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COERCED AGRICULTURAL MODERNIZATION: A POLITICAL ECOLOGY PERSPECTIVE OF AGRICULTURAL INPUT PACKAGES IN SOUTH WOLLO, ETHIOPIA

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ABSTRACT

To address systemic malnutrition, food insecurity, and a need to manage natural resources sustainably, within the context of an agricultural economy, the Ethiopian government has invested more than 15% of the national development budget in agriculture programs as part of the Agriculture Development Led Industrialization (ADLI) plan (MARD 2010; Berhanu and Poulton 2014). This paper explores one such program – row plating of Eragrostis tef (tef). Tef is an important staple crop, with critical nutrient content for child growth and development (Stallknecht et al. 1993). Despite the use of demonstration plots and input packages, adoption of tef row planting in the study region, South Wollo, is minimal. This paper uses a political ecology framework to provide historical context to this issue of non-adoption; as well as, a much needed critique of current innovation programs from the point of view of those most marginalized by modernization efforts. Using a mixed methods approach, this study found farmers' relationship with the agricultural knowledge and information system was built on uneven power relationships and coercion was often used to elicit farmers' purchase of the necessary inputs to utilize row planting, increasing farmers' distrust in the system. Additionally, high-interest loans and a perceived negative impact of fertilizer on tef plants contributed to further distrust and conflict of interest for extension agents. This uneven power structure and coercion has contributed to farmers' gradual shift from cereal production to a cash crop-based production system.

The Ethiopian economy relies heavily on agricultural production. Forty-five percent of gross domestic product and 90% of exports consist of agricultural outputs (Feed the Future 2013). Yet, 30% of the population is living below the national poverty line, 44% of children less than five suffer from stunting, and child undernutrition rates are among the highest in the world – contributing to more than 50% of infant and child deaths in Ethiopia (Feed the Future 2013). This paradox if felt acutely in the Amhara region, and the South Wollo Zone in particular. South Wollo, a region known as the "famine belt" of Ethiopia, where landing holdings are so small they are termed "starvation plots," is a place where population growth, increasing rain unpredictability, floods, drought, and extreme poverty create the perfect storm for systemic malnutrition and food insecurity (Little et al. 2002, 2004, 2006; Rosell and Homer 2007; Rosell 2011).

In response to this pressure, Ethiopian farmers continue to increase the land put into production annually (Dercon and Hill 2009). This expansion process means more marginal lands, which are not ideal or even appropriate for agricultural

production, are being farmed, essentially degrading Ethiopia's natural resource base by accelerating soil and land degradation (Awulachew et al. 2007; FAO 2003). A deteriorating natural resource base limits smallholder abilities to be effective producers and confines future options for intensification. Additionally, at an aggregate level this deterioration hinders national efforts toward agricultural led economic development (Dar and Twomlow 2007; Davis et al. 2012).

Push for Agricultural Modernization

To address systemic malnutrition, food insecurity, and a need to manage natural resources sustainably, within the context of an agricultural economy, the national government has invested more than 15% of the national development budget to agriculture as part of the Agriculture Development Led Industrialization (ADLI) plan (Berhanu and Poulton 2014; MARD 2010). There are several new programs, implemented as part of the ADLI plan, designed to 'modernize' subsistence agriculture by scaling-up technical innovations and sustainable management practices to improve yields, which includes a large effort to increase input use (Vandercasteelen et al. 2013).

This paper explores one such program—the promotion of row plating of Eragrostis tef (tef). Tef is an important staple crop, with yields substantially lower than other cereals grown in Ethiopia. However, tef is an important contributor to nutrition in Ethiopia with relatively high iron, protein, and micronutrient levels important in child growth and development (Stallknecht et al. 1993). Traditionally, tef, as with many other crops in Ethiopia, is sewn using a hand broadcast method that is highly inefficient about seed use and distribution, and typically produces much lower yields than alternative methods, particularly row planting (ATA 2013a). Row planting allows for correct and predictable seed rates and seedling space, which allows for easier weeding and efficient fertilizer application, and consequently improve yields (ATA 2013a). In controlled experimental settings yield increases have been as high as 100%, but more conservative on-farm estimates are around 2-12% (ATA 2013b; Engeda and Benson 2013; IFPRI 2013). It is important to note that in this study area farmers are sowing seeds directly into rows in the field they will harvest from, rather than row seeding tef in nurseries and then transplanting into rows in the field, as with other interventions.

