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THREE ESSAYS ON SUSTAINABILITY

A Dissertation Presented

by

MARK PAUL

Submitted to the Graduate School of the
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DEDICATION

This dissertation is dedicated to the family and friends who inspired and supported my research. I am grateful for the countless discussions and debates I have enjoyed with my fellow graduate students in the Economics Department at UMass Amherst. Many of the ideas in my research originated from those conversations. My comrades also showed me the value of investing in one's intellectual community.

Neither my graduate studies nor my doctoral research would have been possible without my friends and family's help and encouragement.

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I would especially like to thank Michael Ash, for his patience and endless encouragement. This dissertation would not have been possible without him. Finally, I would like to thank Anita Milman for her dedication to detail and generous support of my work.

ABSTRACT

THREE ESSAYS ON SUSTAINABILITY

SEPTEMBER, 2016

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Chapter 1 investigates the inverse relationship between farm size and agricultural yield. While there are a large number of studies internationally, there have been few conducted in African countries. Using household-level data from a national survey we explore the relationship between farm size and yield in Ethiopia's post land reform scenario. We find a robust inverse relationship between farm size and yield, and a positive association between yield and land fragmentation. These findings raise important questions for current agricultural development strategies that favor larger farms and less fragmentation in Africa

Chapter 2 investigates the uptake of top-down flood mitigation policies in Vermont. Despite consensus on the need to adapt to climate change, who should adapt and how remain open questions. While local-level actions are essential, state and federal governments can play a substantial role in adaptation. In this chapter we investigate local response to state-level flood mitigation policies in Vermont as a means of analyzing what leads top-down adaptations to be effective in mobilizing local action. Drawing on interviews with town officials, we delineate local-level perspectives on Vermont's top-down policies and use those perspectives to develop a conceptual framework that presents the 'fit' between top-down policies and the local-level context as comprised of

three components: Receptivity, Ease of Participation, and Design. We explain how these components and their interactions influence local-level action. This analysis points to how careful consideration of the components of ‘fit’ may lead to greater local-level uptake of top-down adaptation policies.

Chapter 3 investigates farmer’s livelihoods within Community Supported Agriculture (CSA). In the United States there is a tremendous amount of interest in CSA among farmers, consumers, activists, and policymakers. Despite the attention garnered by CSA farms and the resurgence of local agriculture, relatively few studies have examined the livelihood opportunities for farmers within local agriculture. This chapter takes a step in this direction, evaluating livelihoods for CSA farmers through in-depth interviews conducted in the Pioneer Valley of Massachusetts. Based on the principles early advocates set forth as goals of the CSA movement; the chapter evaluates how CSA farmers are doing from the farmers’ perspective. The chapter finds that while CSA farmers are faring better than other farms across the United States and in the study region in terms of earned farm income, they still earn far less than the median national income of all households. Community Supported Agriculture also provides broader social, ecological, and economic benefits to farming communities as a whole, with its focus on providing food for the community rather than producing mass commodities for the market. These non-market benefits are a significant source of well-being from the CSA farmers’ perspective.

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INTRODUCTION

This dissertation has been long in the making. The central theme of the three essays I present below is that of government planning and intervention in the economy. While many economists would have their students and readers believe that capitalism is about free markets, freedom for individuals, and maximizing choice, I have learned that these concepts only exist in fantasy. As a political economist, I not only seek to understand the world, but to change it – and for that, a deeper study of government intervention in the economy was needed. These essays arose out of my deep passion for agriculture and the environment, and the understanding that for either to thrive, well-planned government intervention is essential. While these passions started in the woods and in the kitchen, they have been brought into this dissertation in order to develop a deeper understanding of government intervention in the economy and environment.

The three essays rely on a diverse set of methods. While modern economics has quickly moved in the direction of applied microeconomics, relying on econometric methods to answer key questions about the economy, I have chosen to rely on a mixed methods approach. In the first essay, on Ethiopia, I rely on household-level data and use econometric techniques to answer an old, but timely question – is there an inverse relationship between farm size and yield? The econometrics in this essay are essential to address this question, allowing for the analysis of a large house-hold level dataset, and allow me to identify that there is indeed an inverse relationship in Ethiopia. The second essay, on planned adaptation to flood in Vermont, relies on in-depth interviews, a qualitative approach, to help contextual understandings that cannot be achieved through quantitative statistical analyses. Finally, the last essay, on Community Supported

Agriculture (CSA), also relies primarily on in-depth interviews to gain a deeper understand of farmers' livelihoods in their own words. This essay in particular was more explorative in nature, in part to gain a better understanding of the CSA model and CSA farmers.

The central theme of government planning and intervention can be observed through all three essays. In the first essay, I am working to gain insight into the outcome of government intervention. Following the extensive land reform in 1975 that redistributed land to the peasants and intentionally fragmented the land holdings to serve the peasant household, I examine the outcomes of these government policies. The second essay is situated in a region that had recently experienced a major natural disaster, hurricane Irene, and attempts to unpack the uptake of top-down government interventional in climate policy. The result of this paper is a framework to inform policymakers and decision makers on the fit between planned adaptation policy and the local context in an attempt to improve outcomes of government intervention. Finally, the third essay studies a new model of farming that is in part responding to the perceived failure of government intervention in agriculture. Seeking to build an alternative to industrial farming, which arose out of direct government planning, the CSA model explicitly rejects government intervention and seeks to build a sustainable farming system that provides for the farmer and the community. This essay focuses on the farmer side, addressing the challenge of farmers livelihoods earned on the farm.

CHAPTER 1
SMALL FARMS SMALLER PLOTS: LAND SIZE, FRAGMENTATION, AND
PRODUCTIVITY IN ETHIOPIA

with Mwangi wa Gĩthĩnji

1.1 Introduction

The existence of an inverse relationship between farm size and yield per unit of land (hereinafter referred to as IR) was observed by Sen (1962) in a paper where he challenged the view that small farms operate at a loss. This idea had been propagated by the Indian Farm Management Surveys, which assessed the status of small farmers using rural market wages to monetize the costs of family labor. Sen pointed out that since the opportunity cost of time for the farmers was close to zero, as the probability of off-farm employment was low, small farmers working on family farms were willing to apply their labor even when the marginal product was below the market wage. This resulted in small farms producing more output per unit of land than larger farms.

Following Sen's article, a rich literature has documented the IR effect in numerous studies across the world, and it became a stylized fact of development economics (Berry and Cline 1979, Cornia 1985, Dyer 1997, Assunção and Braido 2007, Unal 2008, Barrett, Bellemare et al. 2010). T.W. Shultz's (1964) book, *Transforming Traditional Agriculture*, put forth the argument that small family farms were efficient operations capable of responding to markets and technological change. This work, combined with the IR, became the basis for development strategies that focused on smallholder farming.

In the 1960s and 1970s international agricultural strategies focused on on-farm changes as the means of increasing agricultural output and transforming rural lives. Initially the focus was on access to land via land redistribution (Boserup 1965). As this became more difficult politically, the focus shifted to technological improvements via the so-called green revolution (Rao 1986). The failure of agricultural to eradicate rural poverty development during this period, along with the ascendancy of neoliberal policies, led to a shift in strategies. In the 1980s and 1990s development policies were focused on access to markets, a withdrawal of the state from agriculture, and getting the prices "right" (Binswanger, Deininger et al. 1995). By the late 1990s it was clear that these strategies had not worked and had in some cases resulted in rural populations being poorer than they had been in the 1960s (Griffin, Khan et al. 2002).

In 2002 Griffin, Khan and Ickowitz (hereinafter referred to as GKI) revisited the question of land distribution and the IR effect (2002). They made a compelling case that confiscatory land redistribution was a solution to the problem of rural poverty. Given the IR effect, redistribution of land would be a win-win as not only would the poor have access to land and thus income, but the aggregate output of the small farms would be larger than that of fewer large farms working the same amount of land. The claims made by GKI were subject to an extensive critique and response¹, specifically in the African context. Critics argued that an agricultural development strategy modified for smallholders based on the IR was doomed to fail because of three main factors. One, because there were few national studies on the IR in Africa, one could not assume its existence in the African context (Sender and Johnston 2004). Two, even if the IR did

¹ This appeared in a special issue of the Journal of Agrarian Studies (2004) Volume 4, Issue 1-2.

exist, smallholders producing out of desperation would be unfit to catalyze a structural transformation of the agricultural system (Sender and Johnston 2004, Woodhouse 2010, Collier and Venables 2012). Lastly, critics argued that modern technological innovations made the IR obsolete by rendering small farmers in many developing countries *too* small to be efficient (Foster and Rosenzweig 2011).

Within the African country context, the role of small farms for employment is particularly important, as non-agricultural employment has not expanded despite a decade of positive GDP growth. The failed structural transformation of African economies means that the number of small farms continues to grow, resulting in an increasing rural population and continued farm fragmentation (Larson, Otsuka et al. 2013). In the short and medium term these farms are crucial to local populations, and improvements to rural livelihoods and agricultural development cannot be considered without them.

This chapter sets out to revisit the IR between farm size and yield, while focusing on the often-overlooked role of fragmentation of land holdings. Fragmentation is frequently viewed as an impairment to productivity gains, as farmers spend additional resources to travel between plots, plow discontinuous fields, monitor labor in different areas, and move farm equipment (Rahman and Rahman 2009, Kawasaki 2010).

Ethiopia provides an interesting setting in which to investigate whether the IR model holds, as the country underwent a land reform in 1975 that was extensive “in terms of its impact across a broad swath of the rural population, and amount of land redistributed” (wa Githinji and Mersha 2007). The land reform and the “pro-peasant” development strategy undertaken by the government resulted in small average farm size,

high degrees of fragmentation, and poor agricultural development (Rahmato 1984). The resulting highly fragmented farms produce below the subsistence level for many families, resulting in persistent poverty in rural areas (EEA 2002). Ethiopia thus allows us to explore the IR in a post-land reform scenario in which the economy is still primarily driven by agriculture. In Ethiopia, fragmentation has been seen as a major hindrance to farmers and a reason for additional land tenure reform, including liberalization of land markets and land titling, to encourage contiguous plots (EEA 2002 , Holden and Otsuka 2014). Yet fragmentation may have benefits yet to be thoroughly explored in the literature.

The chapter is organized as follows: section 2 provides a literature review of the inverse relationship; section 3 will historicize the study in the Ethiopian context; section 4 presents the data and model; section 5 presents the results; section 6 relates these findings to the broader discussion on farm size, fragmentation, and development; and finally, section 7 concludes and situates the study in the current political economy of the Ethiopian development strategy at this time.

1.2 The Inverse Relationship

The IR has become a widely popularized, hotly contested finding of development economics. Below we discuss the various explanations of the IR in the literature and briefly investigate the potential role fragmentation may play.

1.2.1 Explanations of the Inverse Relationship

(a) Factor Market Imperfections

The most common explanation of the IR in the literature is the ‘factor market imperfection hypothesis’. With constant returns to scale and well-functioning factor markets, output and intensity of input use will be the same across farm sizes. Imperfections in more than one factor market, for land, labor, and capital, will lead to a systematic relationship between farm size, inputs, and yield (Feder, Just et al. 1985). Imperfections in land markets could hinder productivity by restricting the ability of successful farmers to get access to land and hence result in sub-optimal land distribution, while they can also prevent desired consolidation of plots (Foster and Rosenzweig 2011). Pervasive imperfections in labor markets limit smallholders in developing countries from accessing wage labor opportunities, limiting rural households to farm-based labor (Sen 1966, Barrett 1996).

(b) Labor-Based Hypothesis

The labor-based hypothesis differs from labor market imperfections, in that it stems from the labor process rather than a breakdown of labor markets. Smallholders may face a lower labor cost, and in turn apply more labor per unit of land (Sen 1981, Cornia 1985). For example, Sen argues that the marginal disutility of labor for peasants working on their family farm is lower than the marginal disutility of workers on large farms, resulting in a lower real cost of labor (1966). Others see the wage gap as a reflection of the higher social cost of hired-in labor as opposed to family based labor, resulting from search costs, variation in the effort function, and the introduction of monitoring costs (Sen 1981, Feder, Just et al. 1985, Mazoyer, Roudart et al. 2006). The monitoring costs alone can prove to be substantial (Feder, Just et al. 1985, Foster and Rosenzweig 2011),

while Lissitsa and Odening show that recent innovations may reduce monitoring costs to a degree that can eliminate the smallholder advantage (2005).

(c) Misidentification Hypothesis

In an effort to dispel the IR findings and their implications, some economists have argued that the finding of an IR is caused by omitted variable bias or unreliable data (Bhalla and Roy 1988, Assunção and Braido 2007). These issues are centered around parcel size and soil quality data. To address concerns pertaining to land size, researchers have turned to improved technologies such as the use of GPS coordinates. While early results utilizing GPS data indicated that the IR may have been exaggerated (Carletto, Savastano et al. 2013), improvements in measurement analysis have actually strengthened the findings in support of the existence of an IR (Barrett, Bellemare et al. 2010, Winters 2013).

Sen (1999) observed that the IR is more pronounced between communities than within communities, resulting from a bias for fertile land during settlement. Since fertile lands can support higher population densities, small farmers are more productive due to the inherent fertility of the land; hence, the IR is a result of settlement patterns.

Researchers use measures of soil quality to test this hypothesis. Because these soil quality data are scarce, land value is commonly used as a proxy (Berry and Cline 1979).

Evidence from the United States indicates that land markets fail to capture important indicators of quality despite accessible, clear information (Duffy 2012). Other methods include relying on geographical disaggregation (Rudra 1974, Sen 1981, Bhalla and Roy 1988), village and plot-level fixed effects (Heltberg 1998, Assunção and Braido 2007),

and employing instrumental variables to proxy for land quality (Benjamin 1995). To address these concerns, Barrett et al. (2010) were able to measure soil quality² in Madagascar by sampling the soil from plots for analysis at the World Agroforestry Center Soil labs in Kenya. After controlling for soil quality, they still find an IR.

1.2.2 Land Fragmentation

Most previous work on the IR has overlooked the role of land fragmentation. To fill this gap, we will explicitly look at the relationship between fragmentation and productivity, analyzing whether fragmentation strengthens or weakens the IR, if it exists. A few studies have focused on the role of land fragmentation through the lens of land productivity. These studies indicate that differences in soil characteristics between plots may have beneficial effects (Foster and Rosenzweig 2011, Ali and Deininger 2014). Boyce notes that even minor differences in plot characteristics could lead to different crop choices and production techniques (Boyce 2006). Thus, increased fragmentation may beget higher land productivity through diversification.

Due to inheritance rights, land reforms³, tenure schemes, and the structure of land markets, smallholders often hold multiple discontinuous plots (Pankhurst 1966, Deininger and Jin 2006). By increasing fragmentation, traditional economic theory suggests that farmers will receive lower returns on investment due to time travelling between plots and the setup-costs associated with transitioning farming activities between

² This is not typically the case due to the expense involved in large-scale soil sampling schemes that go along with the rural survey. In order to deal with this gap in the data, we use village fixed effects in the model.

³ One of the frequent goals of land reforms is the consolidation of plots for the sake of 'efficiency.'

plots (Rahman and Rahman 2009, Kawasaki 2010). Through fragmentation, however, farmers take advantage of minor differences in local agro-ecology (Di Falco, Penov et al. 2010), staggering planting and harvesting to smooth the labor process (Boyce 1987), hedging risk through spatial dispersion (Blarel et al 1992), and improving biodiversity through increased specialization (McPherson 1982, Bentley 1987, Di Falco, Penov et al. 2010). In the African context, Blarel et al. (1992) find that in Ghana and Rwanda fragmentation facilitates crop diversification.

