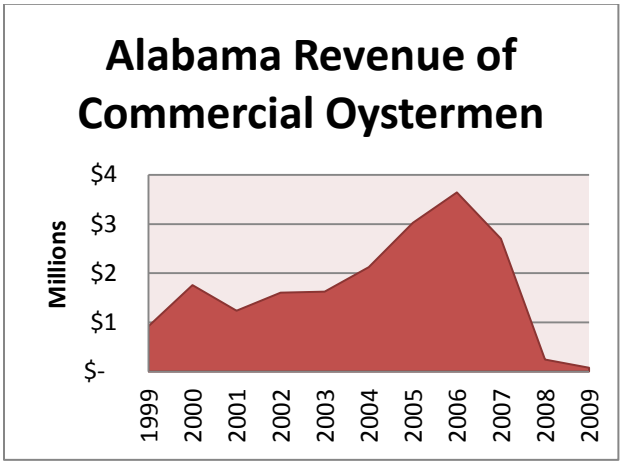

Figure 1. Alabama Oyster Revenue (NOAA 2013)

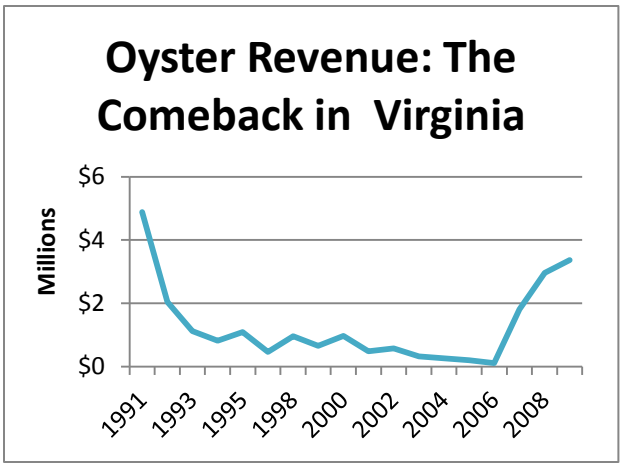

Figure 2. Oyster Revenue in Virginia (NOAA 2013)

The Gulf Coast has some of the best oysters in the US, and receives environmental benefits from encouraged production (Douglass 2002; Biancani et al. 2012). In 2011, the Gulf Coast accounted for almost half (47.5%) of oyster production (NOAA 2013b). Though the environmental benefits of oysters are evident, consumer demand in the US is as well (NOAA 2011). The US is a net importer with the primary oyster suppliers being South Korea, China, and Canada (Lutz, Sambidi, and Harrision 2012). According the Economic Research Institute, the US exports approximately 20% of domestic oyster harvest depending on the year (NOAA 2011).

A consistent high quality annual production of Gulf oysters has commercial and ecological importance (La Peyre et al. 2012; McGuire 2006). The NOAA Fisheries, "Annual Commercial Landing Statistics" publishes commercial harvests by NOAA, FDA, and EPA produce reliable landfall numbers by state each year. The regulated tagging and tracking of shellfish ensures rapid response to disease outbreak, aids in quality control, and helps scientists properly monitor oyster reef removal.

Table 1. Alabama Seafood Industry Impact 2009

Economic Impact	Total Impact
Employment Impact in # of jobs	8292
Income Impact	$ 134,741,000
Sales Impact	$ 336,006,000
Value added Impact	$ 175,902,000

Source: NOAA 2013

OYSTERS 101

The common oyster, *Crassostrea virginica* is a keystone species in bays, lagoons, sounds, estuaries, and tidal creeks along the North American Coastline (Fletch and Neyrey 2011; Guillot 2011; Tallman 2006). This sessile animal filter-feeds as much as five gallons of water per hour. They help confiscate nitrogen, phosphorus, and carbon from the water (Ermgassen et al. 2013). Their presence increases coastal ecosystem health (Tallis et al. 2009).

The health of oyster reefs can be compromised by pollution, oil spills, shipping channels, water irrigation, and overfishing (Beck et al. 2011; Biancani et al. 2012). Predatory sea snails that flourish in salty water can decimate oyster reefs from increased salinity triggered by water retention from dams or drought. Also, hurricanes and dredging threaten oyster reef genetic diversity and population size by dismantling reef structure (McGuire 2006; Rossi-Snook, Ozbay, and Marenghi 2010).

The decline of these reefs not only lowers the number of oysters but consequently leads to a decline in the abundance and variety of other aquatic organisms that rely on the reef ecosystem (Beck et al. 2011; Douglass 2002; Guo and Pennings 2012). The disappearance of oyster reefs is happening on a global scale with 85% of oyster reef ecosystems already gone (Beck et al. 2011). The rapid loss of reefs has prompted restoration efforts by states to rebuild and protect reefs (Cardin and Mikulski 2011; Guillot 2011; Kobell 2013).

HARVESTING OYSTERS

There are different methods for harvesting oysters. In Alabama oystermen mostly tong public beds, its inefficiency make it hard for oystermen to over-harvest the fishery (Banta, Powell, and Ashton-Alcox 2003). The tongs look like two large garden rakes and are handled by an oysterman standing on a small boat who squeezes the tongs to bring up a small basket catch

(Raines 2010). This method is cheap and relatively gentle on the oyster beds, but highly labor and time intensive with a low yielding rate. Another way to harvest oysters is by dredging reefs, which is more cost effective but causes more damage and makes it easier to harvest beyond a healthy limit of the reef (Banta, Powell, and Ashton-Alcox 2003).

ENVIRONMENTAL ANALYSIS OF OYSTER FARMING

Farming oysters can have environmental and socio-economic benefits (Kobell 2012; La Peyre et al. 2012; Tallman 2006). Oyster presence can prevent algae blooms caused by excess nitrogen that decrease oxygen levels and kill fishes (Beck et al. 2011; Vitousek et al. 1997). Oysters reduce suspended sediment which notably increases water clarity and sunlight penetration (Lindahl and Kollberg 2008). The light expands sea grass beds, adding to the total area of fish hatcheries (Grabowski et al. 2012; Ulanowicz and Tuttle 1992). The added water clarity around oyster farms increases sunlight penetration subsequently encouraging growth of submerged aquatic vegetation or SAV (Fletch and Neyrey 2011; Guo and Pennings 2012). The increased coastal buffer promotes denitrification and sediment stability (Grabowski et al. 2012; Reese Robillard, Stunz, and Simon 2010). More stability along the Alabama coast is critical in protecting against hurricane damage (Ortego 2006).

Oyster farming helps create a reef system that can bring new life to dead bottoms (Guo and Pennings 2012). Added structures in water help attract fish and increase other marine life (Banta, Powell, and Ashton-Alcox 2003; Tallman 2006). Positive effects are seen in the fish stock and water health (Ulanowicz and Tuttle 1992; Rothchild et al. 1994). Another benefit is the added maintenance and dependency on a healthy environment (Ostrom 1990). The oyster farmers would be “water-quality watchdogs” that would closely monitor for changes in conditions.

The strain on public beds is lessened with more private leases and farms, which would help ease the strain on public goods (Anderson and Leal 2001; Hardin 1968). Notably, property rights would not push public oystermen out of the oyster market. Instead the externalities like added quality to the oyster stock and lessened reef stressed would increase public stock. These watchdogs would be stakeholders in environmental quality. The added group of environmental agents could help bring green jobs to the Gulf Coast fishing communities and support local economies (Grabowski et al. 2012; Pawlyk and Roberts 1986). If a small number of farmers were allowed to start up under reasonable permits and regulations they could produce more socioeconomic benefit than what selling outlay would indicate. The money made from selling gear, transporting, spat purchasing, hatchery production, and market sales would have positive downstream affects (Chaplin et al. 2009; Kobell 2013; NOAA 2013). This local economic stimulate could be a welcomed contribution to the Alabama coastal economy and its people (La Peyre et al. 2012; Turner et al. 2003).

TRAGEDY OF THE COMMONS—TRADGEDY OF THE COMMON OYSTER

The Tragedy of the Commons (Hardin 1968) is a phrase used to describe the problem that occurs when the benefits of a resource are shared by a large number of people. The unintended effect is that no one invests in maintenance, and people overuse the resource. Long-term productivity falls. This is a real problem in fisheries including oyster fisheries (Ostrom 2008).

Public oyster beds could be a classic example of a common-pool resource (Ostrom 1999; Ostrom 2008). When an oysterman takes oysters beyond the naturally sustainable limit, that oysterman gets all the benefits of selling those oysters but only part of the cost. Oystermen do not throw oysters back to ensure oysters in the future. In the same way no oysterman has any incentive to invest in the fishery as a whole. An oysterman who invests in the fishery pays all the costs but only gets part of the benefits.

There are several ways to deal with a tragedy of the commons. One way is to privatize the commons (Anderson and Leal 2001; Ostrom 1999). Each owner pays all the cost of overuse and gets all the benefits of investment. Naturally, some commons would be very difficult to privatize. This is because certain types of common-pool resources are difficult to monitor and the cost of implementation can be higher than the benefits, for example private property fishing rights in oceans are difficult to implement because fish move locations. The benefit of property rights for an oyster reef is more attainable because water bottoms can be easily distinguished (Chaplin et al. 2009; Kobell 2010).

Throughout human history the change in the seascape has affected both the ecosystem health and the humans dependent on it (Beck et al. 2011; Douglass 2002). Productivity can only be safeguarded if people willfully invest in safe practices for long-term harvest production that leads to long-term environmental health (Ostrom 1990; Ostrom 1999). Commercial quotas and reconstruction of habitats can help restore what has been lost, but constant monitoring by invested stakeholders that rely on the productivity and health of an ecosystem has proven profitable for private owners and cost effective for government institutions (Anderson and Leal 2001; Kobell 2010; Fletch and Neyrey 2011).

When new problems or additional people increase pressure on the commons there is incentive to cheat on the rules for open-access fisheries (Ostrom 2008). Economics shows systematically that self-less behavior tends to diminish when livelihood is involved (Hardin 1968; Ostrom 1999). A way to solve the commons problem is to enact very strict rules about how the commons is used. But rules and regulations are costly to implement and cannot be designed with perfect information (Ostrom 2008).

A healthy oyster population and sustainable oyster harvesting are goals of private, local, and state people. Funding and rule changes can help, but oystermen with a direct personal stake will ultimately be the strongest supporter of cleaner water and healthy fisheries. Many states with

struggling oyster industries have grown the profit, pride, and production when people are allowed to directly invest in their own oysters. Private property in this case, is one solution.

DIFFERENT STATE APPROACHES: RULES AND FISHERIES HEALTH

The federal government does not dictate specific rules for each state oyster fisheries. Different locales have different rules (La Peyre et al. 2012). Mending fragmentated federal, state, and local government policy takes incentive, effort, and ingenuity. Environmental agencies do not always invoke policy that creates the largest environmental and socioeconomic benefit. Each state and local area also has differentiated policies regarding water rights and management. They all must follow certain federal codes, but some Fed codes are "soft[1]" and leave each coastal region room for customization. Customization allows communities to focus on regional species, local environmental issues, and the culture and needs of the society (Ostrom 1990).

Local and state policy independence is propitious because different regions can best address their needs (Ostrom 2008). But fragmentation can lead to confusion of responsibility and prolonged permitting processes. Differing approaches can also allow for comparison of superior and poor policy. Many states are aggressively addressing plummeting oyster populations. Some states have had a positive impact on harvest profits by changing catch limits, increasing privatization of water bottoms, designating non-harvestable areas, setting shorter harvest seasons, encouraging loan lending programs for aquaculture, and making permitting easy and straightforward (Beck et al. 2011; Pawlyk and Roberts 1986).

Virginia

The Common Wealth of Virginia is a model state for aquaculture policy and effective turnover from state to private bed ownership. After facing a huge drop in public oyster reef production in 1993 from disease and reef destruction, $40 million was spent creating artificial reefs and privatization of beds was largely encouraged (Kobell 2010). The state's aggressive actions paid off (Harding et al. 2012), with harvest numbers rebounding in a decade as shown in Figure 2. The state also is promoting aquaculture; January 2011 the Virginia Department of Marine Resources designated 1,000 acres of state-owned water bottoms for shellfish farming (Cardin and Mikulski 2011; Kobell 2010).

Alabama

After decades of year-round public harvest and shell collection for concrete, Alabama was forced to change management policy. Stricter harvest rules were implemented and reefs were more frequently monitored (Raines 2010). The previous lack of accountability amplified tragedy of the commons and has required millions in public-private revenue to restore previously healthy

[1] Soft code refers to the legal outlines or suggestions set forth by NOAA. They are used as a guide for state and local laws, rather than a law that is the same for all regions.

reefs. Oyster leases and riparian rights are allowed but less encouraged in Alabama's coastal water when compared with other lower lease cost states.

Though the value of public oyster harvesting was heavily invested in by the state and local governments, there is still no clear-cut permit for establishing an oyster farm. This is a huge discouragement for potential local aquaculture investors (Fletch and Neyrey 2011). Even with the hard hits to the Gulf Coast seafood industry, other states have seen nowhere near the same crash in oyster production. The current policy changes have yet to bring back 2007 harvest levels.

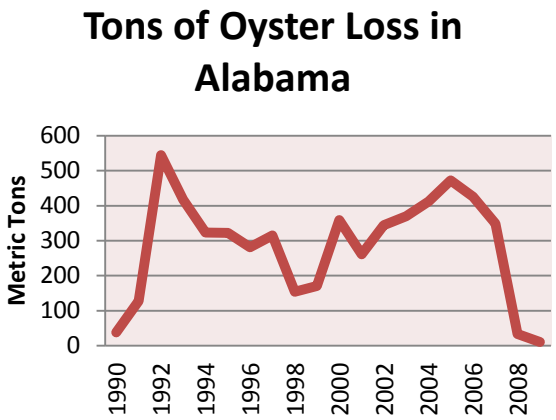

Figure 3. Alabama Oyster Loss, NOAA 2013

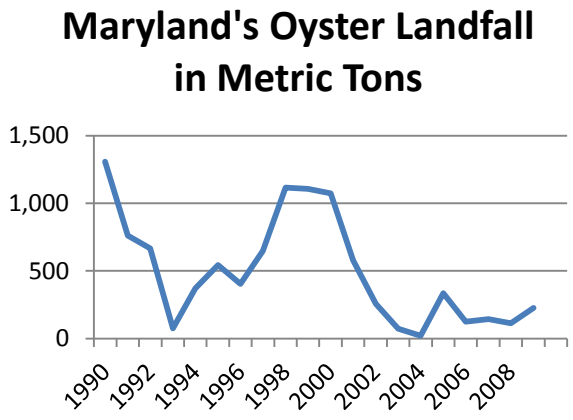

Figure 2. Maryland Oyster Landfall in Tons, NOAA 2013

Maryland

Next to Virginia it seems behind in reconstructing its oyster policy, but a neighbor's success has helped push policy with greater incentive. Maryland recently recognized the benefits of a private industry and developed an Aquaculture Coordinating Council to provide analysis and recommendations (Webster and Meritt 2012). The historically low oyster levels reduced fish species and water quality which fostered disease outbreaks from excess nutrients and affluent (Rothchild et al. 1994). Disease and disappearance called to shore oystermen that prompted a state reevaluation and simplification of ownership rights (Cardin and Mikulski 2011; Kobell 2013). In September of 2010 the oyster aquaculture permit process was streamlined and development loans for oyster aquaculture were put in place. By August 2011 over 129 applicants had applied for leases (Kobell 2012).

Texas and Louisiana

These states combine to form very high yielding oyster reefs. The success of Texas and Louisiana oystermen stems from the proper management of the thousands of acres of public reefs and the affordable leases for water bottoms (McGuire 2006; Meitrodt and Kuriloff 2003). The

affordable private leases allowed for increased oyster landfall and encourage quality maintenance of oyster reefs (Walsh 2010). The privatization promotes industries investment in high yielding sustainable reefs, which incentivizes oyster growth as shown in Figure 5 below. This privatized system has been a model for economic efficiency of private oyster reef property (Pawlyk and Roberts 1986; McGuire 2006).

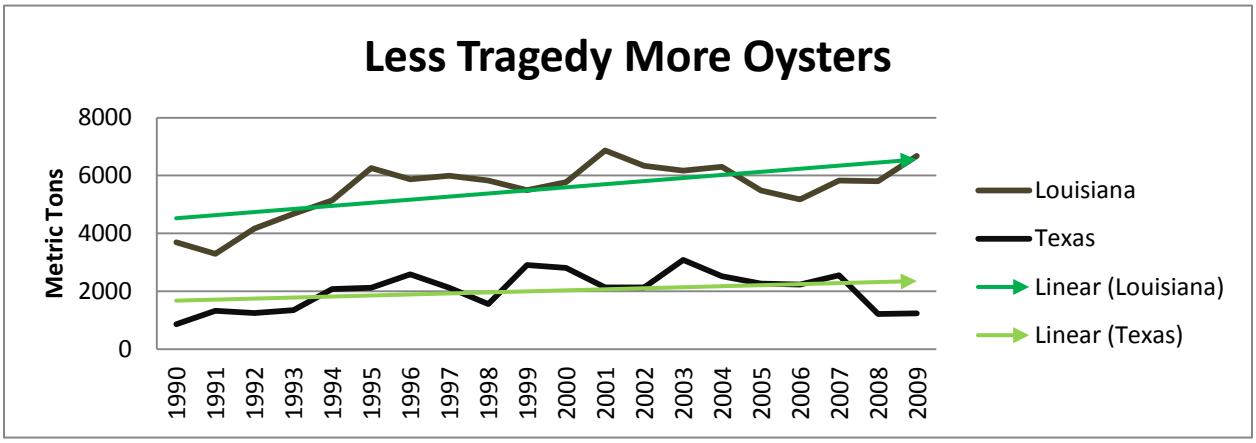

Figure 3. Louisiana & Texas Oyster Harvest, NOAA 2013

PERMITTING PROBLEMS

The process for oyster farming has no current federal legal outline. The placement of any structure in the water must first have confirmation by the Army Corp of Engineers that no impediment to water navigation or seagrass growth will occur (Wallace 2007). The entrepreneur must develop projected profits and timelines (Chaplin et al. 2009). The Mobile District Regulatory Division of the ACOE does not currently have a set protocol for evaluating oyster farming gear, though other offices of the US ACOE do. This means that permits are given on individual basis and involve an undefined timeline along with undefined fees. A sample outline of the permitting process is shown in Figure 6.

The lengthy permitting process in Alabama is due to the local, state, and federal agencies varying responsibilities. The Department of Marine Resources, FDA, EPA, State and Land Management, and Department of Agriculture all have some sort of stake in an oyster farm in their jurisdiction. For Virginia, they combined state and federal paperwork so one filed permit clears several state and local authorities (Cardin and Mikulski 2011; Kobell 2013). As a result, eased startup and reduced wait time encouraged more investment in oyster aquaculture (Kobell 2013).

The waterbottoms must be surveyed and registered with the Marine Resource Division. The oyster riparian rights in Alabama are established by common law, the remaining waterbottoms under the water's surface are state owned—meaning the state has jurisdiction on all coastal aquatic life and considers the public interest with every permit issued (Wallace 2007).

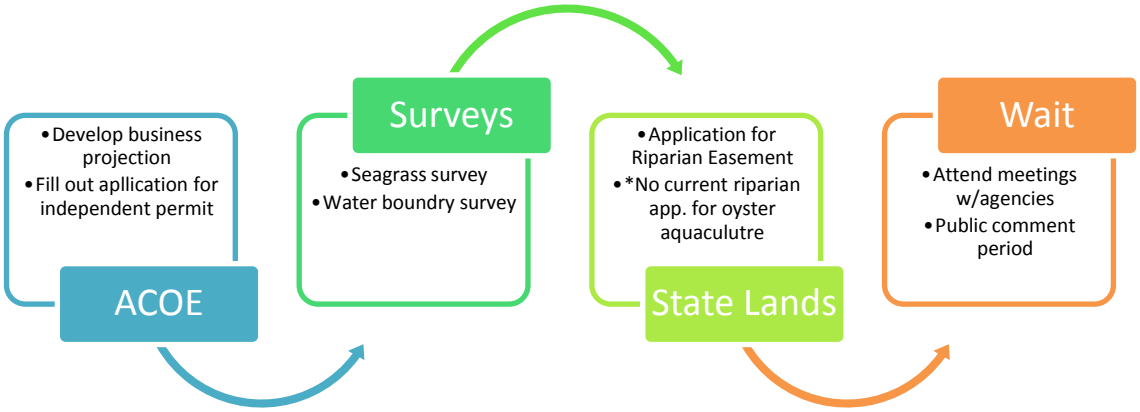

Figure 6. Sample Outline of Alabama Permitting Process

PROPOSED SOLUTION

State legislation is required in order to lower private lease costs, reduced permit wait time, lower survey costs, and establish an oyster farming protocol. The reason state legislation is needed on these issues is lack of environmental laws on the books in Alabama, leading to territorial bureaucratic policy and control confusion among various state and federal agencies, meaning no real change can come from a single entity. Policy and protocol can adjust with changing commissioners making the lack of state government regulations produce murky definitions and inconsistent processes. This is a case where more state laws could create less government intervention.

An independent permit procedure for any oyster farm entrepreneur in Alabama was needed for in 2011. The data gathered on the Gulf Coast from Seagrant and the plethora of information gathered by east and west coast oyster growing states should give lawmakers more than enough information to create a standard permit that average citizens can understand and receive in a reasonable time for a respectable price. A quick but effective solution for an industry startup is to follow other states leads and designate current state lands as acceptable aquaculture area. The acres could be auctioned five year leases to public investors who want to oyster farm.

CONCLUSION

Public and private funding has been responding to the degradation of coastlines and coastal ecosystems. Though efforts were made to increase production, some government policies have been all bark and no bite. The brief overview of state response has shown that waterbottom rights and aquaculture permits can be both economically and environmentally savvy.

Stakeholder with varying views, needs, and interests in natural resources often have differing perceptions of an ecosystem and the problems in and around it (La Peyre et al. 2012; Turner et al. 2003). But these varying perspectives and concerns can be brought together to promote better ecosystem health by encouraging people to help protect it. Just like a farmer is concerned about his field, an oysterman is concerned about his tide. These human-environment interdependencies can help protect livelihoods and the environment (Ostrom 1990; Ostrom 1999). With increased environmental problems and a growing global population, people need to become stakeholders in the quality and sustainability of natural resources. Every coastline *including Alabama's* could use more water-quality watchdogs.

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Chitimene Agriculture: Cultural and Economic Factors Related to Population Increase Contributing to Forest Degradation of Miombo Woodlands in North and Central Zambia*

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ABSRACT *The plight of rural people in the Bantu regions of Africa is reflected in the conditions of the land they depend upon, which becomes unproductive or degraded in various ways. Since the 1960's, this degradation has been increasing in reflection of the population growth, which is influenced by cultural and economic attributes of Zambian society. This paper will argue the primary contributors to this problem in Zambia's miombo woodlands, the dominant forest system in the northern and central parts of the country, are the economic and cultural factors which influence the traditional form of agriculture. Additionally, the deforestation occurring in this forest system is further accelerated by the everyday needs of the rural population. Since rural Zambians live directly off the land and the forest resources available, as the rural population is increasing, what was formerly a sustainable situation has become a struggle for resources.*

[**Zambia, agroforestry, deforestation, population**]

INTRODUCTION

Background

The vast majority of sub-Saharan African indigenous residents belong to rural communities. Since most of these people live directly off the land which they inhabit, many, if not most, can be considered farmers. To fulfill the greatest number of their subsistence requirements, these rural communities cultivate a wide range of trees and plants for food, and herd various forms of livestock. To supplement the products of domesticated farming, many communities actively participate in hunting and gathering activities including traditional hunting, fishing, and extraction of forest products for construction, fuel and the collection of fruit, vegetables and medicines from uncultivated woodlands.

Central, Northern, Luapula, Copperbelt and Northwestern Provinces in Zambia, are plateau regions of forest, savanna, grassland, and other similar ecosystems. These regions experience extreme wet and dry seasons and are in many ways representative of the greater sub-Saharan

African region. The author's experience is extensive within Zambia, and most likely applicable to other Bantu-speaking countries, and the residents of those countries.

The plight of rural people in the Bantu regions of Africa is reflected in the conditions of the land they depend upon, which becomes unproductive or degraded in various ways. Since the 1960's, this degradation has been increasing in reflection of the population growth, which is influenced by cultural and economic attributes of Zambian society. While many have been offered, few alternatives to the increasing rate of deforestation have proven effective at being sustainable. One of the most apparent forms of this degradation is in the rapidly progressing rate of deforestation in sub-Saharan Africa. Though current research which correlates does not yet exist, the rapid rate of deforestation is also indicated by the continued growth of non-government organizations (NGOs) which operate under a mission of alleviating deforestation.

This paper will argue the primary contributors to this problem in Zambia's miombo woodlands, the dominant forest system in the northern and central parts of the country, are the economic and cultural factors which influence the traditional form of agriculture. Additionally, the deforestation occurring in this forest system is further accelerated by the everyday needs of the rural population. Since rural Zambians live directly off the land and the forest resources available, as the rural population is increasing, what was formerly a sustainable situation has become a struggle for resources.[1]

Study Area Geography

The areas studied for this research are within Central, Copperbelt, Northwestern, Northern and Luapula provinces of Zambia (Figure 1). Zambia is in southern Africa, between 15 degrees south and 30 degrees east with an area of 752,614 square kilometers out of which 740,724 square kilometers are land and 11,890 square kilometers water (The World Factbook 2006). Zambia is land-locked, bordered by the Democratic Republic of Congo and Tanzania on the north, Malawi to the east, Mozambique, Zimbabwe, Botswana, and Namibia to the south, and Angola to the west.

Zambia consists largely of a highland plateau, which rises in the east. Elevations range from 915 to 1,520 meters and higher altitudes are attained in the Muchinga mountains, where Zambia's highest point, 2,170 meters is located; the lowest point of 329 meters is at the Zambezi river. Also in eastern Zambia are lake Bangweulu, parts of lake Mweru and Tanganyika and the Luangwa and Chambeshi rivers. The Zambezi river drains much of the west of the country (were the elevation is about 460-910 meters) and forms a large part of Zambia's southern boundary. Victoria Falls and Kariba dam, both on the border of Zimbabwe, are part of the Zambezi in the south. The Kafue River drains west central Zambia, including the Copperbelt region in the north. Several large swamps, or flats, are noted for their concentration of wildlife. The country has numerous national parks (Figure 2) where the commonly accepted emphasis is on tourism rather than conservation. There are four major valleys: the Zambezi, the Kafue, the

[1]Henry Chilufya, personal interview, March 16, 2008, National Resource Development College, Lusaka, Zambia

Luangwa and the Luapula. Zambia has several large lakes: man-made Kariba in the South, lakes Tanganyika and Mweru in the North and Lake Bangweulu in the interior.

Zambia's vegetation is of the savanna woodlands type in high rainfall regions and tropical grassland in low rainfall regions. Over half of the country is covered by trees, varying from the more open conditions in the drier south to tall dense woodlands in the north and northwest. The trees are only bare for a brief period and the leaves appear before the start of the rains. Grass fires spread rapidly in the dry season but new shoots soon push through the blackened earth.

The soil types in Zambia can be broadly categorized into four regions, and include the study area represented by region three:

- *Region 1*: embraces the Southern and Eastern river valleys characterized by low rainfall, less than 700 mm, flat and steep topography with Haplic Luvisols (FAO 1973) and Haplic Solonetz on the flat land and Dystric Leptosols on the hills and ridges. The Solonetz are highly erodible; arable production is concentrated on bulrush millet (*Pennisetum glaucum*), sorghum and livestock. Food security concerns predominate due to recurrent food shortages.
- *Region 2a*: constitutes the central plateaus with rainfall of 800 to 1,000 mm. The soils are mainly Haplic Lixisols (FAO 1973), Haplic Luvisols, Haplic Acrisols and other soil types. These soils are more productive, permanent cultivation of sorghum, maize, groundnuts, cow peas and a range of cash crops including tobacco, sunflower, irrigated wheat, soybean and horticultural crops.
- *Region 2b*: this is the aggraded Western plateau with rainfall of 800 to 1,000 mm. The soils are Ferrallic Arenosols which are infertile, coarse sands. Cassava, bulrush millet and Bambara nuts (*Voandzeia*) predominate on the upland with some maize and sorghum; in the flood plane rice, maize, and sorghum are grown.
- *Region 3*: this includes the north and north-western plateau characterized by high rainfall, 1,000 to 1,500 mm. The soils are mostly Haplic Acrisols which are highly leached and acidic. Traditional farming systems are based on slash and burn. The main crops are finger millet (*Eleusine coracana*), beans and cassava. Cash crops include maize, sunflower, coffee, tea, tobacco, irrigated wheat and soybeans.

MIOMOBO REGIONS

Zambia is one of the sub-Saharan African countries which contain extremely bio-diverse forest systems known as miombo woodlands. Extending from the Indian to Atlantic oceans, miombo woodlands are represented in several sub-Saharan countries and encompass approximately three million square kilometers in the tropical and sub-tropical regions of central and southern Africa (Chidumayo E. N. 2002). As indicated by Oldeman's 1996 study of miombo forest management and silviculture, various cultural and economic factors apparent in Zambian Society coupled with increasing population has led to Zambia's miombo woodlands being deforested an alarming rate (1996).