Information on tef row planting is part of an input package system promoted by the Ethiopian Agricultural Transformation Agency (ATA) and extension agents. These input packages include fertilizer, to be purchased by the farmer, and information on techniques related to row planting, provided freely by extension. These techniques, ideally, allow for increased yield and efficient application of the fertilizer. Despite the use of demonstration plots, delivery of input packages, more participatory approaches in the National Agricultural Extension Intervention

Program (NAEIP), and empirical evidence that these methods increase yields, extension has failed to achieve widespread adoption of, new agricultural practices, including tef row planting (ATA 2013a, 2013b; Gebremedhin, Hoekstra, and Tegene 2006).

Potential Barriers to Adoption

Though there are several explanations for non-adoption, this paper focuses on the socio-political aspects of input packages, with an emphasis on farmer perceptions of delivery and implementation. The tef row planting input package, stipulates that farmers purchase the necessary inputs to compliment the new management practice. A major tenet of row planting is that the reduced seed rate allows for more space to efficiently apply inorganic fertilizers that will boost yields. However, fertilizer purchase and use in Ethiopia is minimal, and in some regions less than 40% of farmers purchase and apply fertilizer (Assefa et al. 2008; Negatu and Parikh 1999). In this specific region of South Wollo, fertilizer use has been documented at 59% (Cafer et al. 2015). However, farmers often complain the cost of fertilizer is too high (Cafer et al. 2015). Highland farmers, who only grow for household consumption and do not sell their product at market, are increasingly seeking other money making activities (paid labor, cash crop production) to pay for these types of expenses related to production (Assefa et al. 2008; Wale et al. 2006). Despite farmers' resistance to the purchase and use of fertilizers, extension in this region continues to press forward with agricultural modernization as outlined by ADLI. This paper uses a political ecology framework to provide historical context to this tension between farmers and the AKIS in this region; as well as, a much needed critique of current modernization efforts from the point of view of those most marginalized by modernization efforts.

A POLITICAL ECOLOGY PERSPECTIVE ON AGRICULTURAL MODERNIZATION

Among leaders in the international development community the explanation for this failure of farmers to adopt new technologies, has been tied, almost exclusively, to improper economic incentives. Especially a failure of input packages to convince farmers to financially invest in these practices on a systematic level. However, from a political ecology perspective, this dominant discourse, which relies almost exclusively on economic incentives and their role in adoption prevention, has failed to incorporate the political tensions between smallholders and regional governments and minimalized the historic marginalization of smallholder farmers in Ethiopia, particularly by extension and the agricultural development machine.

Political ecology is a multidisciplinary framework that provides intellectual tools necessary to integrate concepts of political economy and ecological analysis (Greenberg and Park 1994). The traditional link between power relationships and

agricultural productivity are augmented by a broader contextualization of the natural environment within which those relationships and productive activities take place (Greenberg and Park 1994). Robbins (2004) uses two metaphors that aptly characterize the goals of political ecology: the hatchet and the seed. The hatchet refers the use of political ecology to serve as a critique of dominant development discourse (Robbins 2004). Political ecology as a critique calls into question a historic dialogue that has removed issues of power, economic exploitation, political forces and subsequent marginalization from conversations on natural systems, in particular environmental degradation (Robbins 2004). Dominant discourse depicts environmental degradation as an inevitable phenomenon of ill-educated farmers or dysfunctional local communities, with no reference to the displacement or marginalization of previous caretakers of the environment (indigenous groups, native peoples, rural communities) and willfully negates the impact and role of powerful entities (industry, governments, urban populations) on the displacement of these marginalized groups and the degradation of the ecological system (Robbins 2004).

The seed refers to the ability of political ecology to serve as an avenue for understanding how marginalized populations cope with endogenous and exogenous drivers of environmental degradation and natural resource appropriation, with particular reference to the dominant system within which they operate (Peet and Watts 1996; Robbins 2004). The seed aspect of political ecology draws on the importance of cultural adaptation to environmental change (Walker 2005; Wolf 1972).

The Hatchet and the Seed – In Ethiopia

Extension (the hatchet). Extension in Ethiopia, from its inception in the 1950s, has been a top-down process of information and technology dissemination to farmers from extension agents and researchers housed in national educational institutions, such as Alemaya University (Egziabher et al. 2013; Gebremedhin et al. 2006, 2009). Later, during the Derg period, Ethiopians saw the implementation of extension services as a mechanism for collectivist reform and later as a tool of political control (Spielman et al. 2012).