In the few studies that report on the relationship between yields and land fragmentation, the findings are mixed. While some studies in Turkey find fragmentation is positively correlated with yields (Kaldjian 2001, Unal 2008), others in Rwanda, China, and India have indicated that fragmentation is negatively correlated with yield (Tan, Heerink et al. 2008, Manjunatha, Anik et al. 2013, Ali and Deininger 2014). Ali and Deininger also argued that decrease in yields is amplified as the distance between the plot and household increases (2014). Beyond the implication on yield, studies have also indicated that increased fragmentation may lead to reductions in poverty (wa Githinji and Mersha 2007).

Explanations for the effects of fragmentation on productivity rely both on supply and demand side rationales. On the supply side, farmers are land-constrained to the degree that they will accept any parcel of land available (Berry and Cline 1979). In this case, there are assumed to be adverse effects of fragmentation stemming from transportation of resources between plots, losses in economies of scale, and additional monitoring costs (Manjunatha, Anik et al. 2013). On the demand side, fragmentation at

times functions as an adaptive response by farmers. In this case, the effects on yield may be positive.

1.3 The Case of Ethiopia

Ethiopian agriculture is typified by smallholder agriculture, primarily located in the highlands between elevations of 1,500 and 2,500 meters. The lowlands on the other hand are dominated by pastoralist communities and are typified by infrequent and erratic rainfall and poor soils susceptible to erosion and disease (Nyssen, Haile et al. 2009). The highlands continue to be the population centers and the heart of agricultural production.

Ethiopia, in its current configuration, came into existence in the late 19th century (Zewde 2001). For the purposes of this chapter we shall provide a brief overview of the agrarian landscape prior to the 1974 coup by the Derg. We will then discuss the 1975 land reform and the impact of the regime change that took place in 1991 on the agrarian economy.

From the rule of Emperor Menelik II in the late 19th century until the fall of Emperor Haile Selassie in 1974, the crown divided much of the land between members of the imperial family, the clergy, members of the nobility, top military officials who demonstrated their allegiance to the crown, and local officials (Markakis 1974, Mersha 1985). The clergy alone controlled over 20% of arable land, often renting out the land to peasants for tribute or tax. During this era the two most common tenure forms were *rist*, a communal or kinship system where rights were usufruct and could not be transferred, and *guly*, a form of rights typified by large estates granted to members of the aristocracy. In

guly regions the ruling aristocracy required peasants to work their land as tribute, though ultimate land rights were retained by the state (Rahmato 1984 pp. 18).

Though tenure structures varied, one consistent feature of these traditional systems was that they resulted in significant fragmentation. In 1971 the Ministry of Land Reform conducted a study in Gojjam and found that 59% of peasant households worked three or more plots, while 34% worked at least five noncontiguous plots (MacArthur 1971). Academics at the time often blamed peasants and their ‘traditional’ ways for the fragmentation, asserting that it hindered productivity growth and condemned the peasants to petty production. One writer noted that,

the problem was in part tied to the prevailing system which often made it difficult for peasants to hold consolidated plots. In part, peasant attitude was also responsible for it because of the belief that it was advantageous to have several scattered plots. (Ibid, p. 31)

Addressing fragmentation was an explicit goal of the 1975 land reform (Rahmato 1984 pp. 50). Months before, a military regime, the Derg, had detained the Emperor Haile Selassie and taken control of the country in a creeping coup. The Derg quickly prioritized the main political concern of the time – land. The new regime reckoned that in order to uproot the landed aristocracy and secure their hold on power, a swift implementation of a radical land reform was necessary.

Proclamation 31 of 1975, entitled ‘Public Ownership of Rural Lands Proclamation,’ drastically changed the agrarian landscape across the nation. The reform immediately expropriated all rural lands without compensation and claimed the lands were now the collective property of the people of Ethiopia. The proclamation promised any peasant ‘willing to personally cultivate land shall be allotted rural land sufficient for

his maintenance and that of his family' (Rahmato 1985). The land reform instituted a ceiling on landholdings, limiting farms to 10 hectares⁴, though exceptions were made for collective farms and large investors. This land reform was a revolution from above, devised and implemented by the state with no active participation from the peasantry (Rahmato 1984 pp.45)

To implement this reform across the nation, the Derg set up Peasant Associations (PAs). These associations were set up to govern each a 800-hectare area,⁵ and were primarily headed by small landholders and the clergy, while leaving the landless powerless. The associations were meant to be inclusive to some degree, providing membership to all peasants over the age of eighteen who held land. Within six months of the initiation of the land reform, over 16,000 PAs had been established across the country with over 3,500,000 members (Rahmato 2008 pp. 159).

The PAs were in charge of carrying out the distribution, and the Derg provided them some leeway in establishing the details of the redistribution in their district. When the PA distributed the land, they were only distributing usufruct rights, which could be reallocated with changes in household population sizes. PAs prioritized different goals, with some prioritizing redistribution to the poor and landless, and others prioritized distribution based on land size (disregarding quality) and its proximity to the household. In some districts, plot consolidation was a goal of the PA, while others emphasized equity as perceived by the peasantry. Many districts provided households with at least two plots, with one suited for cash crops and the other, usually smaller, for producing

⁴ The government established this limit, concluding ten hectares was the maximum a household could cultivate efficiently with a pair of oxen.

⁵ The PAs were seen by many as supporting the villagization process promoted by the Derg.

subsistence crops. Many PAs argued the best insurance against crop failure was for the household to have multiple plots and then to divide these into subplots for different crops (Rahmato 1984). The high degree of diversification, amplified by having different plots located in different areas within the PA region, provided households an improved ability to hedge risk.

Despite these reforms, the agrarian policies of the Derg did not deliver widespread improvements in the agrarian sector. Rahmato argues that the peasantry is no better off today than they were under the imperial regime (2008 pp. 23), as food insecurity still plagues the countryside. The Derg, plagued by infighting, failed development strategies, and the crumbling of the Soviet Union, which had been providing substantial support, fell in May 1991, when the Ethiopian People's Revolutionary Democratic Front (EPRDF) took power and formed the Second Republic. Despite calls for privatization and marketization, the EPRDF decided to uphold the land reforms instituted under the Derg, thus prolonging state ownership of land and other natural resources (Ethiopia 1995). While maintaining state ownership of land, the EPRDF allowed more flexibility in the leasing of land to be determined at the local government level (wa Githinji and Mersha 2007) The state attempted to construct smallholder-based development strategies that would improve equitable access to subsistence cultivation for the peasantry (Makki 2012). Some observers were skeptical of the strategy, claiming for example 'the equity that is unfolding in the countryside is equality of poverty' (Rahmato 2008 pp. 306).

Today Ethiopian smallholder agriculture is characterized by extremely small farms fragmented into multiple plots with relatively large families that depend on labor-

intensive methods of cultivation. Many of these farms are too small to meet subsistence needs given available technology and resources (Bezu and Holden 2014, Josephson, Ricker-Gilbert et al. 2014). There is also enough diversity in holding size, however, to result in a high land gini coefficient in Ethiopia (wa Githinji and Mersha 2007).

The role of fragmentation in agricultural holdings has been a matter of ongoing debate in Ethiopia, discussed extensively in government reports (EEA 2004). We have obtained a nationwide dataset for Ethiopia that enables further exploration of the effects of fragmentation, including household-to-plot distance. According to the prevailing view in the Ethiopian government, fragmentation is a hindrance to productivity gains (Gebreselassie 2006). Despite this concern, Holden and Bezabih (2008) consider fragmentation to be an important source of reduction in production risk and note that it smoothes the agricultural labor process in Ethiopia.

1.4 The Data and Model

The data for this study were collected in 2000 and 2001 by the Ethiopian Economic Association and the Ethiopian Economic and Policy Research institute (EEA/EEPRI). The organizations worked with PAs to contact households across all Killils⁶, which included seventy-one Woredas⁷ that were diverse in agro-ecological terms. The survey covered rough 8,500 rural households, including those that were landless⁸,

⁶ There are nine Killils across Ethiopia. These are ethno-linguistically based regional states.

⁷ These are lower levels of regional governments.

⁸ Landless households account for 10% of our sample, though we believe this number is underrepresented since the EEA/EEPRI used PAs to identify households. To be a member of the PA, one needs to hold land. Thus, the landless tend to be bypassed by the PAs.

and is representative at the national and regional levels. To construct our samples, we only include households in which we have data for all of our key variables.

Table 1.1: Summary Statistics			
Variable	Mean	Standard Dev	Observations
Agricultural Product (Birr)	1,447.670	2,076.970	5,628
Farm Size (Hectares)	1.709	2.266	5,628
Number of Plots	2.420	1.372	5,628
Farmer Experience (years)	22.727	12.407	5,628
Farm Service Visit	0.384	0.486	5,628
Household is Food Secure (%)	0.203	0.402	5,628
Land Improvements (%)	0.981	0.193	5,628
Hectares Per Person	0.278	0.328	5,628
Female Head of Household	0.020	0.262	5,628
Avrg Distance to Plot (meters)	450.000	314.750	5,628
Household Adult Equivalence	5.279	2.046	5,628
Age for Head of Household	45.108	14.067	5,628
Illiterate (%)	0.498	0.500	5,628

Table 1 provides summary statistics for the sample. The mean value of total agricultural production per household is a mere 1,448 Ethiopian Birr, which translates to about \$175 USD in 2001. The mean farm size is around 1.7 hectares, which is split between multiple plots and well below the estimated average farm size of 2.5-3.5 hectares needed to meet subsistence needs for households in Ethiopia (Rahmato 2008). Only 7.5% of households have at least three hectares, while the majority of households (55%) try to survive on one hectare or less. The high degree of poverty is reflected in the fact that only 20.3 per cent of households qualify as “food secure.” The typical household crops multiple plots, with an average of 2.42 plots per household. These plots are broken into sub-plots leading to an average plot size of .71 ha, although most plots are micro holdings of under 0.5 ha. The average distance to a plot is 450 meters, or about a quarter of a mile from the home.

To analyze the relationship between farm size and yield, we start with the classic regression in the literature, using ordinary least squares (OLS). In this log-log model, Q is total farm output in monetary terms; H is net operated farm size; and u is the error term.⁹

$$\text{Log (Q)} = \alpha + \beta \log (\text{H}) + u \quad (1)$$

Farm size is the total size of *operated* holdings including various tenure forms. β is interpreted as follows: a doubling of farm size leads to a $\beta\%$ increase in output, with $\beta=1$ indicating a linear relationship between farm size and productivity. $\beta>1$ indicates a positive relationship between farm size and productivity, and $\beta < 1$ indicates an inverse relationship between farm size and land productivity.

Bardhan (1973), who was one of the first to explore the farm-size-productivity relationship in a systematic manner, was wary of the model in equation 1, noting the assumption of homogeneity of farm output. Because farm output is measured by the total value of a range of specified products produced, the estimates may be biased since crop prices may vary significantly by crop and by region. Additional complications may arise as farmers' shadow prices for their crops are at times significantly higher than the going market rate (Arslan and Taylor 2009). Thus, the shadow price, not the market price, is the

⁹ There are various ways to measure farm size. Firms, for example, are often measured by the number of workers they employ, or perhaps by net sales; in the case of farms it is standard to measure them instead based on input quantities such as size of harvested cropland or number of cows in milk production. Farms could also be measured by output quantities such as bushels of corn, or gallons of milk, or perhaps the value of output (as is the case in this work). Finally, further possibilities include value added, net revenue, or return to management, and fixed assets though data is not readily available for these measures (Sumner, D. A. (2014). "American Farms Keep Growing: Size, Productivity, and Policy." Journal of Economic Perspectives **28**(1): 147-166.

guiding factor¹⁰ for cropping patterns and resource allocation for the peasantry. To control for these and other potential differences, we use fixed effects at the agroecological level with the expectation that farms in similar agro-ecological zones produce the same kind of crops and obtain similar prices in the same geographical areas. In the various agro-ecological niches between valley floor and ridge line that may exist in farming in the East African highlands, going beyond district-level fixed effects is important because farmers may have access to different agro-ecological niches within one district or even village. The study contained fifteen different agro-ecological zones, noting if the region was hot, warm, tepid, cool, arid, semi-arid, sub-moist, moist, humid, highland, mid highland, lowland, plains, etc.

We also introduce an array of control variables to account for farmer heterogeneity, as economic theory suggests that individual preferences and abilities contribute to differences in productivity.

To account for farmer heterogeneity, we add a matrix (X) containing number of plots, average distance to the households plots, gender of head of household, household size (in adult equivalents), literacy, farmer experience, and farmer age, as well as agro-ecological zone fixed effects.¹¹

$$\text{Log (Q)} = \alpha + \beta \log (\text{H}) + \gamma \log (\text{X}) + u (\text{Agro-ecological fe}) \quad (2)$$

¹⁰ The use of specific crops in ceremonies and rituals, regional dishes, medicine, etc. may drive the variation between market and shadow price. In other words, culture and tradition affect the shadow price of many crops and therefore influences peasants' resource allocation.

¹¹ Data is normally distributed.

We run two slightly different regressions with equation two. The second regression omits the number of plots and the average distance to a plot from the regression. The third regression is the fully specified model. Number of plots, or fragmentation, is included in order to test the hypothesis that concentrated holdings are superior to fragmented holdings (Ali and Deininger 2014). The number of plots squared is included, along with average distance of plots from household, to observe if production is sensitive to a higher degree of fragmentation or distance traveled.

1.5 Results

Our results, presented in table 1.2, show an IR that is strong and statistically significant. In regression 1, the naive model with no controls for farmer heterogeneity or variation in agro-ecological zones, the estimated coefficient on farm size implies that a doubling of average farm size at the national level would lead to a 27% *reduction* in farm output. Since the coefficient is .73, if the average farm size were to be doubled, the output would only increase by 73%. The magnitude of these results are in line with other studies that have observed the IR in Africa (Barrett, Bellemare et al. 2010, Ali and Deininger 2014). In regression 2, the main results continue to hold once we account for variation in farmer characteristics and household size. In regression 3, the fully specified model, the results indicate that a doubling of the national average farm size would lead to a 41% reduction in farm output. The inclusion of the control variables thus strengthens the inverse relationship between farm size and yield.

Turning to the second question this chapter sets out to address: is there a relationship between land fragmentation and yield? Results from regression 3 indicate

that fragmentation has a positive effect: an additional plot of land, holding farm size constant, leads to a 10% *increase* in yield. We cannot distinguish the causes of fragmentation from our data, i.e. whether it is due to farmers desiring more plots for a given size of land, or due to constraints that impel farmers to accept any additional land even when non-contiguous. The result suggests, however, that on the whole fragmentation is advantageous in terms of land productivity.