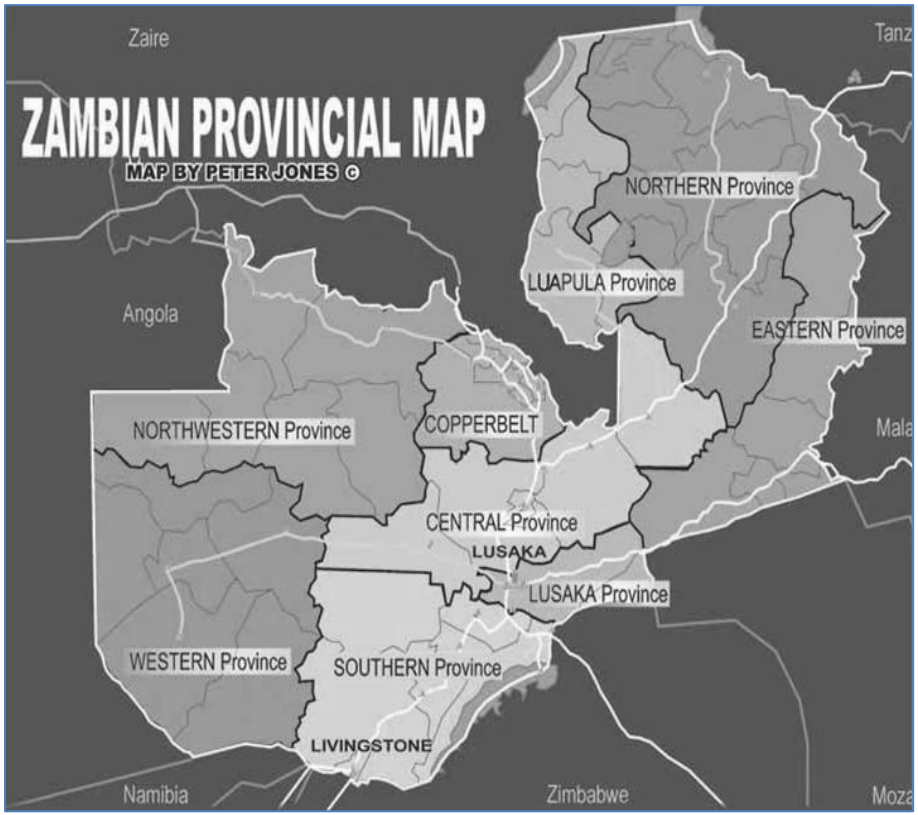

Figure 1: Zambian Provinces

Figure 2: Zambian National Parks and Waterways

Since they are the forest and woodlands which are most extensive in this region of Africa, not only are they the biome of greatest size in both Zambia and Tanzania; they extend into several countries in sub-Saharan Africa covering more than one thousand miles of territory (Oldeman 1996). This type of forest which includes grasslands, savannas and shrublands constitutes the majority of treed areas within Zambia borders (Figure 3). Miombo woodlands are primarily represented by trees within the subfamily Caesalpinioideae, comprised largely by the genera Brachystegia, Julbernardia and Isoberlinia (Ryan 2010).

Due to their variety of ecological structure, these woodlands are areas of high biological diversity, revealed by the large amount and variety of tree and shrub species (Vogel 1986). This biological diversity is surprising, however, due to the irregular rainfall, seasonal fires, and poor soil quality indicative of miombo regions including both northern and central Zambia (Oldeman 1996). The nutrient poor soils in miombo regions produces an acidic quality indicated by the diminished nutrient content when compared with non-miombo regions of sub-Saharan Africa.[2]

Currently, the Miombo woodlands in the north and center of the Zambia are being deforested the fastest (Oldeman 1996). By examining existing research, and assessing the causes of this rapid rate in northern and central Zambia, the major contributing factors are identifiable as relating to cultural and economic pressures affecting rural Zambians, in addition to ineffective government policies for forest management. While few recent studies focus on agricultural practices that are speeding miombo degradation, this study provides an understanding of the social and economic factors behind that phenomena (Angelsen 2010). This research finds evidence of those factors in relation to increasing population, have precipitated forest degradation in rural Zambia.

Prior to 1980, Zambia as a whole was deforesting at a rate reaching almost 70,000 hectares per year (Reed 1996). This rate has only increased since then, as population has increased, as indicated by Holden's study of deforestation in northern Zambia (Angelsen & Kainmowitz 2001). According to Muyaniza and Oldeman's 1996 case study of ecological strategies for miombo areas, the vastly uncoordinated forest degradation and deforestation is prone to massive erosion resulting in over-sedimentation of water sources, lack of wood fuel and a decrease in hunting and gathering resources; all of which result in food insecurity from the inability to provide cooked food (Oldeman 1996).

Munyanziza and Oldeman continue to describe how "the current rate of decrease in the miombo woodlands and other natural vegetation types" (Oldeman 1996:454) is continuing at an alarming rate, which has increased the situation's severity from being a persistent problem to a deforestation crisis. While the recent rural population increase has exacerbated the deforestation rate, the link to deforestation requires consideration of certain factors attributed to agricultural production to understand the situation.[3] As determined by Vosti and Witcover, population increase can result in increased deforestation, but as their findings indicate, the resultant deforestation is reflective of agriculture to meet growing food supply demands for the increasing population (1996).

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[2] Henry Chilufya, personal interview, May 6, 2010, U.S. Peace Corps Resource Center, Mansa, Zambia

[3]Henry Chilufya, personal interview, March 16, 2008, National Resource Development College, Lusaka, Zambia

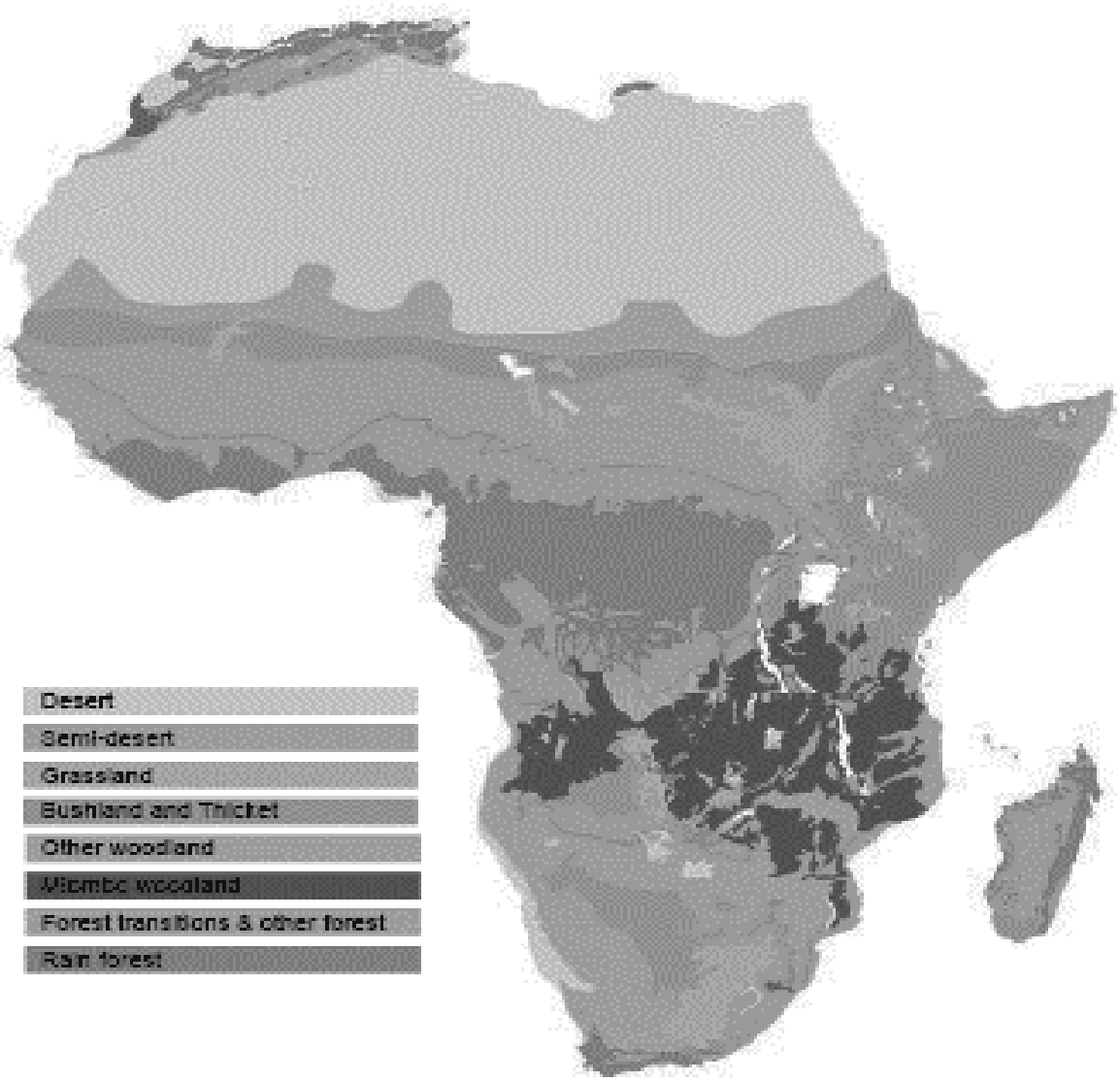

Figure 3: African Vegetation.
***Miombo Woodlands indicated by dark regions**

CHITIMENE

Chitimene is a traditional form of agriculture in Zambia, whose name is derived from a Bemba tribal word which means an area where branches have been cut or removed. The Bemba, and other Zambian tribes in the northern and northwestern parts of the country are those which most utilize this form of smallholder agriculture. The chitimene system of farming utilizes some practices which are extremely damaging to forest areas within Zambia. First, it relies on slash

and burn forest management to contribute to soil fertility (Stromgaard 1988). As such, it is viewed as a high yield farming strategy that requires few inputs (Holden 1993). Second, chitimene is a farming system that employs shifting cultivation techniques resulting in the planting of crop plants which include maize, sorghum, millet, and cassava (Swab 1993).

While it sounds as if those are beneficial ideas, serious environmental degradation results from those practices within the current agricultural framework. Since chitimene has been the primary traditional system of agriculture in Zambia's miombo regions (Holden 1993; Davies 2000), as population has increased, the formerly sustainable nature of this farming practice has been altered to become one that is damaging to the ecology of the planting areas. Chitimene is traditionally characterized by short growing periods of one to two seasons, followed by fallow regrowth that can last more than a decade, which historically was suitable for Zambia's population and its dominant ecosystems (Chidumayo 2002).

Northern and central Zambia's miombo regions were areas of extremely low population density until the early 20th century. Partially, due to the colonial influence of controlling population density by managing tribal movement and settlement, the two main forms of agriculture in this region gained even greater support and widespread use. During this period in Zambian history, the indigenous population utilized both chitimene and fundakila, a method of mound planting also commonly found in Zambian agriculture.[4] As early as the early portion of the 20th century, the British colonial government came to the conclusion that deforestation was best controlled by preventing farmers from practicing chitimene by examining agricultural practices of indigenous farmers (Angelsen & Kaimowitz 2001).

This concept of preventing chitimene in the early 20th century presented enormous difficulty[5], however, due to a few important factors. First, there is a three year fallow period required in fundakila farming for each planting year.[6] Additionally, during this time period, planting land in miombo regions was abundant due to the low population density. Because of the low human population density, there was also a significant problem of invasive animals and pests on farmlands, which encouraged limited production and the colonial decision to introduce cassava as a staple crop in northern and central Zambia (Angelsen & Kaimowitz 2001).

Cassava was initially introduced by the British as an insurance of food security in the early 20th century. While it was initially viewed as a "poor man's crop," and very poorly supported by the indigenous population, cassava eventually was seen as highly advantageous by tribes in Northern, Luapula, and to a lesser degree, Northwestern Province.[7] It was a crop that was well adapted to the nutrient poor soils of the region, and produced high yields while reducing labor time and inputs within the chitmene system. Additionally, cassava's introduction to chitimene directly reduced deforestation rates[8] by simultaneously increasing productivity of agricultural space, alleviating the need for increased clearing of miombo woodlands for planting areas (Angelsen & Kaimowitz 2001).

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[4] Henry Chilufya, personal interview, March 16, 2008, National Resource Development College, Lusaka, Zambia
[5] Charlton Phiri, personal interview, March 24, 2009, In-Service Training Trust, Chongwe, Zambia
[6] Donald Phiri, personal interview, April 18, 2008, U.S. Peace Corps Office, Kabulonga, Zambia
[7] Henry Chilufya, personal interview, April 7, 2009, In-Service Training Trust, Chongwe, Zambia
[8] Henry Chilufya, personal interview, April 7, 2009, In-Service Training Trust, Chongwe, Zambia

Due to its versatility and ease of planting, cassava eventually transitioned from being a chitimene crop to a fundakila, mound-planted crop in the northern parts of Zambia by mid twentieth century (Angelsen & Kaimowitz 2001). As land shortages became more common with increased population during this time period cassava became even more prevalent, eventually becoming the staple crop of the region. As a result, the increased labor productivity of cassava led to shorter crop rotation systems, which proved to be effective alternatives to chitimene (Angelsen & Kaimowitz 2001).

In regards to long-term agriculture production and miombo forest management, the chitimene system is both flawed and unsustainable (SPRP 1994). The affected woodland cannot regenerate sufficiently unless the rural population adopts agricultural practices which necessitate less use of forest-based natural resources,[9] or extends their fallow period to facilitate sufficient regrowth of miombo species (Chidumayo E. N. 1987). If current trends continue, Zambia's miombo woodlands will be completely deforested in less than fifty years.

Though the system is now prone to flaws due to an unsustainable population size in relation to agricultural space, chitimene has been an excellent method for providing people with seasonal production of numerous vegetable and grain crops in highly acidic soils in the past.[10] Although it has been such an excellent form of production, in terms of nutrition there is a shortage of protein available in the crops produced (Joy 1993). As common in the northern portions of Zambia, where wetlands are in greater abundance, fish has taken on the primary protein alternative. Until quite recently, the system of fishing, supplemented by hunting and livestock combined with chitimene agriculture was suitable to sustaining the ecology of miombo woodlands for long periods of time, but "only as long as human population densities stayed at low levels (Joy 1993:127)."

Though population density is significantly lower in Zambia than in many countries, existing research indicates farming is incapable of supporting people in a sustainable manner under the current chitimene agricultural system. As Joy relates in his 1993 study of Luapula agriculture practices, "even in a normal season people suffer from a lack of energy, protein, vitamins and minerals in the diet (1993:128)." This is easily apparent in the large number of children under the age of five brought to clinics which are either losing weight or nearly stable in growth pattern (Gobezie 1984a, 1984b).

FOREST PRODUCTS

As a result of inadequate fallow periods, the chitimene system, and subsequent miombo deforestation, are accelerated by the extraction of natural resources for production of goods including, but not limited to, charcoal production (Kalapula 1989). Traditionally, miombo forests have been the location for rural families' resources, including honey and beeswax, indigenous fruits, medicines, and charcoal (Oldeman 1996).

Historically, most of the 72 tribes in Zambia have utilized trees and forest products as means of survival, and areas of agricultural development (Crehan 1983). From the Bantu migration

[9]Donald Phiri, personal interview, April 18, 2008, U.S. Peace Corps Office, Kabulonga, Zambia
[10]Henry Chilufya, personal interview, April 7, 2009, In-Service Training Trust, Chongwe, Zambia

approximately 2,500 years ago, inhabitants of this region relied on miombo forest as their source for various household and agricultural implements (Chidumayo E. N. 2002) As population has increased in the region since the Bantu migration, "chitimene" agriculture has increased the deforestation rates within Zambia's miombo woodlands, and remains the primary agricultural method of farmers of Kaonde and Bemba tribes, the major tribes in northern and central Zambia, and several other of the smaller tribal groups.

Though they contribute to the majority of rural Zambian economies, non-household forest products are a major source of forest degradation.[11] As mentioned above, charcoal production is an accelerant of miombo deforestation. Charcoal is the main source of fuel in Zambia's urban areas, and one of the few income sources for many of the rural population (Kalapula 1989). Additionally, the allocation of construction materials is deforesting the miombo woodlands in a manner reflective of the population growth.[12] As seen repeatedly in rural Zambian communities, timber, and lashing material taken from certain miombo trees are both a cultural and economic attribute necessary for most rural residents, which continues to be a major source of deforestation to this region (Chidumayo E. N. 2002).

CONCLUSIONS

Without understanding of what is causing harm to the miombo ecoregions, rural Zambians are unable to change their formerly sustainable traditional practices, or adapt them to the current situation. In order to make that possible, it is first necessary to identify which traditional practices are most ecologically damaging. With that as a foundation, culturally acceptable alternatives can then be created which will allow rural Zambians to maintain or advance their current socioeconomic status.

The implication of the current situation in northern and central Zambia in regards to deforestation is that it is a trend bound to continue. We find that agriculture, and other livelihood–related causes are on the rise, regardless of the efforts of various NGO and Zambian government efforts to curtail this increase through deforestation alleviation programs. As a social scientist, one may argue that interfering with this situation is contradictory with principle. However, as a humanist it can also be argued that providing the necessary skills and knowledge to enact positive change is tantamount to the success of Zambia as a society, especially long-term.

The social scientist has numerous tasks in a situation such as this. In proposing any type of action, the scientists(s) should discuss potential tensions which may arise as a result of imposing any change. Additionally, the scientist(s) have an obligation to make those conclusions known to stakeholders and concerned individuals or groups prior to any change. In reality, however, social scientists are infrequently consulted before change is initiated, whether by government or otherwise. Regardless of any change that may occur, by assuming change is necessary from an outside group is to assume that rural Zambians are incapable of sustaining themselves. Understandably, the education which is necessary to comprehend the scope and severity of the problem is beyond the capability of many rural Zambians. However, to enact change on their

[11]Charlton Phiri, personal interview, March 24, 2009, In-Service Training Trust, Chongwe, Zambia
[12] Charlton Phiri, personal interview, April 12, 2008, Natural Resources Development College, Lusaka, Zambia

behalf without directly involving them in the process of developing how that change would take place would be a situation rife with conflict, and indicative of neo-colonialism.

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Socioeconomic Factors Affecting Household Food Security: A Case of Kailali District of Nepal*

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ABSRACT *Food security at the household level is an outcome of many socioeconomic factors. This study investigates socioeconomic issues in household food security. In order to identify these socioeconomic issues, a household survey, group discussion, and key informant survey were conducted on randomly selected households in the Kailali District of Nepal. Information collected through surveys and group discussions were analyzed using standard statistical methods such as regression and t-tests. In addition, households' perceptions of food security are analyzed. The analysis indicates that members of the Sudra caste are the most vulnerable households among the Brahmin, Chhetri, and Tharu caste/ethnic groups. The Tharu households are the second most vulnerable group. Some of the Tharu households appear to be food secure, but they can easily fall into food insecurity if they are unable to continuously participate in sharecropping. The study also finds that the adult equivalent, animal equivalent and expenditure on agriculture are the main factors affecting food availability at the household level. Moreover, small landholding status, low income, and inadequate knowledge about improved practices also affect the food security of households.*

[**Food Security, caste, ethnic group, food availability, calorie requirement, food access, socioeconomic factors**]

INTRODUCTION

Nepal is one of the poorest countries in the world. Food security has always been a major issue in Nepal. In 2010, Nepal was ranked 27th out of 84 countries[1] on the Global Hunger Index [2] with a score of 20 (Hollema and Bishokarma 2009). The Ministry of Agriculture and Cooperatives[3] reports Nepal produced more than sufficient food grains to meet demand between 1999 and 2004. Despite the excess food production, about 50.5 percent of children under five years' of age were chronically malnourished in the nation in 2001 (UNDP 2004). The United Nations Development Program (UNDP) stated that the percentage of children who were malnourished was higher in rural than in urban areas. Similarly, looking at the agro-ecological zones, the percentage of malnourished children was higher in the mountain region than the Hill and Terai[4] regions (UNDP 2004). Additionally, the percentage of malnourished children increased as one goes from the eastern part of the country to the western part of the country (UNDP 2004).

Kailali district is a food sufficient district of the Terai region. The Terai region is considered a granary of Nepal (Gill 1996). According to the District Agriculture Development Office (DADO), Kailali district exports food grains to other districts of Nepal. However, in the Kailali district, the percentage of children who are chronically malnourished was 43.2 percent for the year 2001, which is only slightly lower than the national average, despite the fact that the district is producing enough food (UNDP 2004; DADO 2003). The total population of this district is 0.61 million with about 94,430 households (CBS 2003). According to DADO (2003), the average household family size is about 6.53 members per family, which is higher than the national average of 5.44). The Human Development Index (HDI), which is a composite index of life expectancy, literacy and income, is 0.442 compared to the national HDI of 0.471 which ranks the district 46th in the nation in the year 2001 (UNDP 2004). Similarly, the Human Poverty Index (HPI) for the district 24th out 75 districts. The rank of the district on the Gender-related Development Index (GDI) is also below the national average, and it ranked 41st out of 75 districts (UNDP, 2004).

At the national or regional level, food security is measured by indicators such as food production, trade balance, and per capita income. These indicators reflect the country's or region's aggregate food demand and supply situations. As shown in other studies, food availability at the national or regional level does guarantee food security at the household level (FAO 2002; Sen 1981). This is because there are many socioeconomic factors jointly involved in determining food security at the household level. The household is the place where food production and consumption are actually determined. Therefore, the household level is an appropriate level for studying the factors affecting food security (Gittelsohn, Mookherji, and Pelto 1998). Additionally, there has been little work done to operationalize the food security concept at the household level in Nepal (Gittelsohn et al. 1998). An important aspect of this study is that it is done in a food sufficient district. By selecting a food sufficient district, it is easy to compare households in terms of factors other than aggregate food availability. This study helps to understand the concealed problems of food insecurity at the household level. Identifying the factors leading to household food security is likely to help policy makers and development workers initiate the intervention measures needed to resolve food insecurity problem in the future.

The main objective of this study is to identify the most important socioeconomic factors affecting food security at the household level in a food surplus district. Additionally, the study examines food stability at the household level.

LITERATURE REVIEW

According to FAO (2002) food security is defined as "year-round access to the amount and variety of safe foods required by all household members in order to lead active and healthy lives, without undue risk of losing such access." This definition carries the four sequentially linked components of food security – food availability, food accessibility, food access stability and food utilization (FAO 2002).

1. Food availability: Food availability indicates the degree to which food is available to households either through their own production or through importation in sufficient quantities, with appropriate quality, throughout the year (FAO 2002). Food availability is often confused with food security. Food availability should be seen as only a part, albeit an important part, of food security (FAO 2002).
2. Food access: Households require adequate resources ('entitlements'[5]) to have access of food in the right amount, with appropriate quality, and at the right time. According to Sen (1981), entitlements are "the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces". Entitlements could be money or traditional rights to share common resources (Sen 1981). Sen (1981) further states that households derive food entitlements from their own production, income, wild foods, community support (claims), their assets, and/or through migration. Sen (1981) has identified four main categories of entitlements: a) trade based, b) production based, c) own labor, and d) inheritance and transfer entitlement.
3. Food Stability: Food stability is a dynamic concept. At any point, a household may be food secure, but it may fall into food insecure situations in the future or it may have experienced it in the past (FAO 2002).
4. Food utilization: Food security is a complex issue. In addition to food items, it also involves non-food items like clean water, sanitation, and health care services. These non-food factors are important for food utilization in the body. Household members may consume an adequate amount of food, but if they cannot utilize their consumed food due to illness then they can fall into a food-insecure situation.

Food security at the household level is not the same as demand for, and supply of, food items. Gittelsohn et al. (1998) say that the household is a multilevel construct and that cultural factors govern household food selection and intra-household food distribution among its members. In addition, socioeconomic factors of the households govern food production and food purchase decisions. For example, the Brahmin or Chhetri consumes more green leafy vegetables, tubers, and dairy products and significantly less meat (Gittelsohn et al. 1998). Gittelsohn et al. (1998) adds that community-level exogenous factors such as health services, sanitation, and water supply influence individual nutritional status through morbidity (Figure 1).

Determinants of Household Food Security

Household resource endowments determine the status of household food security. Hoddinott (1999) divides household resources into two categories: labor and capital. The labor resource includes both qualitative (highly skill and educated) and quantitative (number working members) dimensions of household members (Hoddinott 1999). According to Hoddinott (1999), capital

includes resources such as land, tools for agricultural and non-agricultural production, livestock, and financial resources that, when combined with labor, produce income. Households allocate these resources to various activities such as food production, cash crop production, and non-agricultural income generating activities (such as wage labor, handicrafts, food processing, services, etc.) in response to relative rates of return (Hoddinott 1999). Capital and labor are both used for food production and income earning. In addition, households may receive transfer income from other households or from public offices (Hoddinott 1999). All these economic activities and transfers help to create security for households. The market prices also affect consumption and production decisions. Hoddinott (1999) acknowledged that health care goods such as shelter, sanitation, and water affect the health environment and thus household food security indirectly through illness and individual food intake.

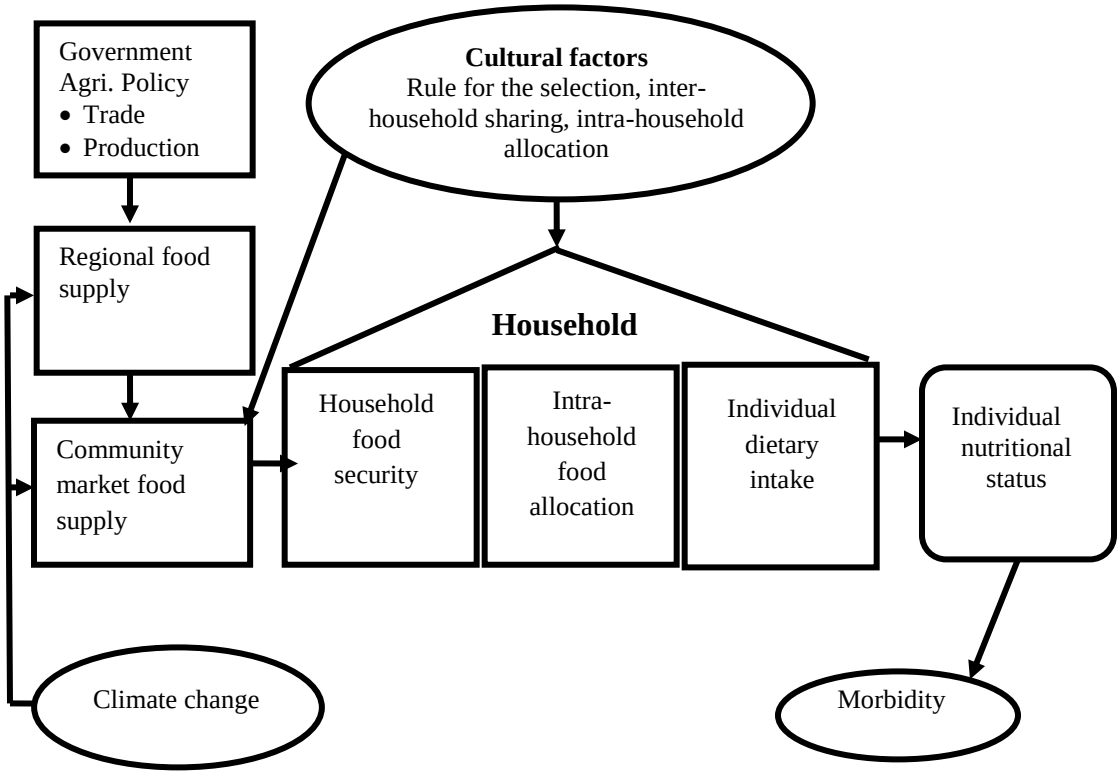

Figure 1: Conceptual framework for examining household food security, Gittelsohn *et al.* 1998.

Socioeconomic Characteristics of Nepalese Households

Agriculture is the main economic activity that provides food and income in the study area. Off-farm job opportunities are limited in the study area. As a result, the food security of households largely depends on the performance of the agriculture sector. The performance of agriculture, in turn, largely depends on the landholding size especially when there are institutional constraints on technological dissemination and capital investment (Chapagain 1999). The small size of

holdings and skewed distribution of land further limit the performance of the agriculture sector. Additionally, about 70 percent of farmers have one hectare or less of land and these farmers occupy about 30 percent of the total area (CBS 2002).

A majority of the population in the rural areas is in poverty and has a low level of education. The younger and educated members of the household frequently migrate to the city in search for jobs. As a result, rural households are left with children, elderly, and women members. These family members are left to make all production decisions on their farms.

Based on traditions and customs some castes or ethnic groups are discriminated against and have less opportunity to access resources and off-farm jobs (UNDP 2001). Additionally, women are discriminated against when accessing resources, jobs, and education irrespective of caste/ethnic groups. Gittelsohn, Thapa and Landman (1997) find that adult women are at a disadvantage when micronutrient rich food items are allocated among members of rural Nepali households. The incidence of poverty differs by the caste/ethnic groups. The incidence of poverty is highest among Limbus, followed by the socially underprivileged formerly untouchable castes i.e Sudra such as Kami (metal worker), Damai (tailor) and Sarki (cobbler) (UNDP 2004). These castes are more vulnerable to food insecurity (Shakya & Singh, 2000). The incidence of poverty is lower among Newars followed by Brahmins (UNDP 2004).

The data show that about 80 percent of the population has access to piped drinking water (UNDP 2001). However, piped drinking water is frequently contaminated due to leakage in the water delivery system. As a result, diarrhea is the second most prevalent disease in Nepal (UNDP 2001). On top of that, about 75 percent of the pregnant and 67 percent of non-pregnant women are anemic (UNDP 2001). In addition, the majority of children and women have vitamin A deficiency and Iodine Deficiency Disorder (UNDP 2001). This shows the poor health status of Nepalese households.

RESEARCH METHODS

There are two approaches used to assess the food security at the household level i.e. the nutritional approach, and the socioeconomic approach. The nutritional approach is involves anthropometric analysis (biological) and is generally performed by nutritionists or public health specialists. This approach focuses on food utilization. The socioeconomic approach mainly considers food availability, food stability, and food accessibility. This study uses the socioeconomic approach for analyzing food security at the household level. In the socioeconomic approach, socioeconomic factors of households are analyzed to determine their food security situation. Usually the socioeconomic approach does not consider the quality of food (a balanced diet) consumed in the household.