These centralized top-down approaches, despite improvements in agricultural technologies coming out of the green revolution, hindered realizations of the potential agricultural innovations in Ethiopia (Egziabher et al. 2013; Rivera 1997, 2001). This failure, though not necessarily a reflection of the technology itself, but of the poorly conceptualized implementation and political turmoil, has prevented Ethiopian agriculture from keeping up with population growth and ultimately contributed to increased food insecurity in rural areas. Additionally, extension's focus on large, resource rich farmers and marginalization of the most vulnerable

farmers, has further increased the exposure of the most vulnerable households to food insecurity (Aredo 1990; Assefa et al. 2008; Belay and Abebaw 2004; Egziabher et al. 2013). In light of this failure and in an effort to extend the EPRDF's reach, Ethiopia has expanded its extension system significantly – it now spends more than 2% of agricultural GDP (Spielman et al. 2010). This system consists of more than 60,000 diploma holding extension agents who work with communities through more than 10,000 farmer training centers (FTCs), funded by local agricultural offices (ATA 2013; Gebremedhin et al. 2006). With the expansion of agricultural technical and vocational education and training (ATVET) colleges each village houses three extension agents (Gebremedhin et al. 2009). This growth in extension infrastructure and personnel is unparalleled in the developing world; with 60,000 agents, Ethiopia's extension personnel make up nearly 40% of extension workers in Sub-Saharan Africa (Berhanu and Poulton 2014; Davis et al. 2010).

The newly expanded extension system is driven by a national and international agenda focused on economic incentivization, commodity production, and internationally defined nutrition goals – all couched within the dominant discourse focused on food security, export markets, and agricultural industrialization (Berhanu and Poulton 2014; Ethiopian Economics Association, 2005). To accomplish these goals, extension relies on the Extension Management and Training Plots model and input packages, in conjunction with farmer training centers, cooperatives, and NGOs. In this model farmers and extension agents manage community level demonstration plots as education tools for the village and extension agents make input packages that include information on a specific agricultural technology or practice, the necessary inputs, and credit to support their adoption, available to village farmers (Alemu and Demese 2005; Ibrahim 2004; Planel 2014). Cooperatives and NGOs often assist in helping farmers' access inputs at a reduced cost or lower interest rates on credit.

As the purveyors of input packages, extension agents often see themselves as little more than fertilizer and credit distributors, rather than extension specialists (Spielman et al. 2012). Additionally, as extension agents are also charged to serve in the capacity of debt collectors for farmers who have borrowed to purchase and use capital intensive inputs, tensions between the government endorsed extension and farmers have increased as the power relations shift from knowledge exchange to creditor/debtor (Belay 2002; Spielman et al. 2012). To succeed in this role as creditor, extension often focuses on wealthier, party-affiliated, farmers rather than resource poor farmers; and, since extension agents are responsible for selecting participants for on-farm demonstrations and participation in extension activities, the impact on and participation of the most vulnerable farmers is likely to be more minimal (Assefa et al 2008; Belay and Abebaw 2004). To understand the power extension agents have in their role as input suppliers, understanding how they are

selected and ultimately function within the local governance system is important. Though applicants for extension training are required to meet minimum educational and testing requirements, affiliation with the political party in power, EPRDF, is an important selection criterion (Berhanu and Poulton 2014). Once these applicants have successfully completed the program they are assigned by the state to a district (kebele, village level) (e.g., Amhara, Oromo, Gambella, etc.). After being assigned to a *kebele*, an extension agent, usually the one with expertise in crop production, is assigned by the *kebele* Council, which also selects the members of the *kebele* governing body, the Cabinet, to serve on the Cabinet (Berhanu and Poulton 2014). The Cabinet is responsible for local planning, including land assignments, mobilization, service provision (i.e., food aid distribution), and security (Berhanu and Poulton 2015; Interview with local PSNP Officer, January 29th, 2015). This appointment to the Council makes extension workers important decision makers within the community, which has potentially severe consequences for smallholder farmers, whose relationship with the extension agent may have costs far beyond the specifics of a particular farm practice (Spielman et al. 2011).