Table 1.2: Regressions			
	(1)	(2)	(3)
Log Farm Size	0.734*** (0.0166)	0.654*** (0.0173)	0.5921*** (0.182)
Fragmentation			0.1009*** (0.0103)
Average Distance to Plot			0.000132*** (0.00004)
Household Adult Equivalency		0.0418*** (0.0068)	0.0348*** (0.00698)
Literate		0.0939*** (0.027)	0.0875*** (0.0277)
Farmer Experience		-0.00019 (0.0017)	-0.0006 (0.00173)
Female Household		0.0338 (0.09105)	0.0385 (0.0903)
Farmer Age		-0.0018 (0.0014)	-0.0018 (0.0015)
Agroecological fixed effects	N	Y	Y
Observations	5,628	5,628	5,628
Number Agroecological Zones		15	15
R-squared	0.249	0.2215	0.263
Standard errors in parentheses		***p<0.01, **p<0.05, *p<0.1	

The average distance to a farmer's plot from the household also is statistically significant. This indicates that plots that are farther away positively affect yield, though

the magnitude is small. One possible explanation is that distance is a proxy for differences in land qualities that confer diversification advantages. This result is at odds with the findings of Ali and Deininger in Rwanda. Two hypotheses that potentially could explain the difference in this respect between Rwanda and Ethiopia are the degree of agronomical difference in plots and demographic differences. If Rwandese plots are more homogenous, as compared to Ethiopian ones, then the smaller benefit from having different plots may be more easily offset by the cost of farming noncontiguous plots. This may also be compounded by a younger demographic structure in Rwanda, resulting in less access to adult labor, especially after the cataclysmic effects of the genocide that took place sixteen years before the data used in the Ali and Deininger study.

We find a strong positive coefficient on household adult equivalents, implying that larger households, and more labor supply, lead to higher yields. The coefficient on female-headed households is negative, but not statistically significant. This is in line with the finding by wa Githinji and Mersha (2007) that female-headed households in Ethiopia were not significantly poorer than male-headed households. As expected, literacy has a positive effect: a literate head of household results in a 9% increase in yield. This is consistent with the literature that shows that literacy and education have significant positive returns in the agricultural sector, even with limited technological inputs. Finally, farmer experience and age appear to be statistically insignificant.

As a robustness check, we took regression three and stratified the model by the three most populated agro-ecological zones in the study. Results are displayed in table 1.3 below. The zones were all highland zones, with zone one being tepid to cool, moist, and in the highlands. The second zone was tepid to cool, sub-humid, and located in the

mid-highlands. The final zone we stratified by was tepid to cool, sub-moist¹², and located in the mid-highlands. The inverse relationship finding and the positive finding between fragmentation and yield held for the three main agro-ecological zones, consistent with the main findings; however, the average distance to the farms plot was significant in only two of the three zones.

Table 1.3: Regressions Stratified by Agroecological Zone

Zone	(4) 1	(5) 2	(6) 3
Log Farm Size	0.399*** (0.0482)	0.938*** (0.112)	0.724*** (0.134)
Fragmentation	0.264*** (0.051)	0.036*** (0.006)	0.014*** (0.0009)
Average Distance to Plot	0.0069** (0.0033)	0.0046*** 0.0015	-0.00017 (0.00036)
Household Adult Equivalency	0.006 (0.028)	-0.05 (0.0422)	0.055) (0.368)
Literate	0.138 (0.102)	0.312 (0.147)	0.0642 (0.114)
Farmer Experience	0.011 (0.0085)	-0.006 (0.008)	-0.0055 (0.0097)
Female Household	0.344 (0.319)	0.0079 (0.332)	-0.185 (0.377)
Farmer Age	-0.0075 (0.008)	-0.009 (0.007)	0.007 (0.0077)
Observations	290	199	204
R-squared	0.535	0.364	0.257

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

¹² Sub-humid and sub-moist differ according to the estimated length of the growing period in the zone, with sub-humid zones experiencing 180-225 days and sub moist zones experiencing 225-270 days for their growing period.

1.6 Discussion

Many studies have found constant returns to scale (CRS) in agriculture, implying that a wide range of farm sizes can coexist (Deininger 2013). The presence of the IR does not conflict with this finding by necessarily implying decreasing returns to scale exist in agriculture. Rather it implies that given the existing resources and demographic make-up, small farms applying more labor per unit of land, and thus have higher yields. This is an important finding for Ethiopia and Africa more generally, where many development strategies have been moving towards support for large-scale agriculture in hopes of achieving efficiency gains. While the IR in this case, as in South Asia, is found in environments where labor-intensive methods of production dominate, recent work by Deininger (2013) has also cast doubt on the existence of increasing returns to scale even in settings with abundant land and capital-intensive technologies.

What are the policy implications of the IR effect? As noted earlier, Ethiopia, like most African countries, has been unable to transform its economy in a manner that absorbs the large number of rural inhabitants in non-farm employment, despite robust economic growth. As Van Der Ploeg (2014) has argued extensively, peasant agriculture is not a remnant of the past. In the short to medium term, therefore, small labor-intensive farms are going to remain a feature of the rural landscape, especially in areas of highland agriculture where machinery is not deployed as easily as in flatland agriculture. Given the fact that these farms absorb surplus labor and produce higher yields, policy should be supportive of the smallholder sector rather than biased against it, while simultaneously promoting the creation of non-farm employment.

Our study points to two specific policy recommendations. The first is direct support to small farmers. African countries need to increase support not just to agriculture as per the African Union recommendations (AU 2010), but specifically focus on small farmers by building and rebuilding extension services and farmer education as well as support for other farm inputs. As our results show, literacy has a positive effect on yields. We also postulate that since African farmers are such low users of fertilizers, both organic and inorganic (Pender and Gebremedhin 2008), increasing the availability of fertilizer is likely to substantially increase yields. In line with an environmentally sustainable approach to improving agriculture, a focus on increased use of organic fertilizers, such as manure produced on farm or locally via integrated farming techniques, could also serve this purpose and result in enhanced food security and income (Okumu, Jabbar et al. 2002). Further rural employment could be created via the local production of organic fertilizer (Cordell, Drangert et al. 2009) and the rebuilding of extension and education outreach services that are needed to complement the use of new or recovered environmentally appropriate agricultural techniques.

Our second recommendation is to reconsider the role that fragmentation plays in small farm production. At present, most policy in response to fragmentation focuses on consolidation. Given our finding that productivity is increased by fragmentation, as also observed in Ethiopia by wa Githinji and Mersha (2007), and in Kenya by Githinji, Konstantinidis and Barenberg (2014), it is possible that such policies are counter-productive. The benefits of fragmentation are related to plot variety, while costs are determined by distance and management. Given this, it is important to examine carefully the role that fragmentation plays, and to differentiate between situations where fragments

contribute to increased yields and where they are an impediment. In instances where labor is generally in surplus, and provided by family members, there may be little reason to expect the distance to a plot to be negatively associated with yields in smallholder agriculture. The argument that distance would reduce yields by increasing the monitoring costs of labor, on small farms where family labor, not wage labor, predominates. In Ethiopia and other settings dominated by labor-intensive methods, moving equipment such as tractors between plots is not an issue.

Where fragmentation is truly an impediment to productivity, policy that encourages farmers to consolidate voluntarily should be supported. Under conditions where fragmentation improves yields, we need to establish policies to support this practice and conduct further research to establish the degree of fragmentation that allows yields to increase. Exploring how the effects of fragmentation and distance may evolve with changes in the production process and the labor market would shed further light on these issues.

We also know from numerous studies e.g., (Gabre-Madhin 2001, Griffin, Khan et al. 2002, Quattri, Ozanne et al. 2012) that small farms with better access to markets have increased yields and incomes. Policy to this end should not simply put farmers at the mercy of markets, but rather help small farms to take advantage of market opportunities by creating the physical and institutional infrastructure that they need to participate successfully in the market. In particular, we believe that organizing small farms so that they can take advantage of increasing returns to scale higher in the agricultural value chain, by controlling the marketing and the processing of their crops, would further increase non-farm rural employment as well as farm incomes. This may be achieved

through cooperative organizations for farmers. Increased rural incomes would have a multiplier effect on other economic activities via the demand created, potentially leading to more broad-based rural growth and employment.

1.7 Conclusion

Heightened interest in African agriculture has led to a debate on the extent to which the negative relationship between farm size and yield, explored extensively in South and Southeast Asia, also applies in Africa. The systematic confirmation of this finding in Africa would have profound implications for countries' development strategies as they strive to increase agricultural productivity and absorb excess labor supply.

We find a robust inverse relationship between farm size and per hectare gross output in Ethiopia. The relationship is strengthened when we control for farm characteristics and household attributes. More intensive labor use by smaller farms is likely to be a key underlying driver of this finding. Additionally, we find that having an additional plot, while holding total land size constant, is positively associated with land productivity. This suggests that enforcing existing subdivision restrictions, or pursuing policy to promote consolidation of farm holdings, will not yield significant benefits and may instead have adverse effects. Our results should not be read as unconditional support for creating small farms or breaking up farms in to multiple plots, but rather as a caution that where small farms do exist in a context of surplus labor, greater support should be directed towards the smallholder sector.

CHAPTER 2

A QUESTION OF ‘FIT’: UNDERSTANDING THE UPTAKE OF TOP-DOWN FLOOD MITIGATION POLICIES IN VERMONT

With Anita Milman

2.1 Introduction

Despite a growing consensus regarding the need to act on adaptation to climate change (Noble 2014; Mimura 2014), who should adapt and how remain open questions. In many countries, jurisdiction over key elements of adaptation, such as land-use practices, building codes and standards, the provision of basic infrastructure and services, and immediate emergency response falls to municipal government. This distribution of authority, combined with the expectation that impacts will be experienced and resources best mobilized at the local-level, has led to the presumptions that adaptation will be undertaken by municipal government or individual actors (Dow et al. 2013) and that a good deal of adaptation will be ‘autonomous’ (Eakin and Patt 2011).

While local and individual actions are essential, there remains a substantial role for intervention at higher levels of government in mobilizing adaptation. Such ‘planned’ (Fankhauser, Smith, and Tol 1999) or ‘top-down’ (Urwin and Jordan 2008) approaches are needed when resources are owned or provisioned by higher levels of government or when significant coordination, organization or incentives and support are required (Eakin and Patt 2011). The use of planned policies and programs for mobilizing action is not unique to adaptation; there is a history of state and national government involvement in directing local action as it relates to public health and the environment. Yet the growing

risk of climate change, and the fact that adaptive outcomes will be the cumulative effect of actions undertaken by a variety of entities, point to the need to examine interactions across scales in more depth (Adger et al. 2003).

Of particular importance are improved understandings of what leads planned adaptations to be effective in mobilizing local action. The literature on environmental governance points to a number of potential factors that influence participation, compliance, or uptake of a public policy, including that there needs to be a good ‘fit’ between the planned adaptations and the local context. The concept of ‘fit’ has been much discussed as it relates to institutions, ecosystems, and responsibilities (Armitage 2005; Folke et al. 2007; Næss et al. 2005), but it has not yet been applied to the analysis of top-down adaptations.

We take a step in unpacking the concept of ‘fit’ as it relates to planned adaptations through an investigation of anticipatory flood mitigation planning in Vermont. Vermont is a useful point of entry for this research, as flooding is not uncommon and, as described below, recent years have seen active engagement of state and federal policies in encouraging local-level actions to protect against negative impacts of flood events. Based on our findings, we develop a conceptual framework of ‘fit’ that depicts factors mediating local-level uptake of Vermont’s top-down adaptation policies. While specific to flooding, our conceptual framework is generalizable to other top-down adaptations that encourage response to climatic risks.

We begin with an overview of flood mitigation policies, explaining the need for research on local-level perceptions of top-down adaptation. We then describe the top-down flood mitigation policies in Vermont and the methods used to collect data on local-

level perspectives on those adaptations. Next, we analyze how the ‘fit’ between top-down policies and the local-level context is determined by three components: *Receptivity*, *Ease of Participation*, and *Design*. Each of these components and the relationship among them is described in detail, with attention to how they affect uptake of flood mitigation in the study area. Finally, we discuss how external factors can moderate ‘fit’ and the implications of our findings for top-down adaptation more broadly.

2.2 Cross-Scalar Mobilization of Flood Mitigation Actions

Flooding represents a substantial risk to human lives and property. In 2014, flood damages in the USA alone exceeded \$2 billions of (NOAA). Anthropogenic climate change (Milly et al. 2002) and the accumulation of people and assets in risk-prone areas (Kreibich et al. 2015) mean these costs are likely to increase in the future. To reduce flood risks, state and national governments have employed a variety of mechanisms to mobilize flood mitigation action at the local-level. Such mechanisms range from legally requiring action via legislative or executive mandates (Lyles, Berke, and Smith 2012; Stevens and Hanschka 2014; Berke, Lyles, and Smith 2014) to incentives and penalties, such as funding, technical assistance, guidance tools (Stevens and Hanschka 2014; Berke, Lyles, and Smith 2014; Bohman et al. 2014), and trainings, and as loss of eligibility for grants and or assistance (Stevens and Hanschka 2014; Burby and May 1997). Unfortunately, these ‘top-down’ adaptation policies have had mixed results in achieving local-level action (Stevens and Hanschka 2014; Landry and Li 2011; Berke, Lyles, and Smith 2014; Lyles, Berke, and Smith 2012).

To explain variation in local-level accordance with ‘top-down’ flood mitigation policies, research has investigated how characteristics of higher and lower levels of government influence action. A strong state mandate (Steinberg and Burby 2002; Berke, Lyles, and Smith 2014) including the willingness and ability of the state or federal government to ensure compliance via review and sanctioning increases the likelihood that local governments develop and implement flood hazard mitigations plans (Deyle and Smith 1998). Local-level capacities, including the engagement of a planner (Lyles, Berke, and Smith 2012), knowledge, experience, educational attainment, and availability of resources (Brody, Kang, and Bernhardt 2010) also increase local-level implementation of flood mitigation. However, a town’s geography, history of flooding, and socio-economic conditions have inconsistent effects on uptake of flood mitigation policies (Jung 2005; Brody et al. 2009; Posey 2009; Landry and Li 2011).

The majority of studies of local-level response to top-down policies encouraging flood mitigation are correlative, looking across large datasets of municipalities and statistically connecting the independent variables being tested with metrics of flood mitigation policy uptake - e.g., presence of a hazard mitigation plan or quality of the plans (see, for example, Berke, Lyles, and Smith 2014; Posey 2009; Brody et al. 2009; Landry and Li 2011). While useful in identifying consistent relationships across a variety of context, these approaches are unable to provide information on the local-level perspective on flood mitigation policies and what leads to or away from uptake. The few studies that address the local-level perspective are either syntheses that call attention to social and political constraints without presenting primary empirical data (Prater and Lindell 2002; Adger, Brown, and Tompkins 2005; Wolensky and Wolensky 1990), or a

cursory attempt to identify barriers as a short addition to an analysis of hazard management plan quality, rather than of plan uptake (Frazier et al. 2013).

Especially relevant to explaining local-level engagement with top-down flood mitigation policies is an understanding of the interactions between the planned adaptation and the local-level context. As studies have shown that adaptation measures that match local interests result in adaptations that are “often carried out rapidly” (Næss et al. 2005, 125) we hypothesize that how the top-down and the local context work in conjunction with one another, in other words, the ‘fit’ between factors that are intrinsic and extrinsic to the town is a key factor influencing local uptake of top-down flood adaptations.