The Brahmin, Chhetri, Baisaya, and Sudra are the four major Hindu castes, whereas the Newar, Gurung, Magar, and the Tharu are ethnic groups. This study considers only the Brahmin, Chhetri, Sudra, and Tharu. These caste/ethnic groups represent more than 90 percent of the total population of the Kailali district. Moreover, the Sudra caste consists of a number of sub-castes such as Kami (metal worker), Damai (Tailor), and Sarki (cobbler). These sub-castes possess more or less similar socioeconomic characteristics and thus these sub-castes are included in the Sudra category.

The study was conducted in Kailali district in the far western region of Nepal. This district was purposively chosen for the study because this district is one of the food sufficient districts of Nepal. Data collection is completed on multi-stage and multi-criteria bases. First, three VDCs or municipalities,Geta, Darakha and Chaumala are selected for study. Seven northern-most VDCs were deliberately excluded from the random sampling process. These VDCs are in the remote area and data collection was almost impossible due to the Maoist insurgency. Next a single ward was selected randomly from each of the three VDCs. From each ward, one village was selected randomly, and from each village households were selected through systematic samplings. While selecting these samples, representation from each of the major caste/ethnic groups of Kailali district was ensured wherever possible. By this process, total 90 households were selected for interviews (Table 1). Additional information was collected from District Development Committee Offices (DDC), District Agriculture Development Offices (DADO), District Livestock Development Offices (DLDO), and Nepal Food Corporation zonal offices (NFC).

Table 1. Composition of Samples from the Three VDCs in the Study Area.

Caste/ ethnic group	Village Development Committee (VDC)			Total
	Darakha	Chaumala	Geta	
Brahmin	1	9	9	19
Chhetri	7	4	5	16
Sudra	12	9	6	27
Tharu	8	9	10	27
Gurung	0	0	1	1
Total	28	31	31	90

Note: The Gurung household is removed from the analysis.

Three group discussions were conducted in each VDC[6] in order to capture factors affecting food security. Group discussions were conducted in two stages. In the first stage, a group discussion was conducted with each of the caste/ethnic groups. In the second stage, a discussion was conducted with the entire group in each VDC. The first stage discussions were focused on the food items consumed, seasonal calendar of income, expenditures, food shortages and morbidity. In the second stage, issues such as, a) problems faced in agriculture, b) major inflows and outflows of food items, c) the process of agricultural development, d) seasonal calendars of labor availability, e) off-farm job opportunities, and f) cropping calendars were discussed. Moreover, a 'rich picture' was created to identify the major underlying causes of food insecurity in each VDC. A rich picture synthesizes the complexity and interrelationship of the elements in a situation without reducing the amount or kind of complexity experienced (Wilson & Morren. Jr, 1990). In addition, a key informant survey was done to validate the information collected in each VDC.

Analysis

The food security analysis was done in two phases. In the first phase, the standard statistical and econometric tools were employed. In the second phase, people's perceptions were analyzed non statistically. In the standard statistical analysis, descriptive statistics, correlations, t-tests, and

regression analysis was used. In the perception based analysis, the seasonal calendar, and rich picture were used.

In order to compare households from different caste/ethnic group, the net food available for a household for each food item in a year is calculated as follows:

$$\mathbf{NFV = (TP+ GR+FP+FRW+FPS) - (FS+FR+PHL+FD+FGW+FKN)} \ldots (1)$$

where, *NFV= Net food available, TP= Total production, GR=Food received as a gift, FRW=Food received as wage, FPS= Food from previous year's stock, FS= Food sold, FR= Food used for religious purposes, PHL= Post harvest loss (including grain kept for seed), FD= Food donation, Food given as wage, FKN= Food kept for next year.*

Once the net food availability is calculated, all food quantities are converted into calories using the following equation (2) to get the net calories available for consumption per adult equivalent (AE) per day (CAL).

$$\boldsymbol{CAL = \frac{\sum_{i=1}^{n} NFV_i(1 - \omega_i - \theta_i)\lambda_i}{AE * 365}} \quad \ldots (2)$$

where, *CAL= Calorie per adult equivalent per day, NFV= Net food available for each household for a year for the ith food item, ωi = extraction rate*[7] *from the grain/raw food for the ith food item, θi= other loss rate*[8] *during handlings processed food (if any) for the ith food item, λi= Calorie value*[9] *per unit for ith food item, AE= Adult equivalent*[10].

After obtaining net calories available for consumption per AE per day, per household, multiple regression is use to identify the factors affecting household level food security. For that purpose, the following model is used.

$$\mathbf{CAL = f}(irriland, hheyedu, caste, loan, agexp, offincome, stkcapital, anieqv, disasc, disforest, aev, parcel) \quad \ldots (3)$$

where, *CAL = net calorie available per day per adult equivalent, irriland = irrigated land area, hheyedu = years of education of household head, Caste = if household belongs to particular group 1 (otherwise 0), loan = loan amount, agexp = expenditure in agriculture, offincome = off-farm income, stkcapital = stock of capital, anieqv = animal equivalent unit, aev = adult equivalent, disasc = distance to agriculture service center, disforest = distance to the forest.*

Once the model is estimated, the contribution of each of the independent variables is compared using standardized coefficients. According to prior expectations, household head's years of education, loan amount, expenditure in agriculture, off-farm income, stock of capital, animal equivalent units and irrigated land area should make a positive contribution to calorie

availability; whereas distance to agriculture service center, and adult equivalent is expected to have a negative relationship with calorie availability.

RESULTS AND DISCUSSION

Ethnicity and Farming System

Most of the households produce agricultural commodities for their home consumption. The consumption pattern of each household is different. In the study area, the Brahmin and Chhetri castes never keep pigs in their home. Brahmin usually keeps Cows, but not chickens. The Tharu households keep chickens and they also keep cows for oxen but not for milking purposes. The Sudra caste also keeps small animals and consumes fewer vegetables. These behavior sis guided by strong traditional beliefs and some of them are guided by their household resource endowments.

Table 2. Comparison of Average Landholdings (in *Kattha*) and Animal Equivalent Units.

Caste/ethnic group		Landholding Size*	Irrigated **	Unirrigated*	Animal Equivalent Unit*
Brahmin	Mean	45.2	18.4	26.7	4.9
	N	19	19	19	19
	S.D.	32.9	17.4	26.7	3.2
Chhetri	Mean	29.6	15.8	13.8	3.7
	N	16	16	16	16
	S.D.	40.6	21.9	23.9	2.3
Sudra	Mean	8.8	2.3	6.4	1.4
	N	27	27	27	27
	S.D.	8.3	3.9	6.1	1.4
Tharu	Mean	29.1	18.1	11.1	4.8
	N	27	27	27	27
	S.D.	36.9	33.7	14.1	3.8
Total	Mean	26.2	12.8	13.3	3.5
	N	89	89	89	89
	S.D.	33.1	23.1	19.2	3.2

Note: *p<0.01; **p<0.10
30 Kattha = one hectare.

In the study area, the Brahmin mostly keeps the larger animals such as cows and buffaloes for milk and sometimes goat for meat purpose; whereas Chhetri keeps cows, oxen, buffaloes, goats, chicken. The Tharu keeps oxen for draught and chickens and pigs for meat purpose; but the Sudra keeps only small animals like chicken and sometimes oxen for the draught purposes. The Tharus usually prefers to keep oxen instead of cows; even if they keep cows, they were not for milking purposes. However, the Brahmin mostly keeps cows for milking purpose. The Brahmin does not keep oxen, because they do not traditionally plow the land. Most of the livestock breeds are found local breeds in the study areas. However, some of the Brahmin and Chhetri households have improved breeds of animal. In the sampled area, the distribution of animal equivalent unit

or livestock unit (LU) is also slightly skewed in favor of Brahmin and Tharu; whereas the household under Sudra caste has the least LU. Statistically, there is no significant difference between the average animal equivalent unit among the households of Brahmin, Chhetri, and Tharu. However, the average size of LU is significantly different (at the 0.01 level of significance) between Sudra and Brahmin, and between Chhetri and Tharu. These households also cultivate vegetable and fruit crops on their farmland. A very few households under the Brahmin and Chhetri sell vegetables in the especially during the peak season (winter). A very few Tharu Households also sell vegetables in the marker in the winter season. However, none of the households under Sudra caste were found selling vegetables in the market.

The Brahmin and Chhetri possess more inputs than other castes. The Brahmin not only possess the bigger landholding size, but also have more irrigated land, and LU than other caste/ethnic group. The Tharu household holds the second position after the Brahmin in term of landholding size and irrigated land and LU. The Sudra have small landholding size and most of their holdings were under irrigated condition (Table 2).

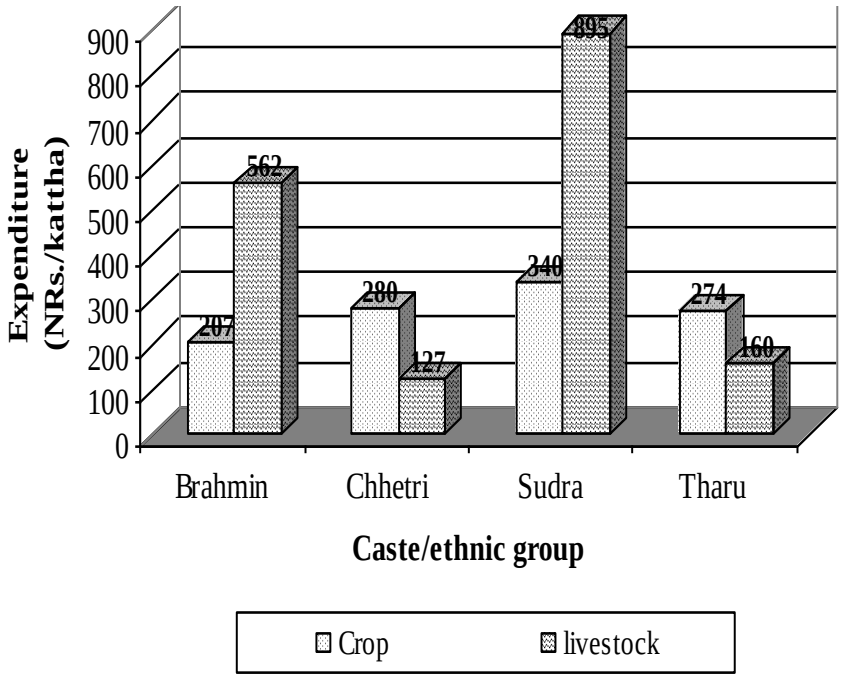

Figure 2. Average Expenditure per Unit of Land and per Livestock Unit.

The average expenditure per unit on agriculture activities is estimated for each type of household. The result shows that the Sudra household has the highest expenditure per unit of land and per unit of livestock. The Sudra caste has invested NRs.[11] 340 per year per Kattha compared to NRs. 895 per unit of livestock (LU) per year. The may be because of inefficiency in farm management and low land quality. The Brahmin households had an average investment of NRs. 207 per Kattha per year, and NRs. 562 per livestock unit. Similarly, for the Chhetri the average expenditure is NRs. 280 per Kattha per year and NRs.127 per livestock unit per year and for the Tharu NRs.274 per Kattha and NRs. 160 per livestock unit per year (Figure 2).

About 43 percent of Brahmin households, 75 percent of Chhetri households, 48 percent of Sudra households, and 59 percent of Tharu households experienced a moderate increase in their income over the last ten-year. About 21 percent of Brahmin households, 12 percent of Chhetri households, 30 percent of Sudra households and 19 percent of Tharu households have experienced no change in income over the last ten-year period. In contrast, 10 percent of Brahmin, 12 percent of Chhetri, 11 percent of Sudra and seven percent of Tharus' households reported that their income had decreased slightly over the previous ten years. Finally, about 10 percent of Brahmin households, 11 percent of Sudra households and four percent of Tharu households experienced significant declines in their income over the last ten-year period. Most of the economically active members of the Sudra and Tharu were found working as laborers on the farms of others in their village, in cities, or outside the country, especially in India.

The Brahmin households had average non-farm incomes of NRs. 45,816 (US$ 646.30) per year per household. This compares total average non-farm incomes of about NRs 25,625 (US$361. 48) and NRs. 37,426 (US$527. 95) per year per Chhetri and Tharu household respectively. For the Sudra household, the average non-farm income is about NRs. 19,573 (US$276. 10) per year per household (Figure 3). Statistically, there is a significant different between the average off-farm income of Brahmin and Sudra households at the 0.1 level of significance. The mean off-farm income difference is also found to be significant at the 0.05 level between Tharu and Sudra households.

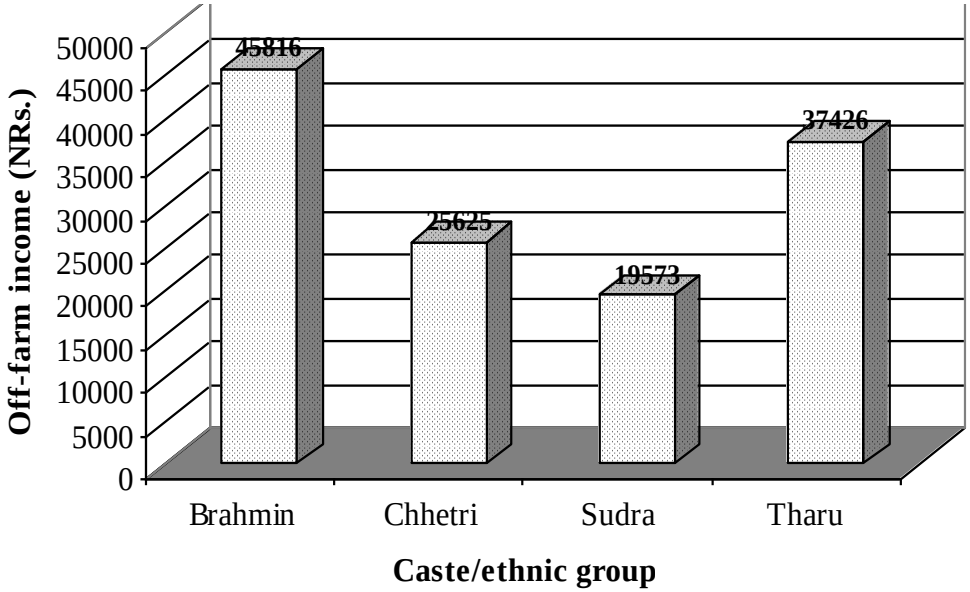

Figure 3: Average Off-farm Income of Different Caste/Ethnic Group.
Note: US$1= 70.89 Nepalese Rupees (NRs.) (buying rate of April 20, 2004)

Non-farm incomes have contributed significantly to food security irrespective of caste or ethnic groups. However, the contribution of non-farm income is most important for the Sudra households. About 92 percent of total household income comes from non-farm sources; thus only eight of household income comes from agricultural sources. The primary reason is households under the Sudra category do not have access to the resources (especially land) needed to cultivate crops. In the Brahmin and Chhetri households, crops contribute two thirds and livestock contributes about one third of total agricultural income. However, in the case of Tharu,

about one fifth of total agricultural income comes from livestock and the rest of their income comes from crops. In the case of Sudra households, about 50 percent of total agriculture income came from crops and another 50 percent from livestock (Table 3).

Table 3. Contribution to Total Income of Households by Various Sources.

Caste/ethnic group	Income from agricultural sector (%)			Non-farm Income (%)
	Crop*	Livestock*	Total	
Brahmin	21.5	10.5	31.5	68.5
	(66.6)	(33.4)	(100.0)	
Chhetri	18.0	11.3	29.3	70.7
	(61.5)	(38.5)	(100.0)	
Sudra	4.4	3.4	7.8	92.2
	(56.8)	(43.2)	(100.0)	
Tharu	17.8	4.2	22.0	78.0
	(81.1)	(18.9)	(100)	

Note: * Percentage in parenthesis indicates an income contribution from crop or livestock sector to the total agricultural income.

Food Availability and Food Security

Earlier analyses have shown that the Brahmin and the Chhetri households have relatively better access to productive resources. As a result, the Brahmin, and to a lesser degree, the Chhetri households were more food-secure than the Tharu and Sudra households. This can be further substantiated with the 2,250 kilocalories[12] threshold level. Using this standard, only the Brahmin and Chhetri households have achieved that threshold level; whereas Tharu and Sudra households could not do so. The Brahmin households consume the highest average caloric levels (2626.6). However, the standard deviation is also higher for the Brahmin households. For the Chhetri households the average caloric intake value is 2,251 calories per adult equivalent. For the Sudra and Tharu households the average value is 1,537 and 2,204 calories per adult equivalent respectively (Table 4).

Statistically, there is no difference between the average calorie values of the Brahmin and Chhetri households. However, there is a significant difference between the Brahmin and Sudra households at the 1% level. Additionally, there is no significant difference between the caloric intake means of Brahmin and Tharu households. There is a significant difference between the mean of calories per adult equivalent of Chhetri with Sudra households at the 1% level of significance, but there is no statistical difference between the mean calories of Chhetri and Tharu households. There is a significant difference between the mean value of calorie of the Sudra and Tharu households at the 1% level of significance.

Table 4. Average Calories per Adult Equivalent per Day Under Different Caste/Ethnic Group.

Caste/Ethnic Group	Mean	N	Std. Deviation	Minimum	Maximum
Brahmin	2626.6	19	1848.1	1211	6925
Chhetri	2251.4	16	653.6	1446	3923
Sudra	1537.2	27	466.7	1086	2479
Tharu	2204.3	27	1234.0	1052	6333
Total	2100.5	89	1204.3	1052	6925

In the Brahmin households, 89 percent of households are food self-sufficient for the whole year and about 11 percent of households have food sufficient for six months. In contrast, about 56 percent of Chhetri households have sufficient food for a whole year; whereas 31 percent households have food sufficiency for 9 months, and about 13 percent households have food sufficiency for six or less than six months. In the case Sudra households, about seven percent of households are food sufficient for the whole year, 15 percent households are food sufficient for 9 months, about 52 percent of households are food sufficient for three to six months, and about 26 percent of households are food sufficient for one month. For the Tharu households, about 30 percent of sampled households have sufficient food for the whole year, 22 percent of sampled households have 9 months of food sufficiency, and about 41 percent of households have three to six months of food sufficiency (Table 5).

Table 5. Situation of Food Sufficiency in Different Caste/Ethnic Groups

Caste/Ethnic Group	Food sufficiency (months)						Total
	12	9	6	3	1	0	
Brahmin	17(89.4)	-	2 (10.6)	-	-	-	19 (100)
Chhetri	9 (56.2)	5 (31.2)	1 (6.3)	1 (6.3)	-	-	16 (100)
Sudra	2 (7.4)	4 (14.8)	11 (40.8)	3 (11.1)	7(25.9)	-	27 (100)
Tharu	8 (29.7)	6 (22.2)	4 (14.8)	7 (25.9)	1 (3.7)	1 (3.7)	27 (100)
Total	36 (40.4)	15 (16.9)	18 (20.2)	11 (12.4)	8 (9.0)	1 (1.1)	89 (100)

Note: Figure in the parenthesis indicates the percentage of the caste category

Seasonality of Food Insecurity

Since agriculture is the main economic activity in the region, the performance of agriculture plays a key role in determining food security at the household level. Due to the seasonal nature of agriculture, the income, expenditure, and food stocks of households vary from month to month. Figure 4 shows the seasonality of household income, expenditures and food shortages.

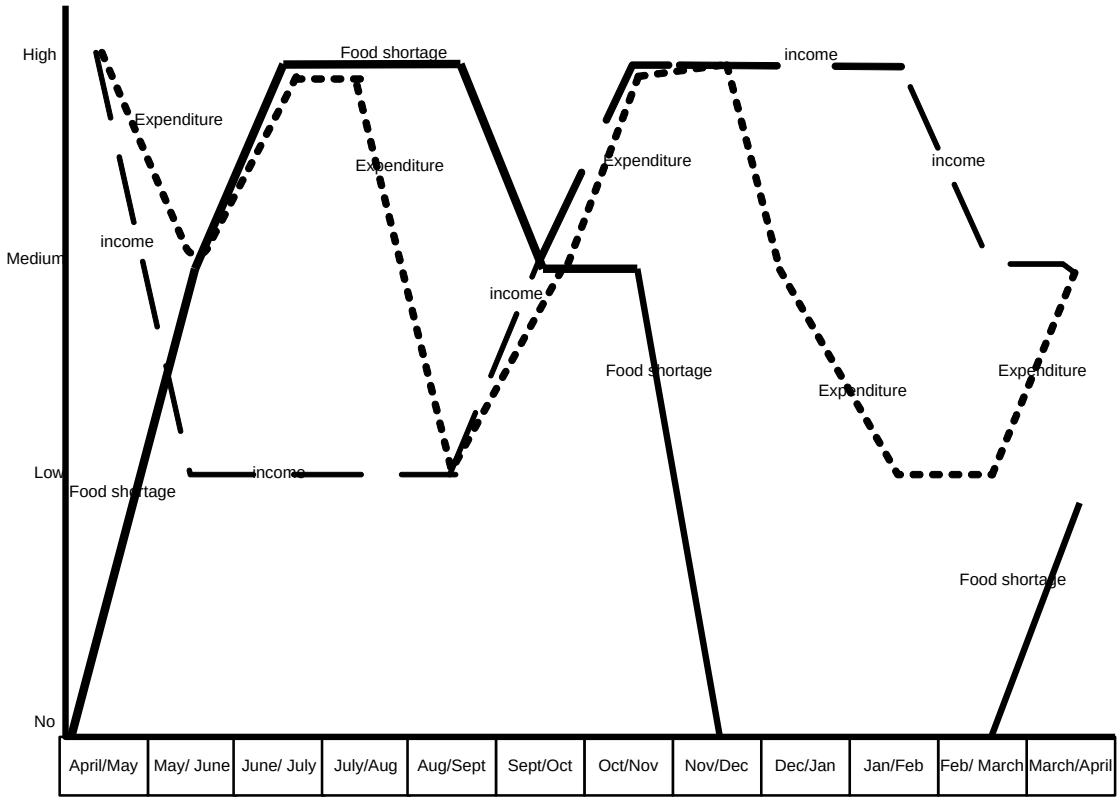

Figure 4. Trends of food shortage, expenditure and income of households.

The level of household expenditures high from May to August when households must pay school admission fees for their children and when children suffer from diseases like diarrhea, and skin diseases, and livestock also suffer from diseases such as foot and mouth disease (FMD) and parasites. During this period, rice is planted and wheat is harvested. These are the major staple food crops in the study area. The expenditure of the household goes up again between September and December when households celebrate the Dashain and Tihar festivals. This is also planting time for rape seed and wheat. During this period, Tharu household expenditure is lower than other groups because they do not usually celebrate the Dashain and Tihar festivals. For the Tharu household, expenditure goes up in January and February during celebration of the Maghi festival.

During the April/ Maytand November to February periods, household income is highest due to rice and wheat and vegetable harvests. The household's income is lowest from June to September, when there are no crops to harvest. From May to August when income remains low and expenditures and food shortage are higher. During this period, households that do not have adequate food stock and those at the margin of food security are likely to fall into temporary food insecurity (Figure 4). During these months, food insecurity is visible in most households including those that are above the threshold limit on an annual basis.

Factors Affecting Food Insecurity

In order to identify the factors affecting \food insecurity a 'rich picture' was developed during group discussions. This rich picture shows agricultural production, income (off-farm, non-farm and on –farm), insurgency, market prices, input availability, irrigation, and expenditures are all major factors affecting food security at the household level. One surprising result is that social issues, like discrimination and illiteracy, are not revealed as important in the 'rich picture'. The factors that affect household food security are depicted on the "rich picture" in Figure 5.

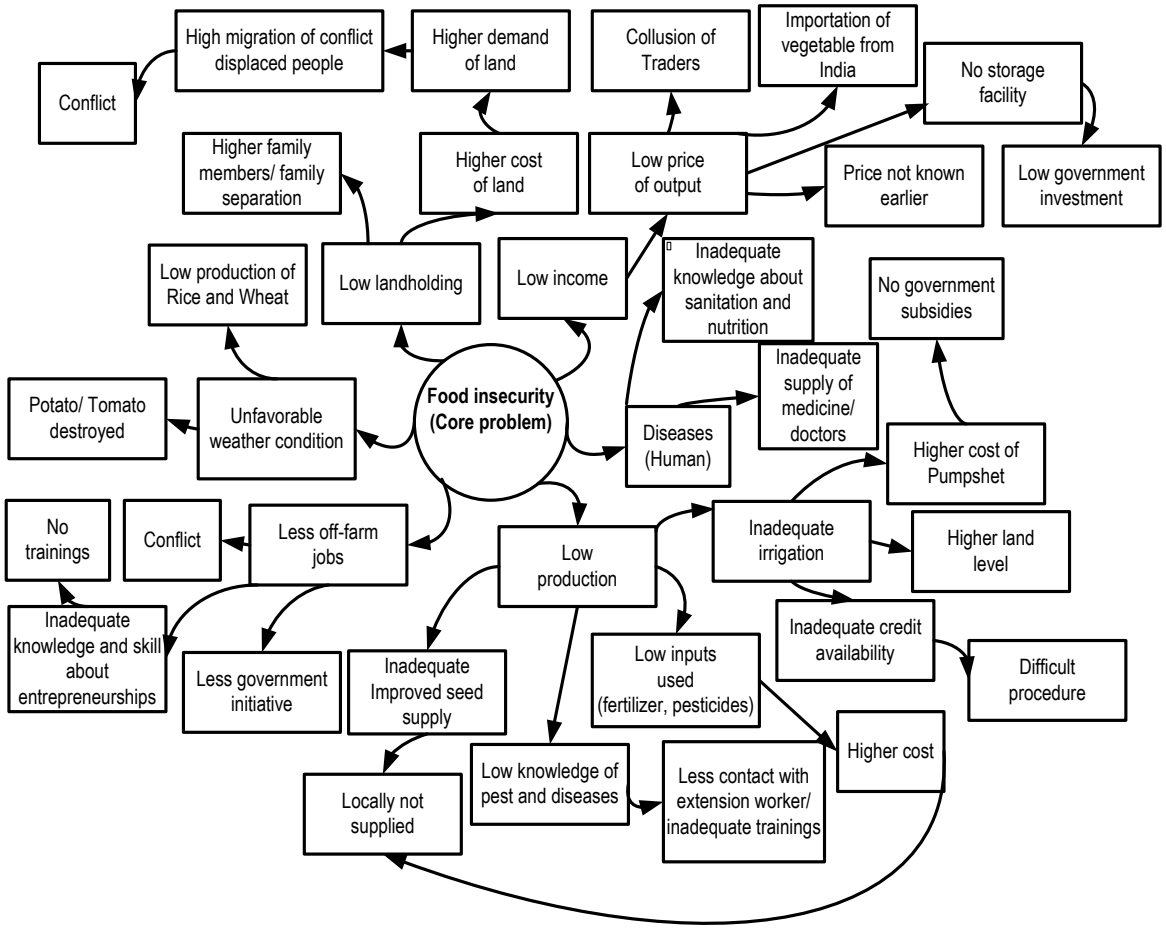

Figure 5: The food insecurity 'rich picture' of the study area.
Note: Arrow represents "caused by"

In order to identify the most important factors affecting calorie availability to households, a multiple log-linear regression model was estimated. The results show that the dummy for *a Sudra* and expenditures on agriculture are significant at the 0.05 level , the ratio of economically active females to total economically active family members and animal equivalent units are significant at the 0.1 level, and number of adult equivalents is very significant (below the 0.001 level of significance), These and other variables that affect the level of food availability at the

household level are shown in Table 6. The standardized coefficients indicate that the adult equivalent household members, contribute most (in a negative way) to food availability. On the positive side, expenditures on agriculture contributed the most followed by the ratio of cultivated land per adult equivalent are the most effective (Table 6). The *Sudra* households are the most vulnerable group among the caste/ethnic groups. For households in the *Sudra* caste, the calorie values are just 1.30 calories per adult equivalent per day (or 474 calories per adult equivalent per year) lower than households in other caste/ethnic groups. Surprisingly, the total cultivated land per adult equivalent and other land related variables do not contribute significantly to food availability of households. This may be because of the household's small landholding size and low productivity. This also indicates that the potential for increasing agricultural production in the study area is rather limited. Generally, increasing household members (especially economically active members) increase household resource endowment and thereby the productive capacity of the households. However, if the households have very limited resources and no off-farm job opportunities, increasing member in a household decreases resources per head and thereby decreases the calories per adult equivalent. Thus it is not surprising to find the negative coefficient for adult equivalents in the model. Increasing productivity by means of training programs and skill development as well as providing job job opportunities are the most immediate and effective measures to help the households in the study area achieve greater food security. Increasing the number of animal equivalents and expenditures on agriculture also contribute positively to food security of the households (Table 6).

Table 6. The Log-linear Model Results

Independent Variables	Unstandardized Coefficients		Standardized Coefficients (Beta)	Significant Levels (p-value)
	Estimated Coefficients	Standard Errors		
Constant	7.923	0.207		0.000
Dummy variable for *Sudra*	-0.261	0.108	-0.208	0.017
Cultivated land per adult equivalent	0.015	0.010	0.186	0.112
Ratio of economically active female members to total economically active members	-0.588	0.334	-0.137	0.081
Adult equivalents	-0.121	0.025	-0.437	0.000
Number of parcels	0.055	0.044	0.146	0.209
Ratio of irrigated land to total cultivated land	0.163	0.111	0.114	0.144
Animal equivalent units	0.030	0.018	0.170	0.087
Expenditures on agriculture	1.09E-05	0.000	0.254	0.011

SUMMARY AND CONCLUSION

Food security is a complex issue especially at the household level. This study examines food security issues in a district which has general food sufficiency. Food security issues can be measured in two ways i.e. nutritional approach and socioeconomic approach. The socioeconomic approach focuses on the socioeconomic characteristics of households. In order to investigate food security at the household level, a household survey, group discussions, and a key informant survey were conducted in randomly selected households. In addition, a 'rich picture' was

constructed to build a holistic picture of the food security problem in the study area. A regression model is used to identify the major contributing factors to food availability at the household level in the study area. Sudra households in the study area were found to be the most vulnerable group in the study area. The study also finds that adult equivalents, animal equivalents and expenditures on agriculture are the main factors affecting food availability at the household level.