To enforce policies at the local level there is a kebele Committee. This Committee is called by local farmers the "1-5 (Interview with Kebele head, January 19th, 2015)." This "1-5" organization consists of one coordinator and four other members, who are responsible for handling issues related to household disputes, "disruptive behavior," and politics (Interview with Kebele head, January 19th, 2015). In reality this governance structure is in place to ensure election of EPRDF party members to positions of power, restrict access to productive land, credit services, food aid, and agricultural inputs to farmers as a mechanism for social and political control in areas traditionally friendly to opposition (Berhanu and Poulton 2014; Dessalegn 2012; Abegaz 2011; Gudina 2003).

Farmers (the seed). Farmers are at the front lines of a conflict between the national and international agendas on agricultural led industrialization and the uncertainty of producing under climate change-induced volatility intensified by a politically charged environment. Furthermore, smallholders' historical exclusion from sources of power, displacement from their land, and dismissal by the AKIS, have created a pervasive distrust of government-sponsored programs within highland communities and stunted smallholders' ability to access information on agricultural innovation or practices. This marginalization has ultimately contributed to the demise of each of Ethiopia's subsequent regimes, and is perhaps why the current Government, comprised (99.5%) of EPRDF party members, has increased their presence in rural communities via extension (Berhanu and Poulton 2014).

As a result, Ethiopian smallholders in this region have developed several adaptive strategies to mitigate the uncertainty of small scale agricultural production

under climate change and political marginalization. These farmers continue to increase the land put into production, diversify production, migrate for labor, develop social networks around inputs necessary for production (e.g., seeds, see McGuire 2008); thereby subverting government or government associated retailers, and convert significant parts of their plots to cash crop production that provides them the financial means to purchase capital intensive inputs (based on data from World Bank 2013).

Two of these approaches have important implications for the quality of the highland natural resource base. Extensification has resulted in the crop farming of marginalized lands, which are not ideal or even appropriate for agricultural production, further taxing Ethiopia's natural resource base and placing smallholders in an even more precarious situation in terms of their ecological environment (Awulachew et al. 2007; FAO 2003). Additionally, there has been an increase in the conversion to cash crop production such as *Catha edulis* (khat), a water intensive perennial shrub. The land under khat cultivation has increased 160% in the last 15 years, with the second largest gain in khat hectares in the Amhara region with a 252% increase (Cochrane and O'Regan 2016). This bloom of khat production has important implications for sustainable resource use, particularly water.

METHODS

This analysis is based on fieldwork conducted in South Wollo (11°8'N 39°38'E, Fig. 1), Ethiopia, from December 2014 to March 2015. South Wollo is located in the south east corridor of the Amhara region in northern Ethiopia. A total of three villages in three *woredas*, (Dessie Zuria, Dessie Ketema, Tehuledere) were visited. The study included one highland village (Boru Seyu) and two midland villages (Amemo, Kuty).

This study utilized a mixed method approach, which is particularly useful in helping mitigate the influences of biases of any one particular method and improving the overall validity (Campbell and Fiske 1959; Cook 1985; Denzin 1978; Greene et al. 1989; Webb et al. 1966). Mixed methods research has been critical to the investigation of technology adoption. The blending of quantitative and qualitative methods allows for a more holistic approach necessary to delineate the relationship between a broad range of actors and influences in smallholder systems (Biggs 1990; Biggs and Clay 1981; Chambers and Jiggins 1987; Hall et al. 2001). A combination of semi-structured questionnaires, in-depth interviews, and focus groups were used for this study and are designed to work together in a way that provides clarification and better interpretability of data collected by each instrument (Green et al. 1989; Mark and Shotland 1987). In total 115 households are included in the study and interviews were conducted with five extension officers