Our research contributes to understandings of local-level uptake of top-down flood mitigation policies by investigating perspectives of local-level decision makers in response to top-down adaptations. Our in-depth qualitative approach leads to contextual understandings that cannot be achieved through quantitative statistical analyses. We define top-down adaptations broadly, and include planning mandates, the provision of technical assistance, and incentives for specific hazards mitigation actions. This approach allows us to explore causal pathways and ultimately develop a conceptual framework for understanding ‘fit’.

2.3 Top-Down Flood Mitigation Policies in Vermont

To investigate ‘fit’ of top-down flood mitigation policies, we examine the perspectives of municipalities in Southern Vermont. The region has historically been susceptible to flooding. Spring rains on top of freshets can lead to ice jams and flash floods. Summer storms, including nor’easters and hurricanes, can deposit large quantities

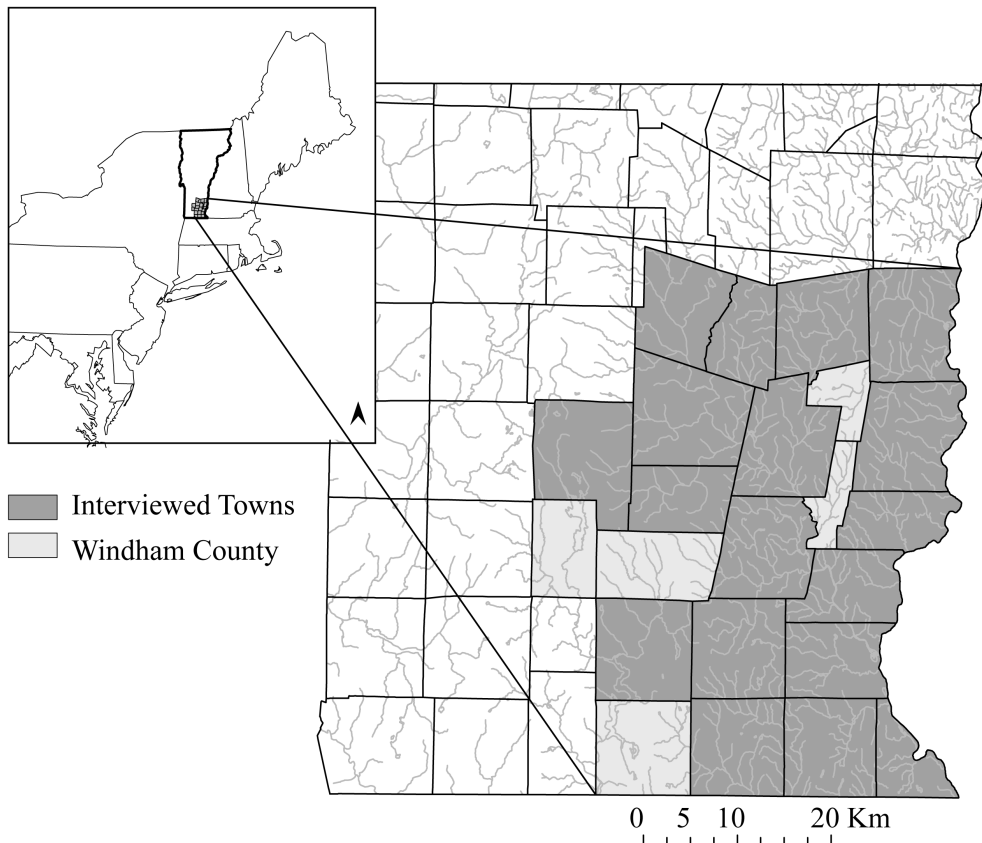
of water during short time periods. Historic modifications to river channels have left the rivers in a state of geomorphic adjustment, increasing the potential for floods to cause damage through river channel adjustments. During the past 20 years, the Federal Emergency Management Agency (FEMA) has issued 24 flood related disaster declarations in Vermont, nine of which occurred in just the past five years (FEMA). The largest most recent flooding occurred during Tropical Storm Irene, and damaged more than 200 road segments, 280 bridges, 1000 culverts, and 3500 homes (Mears and McKearnan 2012; Pealer 2012; Baker, Hamshaw, and Hamshaw 2012).

A number of state-level policies have sought to encourage local uptake of flood mitigation measures. The Vermont Emergency Relief and Assistance Fund (ERAF) encourages local-level hazard mitigation by increasing state-level contributions to federal matching funds requirements if the municipality has undertaken a minimum level of mitigation measures including implementation of Vermont's Town and Road Bridge Standards, of the flood hazard and floodplain development regulations required for eligibility under the Federal National Flood Insurance Program (NFIP), and of at least three of the twelve flood hazard mitigation measures listed in the ruling (State of Vermont 2013a). Vermont Acts 110 and 138 also provide both technical information and financial incentives to facilitate local-level flood mitigation. Act 110 directs the Vermont Agency for Natural Resources (ANR) to develop procedures, maps and best management practices for river corridor protection. The Act also provides financial incentives to towns through grants and pass through funding to encourage implementation of zoning bylaws that protect river corridors and buffers. Act 138 directs ANR to provide education, technical assistance and guidance to municipalities to help them comply with the NFIP

program and to help them develop flood hazard bylaws and ordinances (State of Vermont 2013b). As a result of this law, ANR, in conjunction with participating towns, has conducted geomorphic assessments of watersheds to identify areas of high risk. Lastly, Act 16 requires municipal and regional plans include a flood resilience element (State of Vermont 2013a). To date, awareness of these top-down policies and overall progress on municipal flood resiliency has been mixed (INT#33, Personal Communication, August 28, 2013).

Our research focuses on flood mitigation by towns located within Windham County. These towns are located in southeast Vermont, with Massachusetts at its southern border and New Hampshire to the east (See Figure 2.1). We focus on towns in this region because they were among the most recent in Vermont to have preliminary digital flood insurance rate maps put into effect (State of Vermont 2015) and because these towns were highly affected by Tropical Storm Irene. Thus we expect flood mitigation to be a priority for those towns. The county covers 798 square miles and encompasses 23 towns. Towns range in size from a population of 213 to 12,000, with a median population of 1,124. Small rural towns located along glaciated river valleys and facing similar flood risks are common across Appalachia and the Allegheny Mountains, including in New Hampshire, Maine, Western Massachusetts, Western Pennsylvania, and West Virginia.

Figure 2.1. Southern Vermont. All towns located in Windham County are shaded in grey. Interviews were conducted with municipal officials from towns shaded a darker dark grey.



Towns in the study area vary in terms of their tax base, professional staff, impacts from previous flood events, and degree of flood hazard planning. In Vermont, as in much of New England, counties have limited authority, thus local government occurs at the town-level. While town officials are elected, civil service is voluntary and in many towns, unpaid. Five of the 18 towns in our study had professional staff members. In terms of prior flood impacts across Windham County, town receipt of FEMA public and individual assistance after declared flood disasters between 1963 and 2012 ranged from \$33,397 to \$5.18 million in FEMA. With respect to local flood mitigation measures, all

towns participate in the National Flood Insurance Program (NFIP), eleven have active Hazard Mitigation Plans (HMP), three have special flood hazard areas, three have steam buffer bylaws, and thirteen have up-to-date Town Plans.

Town officials from all 23 towns in the study area were contacted by telephone and invited to participate in the study. Between August and December 2013, 31 semi-structured interviews were conducted with town-level decision makers across 18 towns. Interviewees were selected based on their knowledge of the town and adaptive actions considered. The official role of interviewees varied, with some interviewees multiple roles, depending on the governmental structure of the municipality. Interviewees included select board chairs (11), select board members (6), town managers (5), zoning administrators (1), planning board members (1), town administrators (1), town clerks (2), road commissioners (1), emergency operations directors (4), and a FEMA coordinator (1). Where possible, two interviews were conducted in each town. To triangulate town-official perspectives, four additional interviews were conducted with representatives from higher levels of government, including Windham Regional Planning Commission and Vermont ANR.

All interviews were recorded and transcribed verbatim. NVivo qualitative analysis software was used to code and analyze the data. Data coding was iterative. Contextual information about the interviewees and transcriptions were initially coded using preliminary themes (a priori codes). Emerging patterns and secondary coding were then applied to further identify recurring themes and theoretically important concepts (inductive codes).

2.4 Conceptual Framework of ‘Fit’ For Top-Down Flood Mitigation Policies

While there is heterogeneity across the eighteen towns in the study, patterns emerged as interviewees discussed their perspectives on top-down flood mitigation policies and town decisions regarding uptake and compliance with such measures. By analyzing interviewee responses and comparing with the prior academic research on adaptation, we develop a conceptual framework of ‘fit’ that describes how top-down flood mitigation policies interact with the local context of the town. ‘Fit’ in the eyes of our interviewees is related to features that are intrinsic to the town, including the specific geography, and dynamics of the town, as well as features that are extrinsic to the town, arising instead from how the planned adaptation is formulated and presented by higher levels of government. We first delineate the components of the framework and then explore interactions between those components.

Three main components of fit emerging from interviews include *Receptivity*; *Ease of Participation*; and *Design* (Table 1). These components are interacting and at times mutually reinforcing. Each of these components is described in-depth below.

Table 2.1. Components of ‘Fit’ between Top-down Flood Mitigation Policies and Local-Level Context

Component	Description
<p>Receptivity: the openness and interest of the town to consider the actions to be undertaken as part of the planned adaptation</p>	<ul style="list-style-type: none"> ▪ Perceived Flood Risk: the town’s perception regarding the likelihood and extent of damage from flooding, including actual physical risks as well as cognitive factors (heuristic biases, dread, etc.) that serve to influence perceptions of risk. ▪ Perceived Adaptation Efficacy: the town’s perception that planned adaptations can attenuate the potential negative impacts of future flood events.
<p>Ease of Participation: the relative effort required for uptake and the barriers towns would encounter in undertaking the planned adaptation</p>	<ul style="list-style-type: none"> ▪ Local Adaptive Capacity: the resources available at the town level (including human, financial, and physical capital) to engage with planned adaptation policies. ▪ Community Support: the degree of support from the electorate for town decision makers to take necessary actions for the uptake of planned adaptations.
<p>Design: the requirements for and expected outcomes from the planned adaptation and how those align with the characteristics of the town.</p>	<ul style="list-style-type: none"> ▪ Flexibility: the degree to which a town is able to adjust the planned adaptation during uptake to accommodate unique local, physical, social, economic, and political characteristics. ▪ Ease of Implementation: the efforts required by towns to undertake the planned adaptation.

2.4.1 Receptivity

Receptivity refers to the openness and interest of the town to consider the actions to be undertaken as part of the planned adaptation. *Receptivity* is predominantly determined by intrinsic characteristics of the town. Fostering ‘fit’ occurs when the town’s decision makers evaluate the flood threat and determine the town’s ability to mitigate the threat i.e., it is their appraisal of the situation. Interviewees described town *Receptivity*

along two dimensions: perceptions of the need to undertake action to mitigate the risks of future floods and perceptions of the effectiveness of the actions to be undertaken in reducing the negative impacts of future floods.

2.4.1.1 Perceived Flood Risk

Town perception of risks includes actual physical risks as well as any cognitive factors (heuristic biases, dread, etc.) that serve to increase perceived risk. Interviewees discussed floods as a threat due to the potential of floods to damage infrastructure, assets or property; to disrupt services or transportation; to negatively impact the economy; to harm the environment; or to cause physical and emotional damage or otherwise decrease the wellbeing of town residents.

Within the study area, perception of the flood risk varied. Twenty of the thirty-one interviewees described floods as a significant concern for their municipality, with some describing floods as *one of the more pressing concerns* (INT#24, Personal Communication, September 20, 13), and noting that *another flood would be devastating* to the town (personal communication with interviewee 16, 8/16/13). Two interviewees described flooding as a moderate concern, *competing with many other pressing concerns that we have on a day-to-day and periodic basis* (INT#1, Personal Communication, September 16, 2013), such as fire and winter storm events (INT#4, Personal Communication, December 13, 2013). The nine other interviewees characterized their towns' flood risk as low, or not a concern to the general public (INT#19, Personal Communication, September 27, 2013). These interviewees recognize extreme flood events, such as occurred during Tropical Storm Irene, are part of the long-term cycles and

view other risks or stressors, including a lack of economic development as more threatening. As one interviewee explained *on a priority scale of 1-10, I would put floods down at number eight where number one is the highest and number ten we really don't care* (INT#19, Personal Communication, September 27, 2013).

Interviewees who characterized flooding as a substantial risk to their town described their towns as having an interest in taking action to reduce the threats of future floods. Of those that described floods as a significant concern for their community, 80% said their town is proactive in taking action to reduce the threat. Similarly, 78% of the interviewees who characterized flooding as a low risk to their town described the town as having a low interest in undertaking additional flood mitigation. When asked what flood mitigation actions these towns had taken thus far, some responded they had done *nothing so far* (INT#17, Personal Communication, September 30, 2013), while others acknowledged *flood mitigation is something we are aware of and we responded well to Irene, but it's not at the top of our minds at this time* (INT#4, Personal Communication, December 213, 2013).

Prior flood impacts do not appear to have a clear relationship with perspectives on flood risk. While eight interviewees said Tropical Storm Irene significantly raised their town's perceived flood, not all towns that experienced damage viewed future floods as a serious risk. Five of the nine interviewees who described floods as a minimal threat represented towns that had sustained at least one million dollars in damages during Irene. These findings confirm other studies that have found experience with prior flooding is not consistently correlated to risk perception (Bubeck et al. 2013) and suggests

experience with prior flood events may not be a suitable indicator to establish ‘fit’ between towns and planned adaptations.

2.4.1.2 Adaptation Efficacy

Receptivity is also predicated on perceptions that adaptations can attenuate the potential negative impacts of future floods. This includes the belief that the technology and policy options prescribed by planned adaptations will reduce the risk or the impacts of flooding to the town.

Planning and land management are the primary flood mitigation strategies promoted by planned adaptations in the study area, yet interviewees described their towns as holding varied opinions regarding the efficacy of those strategies. Twenty-three of the thirty-one interviewees said the perspective of their town was that actions could be taken to mitigate the negative impacts of flood, while the remaining eight interviewees said their town did not perceive adaptation as achievable through current technology or planning.

Towns in the study area that described adaptations as effective were engaged in either planning and/or land management strategies aimed at flood mitigation. As explained by the regional planning commission, success or failure to take action is related to *[towns’] perception of or awareness of the fact that there are risks and there are actions that they [the towns] can take that would help mitigate against flood risks* (INT#33, Personal Communication, August 28, 2013). Towns that did not see adaptations as effective were less likely to take action. For these towns, six of the eight interviewees described little interest in action, noting, there is *nothing you [the town] can do to*

prepare, it's [flood] just going to happen (INT#21, Personal Communication, September 6, 2013) or *I don't know what kind of actions we [the town] might even consider* (INT#11, Personal Communication, September 6, 2013).

2.4.2 Ease of Participation

Local-level capacity to respond to flood hazards has long been recognized as a barrier to flood mitigation (Burby and May 1998). According to interviewees, vital aspects of adaptive capacity that are particularly important to town implementation of top-down adaptations include human capital and available resources. As explained clearly by one interviewee, *we're only 2,000 people and we have our own government that is limited in terms of scope of work that it can do, it's limited in the capacity of the folks running it, it's tough* (INT#7, Personal Communication, September 30, 2013).