Moreover, small landholding, low income, and inadequate knowledge about improved practices are affecting food security at the household. The Sudra households are the most severe food insecurity households and followed by Tharu households. Food insecurity is not as visible in some of the Tharu and Sudra households, but these households are often at the margin and could fall into food insecure situation in the near future. One of the reasons for this vulnerability is that among all these food secure households, 44 percent households are involved in sharecropping. These households can be evicted from their sharecropping situations at any time. Generally, food insecure households have small landholdings, less irrigated area, higher family size, less livestock holdings, and less off-farm income. Food availability fluctuates between planting and harvesting seasons (especially for those producing paddy and wheat). The harvesting and planting seasons also determine when the major expenditures and incomes of households will occur. Consequently, during the months of May to August income remains low, expenditure and food shortage goes higher thereby creating a temporary food-insecure condition for those households which barely meet their food requirements over the whole year. This temporary food insecurity condition would not have been captured if this analysis was done on the basis of an annual calories account. By judging against the national basic daily calorie requirement (2250 kilocalories per person per day) only about 30 percent of households sampled met the basic calories requirements. Finally, this study found that women were discriminated against in terms of food sharing within the households. Therefore, a future research is needed to better understand intra-household food sharing.

ENDNOTES

[1] Developed countries are not included in this ranking.

[2] A score of 20 on the Global Hunger Index indicates that the country has an 'alarming' level of hunger. The index is interpreted as follows: 0 to 4.9 is considered 'low hunger', 5 to 9.9 is 'moderate hunger', 10 to 19.9 is 'serious', 20 to 29.9 is 'alarming, and values greater than 30 are considered ' extremely alarming'. For details see the IFPRI web page [www.ifpri.org].

[3] The name was recently changed to the Ministry of Agriculture Development.

[4] Nepal is divided into three agro-ecological zones i.e Terai, Hill, and Mountain. The Terai region is in the southern part of Nepal. This region is a flat, fertile and accessible to the market as compared to other regions.

[5] The term 'entitlement'is used by the Nobel laureate Amartya Sen (1981) to denote as a mean to get food security.

[6] VDC= Village Development Committee. VDC is somewhat equivalent to county.

[7] Obtained from Post Harvest Section, Department of Agriculture .

[8] Obtained from Post Harvest Section, Department of Agriculture.

[9]Source: Nutrients Contents in Nepalese Foods (MOA, 1994).

[10] The adult equivalent (AE) is the conversion of all age group into single adult. The conversion is obtained from the unpublished thesis (Ojha, 1999). The original source is from Vega and Fisher.

[11]NRs = Nepalese Rupees. The exchange rate is US$1= 70.89 NRs.. This is a buying rate of April 20, 2004

[12]This threshold is an average daily calorie requirement for per adult to perform his/her daily activities. The threshold level is calculated by the National Planning Commission. But, the information is the information is taken from Shakya and Singh.

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One More Thing to Worry About Mothers' Perceptions of Risk in Food[*]

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ABSRACT *The purpose of this research was to understand and describe how mothers provision healthy food for their families and what methods did they use to avoid risk.. It aimed to analyze how mothers make meaning of their food consumption practices which are embedded in a system of modern industrialized agriculture. Healthy food is highlighted in this study due to the mainstreaming of natural and/or organic foods in the nation marketplace. The research is based on a qualitative study conducted with 14 mothers. In-depth interviews were conducted to investigate the attitudes and beliefs mothers had about healthy foods and risky foods, and to also explore how mothers made meaning of the provisioning practices required of them to feed their children healthy, risk-free food. Additionally, the topic of food borne illness was explored to determine if the mothers conceive of this as a risk and what actions they may take to avoid this danger present in food. Overall findings display that mothers' risk perceptions are concerned with food produced in the industrial sector and many have turned to locally produced food to mitigate these perceived risks in the quest to protect their families and feed them healthy food*

[**food-borne illness, mothers, risk-avoidance, food systems, consumption**]

INTRODUCTION

Food-borne illness has been a growing problem in recent years. News stories and public debate has focused on the instances of food-borne illness outbreaks due to contaminated food. Consumers are beginning to question the efficacy of protection agencies designed to prevent food-borne illness. The rationale behind this study is to extend the research in the area of consumption in the rural sociology literature and explore the attitudes and beliefs of mothers relating to risks in the consumption of food. I argue that the state sponsored agencies responsible for food safety place the onus of responsibility of protecting against food borne illness within the private household instead of placing the responsibility with the industrialized system which introduces contamination into food. Safe food handling practices at the private level are ineffective at protecting one's home from illness if the product arrives into a home already contaminated.

The purpose of this research was to understand and describe the methods of risk avoidance performed by mothers concerning food consumption and food-borne illness. It aimed to analyze

how mothers make meaning of their food consumption practices. I wanted to see what motivated their choices, how they perceive risks related to food, and what they do to avoid these risks while feeding their families. I wanted to see if mothers consider food borne illness a risk. I wanted to discover other germ avoidance behaviors mothers were using to lessen their family's exposure to risk. I wanted to see if mothers are sanitizing their home as part of their housework, and whether or not they also engage in germ avoidance in their food consumption practices. Overall, I hoped to discover the lived experiences of mothers who feed a family.

Organic food is highlighted in this study due to the mainstreaming of natural and/or organic foods in the national market and consumers' increased concerns over the safety of food grown with conventional agriculture methods. (Belasco 2007) "Increases in sales of organics have ranged between 17 and 21 percent each year since 1997, compared with total U.S. food sales, which have grown on an average rate of 2 to 4 percent each year." (Onyango et al. 2007). Studies have shown that women are likely to purchase organic products due to their increased worries about ingredients. (Knight and Warland 2004; Little, Ibery and Watts 2009; Onyango et al. 2007). Middle class women are more apt to define healthy food in terms of its nutritional components (Lupton 1996; Charles and Kerr 1988; DeVault 1991). Middle class women are also in a position that affords them the opportunity to consume distinguished food like organic food (Cairns et al. 2010). By describing how mothers feel about risky food unpacks the motivations behind their consumption practices while embedding them in the overall system of modern American agriculture.

The current method of food production in the United States centralizes power among a several large corporations that wield their influence to maximize profits. In a capitalist society such as ours, the behavior is encouraged by the systems set in place by the government which benefits corporations at the expense of the general public. Livestock and products of agriculture are now corporate commodities which are produced in a way that degrades their quality and has the potential to jeopardize the health of its consumers. "As with all the myths of industrial agriculture, things are not exactly as they appear. The Centers for Disease Control (CDC 2009) report that between 1970 and 1999, food-borne illnesses increases more than tenfold." (Kimbrell 2002) As our food production system becomes increasingly industrialized, there is a greater chance of becoming ill from eating food produced in this manner.

Food production in modern America is left in the hands of a few corporate giants. There are over 50,000 brands of food on supermarket shelves and there are less than ten companies responsible for manufacturing these products. (Howard 2009) When power is condensed as it is in our food system, there are many opportunities for bacteria and viruses to flourish. The agents in control of our food quality can be considered responsible for many deaths due to their negligence, but we do not socially construct this form of negligence and wrongdoing as murder. Instead, the victims of foodborne illness usually are blamed for their unsafe food handling practices. "The CDC estimates that food-borne diseases cause approximately 76 million illnesses, 325,000 hospitalizations and 5,000 deaths each year. In medical costs and productivity losses, food borne illnesses related to five principal pathogens cost the nation about 6 billion dollars annually, the USDA estimates." (Robinson 2002)

Through the creation and employment of consumer education programs that relate to food safety such as the Fight Bac! Program (USDA 2006) consumers are given the impression that keeping

their hands and kitchen clean is the proper way to eliminate the possibility of contracting an illness from food. *Is It Done Yet?* and the formulation of the character Thermy, both consumer-education programs originating from the USDA instructing consumers to make sure their food has been cooked to the proper temperature with a thermometer. In addition to the knowledge produced by these programs, consumers are reminded to eliminate the chance of cross contamination and to chill and store any leftover food. I argue that through this particular way of producing the ways to avoid potential food risk like food borne illness; The USDA has placed the onus of responsibility for avoiding foodborne illness onto the consumers in the modern food system absolving the producer's responsibility to deliver a product which is free of risk.

Bryson, McPhillips and Robinson (2001) use a feminist analysis to display how mothers were blamed for their children's lead poisoning by deconstructing the advice given to them by the government concerning ways to clean their house, ensure proper hygiene and alter their behaviors to prevent lead poisoning from happening within the private sphere of the home. State intervention at the private level, in terms of managing behaviors of mothers, did nothing to address the root of the problem which was the pollution-producing lead smelters. I argue that the regulatory agencies in charge of the American food system use similar blame tactics to mitigate their responsibility to protecting consumers from risk. The onus of responsibility of preventing contamination and illness is placed with the person cooking, not with the practices that caused the contamination in the first place. This public problem has now become a private issue.

I argue that as the food system becomes more industrialized, these private measures of prevention are potentially not enough to prevent food borne sickness. The neo-liberal project of a more industrialized food system have allowed for viruses and bacteria to flourish. Factory farms can be considered the starting point of the microbes' lives. "According to the CDC, reported cases of disease from salmonella and E. coli pathogens are 10 times greater than they were two decades ago, and cases of campylobacter have more than doubled. The CDC saw none of these pathogens in meat until the late 1970s when 'animal factories' became the dominant means of meat production. Even our fruits and vegetables get contaminated by these pathogens through exposure to tainted fertilizers and sewage sludge. Contamination can also occur during industrialized processing and long-distance shipping." (Kimbrell 2002)

Governmental policies and practices contribute to the problem of contaminated food. Inspection programs have resulted from a risk management program started by the USDA's Food Safety and Inspection Service (FSIS). By the year 2000, food processors were required to implement a program called Hazard Analysis and Critical Control Point (HACCP). "These requirements are intended to ensure that plants operate food safety systems that are prevention-oriented and science-based. As the foundation of the HACCP system, plants are responsible for developing HACCP plans that, among other things, identify all of the contamination hazards that are reasonably likely to occur in a plant's particular production environment, establish all of the necessary steps to control these hazards, and have valid scientific evidence to support their decisions." (Dyckman 2004) Even with these HACCP plans in place, government inspection agents are given approximately two seconds to inspect each carcass for a myriad of diseases and disorders, most of which are microbial or viral in nature. A visual inspection is not sufficient enough to identify microbial contamination.

These policies of risk assessment and prevention are erected using scientific measures and technological practices which work in favor with state regulation that protect the interests of

corporate food producers and the stockholders of these companies. Catharine MacKinnon argues that the "state is male in the feminist sense….The liberal state coercively and authoritatively constitutes the social order in the interest of men as a gender, through its legitimizing norms, relation to society and substantive policies." (MacKinnon 2004) Using a feminist analysis of the state and using the lived experiences of mothers, I argue that governmental regulatory agencies promote industrialized food production practices while turning a blind eye to methods which increase the propensity of risks happening in the food chain. This places the burden on women in the private sphere to mitigate their public problem of food safety derived from these state-sponsored practices within the corporate- industrial food system.

Marjorie DeVault's (1991) study on feeding the family explains how a mother's care is expressed through the act of provisioning food for her family. She recognized that most of the work that is needed to complete the task of feeding a family is "invisible" and this work involves emotional labor as well as daily activities that women do in order to produce and reproduce the family as it is socially constructed. I extend DeVault's study by considering the multitude of variables that the women in DeVault's study were not concerned with, potential hazards like pesticide residues, genetically modified organisms, growth hormones and antibiotics.

I use DeVault's term provisioning to describe the layers of practice that constitute the feeding work done by women in the household- planning, shopping and cooking- which are all "embedded in a socially organized household practice." (DeVault 1991) Additionally, I argue that mothers are challenged to provision healthy, safe, risk- free food. They have the added pressure to feed "proper" meals to their children. (Charles and Kerr 1988; Knight and Warland 2004; Little, Ilbery and Watts 2009; Lupton 1996) These authors call for a greater attention to be paid to the food consumption behaviors of mothers. Little, Ilbery and Watts (2009) suggest that a gendered approach to local food systems analysis is needed, because women are responsible for a disproportionate amount of the work involved in feeding a household. They also argue that

> "both health and body size/shape are very powerful considerations in terms of the food choices of some sectors of the populations. Often such considerations call into question arguments surrounding the relative merits of natural versus processed food. While concerns about health and the body are by no means exclusive to women, women's domestic role again assigns them greater responsibility for managing the health of the family and responding to moral panics and food scares surrounding issues associated with fast food. ." (Little, Ilbery and Watts 2009)

This literature supports the decision to focus on mothers in this study. Women aim to care for and protect their families from harm and research is warranted to explore how they perceive risks from food consumption and how they avert these risks in their habitual consumption practices.

Additionally, I believe that mothers have great potential for activism and affecting social change. Feminist research has displayed how resistance and activism can emerge from the role of being a mother in the greater community. Mothers have been on the leading edge of activism against pollution within their own communities. (Abrahams 1996; McPhillips 1995; Naples 1991) Mothers are more willing to venture out and bring attention to issues such as pollution (Brown and Ferguson 1995) and food safety based on their family commitments that are rooted in their role as the principal caretaker for the health of their families. "Many activists, as primary

caretakers of young children in the home, attribute their work to a special concern for family health and safety. They see their work as the natural extension of the nurturing and parenting role." (Verchick 2004) While I did not question the mothers in my study about their feelings towards assuming an activist role, a majority of them revealed a desire to engage in resistance towards the patriarchal, industrial food system through the consumption of local or organic food. As such, I acknowledge alternative food consumption as an activity of resistance and activism in which these mothers participate.

THEORETICAL FRAMEWORK

Marjorie DeVault's (1991) groundbreaking feminist, ethnographic study *Feeding the Family: the Social Organization of Caring as Gendered Work* (1991) argued that an analysis of the social organization of the household reveals the effort and skill behind the "invisible" work mothers do that consists of shopping, cooking, and serving meals in order to feed their family. She posits that society constructs caring for a family as feminine, so feeding a family is seen as a gendered act. She states that providing food for children and husbands is a way for them to perform a socially constructed gender role. She describes five elements of feeding the family; the multifaceted nature of the work, the social characteristics, the symbolic quality, they ways in which class and race influence the practices and how the work of feeding the family operates to reproduce gender and class in society.

DeVault sought to understand the complicated processes of feeding a family through the women's sensuous activity and their descriptions of the work. She relied on the women's lived experiences to inform her analysis of an everyday, overlooked activity. The notion of 'caring' is central to the act of feeding a family and she explains how caring is a gendered act. It is through the act of caring that women are subordinated and the gender order is reproduced. Women learn to care and how to be a good mother through witnessing their own mother's behavior, but also through the wider discourse of femininity and family life.I argue that contemporary mothers have additional invisible work which extends from DeVault's original conception of feeding work. Mothers are now faced with increased worries about chemical additions, allergies and sensitivities, and a concern towards the naturalness of the food.

DeVault relies on West and Zimmerman's (1987) concept of "doing gender" to express that gender is not conceptualized as a trait, or a role, but as an accomplishment. They argue that feeding work can be envisioned as the "material embodiment of the wifely role" (West and Zimmerman 1987). This understanding of gender is situated in an overall context of a larger structure which reinforces this type of reproduction of gender. Women are gendered through the actions performed in order to provide food in their household.

Charles and Kerr (1988) studies women in England to determine how "food practices contribute to the reproduction of the social order." (Charles and Kerr 1988) They focused their attention on women, the family, and class to explore the relationships between age, class and gender and how food work is practiced. They uncovered what is considered 'good' food and what makes a 'proper' meal. They determined that food practices and gender divisions within the family are mostly determined by class. Deborah Lupton (1996) uses a post-structuralist argument to

describe the ways food practices and preferences are largely determined by culture and symbolic meaning. She explains how many people have embodied an eating philosophy to justify their choices. She distinguishes between the conceptions of good/bad, healthy/unhealthy, edible/inedible, and pathogen/medicine. Lupton creates a framework from which the preferences for organic or natural foods can be explored in greater detail.

Douglas and Michaels (2004) have theorized that depiction of motherhood in the media have created an unattainable standard of what it means to be a good mother. Beginning in the 1970s, they track the media portrayal of motherhood and explain how current common-sense understanding of motherhood are debilitating to many women and this "new momism" supplies a new set of anxieties and worries while at the same time creating a role that many women cannot attain. I argue that new momism has influenced the mothers in my study by influencing their ideas and perceptions of what it means to be a good mother. Along with an escalating set of expectations, new momism places the responsibility of raising a well-rounded productive member of society with the mother. "The new momism insists that the formation of a child into a successful, happy person is exclusively the handiwork of one person- Mom." (Douglas and Michaels 2004). I argue that not only are moms expected to raise happy children, but also among the women in my study, feeding your children healthy and safe food is part of what is expected of a good mother. New momism suggests that provisioning healthy foods for their kids is one more achievement that mothers must attain to show that they have their child's best interests in mind.

Ulrich Beck's (1992) renowned book *Risk Society* explains the growing anxiety, dread and concern constantly faced by citizens of Western countries relative to threats to human well-being that come from the environment. These threats include radiation, environmental pollution, and food contamination. He argues that citizens of the Western world have an increased awareness of risk and that we are no longer part of an industrial society, but a risk society. He states that some people are more affected by risks than others and I argue that due to the household labor distribution, mothers are more affected by the threat of risks in food because they have to learn what the risks are and what the proper practices are to reduce their exposure to these risks.

Mothers who choose organic foods for their children are practicing what Andrew Szasz (2007) calls the inverted quarantine. Consumers have been made aware of the potential dangers to their health that may come from eating conventionally produced food. People have embraced the belief that they can avoid pesticides, hormones, and chemicals through the consumption of organic food. This segment of consumers are not buying organic foods to contribute to a larger social justice movement, but are purchasing organic foods to keep hazardous substances out of their bodies and their children's bodies. I argue that the women in my study are employing the inverted quarantine as the motivations for purchasing organic foods (Szasz, 2007). Overall, the theoretical framework provides a foundation to interpret the practices and beliefs of mothers through the lens of what they perceived as risky while consuming food.

METHODS AND RESULTS

This study is based on the qualitative analysis of the transcripts from 14 semi-structured open-ended, face-to- face interviews which were conducted in a Midwest college town in the spring of 2012. The interviews investigated the attitudes and beliefs mothers had about healthy foods.

They explored how mothers made meaning of the provisioning practices that were necessary to feed healthy food to their children. Main research questions interrogated what particular risks were perceived and what did they consider healthy in terms of the food they feed their children? What influenced their practices and how did they actually do the work? I asked all of the mothers about the typical meals they prepared, their planning routines and shopping habits.. I also asked questions which pertained to where they received information about healthy food and which of these sources they trusted the most.

Participants were recruited with flyers which advertized the study. These were placed in strategic locations as an attempt to gain the most attention from women with children including the public library, grocery stores, local coffee shops and local restaurants. The flyer was worded to highlight the focus of the study with the main concern being on healthy feeding practices. I sought women that focused on feeding their children healthy food as a primary dimension of being a good mother. The sampling process focused on garnering the women that were most focused on food. I also employed snowball sampling, through which I utilized the social connections of respondents to recruit other mothers which provided me with 4 additional points of entry. I could have snowballed further, but I began to hear repeated patterns in the responses to my questions after a certain point. The small size of my sample along with my use of the snowball sampling technique means that I cannot claim that these results are representative or able to be generalized.

As seen in Table 1, the 14 mothers were diverse in age, income levels, and employment status. Though I attempted to recruit a sample that was as varied as possible, all of my respondents were white and heterosexual. Ages ranged from 26 to 47. Seven of the women had one child, five of them had two children and two of the women had three children. 10 women are married, two are divorced and two women cohabitate with their partner, one of which is a stay at home mother and the other woman works part time so that she and her partner can split the childcare responsibilities of their two children. The women who were divorced shared custody of their children with their ex-husbands. Both of these women had full time jobs and one of them held a part time job as well. The mothers held a variety of occupations from a breast-feeding counselor,a librarian, a human resources director, and a communications manager for the local university. Four of the married work full-time. 3 of them work part-time and three of them identified as stay-at-home mothers. Regarding household income, 2 women reported incomes of $15,000-$29,000, four reported incomes of $30,000-$59,000 and eight of the women reported incomes over $60,000.

While transcribing, I was careful to preserve the emotional tone of our woman-to-woman conversation. (DeVault 1990; Kvale 1996) Feeding work often happens without a second thought so many of the women said things like “I’ve never thought of this before” or “I need a minute to think”. I felt it was necessary to preserve the pauses and the ambiguities in their language that arose during the interview process to capture the struggle to find the vocabulary to explain how they accomplished the work that seemed invisible. I also noted the positivity in their voice where they described successes that they had in feeding their children. I captured everything verbatim and verified the reliability of the transcription process by comparing the recordings of the interviews to the transcripts and made the necessary corrections. I assured the women that the interviews would remain confidential and received their written consent to participate in the study. I assigned each respondent, along with her family, a pseudonym and

changed any detail that might have described identifying characteristics, such as a particular occupation.

Table 1. Mother's Age, Number of Children and Their Ages, Employment Status, Educational Attainment, Family Income and Marital Status

	Age	Number of Children	Ages of Children	Employment Status[a]	Education[b]	Family Income[c]	Marital Status[d]
Stephanie	43	1	8	FT	B	60+	M
Valerie	42	2	16,14	FT & PT 2nd job	B	15-29	D
Brittney	31	1	2.5	FT	B	60+	M
Patty	47	2	9,11	FT	Some college	15-29	D
Whitney	27	1	1.5	FT	B	30-59	M
Tamar	37	1	3	FT	MA	60+	M
Shannon	33	1	1	PT	MA	60+	M
Sarah	45	3	15,10,6	FT	MA	60+	M
Hanna	30	2	2,4	SAH	B	60+	M
Deidra	26	2	4,1	PT	B	15-29	S
Faith	38	3	6,4, 3mo	SAH	B	30-59	M
Kara	28	1	14mo	SAH	B	30-59	S
Ramona	39	2	4, 16mo	PT	B	60+	M
Kirsten	32	2	2.5, 3mo	SAH	Some college	60+	M

Note a: FT = full-time employment, PT = part-time employment, SAH refers to a stay at home mother status.
b: B = Bachelor's degree, MA = Master's degree and some college refers to a non-completed degree.
c: Reported in thousands
d:M refers to married, D refers to divorces and S refers to single but cohabitating with domestic partner.

The data analysis proceeded from standards of grounded theory. Saturation levels were reached when new data provided no fresh insights. (Charmaz 2006) I reread the transcripts multiple times and I initially created initial literal categories that used the women's own words. (Hesse-Biber 2007) These initial codes stayed true to the main questions in the study. From there, I moved to focus coding which allowed me to use the "most significant and/or frequent earlier codes to sift through large amounts of data." (Charmaz 2006) This process allowed for a deeper analysis, a comparison of the respondent's answers to one another and a comparison of their responses to the greater body of literature that dealt with motherhood and food consumption. It was through focused coding that I developed the themes found in this article which interpret how mothers characterized the risk of food borne illness and what they perceived as the overall risks found in food.

Risk in Food

I asked the mothers whether they perceived any risks in food and this evoked a variety of responses. Overall, they define risky food in terms of fat, calories, sugar, and sodium. They also include in that definition food that contains chemical residues, hormones or antibiotics and genetic modification. There were worries about the negative health impacts of eating processed foods which were high in sodium, sugar, and fat. Mothers had to consider health troubles like

food allergies, hypertension, insulin resistance or lactose intolerance when making decisions about what would be the healthiest nutritional choices for the whole household to consume.

Lupton (1996) found that recent discourse on nutrition that focuses the naturalness of food can be very influential on the decisions that the moms make about food. A majority of the mothers stated that "healthy food" is food that is free of adulterants, pesticides, hormones, or antibiotics. Nine women explicitly stated that food free of chemicals or grown without synthetic inputs were the ideal food for children. There were concerns over how these unnatural additions to the food might possibly affect the development of the child. Women with daughters, in particular, were more likely to mention apprehension over milk containing bovine growth hormones (rGBH) due to the alleged affect that it has on precocious puberty. (DuPuis 2000)

> "*We try to stay away from the growth hormone. We try to feed our daughter organic milk just because of the hormones in the milk. And I think, especially for girls nowadays and they just seem to develop so quickly. Ever since she has been a baby and started drinking milk, we have pretty much kept her on organic milk*." Sarah, 47

DuPuis (2000) conveys that the relationship Americans have to milk is intricately linked to "mainstream concepts of American identity." Overall, the mothers identify milk as part of a healthy diet, but they see the use of growth hormones during production as problematic and as something from which they need to protect their children's bodies. Additionally, some mothers perceived the pasteurization process to be deleterious of nutrition.

BPA (Bisphenol-A) was of great concern to these mothers. Twelve of the mothers mentioned their fears of BPA and they worried about the potential effects it has on their children's health and development. Shannon directly explains why see sees BPA as a danger to children.

> "*The thing that has really bugged me lately is BPA in canned food which is so easy, especially when you have a little person. I won't use cans now after some of the things that I have heard about it. BPA exposure is not dose-related, it is timing-related. The timing of exposure is most important. It's an endocrine disruptor and if you are developing and your body is using and recepting certain types of hormone signals, it disrupts those. So the development of secondary sex characteristics and the growth of certain organs, the creation and distribution of fat in the body. BPA disrupts that. I can sit and eat canned soup all day and it's no big deal. But I don't want my daughter anywhere near canned vegetables or canned soup…nothing*." Shannon, 33

Shannon's background in the sciences allows her to see the specific reasons why BPA is dangerous for growing children and provides a deeper explanation for her worry. Other mothers expressed a more general concern. Kirsten, a stay at home mother of a newborn and a toddler discusses how BPA and other chemicals are a worry for her due to their lack of being proven safe through long term studies on their effects on the human body.

> "*There are all sorts of other chemicals in our plastics that who knows if they have an effect or not? The studies to determine long-terms effects would have to be longitudinal and that would have to happen over many years. So to a certain extent, you are just playing Russian roulette with whatever it is that you use. It's the same thing with the chemicals that go on the crops."* Kirsten, 31

Mothers choose organic food as a way to opt out of the assumed negative impacts that go with eating food produced by conventional farming. Mothers whose behavior references the inverted quarantine consume organic products to keep toxins out of their bodies as opposed to those who do so for the environmental benefits of organic agriculture. They do so to put a barrier between what they see as threatening and the bodies of their children (Szasz 2007). As discourse that supports consumption of natural or organic food products gains traction in the public sphere, mothers worry more about what is lurking in their food and respond to this public threat by altering their consumption practices in the private sphere. Adding to DeVault's findings, these mothers perceived foods containing chemicals like pesticides, antibiotics, hormones or products used in packaging like BPA to be dangerous and as something they should actively avoid feeding their children.

Food Bourne Illness

I asked the mothers if they were worried about food borne illness, generally speaking and the majority of the women reported that they did not fear food borne illness. Overall, the women did not see it is a problem that they have or would come across in the future. The women felt that food was safe in regard of being potentially pathogenic and that, generally speaking, they felt no reason to worry about it. Hannah age 29, mother of two young girls states "I probably should be more worried about it, but because we've never encountered it, so I am more relaxed about it." On the other hand, those women that have experienced illness prior in their lives reported concern over safe cooking practices in restaurants and an increased concern over proper food handling in the home. The women who were not confident cooks or had little experience cooking meat felt the greatest concern over food borne illness being transmitted in their home. Ramona shares her fears, "I am very worried about it. I probably over-cook meals, especially since I don't cook that much beef, I am more careful. I am just so paranoid about making someone sick. I just always tend to err on the side of overcooking." Once the women were able to unpack how they felt about food safety, they were able to identify several problems that arise from consuming meat. The mothers in this sample had a healthy skepticism concerning the cleanliness of their food and did so for a reason.

Most of the women were well informed about the risks from industrial meat processing which they claimed came from reading books written by Michael Pollan, Eric Schlosser and Jonathan Safran Foer . "Once upon a time, USDA inspectors had to condemn any bird with such fecal contamination. But about thirty years ago, the poultry industry convinced the USDA to reclassify feces so that it could continue to use automatic eviscerators. Once a dangerous contaminant, feces are now classified as a "cosmetic blemish." (Foer 2009). Most consumers would be disgusted to learn that industrially produced meat potentially contains additional contaminants like feces and pathogens. Being that these contaminants are undetectable by the consumer at the point of purchase, this heightens the anxiety these mothers have concerning the cleanliness of their food. In addition to these anxieties, some women were concerned over the practices engaged in by the industry to rectify the external consequences derived from the industrial slaughtering of meat.

> *"I find it really disgusting that meat slaughterhouses are using chlorine to wash the meat because of the worry over contamination. I mean, I don't even want my kids to get pool water in their mouth when we swim. I know that I definitely don't want them eating meat*

> *that has been sprayed with chlorine or some other chemical. Who knows what that will do to them in the long run?"* Faith, 38

Several of the mothers described similar fears of meat contamination in terms of pathogens, but also in terms of the undesired additional chemicals that the meat may have encountered during processing. These mothers attempted to mitigate this risk through the purchase of locally sourced meat which gave them the comfort of consuming meat that had not been slaughtered in a large, industrialized meatpacking house.

I wanted to interrogate the question of food safety improving over time so I asked the women whether or not they felt like food safety has improved or gotten worse over the last 10 years and most reported that they felt it was the same, but that now there was more awareness about food safety and potential risks. There were two women who felt that food safety has decreased over the years. Valerie was very well educated about the state of the food system because of personal relationships and her employment in a job in a college of agriculture. She felt that she must keep her overt criticisms hidden while at work, but was very candid in her discussion of her feelings towards the food system. She pointed out the state's involvement in food safety and how corporations are able to circumvent the rules in place that are there to protect the consumer, not the producer.