2.4.2.1 Human Capital

When describing needs related to human capital, interviewees discussed how town officials need to have the competency, knowledge, habits, cognitive abilities, and resourcefulness that enable them to effectively assist the town in uptake of planned adaptation. Prior research on flood mitigation has highlighted how local decision makers are everyday citizens of the community at large (Brody et al. 2009) and may lack technocratic and scientific knowledge of flood mitigation. Across the study area, awareness of state flood mitigation policies constrained town actions: three interviewees were familiar with State Acts 110, 130, 16, and the ERAF program; four interviewees were aware of only one or two of those policies; and 24 interviewees had no knowledge

of them. Many interviewees described how limited knowledge of state flood mitigation policies stems from town capacity constraints and inadequate educational outreach. As explained by one: *We have a volunteer town government. Being aware of all of the regulations and rules coming down, I suppose is the real difficulty. We all have other jobs and occupations* (INT#3, Personal Communication, November 22, 2013).

Uptake of top-down adaptation entails costs, whether financial or administrative (Posey 2009). Thus in addition to human capital, local-level resources including financial resources, assets, in-kind goods and services, and staffing, are essential for local-level engagement with the top-down flood protection. When significant resource constraints are present, it may be difficult for towns to allocate the necessary resources for planned adaptations (Benson and Twigg 2004). Financial constraints were cited by all but three interviewees as a hindrance to action.

Of those interviewees who did not describe their towns as hindered by major financial constraints, two represent towns with the largest population in the study region while the third cited a particularly strong tax base coupled with additional financial assistance from residence (INT#5, Personal Communication, October 25, 2013). As explained by one interviewee, the pursuit of commercial development by their town generated additional resources that could be directed towards planned adaptation while most other towns struggle with budgets every year (INT#6, Personal Communication, November 4, 2013).

Human capital and available resources are inter-related. For example, the interviewees with greater knowledge of state flood mitigation policies represent towns with higher levels of educational attainment and economic development. Towns with

larger population sizes were more likely to employ full-time town staff and had the administrative capacity to employ experts, such as grant administrators and planning departments (INT#1, Personal Communication, September 16, 2013). Whereas towns with fewer resources expressed concern regarding their ability to engage with planned adaptations, noting *we certainly have to go outside the borders of the town for help, monetarily and administratively* (INT#12, Personal Communication, September 16, 2013).

2.4.2.2 Community Support

Interviewees also described community support as essential to local implementation of top-down flood mitigation policies. In the study area, local governments are downwardly accountable. Public opinion is particularly influential due to the nature of the election cycle and the close, often social or familial relations, with constituents. Without community support, decision makers may be unable to leverage the political capital they need to pass by-laws, to appropriate funds, or to otherwise engage in activities necessary to implement the planned adaptations.

According to interviewees three main factors impact community support for planned adaptation: differences in opinions across the community regarding fiscal spending, concerns pertaining to property rights, and the perceived scientific rigor of the information used for the planned adaptation. Twenty-seven of the interviewees said fiscal considerations reduce community support for planned adaptations. Fiscal concerns dominated even when the community recognized the value of the planned adaptations. As explained by one

There is a small group of individuals that understand that we need to do things better, smarter, but at the same time you have to count in the fiscal concerns. So you know, for municipal governments it's going to be very difficult (INT#22, Personal Communication, November 18, 2013)

Town officials noted that community support, and thus actions, were contingent on fiscal support, stating *we can't do anything that the federal government won't pay back* (INT#16, Personal Communication, August 16, 2013). Furthermore, interviewees explained how they struggled in working with the community, since *[residents] were very nervous about the amount of money [the town was spending on recovery and mitigation]* (INT#5, Personal Communication, October 25, 2013).

In addition to fiscal concerns, community support is particularly difficult to achieve when adaptations include provisions that can be interpreted as infringing upon individuals property rights. Zoning, river corridor bylaws and ordinances, and geomorphic assessments that influence the use or development of private lands were found to be highly contentious. As one interviewee explained, *it's going to continue to be a political issue going forward about how to balance private property owners' property rights against the good of the community as a whole* (INT#1, Personal Communication, September 16, 2013).

Lastly, interviewees described how the perceived scientific rigor of the information used for top-down adaptation influences community support. For example, Act 138 encourages towns to incorporate fluvial erosion hazards into their zoning and directed ANR to generate fluvial erosion maps for towns to use in this process. ANR's first phase of geomorphic assessment estimated fluvial erosion zones using existing datasets that did not incorporate channel changes from recent flood events. Interviewees described how community members and regional officials perceived these estimated

erosion maps to be insufficient and therefore towns were not supportive of incorporating erosion hazards into local zoning policies. One interviewee noted the lack of community support would be assuaged if the community believed science was used that could be defended empirically (INT#2, Personal Communication, August 28, 2013).

2.4.3 Design

Design refers to the requirements for and expected outcomes from the planned adaptation and how those align with the intrinsic characteristics of the town. While policy *Design* is predominantly determined by extrinsic factors, as policymaking takes place at the state and federal level, we are concerned here with the interaction between town dynamics and the prescribed policy. To foster ‘fit’, the policy should contain clear goals that are easily interpretable, provisions that facilitate implementation by fostering local commitment and capacity to achieve the goals, and persuasive tools (penalties and or incentives) to promote compliance in the absence of sufficient local commitment and capacity (Burby and May 1997; Stevens and Hanschka 2014; Zahran et al. 2010). Interviewees described *Design* as having two dimensions: flexibility to address specific conditions and ease of implementation.

2.4.3.1 Flexibility

Interviewees described that for planned adaptations to be effective in mobilizing local action they must incorporate specificity, while retaining enough flexibility to account for the diversity of local, physical, social, economic, and political characteristics of the towns. The bulk of interviewees said state policies lack the necessary flexibility to

address the specific concerns of their municipality. One interviewee described how the state *tend[s] to make blanket rules that affect each town differently* (INT#12, Personal Communication, September 16, 2013), while another expressed concerns about the applicability of state driven planned adaptations, claiming *they [the state] have to paint it [policy] with a broad...brush, so we get pulled into it sometimes with requirements that are really inappropriate for us* (INT#26, Personal Communication, October 7, 2013).

Interviewees explained that towns are frustrated because the rigidity of the top-down adaptations is a barrier to action. Of particular concern is that the top-down adaptations do not account for differences in geography and population across the state and thus the regulations towns are supposed to implement are not appropriate for all towns (INT#19, Personal Communication, September 27, 2013). Interviewees said towns resent such rigid policies, with one arguing that *towns should really be able to manage their own rule making* (INT#12, Personal Communication, September 16, 2013).

To alleviate these challenges, interviewees suggested top-down adaptations should be re-designed to allow for different levels of assistance and mandates dependent on town capacity. For example, they cited the state's inclusion of fluvial erosion hazards in Act 138 as *a regulatory framework that would work [since it is more tailored to the local context and thus] takes into account the kind of flooding that we have* (INT#2, Personal Communication, October 4, 2013).

To improve the likelihood of uptake, interviewees articulated their need for guidance from higher levels of government, yet their desires to maintain autonomy to choose policies at the town level. Fifteen of the interviewees expressed strong support for the state's role in providing advice to the towns, noting *the state can give you advice [but*

when it comes to action] you [town officials] have to make the decision (INT#1, Personal Communication, October 25, 2013). These alterations would provide a higher degree of flexibility to meet town's unique needs and thus achieving a better 'fit'.

2.4.3.2 Ease of Implementation

Ease of implementation refers to the effort required by towns to undertake the proposed actions, balanced by the expected payoffs of uptake. Interviewees indicated towns experience two primary barriers to ease of implementation: difficulty in understanding the requirements of top-down adaptations and limited support to aid town implementation.

Variation in the ease of implementation across policies was present in the study area. Twenty-five of the interviewees expressed frustration regarding planned adaptations, noting *even to read and understand these things can be very difficult for us [town decision makers]* (INT#26, Personal Communication, October 7, 2013). Another interviewee explained that *it's easy to pass a law ... it's much more difficult to abide by that law when your towns don't have the resources* (INT#23, Personal Communication, November 14, 2013).

In other instances, interviewees provided examples of successful uptake of policies when the burden implementation was sufficiently reduced. For example, 11 of the 18 towns had developed hazard mitigation plans. As explained by one interviewee, this top-down adaptation was easier to implement because it included a template for towns to follow, and, *for a small town that is a huge help* (INT#8, Personal Communication, October 4, 2013).

Beyond clarity of procedures, a lack of support from the state to aid towns in implementing adaptations presented a frequent challenge to action. Interviewees expressed their view that the state needs to recognize that towns have limited capacities. If the state expects towns to undertake additional adaptation measures, then the state needs to provide the additional support to promote action by the towns. Consistent with the literature, seven interviewees described unfunded mandates from the state as a major hindrance to action, with one interviewee noting *with demands should come money, and that doesn't always happen* (INT#18, Personal Communication, September 27, 2013).

Another interviewee explained:

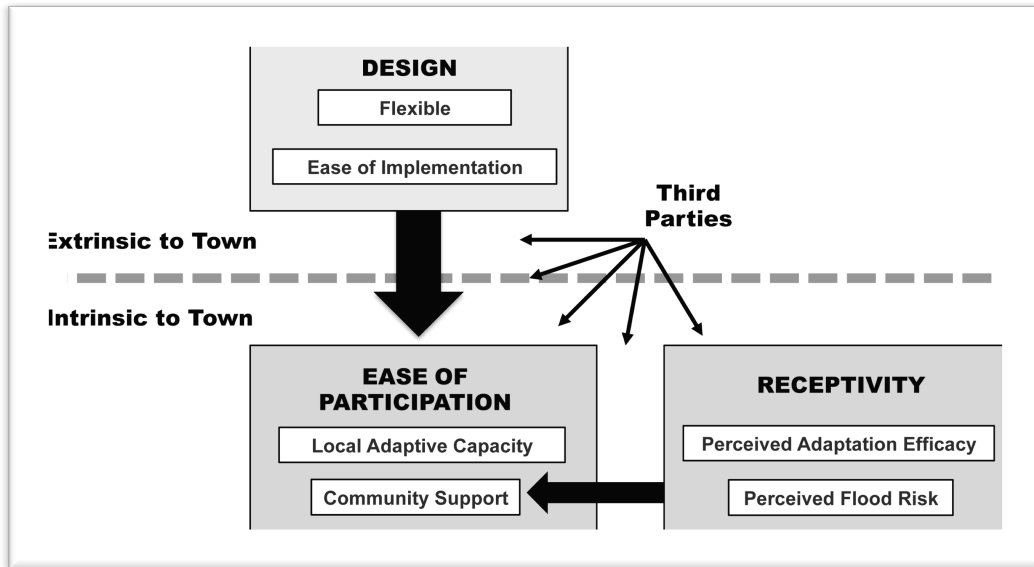
the resources are here for us to comply [with planned adaptations], we have the crews that can do it, we have the material resources and the people to do it, it's just that the cost is so high (INT#17, Personal Communication, September 30, 2013).

2.4.4 Interactions Between Components of the 'Fit' Framework

While individually each of the three components (*Receptivity*, *Ease of Participation*, and *Design*) affects the fit of top-down planned adaptations, interactions between the components also influences 'fit' (Figure 2). *Receptivity* and *Ease of Participation* interact primarily when an increased perception of risk leads to increased community support for actions that may otherwise be less acceptable, such as regulations or fiscal spending. For example, one interviewee discussed how concerned citizens in his town were pressuring the planning commission to adopt fluvial erosion hazard regulations (INT#1, Personal Communication, September 16, 2013) while another interviewee explained how community members' concerns about flood risk were pushing

the town to participate in the Community Rating System of the NFIP, a top-down adaptation (INT#6, Personal Communication, November 14, 2013).

Figure 2.2. Conceptual framework representing ‘fit’ between top-down policies and the local-level context. Receptivity and Ease of Participation are influenced both by Design and by third parties. Receptivity also influences Community Support, a sub- component of Ease of Participation.



Design interacts with both subcomponents of *Ease of Participation*: town capacity and community support. A top-down adaptation that includes support for implementation, such as funding, technical assistance, or other easy to follow guidance can help overcome capacity constraints at the town-level. For example, as described above the Hazard Mitigation Plan template improved *Ease of Participation* (INT#8, Personal Communication, October 4, 2013). *Design* can bolster community support by allowing the communities to incorporate local knowledge and to mold the top-down adaptation to the town’s specific priorities, overcoming the one-size fits all dilemma of rigid policies. *Design* can also overcome a lack of community support when town

implementation a top-down adaptation is not optional. For example, one interviewee also explained that her town complied with the Hazard Mitigation Plan requirement because, due to the strong mandate, they did not have a choice (INT#16, Personal Communication, August 16, 2013). Other interviewees concurred, saying towns will act if they are required to (INT#8, Personal Communication, October 4, 2013).

2.5 External Influences On ‘Fit’

The ‘fit’ of top-down adaptations is determined both by factors intrinsic to the town, such as geography, local capacity, and culture as well as by external factors.

Receptivity and *Ease of Participation* are primarily intrinsic components. *Design* is primarily determined by extrinsic factors, namely decision makers at higher levels of government who develop the top-down adaptations. Yet intrinsic factors are not immutable. Above we discussed how the *Design* of the top-down adaptation can influence both *Receptivity* and *Ease of Participation*. In addition, external factors unrelated to the top-down adaptation, such as third parties, can act as intermediaries that influence *Ease of Participation* and *Receptivity*.

In the study area, the training and education activities of the Windham Regional Commission (WRC), a quasi-government regional agency that assists towns with planning and community development, served to foster ‘fit’. These awareness-raising activities had a positive influence on the town receptiveness to planned adaptations. One town explained how representatives from WRC came to their town meeting and talked about the importance of flood mitigation policies for the towns (INT#8, Personal

Communication, October 4, 2013). These discussions lead the town to implement many of the top-down adaptations.

WRC was also pivotal in improving *Ease of Participation* by improving decision-makers understanding of the rules, regulations, and potential benefits associated with planned adaptations, as well as through directly engaging in plan writing. One interviewee discussed how WRC had been *helping us with the rules [for top-down planned adaptations]. Whenever we [the select board] run into a hard situation, they have been really accessible* (INT#10, Personal Communication, October 21, 2013). Another interviewee explained how: *We depend upon them [WRC] probably for 90% of our guidance relative to the way to go forward and choose the priorities* (INT#6, Personal Communication, October 25, 2013). A third explained how the WRC assisted with the sorting and prioritizing of information as

there was so much information that, I mean, there was just hundreds of emails everyday coming through and it's, what ones do you read? [O]ur regional planning commission was the funnel for all of that information. They would pick through all of it and say okay these are the one's we should really read (INT#7, Personal Communication, September 30, 2013).

Overall, interviewees described WRC positively, complimenting the role it played improving *Ease of Participation* in top-down policies. While further research is needed to determine what characteristics of WRC were most influential and generalizable, the work of WRC as an intermediary between towns and the state highlights how boundary organizations (Cash et al. , Guston 2001) can help improve *Design*.

2.6 ‘Fit’ in Vermont

Vermont’s efforts aimed at encouraging towns to adopt flood mitigation measures have received mixed responses. Our analysis reveals this heterogeneity to be related to town official perspectives on how these top-down policies ‘fit’ with the local-context. More specifically, we find the openness and interest of the town in undertaking the actions prescribed by the top-down adaptation policy (*Receptivity*) and the relative effort required for uptake of the top-down adaptation policy (*Ease of Participation*) interact with the *Design* of top-down policies to influence uptake.

Our findings on the intrinsic components of ‘fit’ (*Receptivity* and *Ease of Participation*) corroborate prior research on uptake of flood mitigation strategies at the local-level. In terms of *Receptivity*, previous flood exposure, risk perception (Becker, Aerts, and Huitema 2013; Whitmarsh 2008; Adger et al. 2012; Neuvel and van den Brink 2009), prior flooding experience (Harries 2009; Burningham, Fielding, and Thrush 2008) and coping appraisal (Brody, Peacock, and Gunn 2012; Grothmann and Patt 2005) have been identified as factors influencing implementation of flood mitigation strategies. In terms of *Ease of Participation*, financial resources, staffing, technical expertise (Brody, Kang, and Bernhardt 2010; Urwin and Jordan 2008; Frazier et al. 2013; Neuvel and van den Brink 2009) and social factors such as community pressure (Tompkins and Neil Adger 2005; Prater and Lindell 2000) also have demonstrated effects on local-level implementation of flood mitigation strategies. While it is to be expected that factors influencing local-level decisions to autonomously implement flood mitigation strategies also influence the success of top-down policies on flood mitigation, explicit recognition

of the role of these factors in ‘fit’ is useful for pointing to potential interactions between the intrinsic and extrinsic components of ‘fit’.

As described above, it may be possible to overcome barriers to ‘fit’ arising from low *Receptivity* or *Ease of Participation* through *Design*. Many of the towns in the study area lacked knowledge of Vermont’s top-down adaptation policies and described low confidence that prescribed actions would reduce flood risks. The inclusion of greater outreach, training, and capacity building in top-down adaptations could help to reduce these barriers to ‘fit’. For example, WRC’s technical assistance and outreach was described by towns as particularly useful. Inclusion of such intermediary agencies in the *Design* of top-down adaptations may be particularly helpful in addressing both *Receptivity* and *Ease of Participation*. Beyond knowledge constraints, many towns in the study area also described inadequate and poorly timed distribution of funding as barriers to uptake. Thus top-down adaptations should incorporate funding mechanisms that are more accessible and provide funds at earlier stages in the implementation process.

While *Design* has the potential to influence fit by altering *Receptivity* and *Ease of Participation*, it also has a direct influence on town perceptions of top-down policies. Many of the towns in the study area described Vermont’s top-down adaptations as problematic because they do not adequately address contextual variation across towns. Incorporating flexibility into the *Design* of planned adaptations is necessary for them to be effective at the local-level (Urwin and Jordan 2008) and has been shown to increase the likelihood that towns implement flood protection measures (Berke, Lyles, and Smith 2014). Additional concerns voiced about the ‘fit’ of Vermont’s top-down adaptations included that procedures for implementation are unclear and that mandates are

insufficiently enforced. These complaints echo findings from other studies that describe how what appear to be clear procedures to state planners may present challenges at the town level (Wolensky and Wolensky 1990) and that strong state mandates will increase local compliance (Deyle and Smith 1998).

Since the start of this research project, Vermont has continued to bolster its efforts to encourage local-level flood mitigation. Vermont released an on-line river-corridor mapping tool (State of Vermont 2016a), issued a flood resilience checklist, and directed ANR to develop model flood hazards and river corridor protection area bylaws and ordinances (State of Vermont 2015). Vermont also amended the Emergency Relief and Assistance Fund rule, increasing the state's contribution of matching funds in the aftermath of a declared flood disaster (State of Vermont 2016a). These new policies seek to increase local-level adaptive capacity and community support (*Ease of Participation*) by providing technical support and improved scientific information and by reducing the burden of cost sharing. The policies also seek to improve ease of implementation (*Design*) by delineating clear procedures for river corridor protection. As interviewees all described a need for such changes, we expect these new efforts will increase implementation of flood mitigation at the local-level. Future research should track the outcomes to determine which of Vermont's new policies has the most impact.

2.7 Conclusion

The framework of 'fit' presented in this chapter provides a framework for understanding and evaluating local-level uptake of top-down adaptation policies. By separating 'fit' into intrinsic and extrinsic components, the framework points to the

potential to improve fit through the *Design* of the top-down adaptations. This analysis of government intervention in planned adaptation policies helps address the question of who should adapt and how. In the study area, we observed a failure of ‘fit’ between state and federal policy, leading the state to take the initiative in designing and implementing planned adaptation policies. Furthermore, we observed relatively unsuccessful government intervention in the study area, as the state government failed to raise adequate awareness of planned adaptation policies at the local level.

Future research should examine the interactions between the components of ‘fit’ in more depth to identify whether there is substitutability between the sub-components of fit and which sub-components are most essential to uptake of top-down adaptations. Moreover, as this study focused on flooding, additional research is needed to determine if and how the relative importance of the components of fit vary across hazards. Additionally, the framework developed in this study was built upon analysis of top-down government intervention. This presents a limitation of the model, which may not be generalizable for bottom-up approaches to cross-scalar policy development. Future work should focus on other scales of policy intervention, such as bottom-up, to identify the applicability of the framework across scales of policy intervention. Future work building on such insights will be useful to the effectiveness of top-down adaptations, as ensuring ‘fit’ will improve uptake of those adaptations.

CHAPTER 3

**FARMER PERSPECTIVES ON LIVELIHOODS IN COMMUNITY
SUPPORTED AGRICULTURE**

3.1 Introduction

Today's consumers are seeking fresh, local, and healthy produce generated in an environmentally responsible way, yet the providers of these products, the farmers, are struggling to make a living. Community Supported Agriculture (CSA) may provide a solution to this dilemma (Bennett 2009; McFadden 2008; Oberholtzer 2004). Advocates claim CSA provides a viable model of production and distribution of food by local, highly diversified farms, while creating conditions for the community and farm to join together in a "symbiotic relationship" that adequately supports the farmer(s) (DeLind 2003). This is achieved through linking consumers, or members, directly to local farms in their community.

The basic economic arrangement of CSA relies on members paying the farmer prior to the start of the season, thus providing working capital for the farm. In return the farmer provides the consumer with weekly produce during the farming season. In theory, the consumer is buying a 'share' of the farm's annual harvest, lasting an average of 24 weeks¹³ across the country (Lass et al. 2003). In its simplest form, the relationship entered into by CSA farmers and members provides fresh local produce to consumers,

¹³ The duration of the share may vary significantly by farm and location.

and working capital, plus a guaranteed market, for farmers; however, boiling down CSA to a producer-consumer relationship that describes market-based economic exchanges disregards many critical aspects of the arrangement. Going beyond simply providing produce for a given price, CSA may be understood as selling a lifestyle that re-connects people to their food and the land (Lamb 1994). At their best, CSA enables participants to engage actively in key decisions regarding the farm, such as the farm's growing practices, and the farm's relationship with the community (McFadden 2008). However, some CSA farms may represent little more than a marketing opportunity for diverse farms seeking to sell directly to consumers.

Since the introduction of the CSA model in the United States in 1986 the number of farms offering CSA has grown rapidly, although still representing less than 1 percent of farms across the United States. While numbers on national membership in CSA farms are not available, CSA continues to grow in popularity (Local Harvest 2014). As CSA has proliferated, the CSA structure has evolved to encompass a wide variety of ways for farmers to organize their 'version' of CSA. Farms offering CSA range from very small family farms providing produce for a handful of families in their community and adhering closely to the original principles laid out by early CSA participants, to large-scale farms using CSA as one of many marketing strategies to sell produce, and everything in-between (Galt et al. 2012). While advocates discuss the benefits and transformative potential of CSA, there is a lack of systematic evaluation to understand exactly what CSA is and is not delivering; where progress needs be achieved; and to what extent CSA represents a viable alternative to the industrial food system. Most important, is the CSA providing a viable farm livelihood for the farmer(s)?

Few studies have examined if CSA farms are delivering on their key principles, including providing viable farm livelihoods. This chapter takes a step in evaluating the farm livelihoods that CSA is providing from a farmer's perspective, and on the basis of principles set forth by early advocates of the CSA model. The chapter is organized as follows: the second section describes the origins and development of the CSA model and elaborates the initial principles that guided CSA; the third section sets the scene for an analysis of farm livelihoods, identifying the shortcomings of current models of agricultural production; section four describes the methods utilized to conduct this study; section five contains an evaluation of CSA farms in the study; section six discusses key findings of the work; and section seven concludes by explaining the implications of the findings and suggesting areas of future work.

3.2 Origins and Development of CSA

In 1986 the first two documented CSA farms were founded in the United States, Temple-Wilton Community Farm in southern New Hampshire and Indian Line Farm in western Massachusetts (Henderson and Van En 2007). They both became aware of CSA from examples in Germany and Switzerland, where small farmers had asked their local community members to pay an upfront sum in order to cover the farms' annual production expenses. In return, the members of the communities would receive a weekly portion of the farms' bounty, including vegetables, meat, and dairy. The movement initially began with a group of women in Japanese who were frustrated by the quality of produce and milk available to them through the conventional food system. Consumers and producers alike were concerned about the health, social, and environmental impacts

of the extensive pesticide use, farm concentration, and the depletion of rural livelihoods that the ‘modernization’ of agriculture brought, and they banded together to form member-farmer partnerships (JOAA 1993). Thus, the movement was born out of the rejection of conventional agriculture on grounds of social, environmental, and economic justice, in addition to the desire for fresh, quality food.

The early CSA farms had promising membership expansion, which early advocates attributed to empowered consumers choosing to “vote with their dollars” for local sustainable agricultural practices (Groh and McFadden 1997). To continue attracting members of the community and provide them with a full understanding of this alternative model of acquiring one's food, the founders of the Indian Line Farm explained the CSA as follows:

The concept of these new cooperatives is simple: divide the costs of the farm or garden among shareholders before the growing season begins. Instead of an agriculture that is supported by government subsidies, private profits, or martyrs for the cause, they create an organizational form that provides direct support for farmers from people who eat their food (ibid).

To understand why CSA advocates are working to build an alternative-farming model, background on current challenges faced by farmers will be reviewed. Under the pressure of rising land prices, competition for land use, and low farm-gate prices, small and midsize farms are struggling to make a living (O'Donoghue 2011). The USDA found land access and farm startup costs to be the largest obstacle for beginning farmers (Ahearn and Newton 2009). Farmers have responded to increases in land prices by continuing on the path of consolidation, attempting to reap any rewards from economies of scale. Yet these supposed economies of scale - that is, the claim that large farms are more productive - have come under much critical scrutiny (Deininger and Byerlee 2012).

From 1987 to 2007 the midpoint acreage for U.S. farms increased in all but five states, and doubled in sixteen states (Ahearn and Newton 2009). Through consolidation, large farms are able to survive by earning small net profits per acre and extracting rents through government programs (Ramey 2014), thus embarking upon a *land-extensive* strategy.

Land is a vital input for farmers – without land, there is no soil to till. As all farmers struggle for access to land, through either ownership or rental, CSA may offer an alternative path forward. CSA farms are highly diversified and use land *intensively*, as opposed to *extensively*, focusing on high-value, labor-intensive crops to provide farm viability on relatively small parcels of land (Tubene and Hanson 2002). By using the land intensively, farmers are able to generate high levels of revenue per acre, thus relaxing the land constraint.

Benefits from land-intensive farming practices are not exclusive to CSA farms (Schnell 2007). While CSA may not directly provide farms with access to land, the community ties, coupled with agro-ecological growing practices, may improve CSA farms' access to land through mechanisms such as land trusts and community assistance (DeMuth 1993; Curtin and Bocarsly 2008). CSA farms do, however, face additional challenges associated with procuring affordable land. Since CSA farms tend to be located in urban and suburban regions in order to be close to their members, they often face land prices that reflect competing non-agricultural uses (Nehring et al. 2006), which may result in significantly higher land costs per acre than for non-CSA farms.

Additionally, CSA advocates were responding to challenges for farmers associated with financing farm operations. Operating loans, money borrowed to finance

farming operations during the season, are of particular concern for farmers. The recent USDA census found that the interest on operating loans alone accounted for roughly 5% of *total* farm expenses over the past decade (NASS 2007; USDA NASS 2014). These interest payments on farm loans have been a primary driver of the demise of the family farm (Dudley 2000). Many farms face credit constraints, resulting in a significantly lower value of total farm production (Briggeman et al. 2009). Other arrangements to finance farm inputs exist, such as contract farming arrangements, where in some instances most of the necessary inputs are provided to minimize the capital requirements for the farmer (Adamopoulos and Restuccia 2014). Whether the financing comes from the bank or the firm, however, the farmer pays a price to borrow, resulting in a reduction of net farm income that can have major economic consequences for the farm and farmer.

Borrowing costs aside, farmers historically have struggled in the United States to make a living comparable to their urban counterparts. In response, the government has provided major financial support to U.S. farmers via farm bill legislation for more than 80 years (Peterson 2009). The justification for this income redistribution, that farm households tended to be less well-off than non-farm households, held true until recently. In 2012 average farm household income (\$108,844) was 53% greater than the average U.S. household income; however, 80% of farm household income was earned *off* the farm. From 1990, when growth in the number of CSA farms accelerated, to 2012, earned income from farming represented only 12%, on average, of *total household income* for all farm households (USDA NASS 2014). With on-farm income averaging a meager \$8,210 during this time period, well below the poverty line, farming households are generally relying on off-farm income for their livelihoods (Weber 2012).

Previous studies have found mixed results on CSA farmer income. Lass et al. found CSA farmers are almost twice as likely to have gross *farm* incomes exceeding \$20,000 compared to non-CSA farms in the USDA census (Lass et al. 2003). Although CSA farmers relied less on off-farm income in Lass's study, 48% of those farmers surveyed reported a lack of satisfaction with their level of compensation (ibid). On average, small and mid-sized farms engaged in local food sales, farmed more hours and were more likely to forgo off-farm employment than farms that did not engage in the local market (Low and Vogel 2011). Previous studies have indicated that insufficient CSA farm income is the main challenge for farm survival (Oberholzer 2004), though these income challenges are not exclusive to CSA farms.

In theory, the CSA model allows for the farmer's income to be priced into the cost of the share, which is determined prior to production, thus ensuring the farmer a living wage; however, previous studies found the share price often does not include the cost of the farmer's labor (Lass et al. 2005). These findings are fueling concerns amongst researchers and advocates that the CSA model may fail to adequately compensate farmers (Tegtmeier and Duffy 2005).

Beyond farmer compensation in terms of wages, interventions from the government to support rural households included addressing the inherently risky nature of farming through the introduction of the Agricultural Adjustment Act (AAA) of 1933 (Rasmussen et al. 1976). This legislation, part of the New Deal, represented the start of large-scale government support for agriculture, initially through activities to raise food prices, and therefore farm income, and only later transitioning to focus on risk hedging strategies. The AAA was instrumental in support to farmers, helping to raise farm

incomes by 50% from 1932-1935 (Rasmussen 1976). Despite the progressive beginnings of the AAA, farm legislation after the depression has primarily supported large commodity farmers while actively pushing small and mid-sized family farmers out of the market and off the land (Ritchie and Ristau 1986).

Government payments to hedge risk for farmers are directly linked to increases in farm sizes, due to their disproportionate allocation to large-scale farms (Williams-Derry and Cook 2000; Key and Roberts 2006). A great deal of the disproportionate support to large-scale monocultures comes in the form of crop insurance and other government supported risk-hedging strategies. The structure of these programs effectively eliminates support to small and mid-sized highly diversified farms.¹⁴ Farms engaging in CSA do not have the ability to hedge risk through traditional mechanisms due to their adherence to agro-ecological growing practices, and therefore must seek alternative avenues to hedge their risk and support long-term farm livelihoods.