> *"I think that food safety has gotten worse. As population goes up, scrutiny goes down and people care less. Big corporations might not have to maintain the FDA or EPA standards if they know certain people and can pay fines that will get them out of trouble, as long as they have the money."* Valerie, 42

Valerie mentions a fear that is grounded in a criticism of the neo-liberal regime that dominates food production in this country. Several of the mothers referenced fears concerning corporate conglomeration and concentration of the system. Along with this comes the desire to increase profits. Britney explains how her fears are grounded in the corporate tendency to cut corners which exposes consumers to the risk of food poisoning.

> *"I think more people are aware of issues with food. I don't remember growing up and hearing if food poisoning and I've gotten it twice in the past 5 years! So it is obviously becoming more common, which is very scary. You hear about it more now. I think that with the economy, people are looking to make shortcuts and to cut costs, which probably sacrifices quality."* Britney, 31

I wanted to know if the mothers in my sample engaged in germ avoidance in general. This idea of germ avoidance would be measured by the use of hand sanitizers, using bleach on a regular basis or any other method of sanitizing they might use. The United States Department of Agriculture advises consumers to wash hands and keep a clean kitchen which is the advice that these mothers followed and most felt they should be followed by any cook, whether in the home or in an industrial setting.

> *"You have to take necessary precautions. When I make chicken, I wash my hands constantly. Anything that has touched raw meat is kept separate and washed in hot soapy water. We don't have a dishwasher, so I am vigilant about the hot water. So I think that you have to have some responsibility in practicing safe kitchen practices."* Faith, 38

Faith expressed fear over chemicals being used in meat production to sterilize the meat. She was consistent in her fears concerning chemicals which extended to their use in her private home. She took great measures to eliminate using them in her routine, household cleaning regimen. This particular practice of chemical-free cleaning was not uncommon in my sample. Nine of the mothers expressed concern over the toxicity of bleach and other harsh solvents that are commonly used in cleaning. To mitigate this risk, they explained that they relied on natural cleaners like baking soda and vinegar to reduce their family's exposure to toxic chemicals in the home.

DISCUSSION AND CONCLUSION

This analysis aimed to critique the current measures and practices deemed appropriate by the American government to address foodborne illness in the context of the private sphere. The current suggestions made by the FDA, CDC and USDA that rely on consumer behaviors in the home are grossly ineffective in dealing with the origins of illness-causing pathogens which are introduced into the food system during production . I have argued the public interest of the state should be to protect the health and welfare of consumers rather than the profit margins of large corporate food producers. Displacing the onus of responsibility of providing risk-free food onto the consumer instead of placing it with the production system, the state is abdicated of culpability. Mothers should be able to place trust the state agencies who are enlisted with the task of keeping the food chain free of risk. Mothers want to be assured that they can be confident in the products on the shelves of their local grocery store. When they lose confidence, they change their food consumption habits to reduce the chance of encountering risk.

Sites of consumption like natural food stores and farmer's markets articulate a discourse of ethical consumption. (Guthman 2008; Hinrichs 2000; Johnston 2008) A discussion about shopping practices with the mothers revealed that these women used a discourse of ethical consumption to explain their motivations behind procuring food from an alternate source like the farmers' market and interestingly, all of the mothers reported that they shopped there habitually. The mothers also claimed that the main emphasis for shopping at the farmers' market was to procure risk-free food. On average, the women spent around $125 a week for food. They procured food from many different sources. Four of the women explained that they prioritized locally produced food over organically- certified food due to the perceived safety of small-scale farming that they felt would be found at the local level. (Delind and Howard 2008) They expressed comfort in knowing where their food came from, that it was safe and risk-free and they found a certain satisfaction in supporting the local economy. The mothers' foremost goal was to provide risk-free food for their children and they apply a discursive argument that states ethical consumption as a secondary motivation which determines their consumption habits.

The women in the sample seemed to desire a deeper control over the production of their food and utilize CSAs, natural grocery stores and gardening as a method to gain control. These findings extend DeVault's conception of provisioning. The mothers in this sample frame gardening and participation in CSAs as a provisioning practice which provides them greater control over their food which also brings greater comfort over the safety of the food. Six of the moms regularly shopped at one of the natural food markets and nine had gardens. Many gardened as a hobby, but one mom explained that she raised backyard chickens and grew food in her backyard because

she has concerns about production practices and the general safety of food. Her primary motivation for growing food was because she was raised in a family that produced their own food and she wanted to give her children the experience of growing their own food in a way that she deemed as the safest due to their ability to control the inputs that go into home food production.

In conclusion, mothers perceive multiple risks while provisioning food for their families. Drawing from DeVault's work I have explored the invisible work performed by mothers through the provisioning of food. As DeVault found, the mothers in this sample also do most of the planning, shopping and cooking in their household. But, I add to her discussion by finding that mothers are saddled with the task of acquiring knowledge about what foods are risky. Reading labels becomes the primary way they determine the purity of the food. To do so, they use alternative sources of food in order to protect their children. Mothers make use of the farmers' market to provision clean food which reaffirms their desires to feed their children risk-free food. The mothers also emphasized the social dimension of shopping at the farmers' market which allows them to construct identity as well as providing a space for interaction with people who hold similar ideologies. I have argued that mothers are navigating risky terrain on the food landscape so they prioritize the consumption of organic or natural foods to keep chemicals out of their family's bodies.

Mothers face an increasing amount of "invisible work" determined by their awareness of the potential dangers found in food. To navigate the market, they have adapted their consumption practices to reflect the concerted efforts made to avoid risk. Consistent with DeVault's findings, mothers do this invisible work to produce and reproduce the family structure. The mothers assume the responsibility for the feeding work as recognition of their place in the intersection of class and gender. As mothers, they are defined as the ones responsible for food and are simultaneously defined as the one's required to raise healthy children. Their accounts of their struggles and strategies show that they still face challenges in feeding their children to avoid perceived risks even in light of their relative privilege.

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Governance Under Sociopolitical Decentralization Efforts and Local Adaptive Actions to Disturbances and Increasing Environmental Stresses Among Rural Communities; Four Case Studies from Southwestern Uruguay[*].

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ABSRACT *During the last ten years, weather disturbances and economic dislocations stemming from climate change and globalization have critically affected the southwestern region of Uruguay. Rural communities' responses to significant natural and anthropogenic changes have been diverse under recent political decentralization policies and programs. Based on semi-structured interviews with key informants from the market, state, and civil society, participant observation at local public meetings and assemblies, including secondary data, this study explores how community governance under decentralization policies and programs influence communities' adaptive actions to environmental risks provoked by natural and anthropogenic disturbances in four communities of Southwestern Uruguay. Preliminary results from this study show that multi-level institutional involvement in governance constrains communities' adaptive actions when local actors are not included in decision-making. When multi-level institutional involvement includes local actors' concerns (including the state, market, and civil society) and direct participation in decision-making, communities are capable of developing adaptive actions to prevent, mitigate, and adapt to environmental risks*

[**rural communities, governance, decentralization, adaptations**]

INTRODUCTION AND LITERATURE REVIEW

Changes and Decentralization Programs in Southwestern Uruguay

Responses to significant natural and anthropogenic changes take place at many levels. Individuals and households, geographic localities at a variety of scales, watersheds, organizations, and governmental units, and communities, all respond to external stresses and risks. Rural communities are becoming more vulnerable, facing new risks from disturbances

[*] I want to thank all the participants of this study, the members of my POS Committee, and my family for their advice and support. Part of this study was funded by the Butler Travel Award for International Studies in Agriculture, Iowa State University.

driven by phenomena, such as globalization and climate change (Wilson 2012). These phenomena increase their environmental stresses. A community can be defined as a social system in a specific geographical location, where local people meet their needs through organizations or institutions (Flora and Flora 2012).

During the last ten years, rural communities from the southwestern region of Uruguay[i] have been critically affected by disturbances and increasing risks provoked by phenomena in this region, such as climate change and globalization (World Bank (WB) 2009; Gaudin 2010). This is a highly productive agricultural area with fertile soils and diversified agriculture, including a mix of row crops with livestock, dairy, horticulture, citrus, and others, accounting for approximately 65-70% of Uruguay's total agriculture production area (WB 2009).Communities in this region are highly dependent on their agro-ecosystems, which provide goods and services. Some of these communities depend on soils covered with natural prairies on soils vulnerable to extreme natural and anthropogenic perturbations.
Climate observations from the last century have shown climate variability and severe weather events have significantly increased in this region (Gimenez et al. 2009), increasing natural disturbances and associated risks. Recent severe climate events and changes, like the droughts in 2000, 2008-2009, and 2010-2011, hydric deficits in some parts of this region, and severe storms such as tornados, will increase and critically affect rural communities from this region. Increasing natural changes and associated risks are becoming critical for communities of this region, which need to adjust either to beneficial or negative consequences.

In Uruguay, new technologies for row crops, artificial prairies, and agroforestry have facilitated the displacement of agricultural systems, based on natural pastures (Arbeletche et al. 2011; Pérez Bidegain et al. 2011), critically affecting communities that depend upon them. These shifts have altered rural communities and their agro-ecosystems located in the most agricultural productive region with a long tradition in different types of agriculture. During the last ten years, southwestern Uruguay has been the epicenter of the Uruguayan agricultural growth and its associated transformations. Affected by Southern Cone financial crisis of 2001-2002 and Uruguayan livestock foot-and-mouth disease in 2001-2002, this region faced one of the most important economic crises of the country's history, critically affecting rural communities. After 2002, communities from this region have been significantly affected by new and foreign investments in the industrial agriculture sector, mostly for commodity crops like soybean and corn, and agroforestry. This new agricultural development has significantly impacted communities by increasing land speculations; thus, increasing land prices, dependency on global trade markets, and, in turn, increasing volatility in commodity and input prices. Additionally, increasing environmental risks have occurred, like overexploitation of their natural resources, erosion of productive soils, pollution provoked by new agricultural technologies, and deforestation, among other critical changes. Therefore, phenomena like climate change and globalization have challenged southwestern Uruguayan rural communities' capabilities to recover from possible disturbances and associated risks. These anthropogenic and natural disturbances or changes are a slow-onset, sudden incidents, or phenomena that occurred and/or are currently occurring and may represent risks.[ii] They could negatively impact or change the social, economic, and/or environmental resources of these communities and/or their agro-ecosystems.

Table 1. Anthropogenic and Natural Changes

	Anthropogenic Changes	**Natural Changes**
Endogenous	Overexploitation of natural resources, pollution, human-induced erosion of soils, biodiversity depletion or reduction, deforestation, deterioration of public infrastructure (recreational spaces, routes, streets, etc.), increasing social insecurity, significant technological changes that represent risks.	Floods
Exogenous	Shifts in the market or global trade, and changes in energy availability.	Drastic changes in temperatures and seasonality that have affected communities' agro-ecosystems or people's health, extreme cold weather events, tornadoes or strong winds, and droughts.

These disturbances have been created by local factors (endogenous or from within communities) as well as by remote factors (exogenous or from outside communities), such as those created by global climate change or globalization.[iii] Natural and anthropogenic disturbances have provoked environmental stresses for these communities, but they have been mitigated or avoided through local responses elaborated by different, local actors. On the other hand, risks associated with these changes have become critical when local actors are incapable of making collective decisions or finding resources for responses. It is difficult for local actors (institutions and/or individuals) to individually respond and/or to successfully develop responses to these phenomena (Adger 2000; 2003). Evidence from different parts of the world shows responses to stresses associated with these types of natural and anthropogenic changes are successful when they are locally and collectively developed to satisfy local priorities, while considering the local context, extra-local linkages, and resources (Adger 2000; 2003; IPCC 2007; Ensor and Berger 2009; Ashwill et al. 2011; Adger et al. 2009; Young 2012).

During the last two decades, socioeconomic development and adaptation theories have shifted from highlighting the importance of rural people as passive actors or "clients" of regional or national governments towards the importance of locality and decentralized social, economic, and political systems capable of developing local responses to changes and risks, having local people as protagonists of change (So 1995; Rist 1997; Piñeiro 2004). These ideas also influenced the approach to rural development by the Uruguayan government. They approach communities as critical social units in a decentralized specific territory with similar sociopolitical, economic, and environmental dynamics or characteristics (Piñeiro 2004). Like other Latin-American countries, in Uruguay, contemporary developmental approaches to rural communities—as part of a particular territory—have been called "territorialidad," the main characteristic of what has been also called "Nueva Ruralidad."[iv] This focus (on a particular territory and its communities) is a response to the historical dependency on centralized national governments and the current necessity to implement decentralization plans and policies, focusing on specific regions or territories to develop responses to regional and local problems (Piñeiro 2004; De Barbieri and Zurbiggen 2011; Bardegue et al. 2012). The implementation of these types of decentralization plans ideally seeks to empower rural communities from Southwestern Uruguay under developmental plans implemented by regional and national governments, while considering communities as critical units of change, capable of making their own decisions, and being actively involved in territorial or regional planning (De Barbieri and Zurbiggen 2011; Bardegue

et al. 2012). However, these goals are not always achieved and their outcomes depend on the characteristics of each community. Exploring specific rural communities from Southwestern Uruguay can significantly contribute to current decentralization efforts and recent academic "rural-territorial" approaches, which seek to empower local people and institutions at the community level. Thus, there is a critical necessity to explore different characteristics of community structures and decision-making processes at the local level (De Barbieri and Zurbiggen 2011) to determine how they influence their actions for adapting to natural and/or anthropogenic disturbances or changes and associated risks (United Nations (UN) 2012).

During the last six years, and as part new decentralization policies and programs, Uruguay has created Municipios at communities and Mesas de Desarrollo Rural for their rural areas. In Uruguay, there are 19 departments. Each department has an Intendencia Departamental or departmental elected government located in its capital city. Intendencias are the second level of government after the national government. The third level of state government, and the smallest units of administrative and elected governments, is the new Municipios at the community level. They are locally-elected governments at community levels and composed of five elected officials (one Alcalde and four Consejales). The jurisdiction of these elected governments is politically designed by Intendencias, usually covering a town and ten kilometers encircling the town at its perimeter.[v] Although the designation of Municipios for specific communities currently depend on the Intendencias, in 2009, Municipios were created by the national law, "Descentralización política y participación ciudadana" (Nº 18.567) (modified in 2010 by the law Nº 18.644), for communities with more than 5,000 habitants. After the elections of 2010, Juntas Locales (JL) of these communities were transformed into Municipios. The implementation of these decentralization plans, through the creation of Municipios, has been supported by some European countries along with national agencies, such as the Oficina de Planeamiento y Presupuesto (OPP).

Municipios are general-purpose governments created to respond to the general needs of the community (Flora and Flora 2012). In Uruguay, the general responsibilities of Municipios are to 1) implement regional and national plans at the local level when required by Intendencias or the national government, 2) apply departmental and national laws at the local level, and 3) cooperate and work with other Municipios, and other local, regional, and national actors to discuss and/or implement local plans (*Presidencia* 2011). One of the main goals of Municipios is to create mechanisms for local decision-making or deliberation for specific topics related to the local community and to create spaces for civic participation at the local level. However, Municipios' governance is still limited by other institutions from the departmental and national levels, and their regulations and policies (De Barbieri and Zurbiggen 2011).

As part of national decentralization programs, in 2007 the Ministerio de Ganaderia, Agricultura y Pesca (MGAP) created the Mesas de Desarrollo Rural (MDRs). These are formal spaces for participation in rural issues for specific territories and communities, accompanied by the creation of Departmental Agricultural Councils to articulate national policies at the departmental level and local levels. These programs have attempted to decentralize the implementation of top-down national programs for rural areas, making local levels more connected with regional and national programs. These spaces include different market, state, and civil actors involved in agriculture and/or rural development. MDRs have had an important role not only in facilitating multi-level collaboration, but also facilitating the participation of local actors in rural/territorial issues.

During the last six years these new modes of governability have been promoted by the Uruguayan government, which has emphasized new governance and collaborative efforts between private and public actors. Under these new sociopolitical scenarios, communities and local actors have gained an important role in public discourse and policies, as alternative localized sociopolitical powers to the traditional centralized states (Cannon and Kirby 2012). In this sense, community governance can be defined as structures and processes, by which public, civic, and/or private groups of people or organizations (also referred as "institutions, stakeholders, and actors") make collective decisions and act at the community level. Robustness or strong structures and high quality of processes are two components of community governance. The nature of structure and processes can determine the main characteristics of governance by exploring how local decisions are made under different structures and processes, who does and who does not participate in the local processes, why some actors participate and others do not and, how this is related to the participation of different actors and interests, among other critical aspects to explore.

Structures of governance can be defined as the presence of social actors (from the market, civil society, and/or the state) considered by other local actors as relevant participants at the community level (Cadman 2011). Structures of governance are represented by the institutions or informal groups involved in local issues. Active participation of different actors, sustained citizen engagement, and linkages with other levels are critical components of their governance, which can provide an avenue for participation beyond voting for local officials (Flora and Flora 2012). Thus, community structures of governance are the different actors actively involved at a local level, the resources they are willing and able to bring to the table, and existing policies that influence their active involvement in local issues. The participation of diverse stakeholders in local governance represents high levels of social capital within communities, critical for communal benefits (Putnam 2000) and an important part of the structure of governance. Community social capital is composed of social dynamic relationships that can provide collective access to resources (Portes 1998; Putnam 2000) to work toward common goals (e.g. responses to natural or anthropogenic disturbances). Two types of social capital can be distinguished—*bonding* and *bridging*—which describe connections within communities and connections with outside institutions and individuals, respectively (Flora and Flora 2012). High levels of bonding social capital imply a strong presence of local actors from the state, market, and civic sectors, and their active participation in spaces for collective decision-making at the community level. Bonding social capital and collaboration in decision-making within communities are critical to mobilize resources from the bottom-up. On the other hand, when bonding social capital is low and only a few types of actors are actively involved in community governance, access to resources is limited (Adger et. al. 2009).

Communities' Adaptations to Natural and/or Anthropogenic Disturbances and Risks

Community adaptation is the local and collective actions (*adaptive actions*) to reduce risks and/or adjust to disturbances and associated risks (Adger 2000; Wilson 2012). Recent studies highlight the importance of adaptations at the community level according to local and regional contexts (Wilson 2012). To understand adaptive actions at the community level, we need to identify the resources mobilized (through actions) by communities, either to minimize possible

risks or to adjust to natural or anthropogenic disturbances.[vi] Adaptive actions can seek either individual or collective interests, but they become significant for communities only when they seek communal rather than individual benefits (Agrawal and Perrin 2008; 2009).

Table 2. Adaptive Actions Explored by this Study in Communities from Southwestern Uruguay

Adaptive Actions	**Indicators (Presence or Absence of Adaptive Actions)**	**Types**
Anticipatory/Reactive	Sharing information and/or plans about possible risks and/or consequences of natural or anthropogenic disturbances.	Widely available weather information, urban/rural planning that includes contingencies for changing conditions, mechanisms to identify new technologies, and widely available information about international markets.
	Development of new technologies and local innovations.	Plans, educational programs, special events, and financial incentives for the adoption of new technologies, technological innovation, and new management practices.
	Development of mobility plans	Relocation of households affected by floods, and relocation of livestock affected by drought.
	Storage improvement	Water reservoirs, crops, seeds, and forest products.
	Diversification	Educational programs for value added products, new crop varieties, new livestock breeds, and skills and occupational training.
	Improvement of market exchange	Local incentives for new economic projects, sharing information, educational programs, and training about: market access, insurance provision, transfer payments and new product sales.
	Improvement of Local infrastructure	Transportation networks (fluvial, terrestrial, and areal), recreational and public spaces, water supply, and sewage.

Modified from Agrawal and Perrin 2008; 2009

Adaptive actions may significantly vary among communities. Therefore, they should be explored and identified at specific communities and their geographical contexts (Resilience Alliance 2007; Adger et al. 2009), considering communities' adaptive actions to endogenous or exogenous disturbances and associated risks (Wilson 2012; Young 2012). Thus, communities' adaptive actions can be described as the collective actions developed by communities to mitigate risks and/or adapt to significant changes and risks. Adaptive actions can be either anticipatory or reactive to natural and/or anthropogenic disturbances (Wilson 2012). Anticipatory actions are those to prevent or mitigate potential damages from disturbances and stresses. Anticipatory adaptive actions reflect the learning aspect of behavior in response to a specific disturbance or risk (Gunderson 2000). Anticipatory adaptive actions can also reflect levels of "start point vulnerability," and communities' acknowledgment of possible risks (Adger et al. 2009; Ensor and Berger 2009). Anticipatory actions are usually composed of the development of plans to mitigate potential risks from natural or anthropogenic disturbances. They are usually developed

in communities that have already experienced negative consequences from natural or anthropogenic disturbances (Adger et al. 2009).
Communities that institute anticipatory adaptations can decrease their risks and prevent them from potential damages (Wilson 2012). On the other hand, reactive adaptive actions are post-event and usually improvised, when negative consequences from disturbances have been already observed and/or occurred, including emergency assistance in response to natural or anthropogenic catastrophes. The absence or presence of these and other adaptive actions at the local level determines different levels of communities' responses, either to minimize or adapt to risks and significant natural and/or anthropogenic changes.

Based on social structuralism and community structure, socioeconomic development, natural resources management, and resilience and adaptation theories, this study focuses on the socio-geographic unit of the community as the relevant arena of collective action, based on work by Young (1999), Adger (2000; 2003), Putnam (2000), Tompkins and Adger (2004), Armitage (2008), Adger et al. (2009), Ensor and Berger (2009), Ashwill et al. (2011), Bardsley and Rogers (2011), Flora and Flora (2012), Wilson (2012), and Young (2012), among others. This study explores (1) how community governance influences communities' adaptive actions to the risk of natural and/or anthropogenic disturbances and (2) how multi-level institutional involvement in governance influences four communities' adaptive actions under recent decentralization policies and programs in Southwestern Uruguay.

RESEARCH METHODS

This study was developed in the southwestern region of Uruguay in two departments with similar socioeconomic and geographical characteristics. I explored adaptive actions and governance of four communities[vii] (case studies) with Municipios. After conversations with staff from the Intendencias of these departments, I selected two communities from each department. For the selection of these communities I considered communities with Municipios. In addition, I selected governance and adaptive actions as the main two key components for identifying variations and highlighting differences between communities. In addition, I considered them as part of a similar territory, their geographic proximity between them, and their similar or linked socioeconomic characteristics based on agriculture. Furthermore, for the selection criterion of the units of analysis, I considered the logistics and resources available for conducting this study, and my familiarity with these four communities and this region. These four in-depth case studies from Southwestern Uruguay allowed me to deeply explore their governance, as well as influence on local adaptive actions.
First, I gathered secondary data about the selected communities and utilized elected officials from the Municipios of communities as key informants. Using a semi-structured questionnaire as the primary methodological tool, two key informants from each community provided information about the presence or absence of local adaptive actions, as well as general characteristics of community governance. In addition, staff of the Intendencias provided additional data about the four communities, as well as departmental policies that affected both governance and adaptive actions at the local level. Elected officials and staff from Intendencias were asked about the key actors who participated in local governance. I used snowball sampling to identify all actors involved in governance at the community level. The snowball sampling

method allowed me to select participants, who also provided contacts for other key market, state, and/or civic actors involved in community governance. Using a semi-structured questionnaire, actors involved in the selected communities were interviewed. Interviews with all actors identified from each of the four selected communities provided information about disturbances and risks, structures and processes of governance, and local adaptive actions.

Figure 1. Selected Area

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Interviews with a staff from each of the Intendencias involved provided data about the four communities and departmental policies and plans, which affect governance and adaptive actions at the community level.

In-depth structured interviews with elected officials (the Alcaldes and Consejales) from these four communities provided data about the natural and/or anthropogenic disturbances (slow-onset/sudden and endogenous/exogenous) and risks these communities face. In addition, these interviews provided information about the community institutional structure and process for governance, and detailed information of local adaptive actions—both anticipatory and reactive. Furthermore, interviews with these key informants provided contacts of stakeholders actively involved in community governance. I triangulated the information gathered from the elected officials with the information from the Intendencias to ensure reliability of the data collected from each of the communities and about the actors involved.

I used semi-structured interviews with one staff from each market, state, and/or civic stakeholder mentioned by the locally-elected officials and staff from Intendencias. These interviews also provided information about the capacity of the institutions, their levels of involvement (regional, national, and/or international), characteristics of their resources, existing policies and/or regulations that affect their involvement at the local level, the opportunities these institutions

have to participate in local decision-making, whether they believe their 'voices' are considered by other actors, and details about absence or presence of local and collective adaptive actions.

In total, I completed 83 interviews with key actors from the market, state, and civil societies involved in the four selected communities. I also utilized participant observation to gather data about governance and adaptive actions to environmental risks at public meetings at Municipios and Mesas de Desarrollo Rural, and other spaces for participation. Other secondary data collected during the field work include research materials, reports, regulations from Mesas de Desarrollo Rural (from 2009, 2010, 2011, and 2012), reports and presentations completed by different types of Non-Governmental Institutions (NGOs), new laws and regulations from the Ministerio de Ganadería, Agricultura, y Pesca (MGAP) (about feedlots, agrochemicals' applications, and soil and land use, among others), and the Ministerio de Trabajo, among others.

FINDINGS AND DISCUSSION[viii]

Community A has 10,630 inhabitants (INE 2011). Immigrants from different countries—like Italy, Germany, Switzerland, and France—founded this community. Its strong local organizations and institutions, and high levels of local civic engagement in local decision-making have historically characterized this community. It has been historically linked with regional, national, and international actors. This community signed agreements for collaborations with governments of other cities and with the government of Switzerland. Its historical economic prosperity, based on diversified agriculture, its high quality structures and processes of governance with high participation of citizens at the local level, and collaboration of actors from different levels have historically facilitated many resources which have made this community a place "without problems" (Staff from Intendencia). Its structures and processes for governance have made local actors develop a diverse number of projects preventive to disturbances, which could represent environmental risks, such as droughts, environmental degradation, and/or pollution. Adaptive actions of this community have been anticipatory to natural and anthropogenic disturbances. Some key informants attributed preventive and anticipatory adaptive actions to the cultural and historical aspects of the community, such as immigrants' origins and the struggles they faced both in their countries and in Uruguay at the end of the nineteenth century. According to key informants, this community has strong institutions and high levels of participation, based on democratic legacies from its immigrant founders. These adaptive actions to possible risks provoked by both development or by nature are based on the diversification of agriculture, different plans to mitigate possible risks, continuous improvement of local infrastructure, strong networks for sharing information, and long-term local platforms for technological innovation.

> *"Agriculture in this community is diversified but most of the production is based on small dairy farms and cheese makers…Citizens are very organized and they have historically created different "comisiones" (commissions) for specific topics related to the development of the city, and they work under the umbrella of the Asociación de Fuerzas Vivas, a civic organization. The creation of the Municipio has reinforced their work and they are doing important things for the city. For example: the local cinema, the library, the firemen station, the kindergarten, and other institutions have been created and run by*

> *citizens organized by different "comisiones" and they do not depend on departamental or national institutions and their funding. Local rural cooperatives created their own Mesa de Desarrollo Rural, which has a critical role and is currently developing a long-term Sustainable Plan to include the creation of an irrigation system for 8,000 hectares and many small farms, technological innovations, and diversification, among other preventive actions. Citizens also have opportunities of direct democracy, such as voting for particular initiatives proposed by Fuerzas Vivas or the Municipio. The method governance works in this community has drawn attention from national and international institutions. "This community was also selected by the national government as an example of governance and decentralization"- said one of the key informants. This community was described (by several informants) as the "locomotora" (locomotive) of sustainable rural development in Uruguay."* (Field notes, January 28, 2013).

According to key informants, recent changes created by industrialized agriculture have not negatively impacted this community. Most of the small/family farmers in this region are increasingly incorporating new technologies, "since 2006-2007." Many of those farmers who rented land, have left agriculture; but, those who own the land remained and incorporated new technologies, and are producing more with more intensification, using soybean and corn as alternatives for fodder, in addition to pastures, as an adaptive action to mitigate possible consequences of droughts. "They learned this after the droughts in 2008-2009 and 2010" (Market actor). After these droughts some actors from the market started to provide new services for fodder and irrigation. Actors from the market, state, and civil societies highlighted this community has incorporated new technologies, but with consciousness of the environmental risks that recent developmental changes could create. According to the interviewees, this community has historically maintained agricultural diversity as a key component of its sustainability and reduction of possible negative impacts from both natural and anthropogenic changes. Anticipatory and preventive adaptive actions have been mostly based on the diversification of the economy and caution use of the community's resources. This has been facilitated by the collective participation of different local actors as well as "good relations" with actors from the departmental, national, and international levels.

There are many opportunities for collective and active participation in decision-making of private, state, and/or civic actors. Opportunities or "spaces" for deliberation or decision-making are facilitated by different *comisiones* under the umbrella of Fuerzas Vivas, the Municipio, and the local Mesa de Desarrollo Rural. These actors and organizations have had a historical role in facilitating local and civic participation at the community level. These spaces for participation have also facilitated the active involvement of actors from regional, national, and international levels, such as recent agreements of collaboration between the Municipio of this community and the government of Switzerland,[ix] which facilitated new resources for the community.

High quality process in governance means all local actors have an equal opportunity to manifest their interests, make collective decisions (with other actors), and decide about the future of the community. In this community, processes of governance involve multi-level relationships that exist among the different actors collectively involved at the community level. Therefore, community governance is shaped by the level of collective deliberation among different types of actors involved at the local level (bonding social capital). Their interactions are configured at

regional, national, and/or international levels (bridging social capital), which have positively affected local actions. Multi-level institutional involvement enhanced processes of governance (e.g., empowering local women farmers) when local stakeholders are taken into account (Folke et al. 2002; Tompkins and Adger 2004; Berkes et al. 2005; Folke et al. 2005; Meyer and Konisky 2007; Davidson et al. 2010; Wilson 2012). Actors operating at different levels enrich the deliberation processes, when deliberation extends downward and outward as well as upward (both top-down and bottom-up), which can improve the processes of governance adequate for adapting to increasing risks (Wilson 2012).