Rather than relying on government support to provide insurance and risk-hedging strategies, CSA farmers rely on crop diversification and their membership base. Most studies of CSA recognize “an important aspect of CSA is that both the farmer and the CSA member share the risks associated with farming” (Cooley and Lass 1998).

According to the USDA, CSA farms share, or sell off, a portion of their risk to their members through the CSA contract, therefore the farm is provided with a risk-hedging

¹⁴ Government insurance and subsidy programs primarily apply to monocultures growing commodity crops. For non-commodity growers, such as CSA farms, the government offers a program called the non-insured assistance program (NAP). This program is not appropriate for CSA farms due to its structure. The program is for individual crops, so a farmer with 30 crops may need 30 different insurance policies. Additionally, payments are only considered after 50% of the crop is lost. Once 50% is lost, NAP covers 55% of the market price for the second 50% of the crop. The USDA is only starting to cover organic prices, though this currently applies to only a handful of crops.

strategy for the season (USDA 2014). Contrary to this view, DeLind (2011) argues that the idea of shared risk has been all but eliminated from CSA – due to erosion of the early principles – and that CSA has transformed into a simple form of commerce rather than a true social movement.

To evaluate how CSA farms are doing, we first need to understand what exactly CSA sets out to do in the first place. A review of the literature was used to generate the following list of the founding CSA principles and goals:

1. A CSA share constitutes a portion of the farm's harvest, thus providing the farmer with a guaranteed market (Cone and Myhre 2000).
2. The price of a share is determined by the cost of production on the farm, including a living wage for the farmer(s). The wage should take into account the average wage of members to minimize inequality and ensure affordability (DeMuth 2008).
3. Members support the farm by providing working capital for farming operations prior to the planting season through pre-payment, thereby reducing or eliminating the reliance of farmers on financial institutions (Lass et al. 2003).
4. Farmers are supported in their endeavor to grow in an agro-ecological manner. This leads to diversification of agricultural production, growing regionally appropriate crops, engaging in sustainable land management, minimizing off-farm inputs, promoting biodiversity, and an array of other ecosystem services (Groh and McFadden 1997).
5. Risk and reward of the farm is shared. Since the members are purchasing a portion of the harvest, they benefit from a particularly good year and share the risks of crop failure (Lamb 1994; Cone and Myhre 2000).
6. CSA promotes vibrant and diverse local food systems where growers are accountable to consumers (DeMuth 2008).
7. CSA rejects the industrialization of farming, challenging members to re-evaluate their community, their food system, and their role (Kelvin 1994).

With these principles at its heart, the CSA model has grown substantially over the past three decades. Starting with two farms in 1986, the CSA model experienced a first significant stage of growth in the 1990s (McFadden 2008). By 1999 there were 1,019 farms participating in CSA across the United States. While the early 2000s saw a lull in expansion, (Adam 2006) by 2009 a second boom of CSA growth was underway. In 2009

there were more than 2,250 registered CSA farms and by 2014 this number had jumped to 6,200, with at least one in each state (Local Harvest 2014). While CSA had its beginnings in the U.S. by producing vegetables, today many farms have diversified and offer a wide variety of share types. This chapter will focus solely on main season vegetable shares.

3.3 **Setting the scene**

In the United States small and mid-sized family farms, once the backbone of the country, have been disappearing since the turn of the 20th century. According to the USDA, ‘family farms’ still account for 97% of all farms and produce 82% of the total value in U.S. agriculture. Farms with small and midsize sales constitute 89.7% of all farms, yet contributed only 16.6% of the total value in agriculture production during 2010 (O'Donoghue 2011). The number of farms in the United States continues to dwindle; farms that do survive often are growing to gargantuan sizes to survive, with the majority of cropland now located on farms of 1,100 acres or larger (MacDonald et al. 2013). The destruction and concentration of farms resulting from the domination of industrial agriculture has come with unsustainable economic, social, environmental, and health consequences (Horrigan et al. 2002; Donham et al. 2007b).

While production and crop revenue across the United States are thriving, farm livelihoods and opportunities are not. Growth in agricultural yields and the expansion of acreage does not automatically translate into improved livelihoods. The social and economic well-being of communities does not benefit directly from the total production or sales of local farms; rather community benefits come from increasing the number of

individual *farms* and *farmers* (Donham et al. 2007a). There is a clear negative relationship between farm concentration and economic growth and prosperity in surrounding communities (Gómez and Zhang 2000). There are significant social and economic benefits from large numbers of farms and farmers as opposed to farm concentration and research supports that communities with fewer total farms experience lower average family incomes, higher rates of poverty, and persistent low wages for farm workers (Pew Commission 2008). With median net farm income a meager \$1,453, according to the 2012 USDA Census of Agriculture, and hence heavy reliance on off-farm income, many farmers have been forced to re-think how they can earn their living on the land.

CSA represents one alternative to the trend of farm concentration that encompasses broad environmental, economic, health, and social justice initiatives in an attempt to provide farmers with improved livelihoods and opportunities. Key aspects of these opportunities include affordable and accessible land and capital, a reliable and adequate income, risk management strategies, and educational opportunities for the next generation of sustainable farmers. The chapter goes beyond simple notions of income, based on household or net farm income of the operation, and includes a robust discussion of the above aspects of farmer livelihoods. Stepping away from a focus on household income allows for an analysis of the livelihood that the farming operation itself can provide for a farmer or farm family. Focusing on just farm income misses key aspects of livelihoods, such as economic security, equity, and potential non-market value gained through work.

3.4 Methods

The study area consisted of three counties in western Massachusetts - Franklin, Hampshire, and Hampden counties - which have experienced robust increases in farms offering CSA shares (Schnell 2007). This region is of particular interest because of its long-standing tradition of support for local agriculture and robust farming networks (Donahue et al. 2014). Western Massachusetts is home to the Connecticut River Valley, a region with deep agrarian roots (Clark 1992). The area has historically been used for farming due to its relatively rich and easily tilled soil (Cronon 2011). Today, Massachusetts has a vibrant local food economy, with direct-to-consumer sales accounting for 8.6% of total agricultural sales in 2007, compared to a national average of 0.3%, and second only to Rhode Island at 9.5% (Low and Vogel 2011). The robust local food economy in the study area, coupled with the fact that it is the birthplace of CSA, make the study area of particular interest. If anywhere were to provide a robust enough local food economy to provide livelihoods to CSA farmers, it may be in the study area.

To evaluate farmer livelihoods and challenges for CSA farms, qualitative interviews, a quantitative survey, and secondary data sources were utilized. Using local and national level CSA databases, including those of Community Involved in Sustaining Agriculture (CISA 2015), Local Harvest (2014), and the Robyn Van En Center (2015), 47 CSA farms offering a main season vegetable share in the study region were identified. The study focused on main season vegetable shares since these are the primary form of CSA offerings, and allowed for comparison across farms (Lass et al. 2003). Eight farms were excluded from the study for reasons including that the operation had been discontinued, the operation was a learning institution (school), the share offered was not

produce-based, or the operation was not the producer of the food it distributed. Thus 39 farms in the study region met the selection criteria for the study.

Farmers from the 39 farms in the region, which met the criteria, were contacted by telephone and invited to participate in the study. From May to October 2014, 16 in-person semi-structured interviews with CSA farmers were conducted, followed by a brief written survey to gather general statistics on the farm and farmer(s). While the response rate for the sample is below 50%, the interviewees covered a breadth of farm sizes and included significant variation across farmer gender, farmer experience, and the duration of the farm's existence. The official role of the interviewees varied. When possible, the interview was conducted with the owner-operated of the farm. Fourteen of the sixteen interviews were conducted with the owner-operator (head farmer), while two of the interviews were conducted with the farm manager. Fourteen of the sixteen interviewees successfully filled out the survey. The surveys included questions on the farming operation, including production methods, sales and income, farm size, and other general statistics. The survey also included questions pertaining to the owner-operator, and up to two farm managers¹⁵ – allowing for the collection of data on farmer characteristics on up to three farmers per farm, providing details on 28 total farmers.

The interviews ranged from thirty minutes to approximately two hours, and were all conducted on the farms. The interviews followed the mental models approach (Morgan 2002), involving open-ended questions followed by probes on specific issues not mentioned in the responses. This method was selected for the exploratory character of this study and by the ability of in-depth interviews to reveal a more nuanced

¹⁵ This follows the methodology used by the United States Department of Agriculture Census.

understanding of CSA farmers. All interviews were recorded and transcribed verbatim. NVivo qualitative analysis software was used to code and analyze the data. Data coding was iterative. Contextual information about the interviewees and transcriptions were initially coded using preliminary themes (a priori codes). Emerging patterns and secondary coding were then applied to further identify recurring themes and theoretically important concepts (inductive codes). The survey consisted of 24 quantitative questions about the farm, CSA program, and farmer(s).

3.5 Are CSA Farms Delivering in Terms of Farmer Livelihoods?

To assess farmer livelihoods, four categories are examined: affordable and accessible land, working capital, reliable and adequate income, and risk hedging strategies. Farmer livelihoods are complex, as they entails far more than monetary compensation. For instance, equity in the farm can account for a significant part of general compensation, as well as things such as the provisioning of food, transportation (trucks), housing, and other necessities, which the farm may cover. Analyzing and comparing farmer responses on farmer livelihoods lead to the focus on these categories.

3.5.1 Affordable and Accessible Land

Without land, there is no farm. Gone are the days of the Homestead Act where one merely needed to work the land in order to acquire property. Today, access to affordable land is a major hindrance to farmers, stopping many young farmers from entering in farming. As one interviewee explained his vision:

I want farming to be something [the future generations] can do without making a tremendous amount of sacrifices compared to other Americans in terms of how much they work and how much they get paid for doing the work. A big part of that is land access and land affordability. (Farmer #9)

The study aimed to evaluate challenges for farmers in the study region, and understand if the CSA operation had any impact on the affordability or accessibility of land for farmers. In the study area, 79% of CSA farmers owned some or all the land they farmed, while 21% owned none. These findings are consistent with earlier studies of CSA farms, reporting 73% and 79% ownership rates, respectively, and are in line with USDA averages for all farms (Lass et al. 2003; Strohlic and Shelley 2004). Farmers who were interviewed expressed concern in regards to access to affordable land, with one noting: “The land is very expensive around here. It is not attainable. Even with the programs that help farmers acquire land it is way, way out of our budget” (Farmer #2).

Only 25% of farmers claimed that CSA improved their access to land, yet some farmers expressed:

[CSA] makes it possible for us to grow organically on this land. It makes it so that we can continue to afford leasing land and the landlords can have crops grown on it and are not forced to sell it. (Farmer #14)

While land ownership rates for CSA farms in this study did not differ from USDA averages, interviewees stressed significant concerns over secure long-term tenure rights to the land. Even with limited land needs due the farm’s land intensive strategies, 42% of the CSA farmers, including all of the interviewees who leased-in land, were concerned the farm’s insecure land tenure status may affect the farm's long-term viability. The farmers discussed how ownership, often financially unattainable for them, is not the only

path forward. Rather, farm security relies on “long-term reliable tenure. Other than that, I don’t really care if we own it or lease it” (Farmer #9).

To ensure secure tenure rights, two farms in the study area worked with local land trusts. One farm was able to

reconfigure the ownership arrangement of a lot of the farmland. [The] land trust did a capital campaign and raised a bunch of money so they will buy the real estate and we can pay off our mortgage... in the end we will be paying \$20,000 less per year to the bank than we are currently with the mortgage. Over the years that’s a very significant amount of money. To do that capital campaign, we appealed to our CSA membership particularly. (Farmer #9)

The other farm working with a land trust, Simple Gifts Farm, had the following statement on their website:

We are the stewards of the North Amherst Community Farm (NACF), community-owned land preserved in perpetuity for farming. The non-profit NACF brought us in as farmers to ensure that the land remains an organic community farm, a wildlife corridor, and a place for local residents to enjoy nature and walking trails. We run the farm as an ecological unit, integrating vegetable crops and livestock, and connecting our members with their food supply. (Simple Gifts Farm 2015)

These two accounts of mutual support between environmental advocates in the community and CSA farms highlight the potential role for functional partnerships amongst stakeholders moving forward.

3.5.2 Working Capital

According to principle number three outlined above, CSA is intended to provide a viable alternative to traditional debt financing in agriculture. Traditionally, farmers purchase inputs in the winter, and need access to financial resources to secure their seed, fertilizer, tractors, employees, etc. The time lag between input purchases and harvest

sales entails a high degree of dependency on the availability of credit. To purchase inputs up-front, farmers generally take out operating loans (Harris and Dillard 2009) which leave the farmer indebted to the bank. Once the harvest is sold, farmers must repay the initial principle borrowed plus interest and fees accumulated.

CSA addresses the need for financing seasonal costs by providing the farmer with a source of non-farm equity capital. By receiving cash up-front through the sale of shares of the harvest months prior to planting, the costs of inputs are covered and interest costs on operating capital can be eliminated. Thus, CSA may improve farmer livelihoods through increased profitability and reduction in the risk associated with carrying large debt loads.

To minimize this financial burden, CSA is structured to provide farmers with access to working capital without debt. Rather than the farmer seeking loans from a bank, members provide the necessary working capital for the season *interest-free*. CSA farmers also gain a great deal of financial security “by selling directly to members who have provided the farmer with working capital in advance” (Farmer #1), and therefore the farm knows what their income is prior to the season.

One farmer explained how significant this was for their operation:

one of the big things about CSA is that it redistributes the timing of that income from the end of the season to the beginning so we get by without loans. It’s better for the farm. (Farmer #2)

By being in debt to their members rather than to a financial institution, the farmer can experience a difficult growing season and remain debt-free, though member retention could be compromised. This working relationship with members relieves the farmer from

dependence on financial markets and government programs, providing the farmer with the opportunity to gain greater autonomy.

Evidence from the interviews and surveys strived to understand if the CSA model provided farms with the necessary working capital for the season, thus reducing the reliance of the farm on financial institutions. The results overwhelmingly revealed the important role of CSA in providing farms with the necessary working capital. Farmers discussed how the up-front payments are “a big help” (Farmer #6), while others noted, “the cash flow makes it possible for us to be viable” (Farmer #8).

The vast majority of farmers in the study, 94%, said CSA helped in financing the farming operation. A younger farmer explained “I’d have to take out a large loan to pay for everything” (Farmer #7) without CSA. Despite the financial support from members prior to the growing season, two farmers continued to take out operating loans. One of these farmers mentioned, “since we started the CSA we haven’t had to do that [take out loans] as much” (Farmer #15). Overall in the study area CSA greatly reduced farm reliance on loans, which may bolster financial security and peace of mind. Additionally, this initial support by the community makes “CSA seem like a great model for people who are just getting started and don't have much capital yet” (Farmer #15) and therefore may reduce barriers to entry into farming.

3.5.3 Reliable and Adequate Income

According to principle number two above, CSA aims to provide farmers with a living wage. The model does not rely on the charity of the farmer, providing food to the community for mere pennies, but posits that all CSA farmers deserve dignity through

being paid a living wage for their work. This is a clear rejection of the cheap food policies championed in the United States. In addition to a living wage, the nature of CSA provides farmers with vital information about the magnitude and timing of their income in advance of the season, thus reducing much of the uncertainty that is inherent to farming.

Contrary to the founding principles, the study largely found that CSA farmers were not earning an adequate income. Eight-one percent of farmers responded that their full-time farming activities were not securing them a living wage. One of the few farmers who perceived their compensation as adequate (19%) stressed that this was only because of “this great place that my father had started. It was such an amazing opportunity to have all the tools, and the land” (Farmer #6). For the majority of farmers struggling to make ends meet, one interviewee summarized it well in response to the question of earning a living wage, stating, “*Farming is labor of love. You never ever make the amount of hours that you put into it.*” (Farmer #15)

A summary of key findings from the survey is presented in table one below. These summary statistics provide insight into how the farm and farmer(s) are fairing.

Table 3.1: Key Farm Variables From Sample			
	Mean Value	Min	Max
Gross Farm Income	\$85,346.15	\$8,500.00	\$300,000.00
Net Farm Income	\$12,044.00	(\$1,800.00)	\$27,000.00
Total Farm Acres	28.20	2.0	135
Acres of Cropland in Operation	8.84	0.75	30
Acres Devoted to CSA	7.00	0.75	17
Main Season Shares Sold	71.96	7.0	215
Ideal Number of Shares Sold	106.14	10	400
Price per Share	461.21	200	675
Duration of Share (in weeks)	21.07	18	24
Farms with Crop Insurance	0.00	0.00	0.00
Land Tenure is a Concern for Farmer	40%	0.00	1.0
Risk of the Farm was Shared with Members	73%	0.00	1.0
Observations	16		

While gross farm income averaged \$85,346 in the study area, net farm income was only \$12,044. Certainly that can't provide a living wage, but it is vital to understand CSA statistics through comparisons with other farms. We observe that the CSA farmers in the study region earned an average of 377.5% more *on the farm* than the national average. Additionally, median farm income of CSA farms interviewed was \$1,280 above that reported by the USDA¹⁶ (2014).

¹⁶ For the above results, farms in the study area are compared to farms in the 2012 USDA Census whom are classified as principal farm operator – intermediate farms. This means the farmer's primary job is farming and the farm earns less than \$350,000 in gross cash farm income. All farms in the study area meet these criteria as well.

Variable	CSA Study Region, Median	CSA Lass et al. Median
Gross Farm Income	\$23,500.00	\$32,081.67
Net Farm Income	\$12,000.00	\$21,117.76
Total Farm Acres	11.00	15.00
Acres of Cropland in Operation	3.75	7.00
Acres Devoted to CSA	3.00	3.00
Main Season Shares Sold	31.00	56.20
Price per Share	\$462.50	\$573.46
Duration of Share (in weeks)	21.0	24.0
Years Farm in Operation	5.0	5.0
Principal Operator Age	46.5	44.0
Principal Operator Years Exp	13.0	10.0

Author's notes: Dollar figures from Lass et al. were converted in 2014 dollars for comparison with the figures from the study.

In the above table, I compare farms in the study area to the only National CSA study, conducted by Lass et al. (2003). These findings indicate that the farms in the study area are similar to CSA farms across the country. The farms in Lass et al. are slightly larger, have slightly higher share price, and have higher gross and net farm sales. While there is variation in the size of the farm, farm operators have many similarities. For instance, farmers in both of these CSA studies are about fifteen years younger than the average for all farmers across the country, and have about fifteen years less experience. Farms across both studies also grew a similar number of different crops, and tended to report growing with organic methods, but opting out of the certification process. The data from this and previous studies indicate that operating a CSA may indeed assist farmers in earning a higher farm income. However, average income earned on the farm is far from providing a living wage and may result in farm exit regardless of the existence of CSA.

Despite the significant income challenges they face, CSA farms continue to crop up across the nation, with no clear slowdown in sight. Income, although vital to farm survival, is only one aspect of the compensation and overall lifestyle that comes with operating a CSA. One farmer shook off the low monetary compensation, mentioning that people “wouldn’t be in this business if you just wanted to make money” (Farmer 8). Another explained, “My wage is my health insurance, my truck, the gas, clothes, and food. That’s my wage.” (Farmer #7) Another farmer stated,

Money is not very motivating to me. I do it because I want to be outside and work with people...As long as that’s there and I can eat and live here, I don’t care what I get paid. (Farmer #1)

Other non-monetary rewards included autonomy on the farm, seeing their labor come to fruition, the opportunity to work the land, the unlimited supply of healthy food during the season, joy received from feeding the community and loved ones, and the rewards of educating future farmers. The non-monetary aspect of farmer compensation may be a critical reason for entry and continuation for CSA farmers.

Beyond the non-monetary compensation, farmers also received a guaranteed market for their produce, and thus a guaranteed income stream. CSA farmers noted that they had a fair idea of what their income would be for the season ahead, providing them with some degree of security and the ability to plan accordingly. This was only true for the CSA portion of the farm, and since 88% of farms in the study area sold produce outside the CSA, significant income uncertainty remained.

3.5.4 Risk Hedging

Within the study area, questions about sharing the risk of the *season*, in other words, what was harvested that year, with members produced a wide range of responses, indicating significant variation exists between CSA farms. One farmer explained, “The way we work, we [farmers] bear the risk.” (Farmer #5) This farmer was not comfortable with putting all the risk on the members, and felt obliged to provide for their members. Another explained, “When people sign up, we tell them that they are assuming the risk” (Farmer #13), which provides essential support to the farm for the duration of the season.

In the study area, over two-thirds of farmers believed they shared risk with members, but none viewed the members as taking on all the risk. Different forms of risk sharing with members were exhibited. One farmer explained: “the original idea is that the customer is sharing the risk...But in our case, the customers [are] sharing the risk in terms of what they are going to get.” (Farmer #16) Another explained, “we split it [the risk] about 50-50 and they are told up front that if there is a crop failure that they take the risk as well as the farmer.” (Farmer #10)

Sharing the risk of the season with farmers may provide members with a sense of satisfaction through supporting their community farm with a needed form of insurance.

One farmer provided a vivid example of risk sharing:

It's easy for people to agree to it [risk-sharing] in theory...but it was really put to the test three years ago now. Hurricane Irene came though and pretty much obliterated everything we had. I mean our entire crop field was under water. (Farmer #10)

The farmer, aware of an impending storm, discussed how they “put the word out to members and tons of people showed up and helped us do this mass harvest of

everything we could possibly get out of the field.” Once the storm hit, the fields were lost for the season, putting the member-farmer relationship to the test. In response to the disaster, the farm “accepted donations from other farms,” showing the strength of the local farm community during crisis.

The true challenge lay ahead as the farmer was unsure if members would stick by the farm and understand that disasters such as these were part of farming. “It was interesting...absolutely everyone was very understanding.” However, the flood certainly stirred some angst amongst members, as evidenced by the fact that “next year we actually had our biggest drop in membership.” But, “that said, there are so many people that have really been steadfast.” Despite the disaster the farm quickly recovered and was back to full membership within one year. Although this provided a good example of how CSA supports farmers who do not have other risk-hedging mechanisms, the farmer expressed some frustration, stating, “I mean it is great on the one hand, and on the other I do not always want to have our hand out to the community.” (Farmer #10)

While 73% of farmers thought spreading the risk of the season was achieved, no farmers believed the risk of *the farm* itself was shared with the members. That lies squarely on the farmers' shoulders. While principle five clearly outlines the risk of the farm is shared, implying a long-term relationship between the community and farm, the results strongly reject this claim. Instead, short-term risk hedging strategies were achieved through sharing the risk burden with members during the season, but members were not tied to the long run well-being of the farm or farmer(s) as strongly implied by the literature.

Other forms of risk management are also crucial to CSA farm viability. Rather than relying on a small handful of crops, farmers rely on crop diversity to minimize the risk of the farm. This high level of diversification also facilitates long-term crop rotation, which reduces the risk of crop failure. Crop rotation reduces the risk of competition from weeds and diseases vectored and compounded by plant pathogens, nematodes, fungi and insects. (Magdoff and Van Es 2000). While this high level of diversity is by no means unique to CSA, the structure of CSA can greatly reduce the transaction cost associated with the harvesting and sale of produce for farmers that engage in high-diversity agriculture.

The interviews demonstrated that farmers in the study area indeed used crop diversification as a risk-hedging strategy. Farmers grew an average of 38 different crops and an astonishing 115 varieties. As one farmer explained, “We hedge our bets by diversifying.” (Farmer #6) This diversification not only reduces the impact, for instance, of blight, but also has tremendous environmental benefits according to the farmers. Farmers discussed how the biodiversity improved organic matter in the soil, reduced pest infestations, allowing for a reduction in applied external inputs, improved water retention, and sustained the soil. Crop diversity allows farmers to give members “a general list of crops” they may receive during the season. But the farmers make it clear that “there’s no guarantee that you’re going to get any one of those crops because they [members] have to account for crop failure.” (Farmer #3)

3.6 Discussion

A key element of civic agriculture and models such as CSA is to ensure fair and adequate livelihoods for farmers. Understanding farmer livelihoods is challenging, but the chapter provides first hand accounts from farmers discussing how they manage their challenges in accessing land, handling low wages, and managing the inherently risky aspects of farming. CSA farms cannot be expected to overcome all the challenges that face the modern U.S. farmer. CSA cannot be expected to fix the gross inequalities that are inherent to our current system – ones that lead among other things to problems of inadequate food access. But in this chapter, CSA farmers have discussed how the structure of the CSA arrangement is helping to improve their livelihoods.

CSA is incrementally improving farmer livelihoods through the provision of working capital to the farmer. This cash flow, supported by their community members, made it possible for many of the farmers in the study to keep working the land and promoted access to farming by reducing financial barriers to entry. While the number of farms and farmers across the U.S. continues to decline (USDA NASS 2014), CSA farms and farmers are booming. More empirical work is needed to understand what aspects of CSA are attracting new and young farm entrants, but farmers in the study area were clear that the reduction, and in some cases elimination, of farmer reliance on financial institutions directly enhanced their profitability, ability to farm, and livelihoods.

In the interviews, farmers focused on the adequacy of income to meet their basic needs and reliability of the income CSA provided. In general, non-CSA farmers grow one, or at most a handful of commodity crops, which they typically sell all at once post-harvest. Since CSA farmers sell shares of the harvest in advance, they know what their

income will be (at least the portion generated by the CSA portion of their farm). This guaranteed income seemed to put much of the farmer's worries to rest.

But were the incomes adequate? As discussed above, incomes fall far short of median wages in the U.S., although mean and median CSA farmer income substantially exceed those for all U.S. farms. These findings are promising, especially in light of the fact that non-CSA farmers rely on agricultural subsidies for a significant portion of their income (Peterson 2009), yet these subsidies were virtually non-existent for CSA farmers. Two primary concerns farmers raised pertaining to income were market concentration and falling prices. While limited data on both issues exist, some farmers discussed how they struggled to sell all of their CSA shares, and thus had to rely on farmers' markets or wholesale. Farmers in the study stated that share prices today are on average less than half what early CSA were able to charge. Building on synergistic relationships between CSA farms and regional consumers through government support (Beckie et al. 2012) could have a modest, yet positive impact on farmers bottom line.

CSA appears to be helping farmers achieve improved livelihoods, providing them with higher incomes and a viable path to hedge risk. CSA and other forms of civic agriculture promote economic development in ways commodity agriculture cannot (Lyson and Guptill 2004). Both the financial and non-market forms of compensation to CSA farmers are vital to their livelihoods. They are opting into farming, not being forced into it. The CSA model is opening doors by offering a structure where farmers can obtain a livelihood, though financially meager, on small, diversified farms.

3.7 Conclusion

Many hopes are being placed on CSA farms in the journey to develop a more sustainable agriculture system. In this chapter I explore the potential of CSA farms to provide viable livelihoods for farmers – in their own words. To summarize, I found that CSA farmers in the study area had higher gross and net farm incomes than non-CSA farms across the country and in the study region. While this was far below median income in the United States, farmers themselves described the added benefits that come with CSA farming, and AFNs in general, including: community building, ecosystem services, food provision and education.

This chapter has made a first attempt at analyzing CSA farmer livelihoods in the farmers' own words through analyzing interviews and questionnaires in the Pioneer Valley of Massachusetts. Much future work is needed to understand better the ability of CSA and other AFNs to provide opportunities for fair and equitable farmer livelihoods. Since this study was relatively small in size, and located in a hub of local food and CSA activity, it may offer a better-than-average case scenario. To expand the study, a CSA farmer survey, similar to what Lass et al. conducted over a decade ago is needed. While the USDA Census of Agriculture provides some statistics on CSA farms, the data cannot get at questions of farmer livelihoods beyond net farm income. A national study to observe regional variation in net farm income and CSA viability would be beneficial to policymakers and farmers. Given that this chapter was trying to unpack farmer income in the farmers' own views, the in-depth interviews in a single geographical location was in order. Moving forward, if CSA farms are to play a role in a transition to a more

sustainable food economy, improving farmer livelihoods needs to be central to the discussion.

CHAPTER 4

CONCLUSION

This dissertation has presented three essays on government intervention and planning in the economy and environment. In the first chapter, I use household-level data from Ethiopia to investigate the inverse relationship between farm size and yield. The findings show that the inverse relationship between farm size and yield holds in the Ethiopian context, indicating that small farms are able to use land more intensively, or efficiently, as some would argue, in terms of land productivity. Furthermore, I investigate the role of having multiple plots on production and find that having more plots, holding land size constant, is positively correlated with total production of the farm household. In other words, fragmentation is not necessarily a bad thing. This is an instance of government planning at the local level, by the peasant associations, increasing yields with given resources. The policy implications of these findings are then discussed. Further studies should focus on investigating causality concerning the mechanisms involved. Additionally, the chapter should be informative to policymakers at the World Bank and within the Ethiopian government. Ethiopia is quickly moving towards a large-scale agriculture strategy – engaging in widespread support of foreign investment in land acquisitions. The data and models presented here indicate that small farmers have an advantage in terms of land productivity, thus perhaps the government should look higher up the value-chain to consider where consolidation may benefit the country.

The second chapter makes a contribution to the environmental planning and management literature by constructing a conceptual framework that presents the ‘fit’ between top-down policies and the local-level context as comprised of three components:

Receptivity, Ease of Participation, and Design. I explain how these components and their interactions influence local-level action. This analysis points to how careful consideration of the components of ‘fit’ may lead to greater local-level uptake of top-down adaptation policies across environmental planning and management.

In the third chapter, I study a relatively new and growing model of agricultural production and distribution – Community Supported Agriculture (CSA). While early pioneers of the model attempted to tie prices directly to farmer livelihoods, I find that farmer livelihoods are not being met under current conditions. Although the CSA model performs better than average farms across the country in terms of net farm sales and net farm income, this has not proven sufficient to provide a living wage for the farmer. Nevertheless, the model continues to grow in popularity amongst farmers and consumers alike. Future work should investigate the reasons for the influx of young farmers into CSA farming despite poor livelihood outcomes, as well as how farmer livelihoods in CSA can be enhanced. In terms of planning, the farmers continue to reject a certification process, as occurred in organic agriculture, largely out of the concern that certification will replace process, thus diminishing the model and allowing for conventionalization of the CSA.

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