> *"When we meet with departmental or national, state institutions, they not only know we will share our problems, but also they know we will propose shared solutions for the community, based on our strengths. For this reason, they love to work with this community."* (Field notes- Repeated by different actors from the state, market and civil society).

When local actors' opinions are taken into account in multi-level decision-making, communities' interests and concerns are addressed and considered (Wyckoff-Baird 2006; Wilson 2012). This not only leads to high quality governance, but also to local actions, according to communities' needs and priorities. An example of this is the development of the sustainable plan for regional rural development being developed by the initiative local actors and the support of departmental and national institutions. This would be unique in Uruguay. This type of adaptive plan is a result of community structures of governance, which occur in interactions between decentralized networks made of multiple institutions functioning at different levels (Cadman 2011; Young 2012). Governance structures at the community level involve institutions that also mobilize resources at regional, national, and/or international levels. Thus, participation of different types of institutions in local governance and at different levels (*bridging social capital*) has an important role in determining resources for this community. How this community has responded to the different challenges is not only mediated by local existing resources, but also by interactions with other systems (Young 1999; Flora and Flora 2012).

Community B has 9,857 inhabitants (INE 2011). In the last ten years, this community has become the main port for the country to export agricultural commodities, such as soybean, wheat, maize, and agro-forestry products. From this community's port, commodities are shipped to Asia, Europe, North America, and the Middle East. During recent years, this community has been transformed by new development projects for agriculture and port enterprises. This community not only has been vulnerable to anthropogenic changes, but also to floods from La Plata River and recent droughts, which have significantly affected the agro-ecosystems of this community.

According to the key informants from this community, during the past five years the port has significantly increased its operations and this has created environmental problems, such as decreasing air and water quality.

The Municipio for this community and the Intendencia Departamental facilitated the development of a strategic plan[x] for sustainable development, which included the direct participation of diverse and local, regional, national, and international actors. This strategic plan includes guidelines for the development of the community and its agro-ecosystems. The plan

identified some community disturbances, such as severe weather events, depletion of natural resources, pollution, and erosion of soils, and deterioration of the infrastructure, among others, which are a consequence of weather events, the growth of agricultural industries in the community, and the growth of the port industries. According to the staff of the Intendencia, some of the adaptive actions stated in its guidelines (plans for risk mitigation from pollution or depletion or natural resources, improvement of local infrastructure based on new regulations, storage improvement, and actions for public risk awareness, among others) have been already implemented or are still being discussed at the local level. According to staff of Intendencia, local actors have developed public spaces for participation to deliberate and develop local adaptive actions, also with the participation of different actors that operate at regional, national, and international levels. However, multi-level involvement in governance has implied some critical outcomes on the implementation of adaptive actions.

> *"Important agricultural/multinational companies have installed silos surrounding the community to operate in the international port. This port has significantly grown in the past years because a great proportion of the soybean production from Paraguay, Brasil, and Bolivia, comes to this port by the Paraguay and Parana Rivers in small boats for shipment from this community to other countries. This has created critical problems, such as high levels of pollution and deterioration of the local infrastructure. Local actors saw the multinational companies were not contributing to the well-being of their community and regional and national institutions (private and public) did not address the problems recent development has created at the local level. Therefore, local actors (including state/civic/and private actors) created Grupo de Trabajo (GT). They organized public assemblies, mobilized organizing protests as well as local solutions, and in some cases they have tried to stop development projects.*" (Field notes, January 19, 2013)

Different local actors mobilized to develop reactive and emergency adaptive actions for reducing on-going environmental risks they perceived, such as air quality controls. They created the GT supported by the local Municipio. According to all the actors interviewed from this community, they are struggling to implement and obtain results to reduce environmental risks, due to omission from some departmental and national institutions, and governments which promote the development of agricultural industries in this port, but omit the community's demands and problems. Local actors see the development of a local plan for sustainable rural/urban development as a tool for future development, but not as a current solution for environmental and infrastructural problems the community is facing. When a representative cross-section of local actors does not have a 'voice' in local decision-making, there is a low deliberation process in governance. In this case, governance is characterized by vertically-oriented (top-down) decisions (through increasing dependency of the communities in externally-controlled business and state institutions). New spaces for decision-making have been created at the local level with the creation of the GT. However, these new structures and spaces for governance lack legitimacy among actors from departmental and national levels, omitting on-going environmental risks and problems, and limiting the community's outcomes from its adaptive actions.

Community C shares its city limits with another community. It has 4,600 habitants, but considering these two communities together provide 10,800 habitants (INE 2011). Community D has 17,174 habitants (INE 2011) and along with Community C are the most important

communities in their department, after the capital city. These two communities are located in the center of the one of the most important regions of the country for grain and agro-forestry production. During the last ten years, these two communities have experienced significant environmental and infrastructural changes, due to expansion and intensification of these two types of agriculture and the increase of foreign investments in agri-businesses. In addition, during the last years, these two communities have faced several natural disturbances—floods, droughts, and severe weather events like storms and tornadoes.

Community C has not been exempt from disturbances (some of them difficult to observe) such as severe weather events, soil erosion, and natural resource degradation, among others. However, they have not developed local adaptive actions.

Historically, "people in this community have been very individualistic…" was mentioned several times by local actors. In this community, there is a traditional way of governing, based on powerful citizens ("caudillos") and their personal contacts at different levels (typical from the two main traditional parties). According to what was mentioned by local actors and field observations, today, there is an important competition between the main local NGO and the Municipio. Their NGO was created during the 1970s because it "was most effective to respond to development with the collaboration of different actors rather than working through elected officials and traditional state institutions" (One of the NGO founders). However, participation in the NGO is not open to everyone because the actors involved invite potential members, who have been described by some of the interviewees, "as part of the local elite."

The Municipio is trying to change the old ways of politics/governance when citizens did not participate. Some people mentioned during the last five years, citizens' participation in organizations and clubs have significantly decreased. Some of the interviewees said the Municipio and the main local NGO, who focused on development, could work together if elected officials and NGO's members forget about their parties and political ambitions, and work for this community. In this sense the community has low bonding capital.

In 2010, different actors from this community and staff from the MGAP created a local Sub-Mesa de Desarrollo Rural because they saw that the departamental Mesa de Desarrollo Rural did not contemplate local small farmers' problems and needs. However, at the departmental level there is an important disconnection between these spaces for participation and the Municipios. The Plan de Ordenamiento Territorial for this community, achieved by the Intendencia and the Municipio, does not contemplate rural aspects, and new spaces, like Mesas de Desarrollo Rural, do not contemplate urban problems. This is an important contradiction to the main objectives of national decentralization programs and policies, which seek "territorial development." Community C's Consejales did not know about Mesas de Desarrollo Rural, and people from these governance structures were virtually unaware of the "Sustainable Territorial Plan" developed by the Intendencia and the local Municipio. An example of this disconnection between these two structures of new governance at the community levels was observed after the strong storm on December 6, 2012, which negatively affected rural areas. However, neither the Municipio nor the Intendencia contemplated farmers' needs and problems after this weather event.

The Sub-Mesa de Desarrollo of this community has facilitated the empowerment of small and disadvantaged farmers who organized collective actions for improving water access, market conditions, and formal institutional status. Today, most of the participants of this Sub-Mesa are local small, women farmers. In this case, top-down approaches from national institutions, such as the MGAP, facilitated the inclusion of local disadvantaged groups not taken into account in the past.

The Intendencia and the Ministerio de Vivienda, Ordenamiento Territorial, y Medio Ambiente (MVOTMA) developed a "territorial and sustainable development plan" for the department.[xi] The plan divides the department in three micro-regions. Communities C and D are considered key communities for the implementation of this plan, which states some guidelines for sustainable development for the communities they involve. Consequently, the Intendencia and the Municipios of these two communities have been working to implement some of the development guidelines, which include adaptive actions to anthropogenic and natural changes, such as mobility plans and improvement of the local infrastructure.

Community D has historically developed local responses to problems and challenges when was necessary. This community is called "*el semillero del pais*" because of its long history in agriculture, particularly with grains. Its history in agriculture and technological innovation make its local people proud. Like other communities in this region, this community has faced many changes during the past ten years. The characteristics of changes are similar to those observed in Community C, for which people highlighted degradation of natural resources, and air and water quality, and deterioration of local infrastructure during the last ten years.

This community has historically tried to develop its own local initiatives through its "caudillos" or leaders and local entrepreneurs with the collaboration of regional or national institutions.

> *"Actors involved in this community tend to act individually and sometimes they work together (like in the financial crisis of 2002). New decentralized spaces of participation could offer opportunities to address these issues. Climate changes are very important for small farmers and poor people, who have worked together with Mesas Rurales and Municipios to solve specific problems under emergencies. However, most of the farms in this community are currently managed by multinational corporations, which obtain crop insurance for soybeans and sign flexible contracts for cases of severe weather events ("if there are negative weather events, the contracts can be renegotiated" (Actor from the market).* (Field notes, December 20, 2012).

Today, this community is experiencing an increasing economic boom, as a consequence of recent industrialized agricultural production. Local and regional actors operating at the community seem to be more concerned for economic growth, agricultural production, and their challenges than natural or anthropogenic disturbances and associated risks. Consequently, this community has many adaptive actions to developmental changes, but few collective adaptive actions to minimize or reduce environmental risks provoked by nature and/or development.

> *"I realized people enjoyed talking with me about these problems; there are no spaces for addressing environmental issues and these are controversial issues at the local level.*

> *People are afraid of complying with pollution concerns because of the labor and economic opportunities that companies have created (…) Pollution from excessive use of fertilizers and mismanagement of glyphosate was recognized as some of the main environmental problems by all interviewees, even by main actors from the market."* (Field notes, December 18 2012)

> *Last year, the city closed both sides of the river for recreational purposes because the river was polluted. As a response, local citizens created an NGO, but they focused on building an indoor swimming pool. "Nobody addresses the causes and consequences of pollution."* (Field notes, December 20, 2012).

Individual adaptive actions have focused on the challenges that development has created. These developments of new technologies and local innovations, storage improvement, improvement of markets, and improvement of local infrastructure omit possible negative environmental consequences from both anthropogenic and natural changes.

Other Critical Findings to Consider

Legitimacy from decisions by Municipios at the local level is still limited by departmental and/or national governments, limiting the decentralization process implemented at the community level. In Communities C and D, Municipios, in collaboration with local actors, could implement responses and adaptive actions to natural or anthropogenic rapid changes (e.g. floods and tornadoes) only after communications and approval from the Intendencias. This is even more critical when Municipios still financially depend on Intendencias Departamentales and the national government from the Presupuesto Nacional en el Fondo de Incentivo para la Gestión de Municipios. Each Municipio must develop a five-year budget, approved by the Intendencias. Municipios do not have the ability to tax or control taxes, and they do not collect revenue, which mostly depends on Intendencias. Despite these limitations, like the case of Community A, Municipios can have critical roles in community governance, facilitating new resources from outside communities. Although these local governments are still limited by other state governments and policies from departmental, regional, and national levels, they can have an important role to involve different actors and facilitate local spaces for deliberation. These are key components for community governance, which "means moving beyond the usual way of doing things and focusing on ends, not the rules that limit the means used" (Flora and Flora 2012, p. 340).

Lack of coordination and duplication of efforts for adaptive actions or lack of responses are other critical aspects of new governance structures and processes like Muncipios and Mesas de Desarrollo Rural. Their critical and potential roles in developing local adaptive actions can reduce environmental risks.

> *"Yesterday, I participated in a local Mesa de Desarrollo Rural with representatives of small and women farmers....The first part of the meeting was about how the severe weather events of last week affected them and how the Municipio and the departamental Comité de Emergencia ignored vulnerable sectors from the rural areas of the community. The second part of the meeting was about how they could periodically*

> *control the watersheds of that region to determine if they are being polluted by agrochemicals. The discussion was an intersection of effects from climate change and recent anthropocentric changes. They want to develop preventive adaptive actions to both future climate changes and risks provoked by agricultural development. However, representatives of the state institutions did not know how they could do that or which institutions could collaborate or co-manage future actions (…) Although the national governmental institutions use climate change and mitigation of risks from development in the public discourse and programs, at the local/regional levels there is no coordination between different institutions and new, decentralized spaces of governance. They do not know what they could do in regard to these problems."* (Field notes, December 14, 2012)

Therefore, legitimacy, efficiency and fluent information among the actors involved in the new structures of governance and adaptive actions seem critical for rural communities and their adaptation.

CONCLUSIONS

Preliminary results from this study show local and collective participation, and decision-making among different types of local actors (high bonding social capital), like in Communities A and B, can develop a significant number of diverse community adaptive actions to reduce environmental risks. On the other hand, like the case for Communities C and D, the presence and/or active participation of a few types of actors (low bonding social capital) can facilitate few resources for adaptation to environmental risks. However, they can facilitate the development of individual adaptive actions to developmental changes, like technological innovation and educational programs. The case for Community A shows when different types of stakeholders with linkages at local, regional, national, and/or international levels are actively involved, they can have equal opportunities to influence local decision-making. Communities with strong structures and high quality processes of governance (with equal participation across the actors involved) can develop a significant number, and diverse and anticipatory adaptive actions, according to local needs over time. Considering the results from Community A and its characteristics, other critical aspects to study are cultural and historical characteristics of rural communities, and how they influence governance structures, and processes and adaptive actions to climate and developmental changes.

Community governance can facilitate local adaptive actions to natural or anthropogenic changes and risks. Robust governance structures and high quality processes involving different types and multi-level stakeholders, like those observed in Community A, can facilitate higher levels of anticipatory adaptation to different changes at the community level. Strong structures and a high quality of deliberation processes of governance with cross-scale linkages through the involvement of local, regional, national, and/or international institutions can facilitate the mobilization of new resources (through actions) at the community level (Ostrom et al. 2002; Young 2002; Berkes et al. 2005; Wilson 2012; Young 2012). When these resources are mobilized considering potential environmental risks from anthropogenic or natural changes, these actions become anticipatory and may avoid negative environmental impacts on the community.

By 2013, the Uruguayan government is mobilizing resources for climate change adaptation and rural sustainable development through the Sistema Nacional de Respuesta al Cambio Climático, Grupo Interdisciplinario de Investigación del Cambio Climático, Instituto Nacional de Investigación Agrícola (INIA), Instituto Plan Agropecuario, MGAP, and the Universidad de la República (UdelaR). Under the increasing complexity and uncertainty of global anthropogenic and natural challenges, new policies and programs should focus on the efficiency and legitimacy of recent institutional transformations. In turn, these could facilitate organizational flexibility on multi-level collaborative platforms, including actors from the state, the market, and civil society from local, regional, national, and international levels (Berkes et al. 2005; Meyer and Konisky 2007; Berkes 2008; Dowsley 2008; Davidson et al. 2010; Ashwill et al. 2011). This could lead to long-term institutional adaptive programs, and avoid the exclusive dependency on national or international aid and loans (*El País* 2011) from the World Bank, the United Nations, or the European Union, which mostly focus on post-events and emergency plans.

High levels of local institutional governance can facilitate collaborative and flexible multi-level systems that can learn from experience, and generate knowledge to enhance resilience and empower self-organization at local levels (Folke et al. 2002; Berkes et al. 2005; Folke et al. 2005). This could potentially facilitate processes of coordination among different stakeholders to plan and achieve sustainable goals in complex contexts, as well as to build new institutions across different levels, capable of dealing with the complex and uncertain risks (Folke et al. 2002; Berkes et al. 2005; Folke et al. 2005; Armitage 2008; Berkes 2008; Dowsley 2008; Cullen et al. 2010; Davidson et al. 2010) provoked by shocks from phenomena, such as climate change and/or globalization.

The empowerment and legitimacy of new structures and deliberation processes of communities with Municipios could lead to community-based governance for better locally-adapted strategies. In Uruguay, the recent implementation of new decentralized structures of the state through the new 89 Municipios and the creation of new interdisciplinary governmental institutions, such as the Sistema Nacional de Respuesta al Cambio Climático, and the future Centro de Transferencia de Tecnología Para Cambio Climático y el Desarrollo Sustentable (CTTPCCDS), are promising for the evolution of new institutional structures across different levels, sensitive to responses from phenomena like climate change and globalization.

This study aims to significantly inform in this regard. Results from this study could also be informative to policy-makers, ongoing institutional programs, as well as other similar studies that focus on rural communities, governance, and adaptation to climate change, globalization, or other phenomena. Future studies should explore more in-depth the different types of governance under decentralization processes of governability, and their impacts in developing effective and local adaptive actions to reduce environmental risks from natural and/or anthropogenic changes.

ENDNOTES

[1] See Figure 1.

[1] See Figure 1.

[1] Risk is a potential loss an undesirable outcome.
[1] See Table 1 with disturbances faced by communities in Southwestern Uruguay.
[1] Nueva Ruralidad or Desarrollo Territorial achieved in Latin America was influenced by the LEADER project (http://ec.europa.eu/agriculture/rur/leaderplus/index_en.htm) initiated in the 1990s by the European Union. During the last ten years, this approach and developmental model have been implemented and facilitated by European and Latin-American scholars and Multilateral Development Agencies between Europe and Latin-American countries (Piñeiro 2004).
[1] It is the Intendencia, who determines the geographical boundaries for each of these governments. The jurisdiction of Municipios varies from community-to-community, and sometimes they are not clearly mapped.
[1] See Table 2: Adaptive actions explored in communities from Southwestern Uruguay
[1] Letters are assigned to each community to protect anonymity.
[1] The results of this paper are based on preliminary analysis (still in process) of field notes and data obtained from November, 15th of 2012 to February, 12th of 2013.
[1] See: http://www.colonia.gub.uy/web2.0/index.php?seccion=leoNoticia&idNoticia=2592
[1] See plan: http://www.colonia.gub.uy/web2.0/index.php?idArticulo=123140
[1] See plans for each of the regions: http://www.soriano.gub.uy/www/manifiesto_ordenamiento_territorial.html

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Wild Hogs and Delta Farmers: A Constructivist Look at the Wild Hog Problem in the Mississippi Delta*

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ABSRACT *This paper looks at the political and ecological characteristics surrounding the Mississippi legislative decision to categorize the animal as a nuisance. Constructivism theory is used as a theoretical framework in analyzing both archival and qualitative data, which looks at how the issue of overpopulation of feral pigs prompted Mississippi farmers to influence social perception and state politics. Outcomes illustrate how the social constructivism of nature can create and change public opinion on ecological issues.*

[**Mississipi Delta, wild hogs, conservation, constructivism**]

INTRODUCTION

Political ecology is the study of the environment and politics and how the two become interconnected through various social phenomena and environmental problems. This interconnection of politics and the environment is a result of changes in the way society interacts with the environment and how the environment shapes society and culture. This paper's topic is on the problem of feral pigs in the Mississippi Delta. More specifically, this paper looks at the political and ecological characteristics surrounding the Mississippi legislative decision to categorize the animal as a nuisance. Constructivism theory will be used as a theoretical framework in analyzing both archival and qualitative data, which looks at how the issue of overpopulation of feral pigs prompted Mississippi farmers to influence social perception and state politics. Outcomes will show how social constructivism of nature can create and change public opinion on ecological issues.

Background

In order to fully understand the political ecology of feral pigs in the Mississippi Delta it is necessary to provide a detailed background on the subject. The following section will provide a history of the Delta and wild hogs in the region and the ensuing political action taken against the animal. First, a look at the generalized history of the Delta animal is offered to afford the reader

with an accurate analytical context. Following the history of the Delta and wild hogs, this paper examines the current data on wild hog populations, inhabited land, and species characteristics. Data presented in this section was acquired through the review of various state documents and websites pertaining to wild hogs in Mississippi.

The Mississippi Delta is a region in northwest Mississippi comprised of eighteen counties located between the Mississippi and Yazoo rivers. The Delta is a cultural region and does not refer to the geographical Mississippi River delta, which encompasses a much larger area. The Delta flourished in the early 19th century in large part to the cultivation of cotton – which relied exclusively on African slave labor. Following the Emancipation Proclamation and passage of the thirteenth constitutional amendment, the Delta's economy continued to rely primarily on agriculture – with former slave's labor exploited as newly appointed share croppers. Presently, the Delta represents one of the poorest areas in the United States – a title typically swapped with the Appalachian regions of eastern Kentucky and parts of West Virginia. The area is still farmed extensively, but human labor has been replaced almost entirely by machine. The U. S. census reveals that in 2010 Deltan counties were generally demographically and economically homogeneous when compared to one another.

Sus scrofa, is the scientific moniker for animals that are commonly called *feral pigs, feral hogs, wild hogs,* and *boar*. *Sus scrofa* is typically referred to as a *wild hog* in Mississippi. Wild hogs in the Mississippi Delta are believed to be the decedents of domesticated pigs, which were brought to the area by the Spanish explorer Hernado DeSoto during his explorations of the region in the 16th century. These domesticated pigs apparently escaped from DeSoto's exploration party and have since exhibited great success surviving and reproducing in the wild (MSU, retrieved from *http://wildpiginfo.msstate.edu/history-wild-pigs.html*). Traditionally, wild hogs have been sought after by hunters and trappers in the region who depended on the animal for sustenance. In recent decades the national population of wild hogs has seen a dramatic increase; however, the precise rise of the hog population in Mississippi is not known due to the state's lack of accurate record keeping. It is argued by many researchers that wild hogs are not a part of the natural ecosystem since their introduction into the Americas occurred due to human error (Sweeney et al., 2003). This is an interesting concept, which surfaced in both academic literature and publically viewed educational websites, and fits within the realm of social constructivism. Wild hogs have been present in the region for the same amount of time as European settlers, and yet the hogs are framed as interlopers. This is an interesting detail, which garners further discussion; however, due to the research interests presented in this paper it will not be expounded upon.

Experts believe wild hogs in Mississippi have become a threat to the environment and economy as well as human health. Table 1 illustrates the dangers associated with having wild hog populations on or around one's land. This information was taken from Mississippi State

University's extension website which focuses on educating the public about the threats posed by wild hogs.

Contemporary literature and public awareness organizations suggest the invasive nature of the species is threatening to the economy and environment as well as to human health (Gipson et al. 1998). This rationale was a deciding factor in the prompting of the Mississippi state legislature to reclassify the species from a "large game" to a "nuisance" animal in 2007 (Mississippi Code of 1972, amendment). The classification of wild hogs as a nuisance animal in 2007 created a dramatic shift in the manner which wild hogs can be hunted and trapped. Table 2 illustrates the methods of hunting and trapping wild hogs in accordance with the Mississippi Department of Wildlife, Fisheries, and Parks website (see http://www.mdwfp.comnuisance-wildlife.aspx).

Table 1: MSU Extension Website Listing of Damage Created by Wild Hogs

Crop Damage
-Damage occurs through eating, trampling, rooting and wallowing in fields -Plant roots are damaged -Holes and ruts are created that damage farm equipment and endanger operators
Livestock Damage
-Hogs may prey on livestock including newborn lambs, goats or calves.
Forests Damage
-Hogs eat acorns, hickory nuts, beechnuts, and other hard mast resulting in very little new tree growth -Hogs use saplings and mature trees as scratching and scent marking posts which causes damage
Native Wildlife Damage
-Hogs compete with native species for food including game animals such as deer, turkey, and quail -Hogs sometimes prey on eggs and newly hatched birds and sea turtles, small mammals, salamanders, frogs, crabs, mussels, and snakes. Hogs have been known to prey on white-tailed deer fawns. -Wild hogs eat native plant species
Environmental Damage
-Hogs can reduce water quality in areas by increasing turbidity and bacterial contamination -Feces from hogs can increase fecal coliform concentrations to levels exceeding human health standards
Human Health
-Hogs are carriers of 45 different parasites and diseases that pose a threat to livestock and humans. 8 out of 10 cases of swine brucellosis linked to wild hogs in Florida.

Table adapted from Mississippi State University Extension website on educating the public on wild hogs

As described in Table 2, the regulated methods of hunting and trapping wild hogs since being classified as a nuisance animal provides greater autonomy to those who wish to remove the species from their property. An obvious critique of the regulations provided by the MDWFP is the use of vague language. The general public's understanding of these regulations is open to interpretation. The ability to shoot the animal at will - day or night and with no restrictions on ammunition – creates uncertainties in the development of future removal strategies, thus opening

the door to the possible development of inhumane removal techniques. Studies have shown that using recreational hunting strategies to reduce wild hog populations are generally an ineffective strategy and significant population reduction only happens in limited areas (Cowled and Lapidge, 2004). In addition to the removal methods mentioned in Table 2, the MDWFP revealed there were no toxins designed for wild hog removal as of yet, so poisoning the animals is not an option. This statement seemed to imply poisoning, as a means of population control, was not out of the realm of future possibilities.

Table 2. MDWFP Legal Methods of Hunting Wild Hogs as Classified as a *Nuisance*

Hunting Wild Hogs
-Wild hogs may be hunted, taken, killed, chased or pursued on private lands during daylight and nighttime hours throughout the year with no firearm restrictions. Wild hogs may also be hunted, taken, killed, chased or pursued on private lands with dogs, except during the spring turkey season.
Hunting Wild Hogs With the Aid of Bait
-Wild hogs may be hunted with the aid of feed/bait except whole, chopped, or ground-up grains. Bait/feed may be placed on or above the ground, year-round, in any type container for the purposes of hunting wild hogs only.
Trapping Wild Hogs
-Any live cage-type trap used to trap wild hogs must be tagged or labeled in plain view (written in waterproof ink or stamped) with the owner or users name, address, and/or trapper ID#. -All live cage-type traps must be checked at least every 36 hours. -All non-targeted wild or domestic animals caught must be released immediately upon detection. -A wild hog live cage-type trap is described as a permanent or mobile containment system made of any type material capable of confining the mobility of a wild hog until otherwise removed. -The trap must consist of a trap door, slide gate, or similar mechanism. -The roof or tops of these traps must be constructed in a manner with ample opening in the top to allow non-targeted deer, turkey, or bear to escape. -Grain or grain products may be used, if placed inside any legally designed live capture-type trapping device for the sole purpose of trapping wild hogs, year-round. -Any person trapping wild hogs must possess either a valid Lifetime, Sportsman, All Game Hunting, or Trapping License. -Wild hogs may not be caught or trapped and released into the wild at a location different from the location where the wild hog was caught or trapped.

THEORETICAL FRAMEWORK

Constructivism theory maintains nature is a social construction. As seen throughout history, perceptions on the environment have changed and what one generation views as an environmental truth will likely morph or be forgotten by future generations. Because the social reality of nature is contingent upon perception, the understandings about how the environment

functions or should function can be manipulated. The social construction of nature tends to change to meet the ideology of the elite within society (Robbins, 2010). Constructivism theory is a useful framework for understanding how social views on the environment arise. In the field of political ecology, changing social perceptions of the way in which the environment should be maintained is often a catalyst for political intervention into conflicts over environmental issues. Those with social power who realize the importance of public opinion can use their influence to change, or sometimes create, the public's perception of environmental issues (Delaney, 2001). Viewing the problem of feral pigs through a constructivist lens connotes political interests of the socially powerful should be taken into consideration. This includes the analysis of the powerful groups within the Mississippi Delta. Their interests are integral to understanding how information, scientific study, and rumors on the negative effects of feral pigs has risen in the Mississippi Delta.

It is likely the information presented on the problem of wild hogs is not entirely socially constructed. There must be some aspect of truth to the information being presented. Wild hogs are scavengers and opportunity dictates they feed from the region's many farms. With this understanding, this paper takes a soft constructivism approach in its analysis of the feral pig problem. Thus, while viewing the issue through a constructivist lens, the belief that not all scientific inquiry is untrue will be upheld. Rather, the understanding that scientific knowledge can be biased, misrepresented, and less than empirical (Robbins, 2010) will be taken into consideration upon reviewing and interpreting the data. It is not inconceivable that perceptions of feral pigs as being detrimental to the environment, economy, and safety of humans are exaggerated. Experts in a given discipline conduct scientific study; however, scientific knowledge is spread through society in ways, which are beyond the control of the scientist. Misinterpretations made unintentionally and the skewing of science by laymen can create an altered view of reality. Knowing this, it is important to gain an understanding through data collection and analysis of what is true in accordance with scientific study and what is true as claimed by and embedded in the perceptions of those living in the region. In sum, political intervention into environmental issues is often the result of popular public perception – perception that can be created or altered by those in control of social power.

Using the soft constructivist framework, this paper garners the following research questions:

1. *Is the legislation that transformed feral pigs into a nuisance animal the result of action taken by powerful groups in the region? If so, was there any opposition voiced by other groups to the action?*
2. *What is the larger society's perception of the feral pig?*

METHODOLOGY

This study employs a grounded theoretical approach to qualitative data collection.

Given the nature of the research objects it is necessary that caution be taken not to influence the researchers understanding of the collected data. That is, applying a predetermined non-constructivist theoretical understanding of the data could inadvertently influence the researcher's ability to decipher the real connotation of the data. It is under this caution and assertion that a grounded theoretical approach was taken in this study. A particularly important preliminary step in a grounded theory study is the understanding of one's on views about the constructivism of reality. (Mills et al., 2006) It is imperative that one understands that grounded theory uses the assumption that farmers and farm workers create their own understanding of reality; that is, there is no one objective reality: rather, reality changes based on one's unique experiences and is thus different for everyone. In addition, grounded theory is based on the assumption that no one theoretical framework can be used to make generalizations about the happenings within society; from a research understanding, it is better to gain an understanding of a respondent's own experiences and create new theories to the particular situation that is being studied. (Strauss and Corbin, 1998) According to Creswell (2013) grounded theory allows the researcher to develop his or her own theory based on their findings. This type of theoretical design reduces preconceived biases typically associated with a detailed theoretical framework; it is a more organic process, although one will typically follow a rigid framework of data collection. (Corbin and Strauss, 2007)

Although grounded theory is characterized by the lack of predetermined notions of what is occurring in a respondent's own view of reality, the researcher needs to have a very good understanding of what is being studied. (Glaser, 1992) In this study it has been necessary to perform a review of the relevant literature associated with the duties performed by Mississippi State University wildlife extension and other relevant resources.

In order to gain an understanding of possible outcomes to the proposed research questions it is necessary that differing research methodologies be employed.

The first research question is one of social power and the influence of politics. This research question is addressed through the analysis of archival data found on the Internet. Searches for farmer interest organizations were conducted with special interests given to language on feral pigs. Organizational viewpoints have been analyzed with special attention given to language calling for political action. Searches were also conducted to disclose any group that was in opposition to the legislation.

In addition to searching online for farmer interest groups, data were collected through the archival analysis of two Mississippi newspapers. The *Clarion Ledger* is Mississippi's most read statewide newspaper. A search of the newspaper's online archives was conducted using the phrases "wild hog," "wild hog" AND "state law," and "wild hog" AND "politics." In total this search yielded nineteen articles that mentioned wild hogs. Of these nineteen articles only one discussed the easing of state laws on the hunting of wild hogs. The *Delta Farm Press*, a pamphlet published by an association connected to farmers located in the Mississippi Delta area,

online archival database was also searched using the same methods. This search yielded about five articles on the subject of wild hogs. A major limitation to these two searches was that both newspapers' databases only went back as far as 2002.

The second research question proposed by this paper focuses on social perception. To better understand how the larger society views the issue of feral pigs, a qualitative analysis of key-informant interviews was conducted. A snowball sampling technique was utilized to find respondents who were farmers, hunters, or both. Key-informant interviews were conducted via telephone to gain insight into their perceptions of feral pigs in the region. Each interview followed a set of predetermined questions (these questions are included in this paper's appendix). Notes were taken during the interviewing process and content analysis was performed. Special attention to repetition of answers between interviewees was given, and an analysis of like-answers was conducted.

RESULTS

Farmer organizations and political action

Results from the online search of special interests groups and political lobbying on wild hogs revealed some intriguing findings. The most active farming association that represents Mississippi Delta farmers is Delta F.A.R.M. (Delta Farmers Advocating Resource Management). Delta F.A.R.M. represents many farmers in the region whose property totals about 160,00 acres of farmland. The organization's goals include the collaborative management of the region's natural resources including: rivers, lakes, other waterways, soil and erosion, and other projects relevant to farm success. With the organization's intention to manage natural resources and the potential threat of natural resources it seems fitting the organization would have some involvement with the management of wild hogs. However, within the organization's project listing there was no discussion of wild hog management in the Delta region.

Further searchers yielded no other major farm advocacy group in the region. However, online blog sites did have lengthy discussion boards on the topic of wild hogs. In total there were about three blogs with at least one discussion board devoted entirely to wild hogs. In a brief review of these blogs, the majority of postings were from amateur hunters claiming to offer, "hog removal services." Although the full analysis of online blogs was not conducted, this researcher believes it may prove useful to paraphrase some of the findings. Upon reading over the blog entries it appeared as though many of the hunters were unemployed adolescents or adults looking for "fast cash." The following bulleted list paraphrases some of the more interesting hog removal blog entries:

- *" . . . Can't drive but daddy says he'll drop me off, I'm a good shot and I promise to get a lot hogs"*

- *"Looking for farmer's with hogs who need them removed. Can do it quick but can't transport them."*
- *"If you have hogs I can take [kill] them for you. It's 15 dollars an hour. I want the meat."*

In addition to searching for any organization which might have interests in the deeming of wild hogs as a nuisance animal, searchers were conducted that targeted any social organization which might oppose the legislation. Upon searching the Internet, no organization objecting to the legislation was found. A further review of PETA's (People for the Ethical Treatment of Animals) website, an international organization known for educating the public on animal right's issues, showed no attention to any state legislation deeming wild hogs as nuisance animals or the removal practices which are often recommended. Only one article focused on wild hogs, and it was primarily concerned with wild hogs used in spectator dogfights.

In searching for newspaper articles on wild hogs only one article was mentioned in the state's premiere paper, the *Clarion Ledger*, and about five articles were found in the *Delta Farm Press*. The article found in the *Clarion Ledger* was quite brief, and it focused on the state's decision to relax the laws on hunting nuisance animals like wild hogs. The article framed hogs in a negative context and cited that the animal was harmful to the environment and economy as well as to human health. Interestingly, the article focused a lot of attention on the negative consequences of having hogs in areas, which are highly prized by big game hunters. The article suggested hogs and deer do not usually coexists because they feed on the same plants and hogs will usually dominate the area, thus driving the deer out. The *Delta Farm Press* did contain about five articles on wild hogs. In reviewing this article, most of the content focused on framing the animal as a nuisance to farmers as well as possible removal techniques. The most frequent removal technique was hunting the animal. Of the two newspapers, no article was found that called for political action of the removal of wild hogs. However, this finding may be due to limitations of the search or the nature of farming associations and state politics. This issue is further explored in the results of the key-informant interviews.

Key-informant interviews

As previously mentioned, key-informant interviews were held using a snowball sampling technique to acquire data on the wild hog problem. After contact was made with the initial interviewee, the interviewee was asked if he or she knew of any other farmers and/or hunters in the area who may be able to provide more information. Consequently, that farmer and/or hunter was contacted. In total, five interviews out of a proposed nine, or about 56%, were completed. Four of the respondents classified themselves as large-land owning (2,500 acres or more) farmers. One respondent classified himself as a farm worker and life-long hunter of regional small and large game. The following paragraphs and bulleted lists represent the significant findings of these interviews. First, each question or prompting question revealed and followed

by summary paragraphs of responses. Second, key quotes supporting each summary paragraph will be provided.

1. *Have you heard of the "wild hog problem" in Mississippi?*

All respondents agreed they had heard of the "wild hog problem" in Mississippi. Three of the farmers concurred in saying they have never seen any seen wild hogs or sign of wild hogs on their land. The only farmer who disclosed he had seen signs of the animals on his land said the problem was minimal, he stated, "The hogs like to root up the newly planted corn, they dig holes in the ground and we have to behind and refill them, etc." In this instance, the total damage was less than five acres out of a total of 6,000 owned or rented by the farmer. Even with this limited damage, the farmer stated he feared the problem might become greater in the future. This fear was exemplified with the statement, "We don't have any hogs right now, but I have heard they are in the area." Most farmers stated that the hogs tended to stay closer to wooded areas rather than the openness of the crop-rows in the farmland, as stated, "The hogs are on my land, I believe they typically stay closer to wooded areas."

2. *Where do you get your wild hog information?*

In response to this question all respondents stated they receive a large majority, if not all, of information on wild hogs from word of mouth. Typically, this information tended to come from casual conversations with other farmers in the area. This is reflected in statements like, "I mostly just hear about it from other people" and "There is a worker on my farm who talks to other farmers who have some hogs on their land" No farmer indicated they have received any information on the animal from state officials or wild life experts. When asked about the suggestions on removal from state game wardens, almost all respondents agreed they have not received any such suggestions or advice. This was brought to life with statements like, "I did hear of something State [Mississippi State University] was doing over in Grenada [county] but I didn't hear nothing of what happened." One farmer exclaimed the game wardens generally tell farms to shoot the wild hogs on their land or to do what it takes to get them off.

3. *Have there been any damages of wild hogs endangering humans?*

When asked about the threat of hogs to human life many farmers stated they have heard hogs can hurt people either through attacks or diseases. Farmers indicated hogs will charge at people and slice at them with their tusks," ". . . They'll charge at you with their teeth and can slice you open." However, when prompted to provide an examples of such cases, no farmer could provide a specific instance of any aggressiveness made towards humans by the animals. The only example produced by any farmer was a rumor that dogs are typically injured in attempts to

remove wild hogs from farmland, "The only thing that usually get hurts is a dog [when dogs are used in the hunting process]" No examples were given to the diseases, which are supposedly transferred from wild hogs to humans.

4. *What methods of removal do you employ?*

All farmers had heard the best method to use in removal is the use of baiting and trapping and hunting with dogs. The one farmer who has seen wild hogs on his or her land indicated that they have taken measures to remove them. This was done so with the use of baited traps. The farmer proclaimed this method was successful in trapping hogs, but it was not practical in the long run given the high number of offspring produced by the animal, "We have put out some traps and had some success, but it is difficult because you don't get a whole lot and you have to check and bait the traps often. It gets to be a headache." No farmer expressed they have sought help from recreational hunters to remove the animal. The respondents were asked their opinion on any useful methods of removal other than using baited traps and dogs; upon this, two respondents revealed that using poison seemed like a possible strategy to reduce the population, they stated, "I think the only way to make sure they stay off the land is to use poison, but that has problems with the environment and stuff." However, this ruse is currently illegal and no farmer stated they have used or have heard of anyone using poison to remove wild hogs.

5. *What do you think the future outcome will be?*

All farmers stated they believed the numbers of wild hogs in their area would only increase, they stated, ""I believe that they will likely be more hogs here in the future."
Farmers believed if the number of hogs in their area increases the government would have to step in a take some sort of action. Farmers mentioned some type of task force, whose objective is in removing hogs, might have to one day be employed. This point was conveyed through the following quote, " "They are coming and we need to get something done now to make sure it doesn't get out of control."

DISCUSSION

This paper used a social constructivism lens to view the *wild hog problem* in the Mississippi Delta. The background information provided seemed to frame the influx of wild hogs in the state as a threat to the environment and economy as well as human health. In 2007 the state legislator took action in labeling the animal as a nuisance animal. With this new label farmers were given greater autonomy to take the problem into their own hands and employ a method of removal method they feel best addresses the issue on their property. Using a constructivist

framework it was proposed that there is likely some powerful group influencing the state to pass legislature, which benefited their interests. Upon review of the data collected as a part of this study it seems this researcher's hypothesis is not a correct assumption. Data yielded from archival analysis points to a lack of farmer interest groups, which focus their efforts and political capital on the removal wild hogs from the state. In addition, findings were slim when a review of newspaper archives was conducted. Most information on the nature of the wild hog problem comes from Mississippi State University; however, in reviewing the key-informant interviews it seems farmers in the region do turn to the state's land-grant university for assistance or knowledge. Rather, most of the knowledge on wild hogs is passed from farmer-to-farmer via word-of-mouth. Indicating that farmers in region have not yet resorted to any organized collective action in addressing the problem.

The key-informant interviews also shed light on another interesting finding, the issue of wild hogs in the area does not seem to be an issue at all. Only one farmer reported any crop damage as the result of hogs in the region, but all farmers had heard of the dangers of hogs and called for action to be conducted at the state level. This finding is interesting when viewed in context from the blog topics discovered while conducting online archival searches. There seems to be a willing and waiting group of amateur hunters in the area hoping for the opportunity to capitalize on the fear of farmers. The emergence of amateur hunters who view themselves as an appropriate means of hog removal may have disturbing affects on future methods of wild life removal. If the population of wild hogs does rise in the area, then it is not inconceivable that inexperienced wild-hog-bounty-hunters will take use of the most effective means of removal as possible, legal or illegal.

In conclusion, it seems there are no powerful group interests being served in deeming wild hogs in Mississippi as a nuisance animal. Its possible that (although no data collected in this paper points to this) Mississippi lawmakers deemed wild hogs a nuisance animal in response to studies of rising hog populations in other states. This is supported by the overall lack of empirical data on wild hogs numbers in state. Farmers and landowners in the Mississippi Delta seem to be receiving information the threats of hogs based on word of mouth. This information frames the animal as a threat and fears have developed about the future of wild hogs coming to area. Premature fears on wild hogs and the state's label as a nuisance animal can have negative effects on the species as a whole. Farmers and a public who have been predisposed to fear the animal may or may not take dire action if the population of wild hogs does increase. Future action on the problem will likely create its own environmental problems.

Viewing the issues surrounding wild hogs in the Mississippi Delta through a soft constructivism theoretical lens allows for the use of scientific study in the conception of reality. In the case of wild hogs, scientific studies are obtainable, however, they are lacking in some major areas. The lack of accurate state data reveals consequential decisions are being made without the proper knowledge of the situation. These are dangerous waters; the reality of the situation has been constructed through the use of incomplete scientific study. As a result, the reclassification of

wild hogs as nuisance animals may prove to have serious social and environmental implications in the future.

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APPENDIX A: MS HUNTERS AND FARMERS QUESTION GUIDE

Introduction

First let me tell you a little about this project. I am conducting interviews as a part of a project I am working on for my political ecology class at the University of Missouri. I am interested in the feral pig situation in Mississippi. Specifically, I would like to gain your insight into the nature of the situation. As a Mississippi Delta farmer or hunter or both, your insight on the nature of the problem will prove to be very valuable to my research. I should inform you that I have chosen not to seek IRB approval for this project, however, I can assure that your name or likeness will in no way be associated to any data yielded from this interview. In addition, this project is not intended to be published, and thus, you can be assured that your identity and any other data gathered from this project will not be made available to the public. Thank you for your cooperation in this project.

Farmers Only

1. First, can you tell me a little bit about your farm or the farm that you are employed at?

- For instance, what kind of crops do you grow?
- How many acres do you or your employer farm?
- Where is your farm located?

2. Have you heard of the "wild hog problem" in Mississippi?

- Where do you get your wild hog information from?
- Are there wild hogs on your farm?
- What kind of damage do they do?
- Have there been any damages of wild hogs endangering humans?
- What methods of removal do you employ
- Are these effective? Is there any state or local organizations that help you remove these hogs?

Hunters

1. Are you aware of the "wild hog problem" in Mississippi?

- Where do you get most of your information on wild hogs? (from other hunters, hunting groups, state wildlife representatives")
- Do you hunt wild hogs?
- If so, how do you hunt wild hogs? (at night, with dogs, what kind of weapon and ammunition do you use?)
- If you hunted wild hogs before 2007, has your hunting strategy changed in any way? Do you think recreational hunting of wild hogs is an effective means of removal?

Both Farmers and Hunters

1. What do you think the "hog problem in Mississippi" will look like in the future? What is it best/worst possible outcome of the wild hog problem?

Water Poverty? A Political Ecology Approach to the Study of Irrigation in Ethiopia*

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ABSTRACT *This paper explores the impacts of social, economic, political, and ecological actors on irrigation use in The Federal Democratic Republic of Ethiopia (FDRE or Ethiopia). Specifically, the reasons for irrigation, its promotion in developing nations, ecological drivers and consequences, and long-term economic, ecological, and cultural impacts of irrigation use will be addressed. This paper compiles data from several different sources (World Bank, International Monetary Fund, Ethiopia's Central Statistical Agency, United Nations Development Program), including independent research conducted during the author's master's thesis. Findings from this study suggest current estimates of water useage in the Ethiopia are drastically underestimated by international agencies. Additionally this paper finds current techno-centric approaches which emphasize Western production systems and utilize capital intensive irrigation schemes in Ethiopia lack sustainability and may be culturally inappropriate.*

[**Ethiopia, food security, South Wollo, irrigation, water, *khat*, *teff***]

BACKGROUND

Famine is an international epidemic. According to the World Food Program (WFP), a major contributor of food aid globally, more than one billion people are classified as hungry worldwide (WFP 2011). Ninety-eight percent of the world's hungry live in developing countries, 75% of these live in rural areas, and at least half of those who are starving are from farming families (WFP 2011). Of the one billion who are hungry, approximately 265 million live in Sub-Saharan Africa. Sixty-three percent of Sub-Saharan Africans live in rural areas, and despite agriculture-based livelihoods, are more prone to hunger (World Bank Group 2011). Current projections estimate a 33% increase in global population by 2030, with significant portions of the increase taking place in developing countries, which includes most of Sub-Saharan Africa (FAO 2002; Faurès et al. 2004). This increase in population will also increase demands on food resources.

Though famine and hunger are both products of social, political, and ecological institutions, the solutions have been predominately technical in nature, and specifically target agricultural production methods. The United Nations' Food and Agricultural Organization (FAO) outlines three solutions to food problems globally: (1) arable land expansion; (2) increased cropping

intensity; and (3) yield growth (FAO 2003). These have traditionally been accomplished through the use of high yielding seeds, irrigation, improved plant nutrition, and improved methods of pest control (FAO 2003). Ethiopia has continued to increase the amount of land that is put into production annually (Fig. 1). This *extensification* process necessarily means that marginalized lands which are not ideal or even appropriate for agricultural production are being farmed, essentially limiting Ethiopia's future attempts at increased production to increased cropping intensity and yield growth (Awulachew et al. 2007; FAO 2003). Though there are many ways to accomplish both cropping intensity and yield growth, this paper will focus on the use of irrigation.

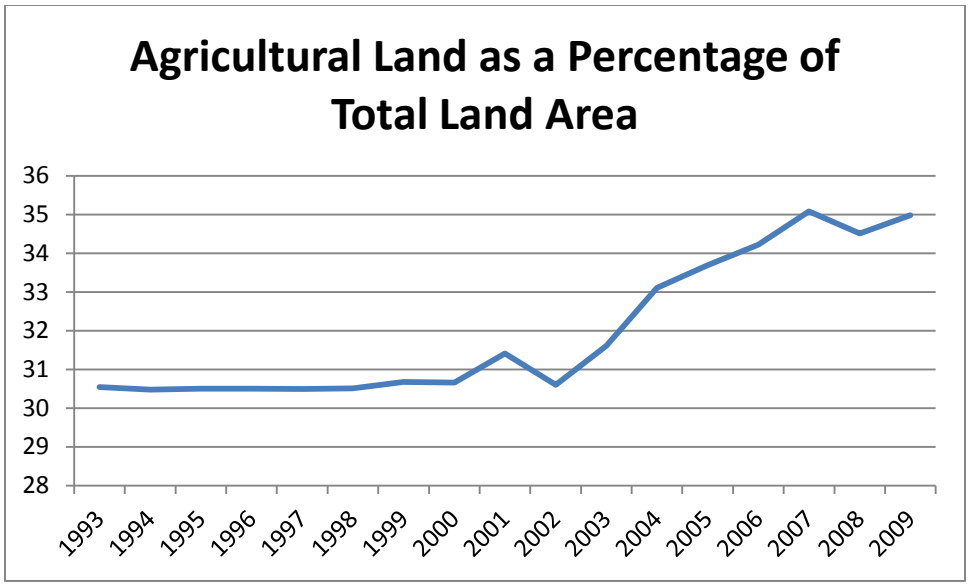

Figure 1. Agricultural Land Expansion from 1993 to 2009
Adapted from World Bank Data, 2012

Ethiopian Context

Ethiopia, situated in the Horn of Africa, is a culturally and geographically diverse country with more than 85 living languages spoken in this single East Africa country (Lewis 2009). Ethiopia shares similar topography with bordering nations, Eritrea, Djibouti, Somalia, Kenya, and Sudan, and is characterized by temperate high plateaus, mountain regions, and dry lowland plains (US State Department 2011).

Sixty-five percent of the world's hungry live in seven countries, one of which is Ethiopia (WFP 2011). Eighty-three percent of Ethiopians live in rural areas and because a substantial number of the world's hungry live outside urban centers, it is not surprising that 10% of the 80 million people living in Ethiopia qualify to receive food aid annually (Croppenstedt and Muller 2000; Makombe et al. 2007; Awulachew 2007; WFP 2011). Ethiopia is the world's third poorest country, with 44% of the population below the international poverty level and almost half of the population is undernourished, despite average caloric intake reaching 2100 calories per capita per day (FAO 2002, 2003; World Bank Group 2011; CSA 2012). At least 39% of Ethiopians live

on less than $1.25 USD per day and 78% live on less than $2 USD per day (World Bank Group 2012).

Ethiopian farmers must tackle human disease, flooding, drought, and agricultural constraints in the context of a poor national infrastructure and lack of economic development (Lee 2004; Ogbaharya 2009). Thus farmers' major concerns center around frequent rain shortages, soil erosion, shortages of farmland, water conservation, lack of grazing land and fertilizers, crop disease, pest control, and poor access to markets, all of which are major constraints to agricultural production (Bekele 2006). These constraints are aggravated by land over-grazing, land-use changes, expansion, resettlement, and an increasing national population (Anbessa and Bejiga 2002; Assefa et al. 2008). But continued population growth and soil degradation make Ethiopians highly vulnerable to seasonal climate variations, particularly the occurrence of drought. This also contributes to the perpetual state of poverty and food insecurity throughout the nation (Bekele 2006; Lee 2004).

There are three types of "food poverty" in Ethiopia: (1) transitory, often the result of severe drought or war; (2) seasonal, the result of discrepancies in rainfall during the short and rainy seasons; and (3) chronic, which is the result of political factors (i.e. land tenure, government policies) and a weak natural resource base (Devereux 2000). These three types of food poverty have serious political and economic consequences, especially for a country that as of 1996 was receiving 20% of all of the food aid sent to Africa (Jayne et al. 2000; Quisumbing 2003).

In a country where 50% of the gross domestic product is comprised of agricultural outputs, there are national as well as individual incentives to make the most out of limited or scarce resources (Makombe et al. 2007). Ethiopia, as a developing country, relies heavily on climatic resources, namely water, and the exploitation of these resources plays an important role in national progress (Downing et al. 1997; Dejene 2003; Bekele 2006; Desalegn et al. 2006). However, this exploitation often comes with a host of environmental and conservation concerns, particularly water table depletion and groundwater contamination.

Drought

In Ethiopia drought is a constant concern for farmers. Severe drought, which results in massive livestock and crop loss, in addition to a significant loss of human life on a national scale, is a substantial contributor to poor health and low agricultural productivity. This type of drought occurs every eight to ten years in Ethiopia, with four major episodes over the last fifty years—1973-74; 1983-84; 2000; 2010 (Croppenstedt and Muller 2000; Salama et al. 2001; Kebede 2008). Perhaps less severe but nevertheless damaging, seasonal drought is a consequence of rainfall shortage during the growing season and generates varied amounts of crop and livestock loss. Historically seasonal drought occurred approximately every two years in Ethiopia, but climate change which has increased rain variability has made seasonal drought a much more frequent occurrence (Desalegn et al. 2006). It is also important to note that the amount of rain is not necessarily as important as the timeliness and distribution of rain. Precipitation at the wrong time, for too short a time, or for too long a duration can devastate crops, and has become an increasing concern for Ethiopian farmers (Deressa and Hassan 2009; Araya and Stroosnijder 2011). Thus between 1970 and 1996 there were 25 drought, famine, or food shortage events

throughout Ethiopia which resulted in the death of over 1.2 million people (Desalegn et al. 2006). Figure 2 illustrates the impacts of drought on crop production. During the 2003 growing season Ethiopia experienced drought conditions during both the *belg* (spring) and *meher* (fall) growing seasons, but post growing season rains flooded many parts of the country (Holmes 2003). There was a noticeable impact on yields of all major crops with the exception of *teff*.

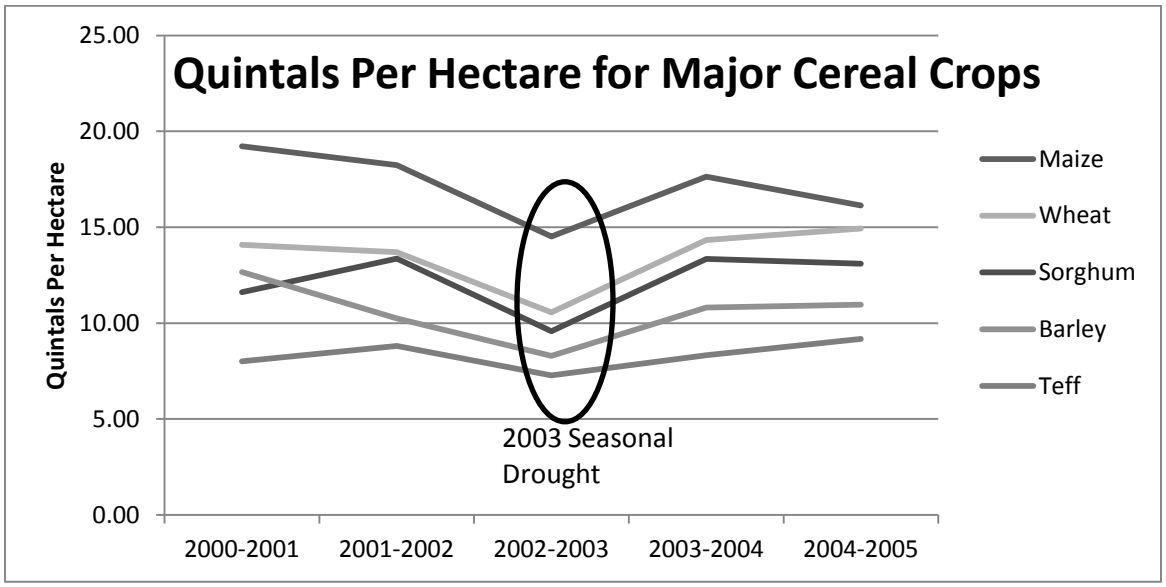

Figure 2. Yield of Major Cereal Crops from 2000-2005.
Adapted from IMF Data, 2006

AGRICULTURE AND TRADE

Agriculture is a social and economic mainstay for many developing countries, particularly those in Sub-Saharan Africa. Thirty percent of gross national product (GNP) in Sub-Saharan Africa and 47% in East Africa is reliant upon agriculture, compared to only 2% in the United Kingdom (Downing et al. 1997). This overwhelming reliance on agriculture means that expansion of production into marginal lands has become commonplace, particularly in Ethiopia. This expansion is due, in part, to the reliance on rain-fed agriculture. Sixty percent of agriculture in developing countries is rain-fed (FAO 2002, 2003). Rain-fed agriculture is particularly prominent in Sub-Saharan Africa where it supplies 90% of staple food products and 60% of all agricultural products (FAO 2003; Cooper et al. 2008). This is the case for Ethiopia as well, particularly in the highlands, where agriculture is also typically a rain-fed operation and associated with low productivity in comparison to irrigated agriculture (Devereaux 2000). As a result, consumption is often directly impacted by the amount and timeliness of rainfall for a given household (Dercon and Krishnan 2000). Even minor changes mean harvest quality and quantity are reduced (Dercon and Krishnan 2000; Rosell and Homer 2007). This situation becomes particularly threatening during drought as the average land holdings, 0.8 hectares of arable land, for many are insufficient to provide enough food for the family even after a good harvest (Deveraux 2000).

Irrigation, fertilizer, seed sources, and income diversification all play crucial roles in the productivity of Ethiopian farms (Bekele 2006; Little et al. 2004). Yet it has also been demonstrated that a household's chance of poverty is most likely decreased by planting export crops such as coffee and *Catha edulis* (*khat*) (Bigsten et al. 2002). Because agriculture for many Ethiopian farmers is not conducted for commercial purposes, any cash that households would need must come from the sale of one's own livestock, alternative crop products (i.e. crops not grown for household consumption), or paid labor (Desalegn et al. 2006). Some individuals trade vegetables or other materials for cash (Bekele 2006). Still others opt for more lucrative crops such as *teff*, fruits, and vegetables, and *khat*.

Teff

Most production in Ethiopia is dedicated to six crops: maize, wheat, barley, *teff*, coffee, and *khat* (Fig. 3, Fig. 4). *Teff* has its origins in Ethiopia which explains its widespread use and production (Roseberg et al 2005; Refera 2001). This C4 self-pollinating annual is both carbon-dioxide and water efficient which makes it naturally drought resistant and a preferred crop for Ethiopian farmers (Rosell and Holmer 2007; Roseberg et al 2005; Refera 2001). However, the plant's drought resistance comes at the expense of high yields, which farmers are increasingly combating with the strategic use of irrigation (Araya et al 2010; Roseberg et al 2005). The strategic use of irrigation is important in grain development for *teff*, whereas non-irrigation tends to produce more biomass, rather than grain, which is typically only used for fodder (Araya t al 2010; Hunger et al 2007). If irrigation is truly as limited as the Government and FAO report this may explain why *teff* fails to produce high yields. Its fibrous root system is also important in soil conservation, but this is perhaps offset by the need for tillage early in the plant's germination as it does not compete will well with weeds at this stage (Refera 2001). *Teff* also has a ninety day growing period which makes it suitable for the *belg* (short) rainy season, as well as the *meher* rainy season, though it is not typically grown during both seasons (Refera 2001; Rosell and Holmer 2007).

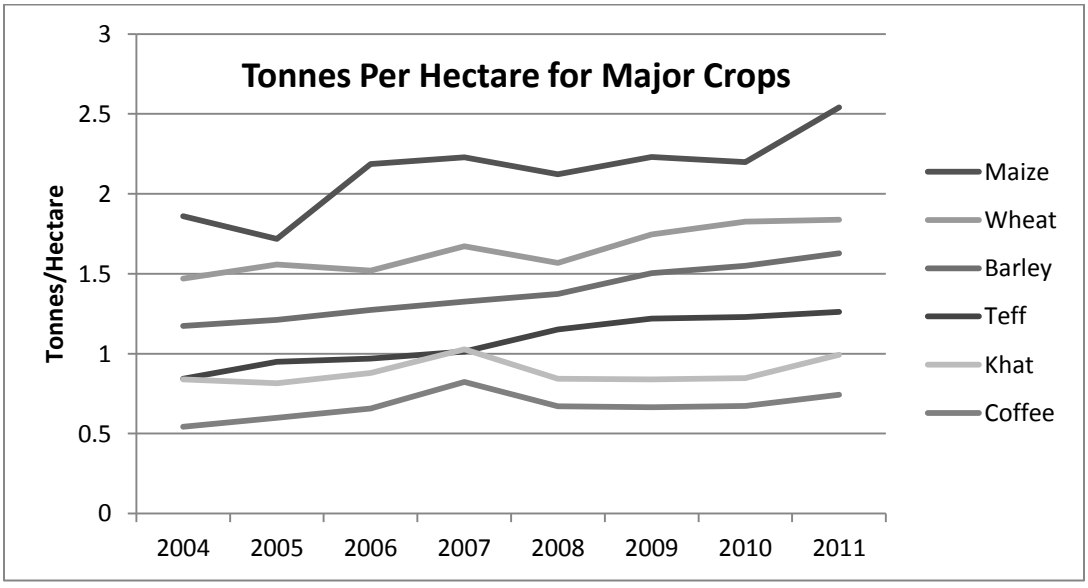

Figure 3. Yield for Major Crop Types Between 2004-2011.
Adapted from Ethiopian Central Statistical Agency Data, 2012.

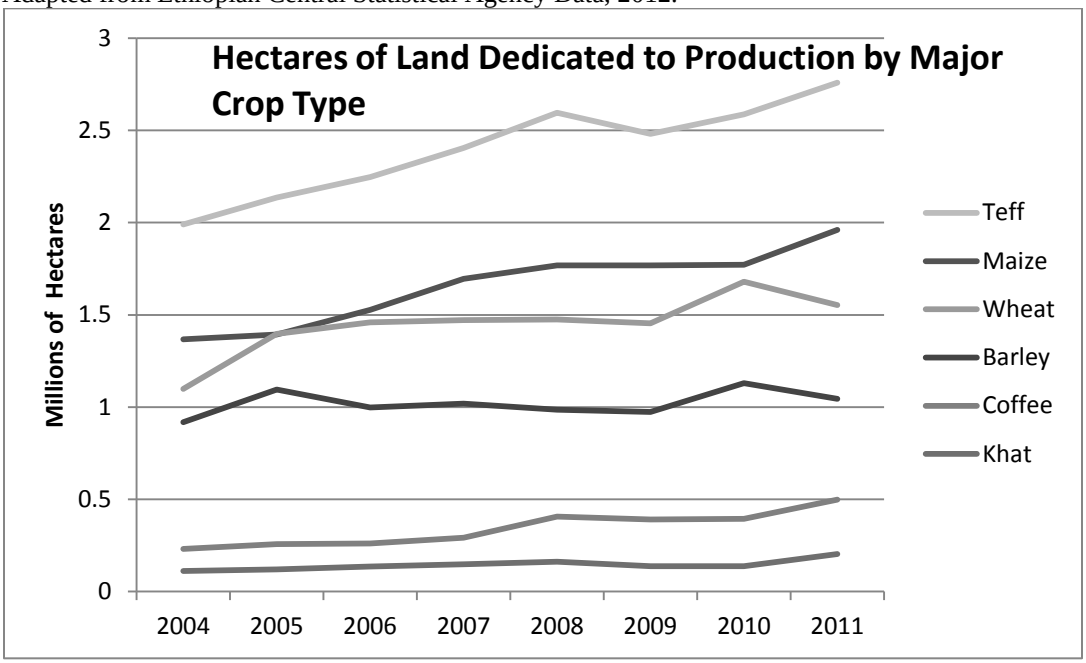

Figure 4. Land in Production by Major Crop Type Between 2004-2011.
Adapted from Ethiopian Central Statistical Agency Data, 2012.

Nutritionally *teff* is an important crop for Ethiopian, containing large amounts of the essential amino acid lysine, as well as high levels of iron and protein (Roseberg et al 2005; Refera 2001). The 12-17% protein content of the plant makes up approximately two-thirds of the average Ethiopian's daily protein intake (Refera 2001).

Teff is also a culturally important plant. Its use in the major food staple, *injera*, may explain why despite having significantly lower yields than most cereal crops *teff* has more hectares dedicated to its production (Roseberg et al 2005; CSA 2012) (Fig. 3, Fig. 4). Additionally, the demand for *teff* both inside and outside the country has resulted in rising prices, to which the Government responded by banning the export of *teff* (ReliefWeb 2006; Refera 2001).

Khat

Another important agricultural product with origins in Ethiopia is *khat*, a perennial tree crop that once established becomes a permanent agricultural crop (Getahun and Krikorian 1973; Tefera et al. 2003). *Khat* is propagated using suckers rather than seeds, which can make investment start-up costs, as well as expansion costs, very low and once established *khat* fields often remain productive for generations (Getahun and Krikorian 1973; Feyisa and Aune 2003). This permanence allows farmers to intercrop using annual crops, such as corn or beans, in the *khat* fields, mitigating some of the impact of reducing land for production of cereals used in household consumption and can help improve soil conditions (Uphoff 2011). *Khat* grows best at altitudes of 5000-7000 feet above sea level, though water, rather than altitude is the most limiting factor for the plant which creates stiff competition for water resources in areas where *khat* is grown extensively (Getahun and Krikorian 1973). Though most of Ethiopia has yet to experience

the harsh impacts *khat* can have on water resources, other Middle Eastern countries, such as Yemen, highlight the damages to water resources large-scale adoption of *khat* farming can cause (Worth 2009). Though *khat* can be grown without the benefit of irrigation, its high return on investment makes the use of irrigation more likely.

With a net return greater than coffee or any other agricultural product, *khat* is the second leading export and one of the second most important cash crops in terms of generating revenue (Tefera et al. 2003; Andrews et al. 2006; Getahun and Krikorian 1973) (Fig. 5, Table 1). Rising market prices, increased export demand from countries such as Djibouti, decreased soil productivity, insecurity of land tenure, and the crop's low production cost and risk factor make *khat* an irresistible economic investment for famers (Tefera et al. 2003; Andrews et al. 2006) (Table 1).

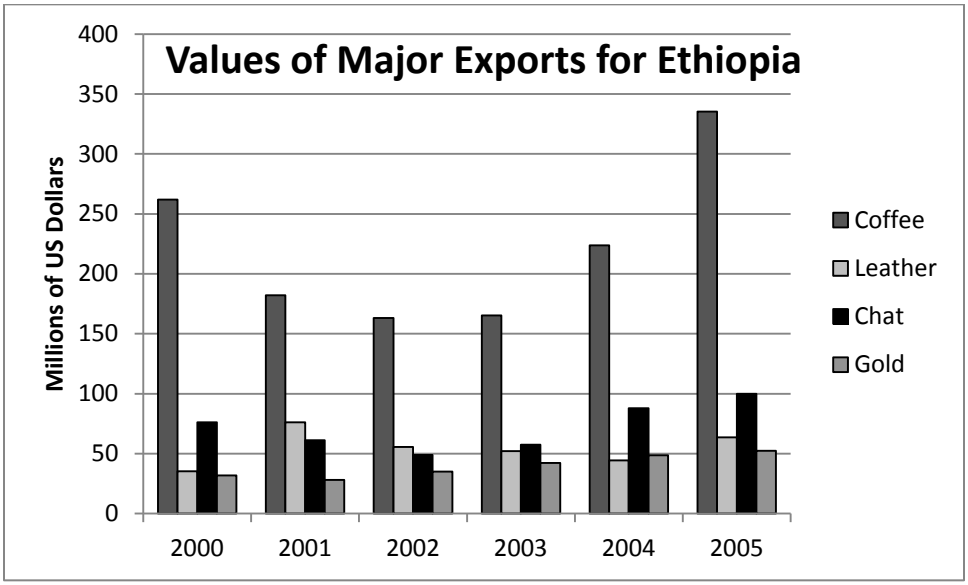

Figure 5. Values for Leading Exports from 2000-2005.
Adapted from IMF Data, 2006.

Khat is increasingly sought out by farmers as a drought mitigation strategy because it typically provides at least two crops a year under rain-fed agriculture and up to five harvests a year with irrigation, which helps insure a steady and constant income flow for farmers (Tefera et al. 2003; Lemessa 2007). This steady flow of income has the potential to allow farmers the capital they need to access food resources, even when market prices for grain are high. There are mixed reviews on the relationship between *khat* production and food security. Some research has found a strong correlation between growing *khat* and improved food security status and even child height for weight z scores, while others have noted that *khat* production is not associated with increased food security but rather, more capital intensive goods such as education and homes (Tefera et al. 2003; Feyisa and Aune 2003). This is most likely due to investments made by the head of household.

Though originally used for Muslim prayer ceremonies, known as *wodaja*, *khat* has become widely utilized by Ethiopians, as well as other countries, for recreational purposes (Getahun and

Krikorian 1973). *Khat*'s stimulant and appetite suppressing properties make it important for Ethiopian farmers working long hours who may be required to forgo sleep and meals (Feyisa and Aune 2003; Getahun and Krikorian 1973). This stimulant property, a product of cathinone, which is recognized as a controlled substance by the US and much of Europe, places restrictions on both export markets and productivity (Feyisa and Aune 2003). *Khat* addiction is becoming a recognized problem in many East African nations, particularly Ethiopia. *Khat* addiction limits household productivity and drought mitigating practices, which includes paid labor.

Table 1. Yield and Income Comparisons for Selected Cereals and Cash Crops

	Sorghum	Maize	Coffee	*Khat*
Yield Per Hectare (kg)	700-1200	1000-1300	400-700	700-1000
Income Per Hectare (Birr/ETB)	560-1800	700-1820	4800-11,200	16,100-23,000

Note: 1000 kg = 1 tonne; 1 ETB = $0.06 USD, 2012 Rates
Adapted from Tefera et al. 2003

WATER

Ethiopia has an abundance of freshwater resources, with most areas receiving between 700mm (27 in) to 1500mm (59in) of rain each year (Fig 6), but access to these water resources is made difficult by their temporal and spatial distribution. Ethiopia's Ministry of Water Resources (MoWR) acknowledges both the need for exploiting these resources sustainably and the rampant inefficiencies in current exploitation (MoWR 2001). Water is acknowledged as a common property of the Ethiopian people and as such usage is fairly loosely regulated by the Central Government (MoWR 2001). However, both the Ministry's Water Policy and Water Strategy documents outline a skeletal plan for approaching the issue, though water rights are an ambiguous element of both documents. The documents also provide an introduction of officials' watershed management approach (MoWR 2001). Ethiopia is comprised of twelve river basins, four of which hold 80-90% of the country's water resources (Awulachew 2007; Ministry of Water Resources 2001). Much of this water is carried away to neighboring countries (MoWR 2001). Appropriate watershed management will be an important step in ensuring water usage for underserved areas.

Usage and Withdrawals

Currently Ethiopia only withdraws roughly 4.5% of its total renewable water resources, double the amount of 1998 (World Bank 2012; FAO 2002). Though they are at low risk of exhausting their water resources at this level, the rate of increase in usage combined with increased climate variability which alters water balances, particularly the spatial distribution of water, may be cause for concern (Downing et al. 1997). Furthermore, the FAO (2001) predicts that water withdrawals will increase by 100% by 2030 in Ethiopia.

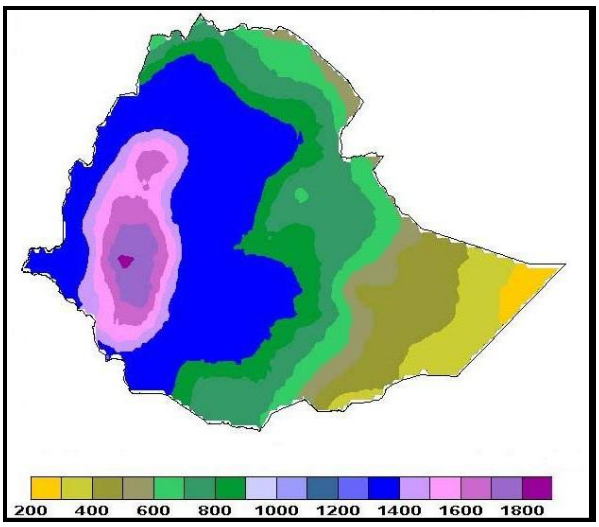

Figure 6. Long-term Average Annual Rainfall (mm). Adapted from UN Food and Agriculture Organization, Grasslands and Pasture Crops Group

Water conservation is a key concern for farmers, as 70% of total renewable water withdrawals and 93% of water usage in the county is dedicated to agriculture; this means water is necessarily tied to economic losses accrued during drought (FAO 2002, 2003). This is a concern held by both farmers using irrigation and those using rain-fed systems. There are current conservation practices, such as dams and water harvesting, which farmers manage in their agricultural activities (Desalegn et al. 2006). Regardless of these conservation practices, which rely heavily on rainfall, the problem of drought still remains a significant source of apprehension for many farmers (Desalegn et al. 2006). Additionally, the Ministry of Water Resources clearly outlines the county's desire to increase their usage of hydropower for development, and given the loose regulation on groundwater withdrawals there is the potential for misuse by farmers and industry alike, placing an added strain on a temporally and spatially sparse resource.

Irrigation

In many developing nations irrigated land accounts for less than 20% of cultivated land but produces 40% of total crops and almost 60% of all cereals (FAO 2002, 2003). As such irrigation, is closely correlated with food security and poverty alleviation and its use is an ancient tradition in Ethiopia (FAO 2003; Bekele and Tilahun 2006; Tesfaye et al. 2008). The number of irrigated hectares has double since 2002, still only 2-4% of arable land is irrigated within Ethiopia's current borders (Bekele and Tilahun 2006; Tesfaye et al. 2008; FAO 2003, CSA 2012; Faurès et al. 2004). Contemporary irrigation systems have only been in place since the 1960s (FAO 2003; Aberra 2004). These systems are often constructed by farmers with their own resources, with little help from entities tied to government or non-governmental organizations (NGOs) (Bekele 2006). The farmers' irrigation schemes are often rudimentary in their construction with temporary headwork, unlined canals, and storage ponds (Bekele 2006). These schemes are done on a small scale, and are typically washed away annually by floods during the rainy season, only to be reconstructed later (Aberra 2004; Makombe et al. 2007). The government has recognized

the importance of irrigation in agricultural production and has invested in the development of several community and public irrigation systems which account for roughly 58% of mechanized irrigation system in the country (Awulachew et al. 2007; Loiskandl et al. Nd.). However, small dams and wells are more closely correlated with improved household resiliency to drought, and are preferred by farmers (FAO 2002).

Ethiopia's increased variability in annual rainfall means rain-fed farmers are only able to grow one *teff* crop every other year (Rosell and Homer 2007). Irrigation allows farmers to grow more than one crop per year or produce other lucrative water-intensive crops (Rosell and Homer 2007; Tesfaye et al. 2008). In fact, farmers who use irrigation often produce more agricultural products worth a greater monetary value on fewer hectares than rain-fed farmers (Tesfaye et al. 2008). Yet irrigation systems are vulnerable to water loss through evaporation as a result of poor scheduling, e.g., watering during mid-day as opposed to evening, and often have a water use efficiency of less than 35% (FAO 2003; Bekele and Tilahun 2006). The average cost to improve underdeveloped structures can range from $1000 to $10,000 USD with the highest associated costs in Sub-Saharan Africa (FAO 2003). For famers whose per capita income is less than $160USD annually, this is simply not feasible (FAO 2003). Correspondingly, as farm size increases, the use of irrigation in the production scheme tends to decrease (Bekele and Tilahun 2006; Makombe et al. 2007; Tesfaye et al. 2008). That said, the FAO (2003) predicts the amount of irrigated area will increase by 33% by 2030, with little noticeable improvement in water use efficiency, less than 40%. It is also important to recognize that the FAO through the Ethiopian government, only tracks medium and large-scale mechanized irrigation systems, so their estimates fail to incorporate the impact of individual farmers using small scale hand forged systems (FAO 2002, 2003).

Secondary salinisation is also a very real concern for farmers using irrigation systems. Tigray, in northern Ethiopia, has an extensive community of micro-dam based irrigation schemes, approximately sixty to date (Kebede 2008). This may be of great benefit in the short-term, with increased production and greater access to water resources, but irrigation adds salt to the soil (Kebede 2008). In its early stages, increased salt in the soil leads to reduced productivity and eventually, complete soil infertility (Kebede 2008). Vegetation will fail to grow and there can be a great decrease in biodiversity and habitat as the land becomes barren (Kebede 2008). Malaria is a second important concern for arid regions that are introducing large-scale irrigation. The introduction of irrigation into arid regions is particularly problematic (Ghebreyesus et al 1999). Stagnant water provides a breeding ground for the *Anopheles* mosquito which carries the pathogen responsible for malaria, *Plasmodium* (FAO 2002; CDC 2010).

LOCAL/REGIONAL, NATIONAL, AND INTERNATIONAL ACTORS

Local/Regional

Gender plays a significant role in access to land, irrigation, and other inputs. On average, female-headed households tend to control less land, own less livestock, and use less inputs, including irrigation. This may be a result of the patrilineal descent system practiced by the Amhara people as well as social and structural mechanisms which tend to favor male heads of household—i.e.

generally, only males may participate in *woreda* (county) and district level farming associations (Messing and Skoggard 1998; Carter et al. 2004). Thus female-headed households must rely on family members to help them farm (Frank 1999; Little et al. 2008). It has been demonstrated that the gender of the head of household is the single most significant factor in predicting household poverty throughout Ethiopia (Bigsten et al. 2002; Carter et al. 2004). Yet resources controlled by women in developing nations are positively associated with better educational and nutritional outcomes, particularly for children (Quisumbing, 2003). Thus the World Food Program, a major contributor to food aid in Africa, now requires that 80% of food programs be targeted at women, allowing them to control any food receipts for the household (Quisumbing 2003).

Wealthier households were found to engage in a variety of income-generating activities and households who diversified income after a drought recovered more quickly (Block and Webb 2001). As the reliance on rain-fed agriculture is combined with a decrease in income diversification, the risk of poverty becomes overwhelming (Little et al. 2006). Wealthier households are also able to access resources for digging deeper wells and extracting larger quantities of water for use in production, possibly limiting the amount of water their neighbors can withdraw.

[Case Study: South Wollo, Ethiopia]

A large percentage of the Ethiopian population lives in highland areas, one of which is South Wollo, located in the Amhara region of North-Central Ethiopia (Fig. 7). Pronounced drought has earned South Wollo a reputation as the "buckle of the country's famine belt" (Little et al. 2002: p.1). Farm families in highland areas are often the least food secure (Little et al. 2004). In South Wollo, the average farm size is 0.82 hectares, smaller on average than other highland areas in Ethiopia (Little et al. 2004). This particular area is ideal for illustrating the transition many agriculturally productive areas are attempting to make from cereal and grain production to a more cash crop production base. In this area barley, wheat, maize, and teff are common, though the extreme highland areas (Boru Meda, Alasha, Gerado, Agala) only grow teff during the *meher* (fall) season. In this particularly area *khat* is grown mostly in two of the lowland villages—Hitacha and Amumo, though a select few were experimenting with its production in some highland areas. These villages are known throughout the region for their *khat* production. For this particular area irrigation is most closely correlated with teff production, not *khat* production, though it is used extensively on farms growing *khat*. In the two villages where irrigation did not play a large role in production (Boru Meda and Alasha) farmers grew barley and maize almost exclusively (Table 2). It is important to note that there are extreme differences in the types of irrigation system for highland and lowland villages, which are reflected in the cost to maintain this resource (Table 2). Highland irrigation systems typically consist of a borehole or tubewell, whereas lowland irrigation systems rely on plastic lined catchment systems. The use of catchments is a reflection of the lowland farmers' need to store water for greater periods of time to provide water for cash crops such as fruits and *khat*. Women in lowland villages, namely

Bishaniko, form independent cooperatives to pool resources in order to purchase materials they need for their irrigations systems.

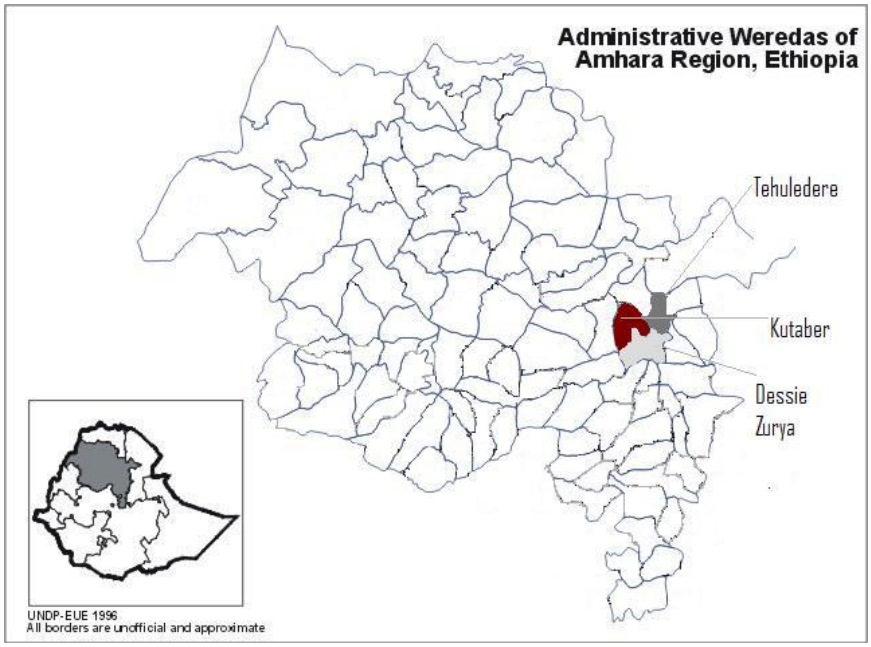

Figure 7. Study Site *Woredas*: Tehuledere, Kutaber, and Dessie Zuria
Adapted from United Nations Development Program Emergencies Unit for Ethiopia (UNDP-EUE 1996)

National

National policies play a large and varied role in the agricultural and food security issues facing Ethiopians. For example, the land tenure system was created during the *Derg* period (i.e., the mid-1970s to mid-1980s) and in this time, all land became property of the state (Ogbaharya 2009). The land tenure system resettled individuals based on ethnic affiliation and hence created ethnic regionalism (Abule et al. 2005). Ethiopia is a very diverse country culturally, and as such there are now approximately eleven such ethnic regions, including ones for the Amhara, Tigray, Oromo, Somali, Afar, and southern peoples. This system also provided each household with a given parcel of land based on household size, which the family must farm in order to retain land use rights (Bigsten et al. 2002). This scarcity of land may contribute to the apprehension many farmers have regarding land redistribution; consequently their small land holdings are nicknamed "starvation plots" (Little et al. 2004; 2006). Land tenure and the resulting lower incomes have had a significant negative impact on other cultural practices such as polygyny. Although once common, polygyny is rarely practiced among highland families in South Wollo (Little et al. 2006).

Table 2. Irrigation and Production Descriptive by Village, South Wollo

Village	Elevation	*Belg (Mar-May)* Rainfall	*Meher (July-Sept)* Rainfall	% of Farmers Using Irrigation	Average Cost to maintain Irrigation (ETB)
Boru Meda	2500-2700	276mm	912mm	20	*0*
Alasha	2500-2700	206mm	927mm	*0*	*0*
Gerado	2500-2700	276mm	912mm	100	5.33
Agala	2500-2700	276mm	912mm	73	4.55
Hitacha	1800-1900	341mm	828mm	50	141
Amumo	1800-1900	341mm	828mm	80	103.75
Bishaniko	1800-1900	341mm	828mm	50	64

Irrigation is tied to poverty alleviation, because of its role in food security. As such the government is investing efforts and money into institutional, organization, and technological changes to promote the sustainable and responsible development of irrigation in the country (MoWR 2001; FAO 2003). Women will also be important stakeholders in poverty alleviation as they are key actors in food production and ensuring household nutrition (FAO 2003). The Government has recognized their important role and has outlined specifically, the desire of the government to include their voice in the development of water strategies and policy (MoWR 2001). Modeling suggests that as Ethiopia, and countries in similar situations go forward with irrigation expansion, policies should embrace value and lifestyle indicators rather than operationalize technological and economic assumptions (Alcamo et al 2000).

In Ethiopia, famine and hunger are often products of drought and weakly developed economic and political infrastructures (Bekele 2006). Agriculture, natural resource conservation, and other social and economic factors influence the impacts that severe drought has on households; consequently, an appreciation for how these variables interact, and how households view and utilize water, particularly at a local level, are important to the overall success of drought mitigation programs. However, needs at the local level do not necessarily translate into policy at the national level; consequently, Ethiopia has failed to achieve effective drought mitigation (Tefera 2004; Desalegn et al. 2006).

International

Ethiopia receives more than $2 billion dollars annually in aid (World Bank 2012). Historically aid has been tied to structural adjustment, and later, good governance policies that require the country to complete massive restructuring of their government in order to receive aid (Peet and

Hardwick 1999). These policies encourage government streamlining in order to decrease spending and market liberalization in the name of a free market economy (Peet and Hardwick 1999). This often means government safety nets such as health care and education are sacrificed. Most importantly, the encouragement of private investment to drive industrialization and economic growth is stressed. As such, these aid lending institution have effectively co-opted the power of Ethiopia's government to address what they see, from a Western perspective, as the most important development issues facing the country. As such, entities such as the FAO, which compile much of the data on agricultural development in these areas, hold an important position in dictating what projects are funded in the country. As the FAO has outlined, these projects are likely to center on methods of increased production, specifically the use of irrigation, fertilizer, and "improved" farming methods (FAO 2002, 2003).

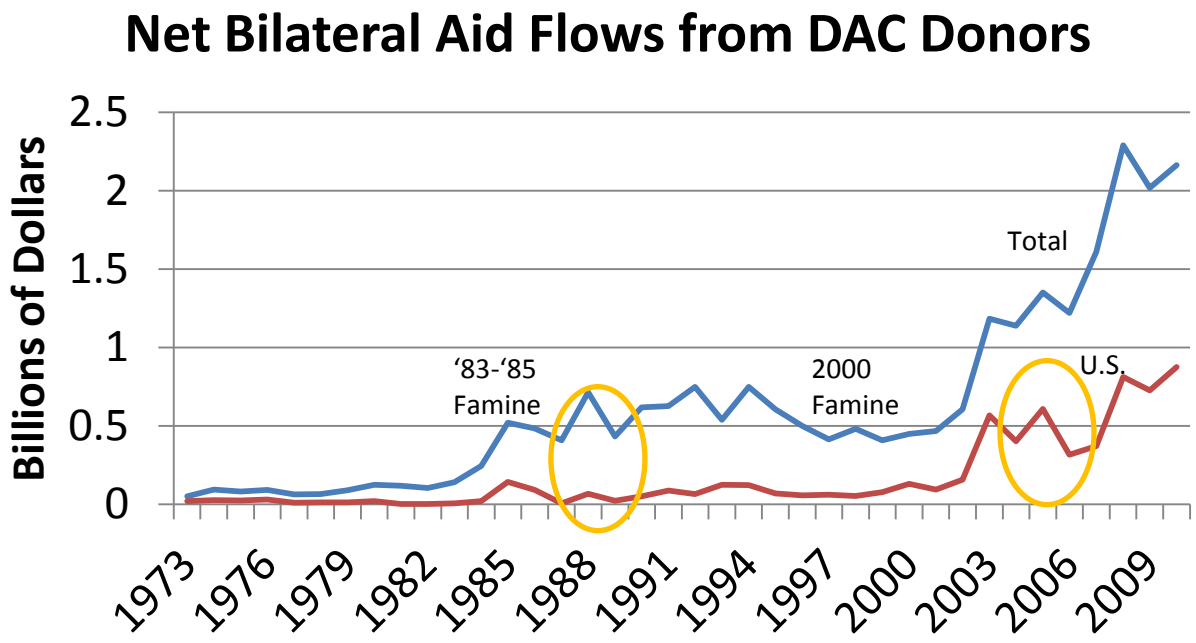

Figure 8. US and Total Aid Flows into Ethiopia from 1973-2009.
Adapted from World Bank Data, 2012

Additionally, international organizations often view food shortages and potential food shortages as a production problem, when it is perhaps a distribution problem. If in fact distribution of current resources is the issues, does increasing production solve the root problem? Instead, development agencies and governments should be looking at the structural causes of poverty and food shortages.

CONCLUSION

This paper illustrates the extremely complex nature of irrigation and agricultural production in Ethiopia. Though international development agencies, such as the FAO, see the

food shortage and water issues through a production lens, the issue is as much a cultural, social, political, and economic problem.

Ethiopia has a cultural heritage tied to production and an economic future dependent on diversification of production. Farmers must produce more in terms yield and economic return on the same amount of land. Increased climate change necessarily requires farmers change their approach to production, or starve. Irrigation, though perhaps not well developed in Ethiopia, provides an opportunity for farmers to extend their growing season and combat increased rain variability. However, the use of irrigation to grow traditionally drought resistant crops, such as *teff*, and cash crops, such as *khat*, can have potentially harmful, long-term effects. *Teff* is the single largest crop in terms of hectares in production, which means farmers will need to increase the amount of area irrigated to maintain current yields. *Khat*, one of the most lucrative crops for Ethiopian farmers requires water to produce multiple crops per year, and though the startup costs are low, the need for intensive irrigation to produce year round, could cost farmers more than they would otherwise be willing to invest. The FAO predicts that only 2-5% of cultivated land is irrigated, but the case study provided shows almost 50% of farmers use irrigation, which covers far more than 2-5% of cultivated land. Though the FAO predicts Ethiopia will be able to maintain its stored wealth of water, lessons from Yemen, suggest the relatively unmonitored water withdrawals of farmers utilizing small-scale irrigation make these projections somewhat inappropriate and dangerous. Additionally, the FAO's predictions are contingent on appropriate policies the Government of Ethiopia has yet to implement, and may actually lack the capacity to enforce.

Ethiopia is a country characterized by paradox. Eighty-five percent of the population engages in subsistence farming, yet Ethiopia is the largest recipient of food aid in Africa. Ethiopia is abundant in water resources, but the people regularly experience drought conditions. As a result, drought mitigation and off-farm employment are becoming increasingly necessary for the well-being of farming households. Ideally, these mitigation actions should come in the form of government policies and programs targeted toward household drought resistance, particularly those households with the threat of future water scarcity. These contradictions contribute to the economic disparity and poverty, and a subsequent decline in health status in the country, yet Ethiopia is often the springboard for various development agencies and initiatives which are ongoing in the country. Still, many initiatives and development projects fail to incorporate a holistic approach to researching food and drought-related problems, particularly irrigation, leaving out the knowledge and perceptions of farmers and household members all together.

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