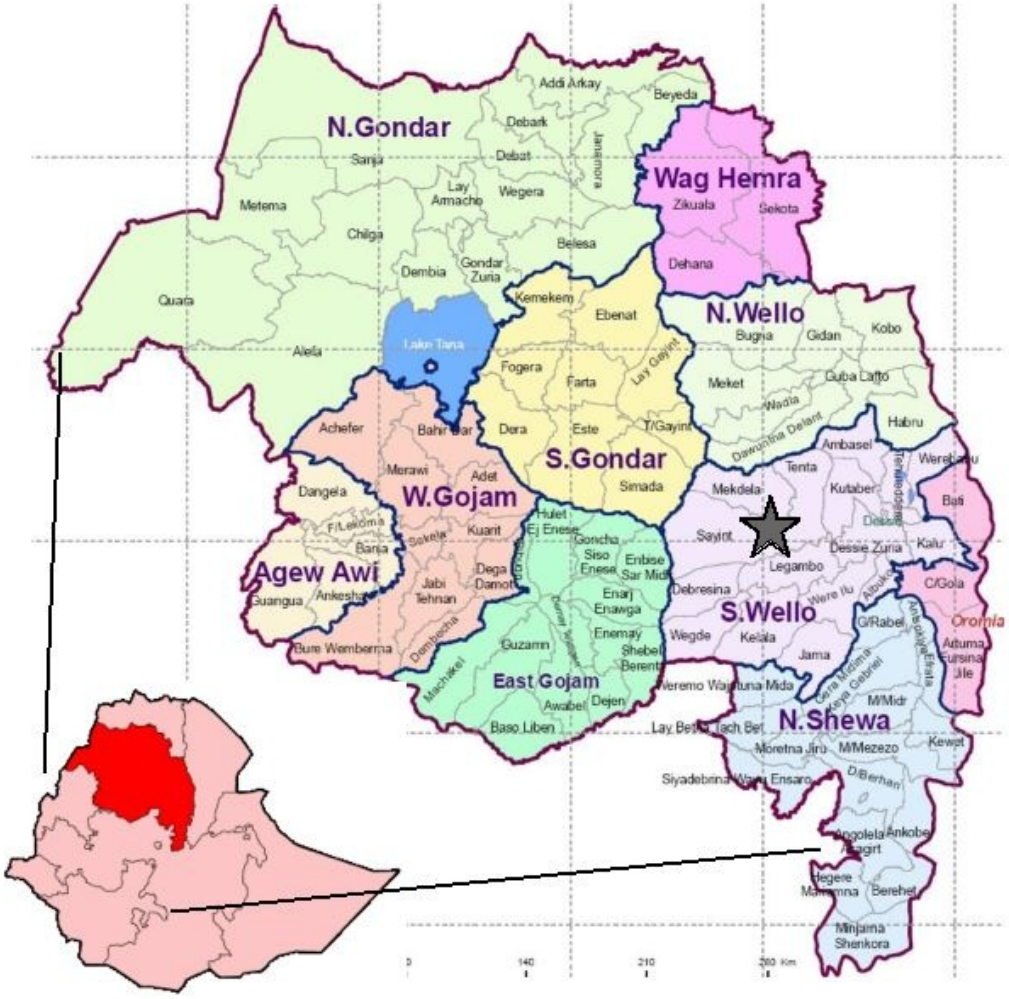

FIGURE 1. MAP OF ADMINISTRATIVE ZONES, AMHARA STATE

(also known as development agents or development officers), two extension administrators for the South Wollo Zone, one faculty administrator from the local agricultural university, one Productive Safety Net Program (PSNP) officer, and one *kebele* administrator. Qualitative data was analyzed through thematic coding.

A stratified sample based on agroecological context and production types (household production based vs. cash crop production) was utilized to determine which villages would be included. Within each village farmers were selected using accessibility sampling. All data collectors were from the study area and familiar with the study population and culture of South Wollo.

Qualitative Instrument

A mix of both in-depth interviews and focus group interviews were used to delineate reasons for adoption or non-adoption. Farmers not using row planting were asked, simply, "what are the reasons you do not use row planting when growing tef?" Farmers who did use row planting were asked, "what are the reasons you use row planting when growing tef?" These responses were recorded and transcribed. The transcriptions from these interviews were analyzed using open and axial coding (Table 1).

TABLE 1. RELATED PRODUCTION CHARACTERISTICS

	SAMPLE n = 115	BORU SEYU n = 40	AMEMO n = 22	KUTY n = 53
Total hectares cultivated[1]	0.75	0.94	0.66	0.69
	(0.28)	(0.39)	(0.12)	(0.21)
Tef hectares cultivated.	0.26	0.09	0.33	0.31
	(0.12)	(0.09)	(0.06)	(0.07)
Tef as % of cultivated hectares . .	40.54	10.28	59.52	47.85
Adoption of row planting (%) . . .	13.04	5.00	45.45	5.66
Use of fertilizers (%).	50.43	70.00	95.45	16.98
Average Input Cost (birr)[2].	636.43	470.69	770.00	744.23
	(237.43)	(163.95)	(236.64)	(198.66)

NOTES: [1]Cultivated area refers specifically to food crops, land under cultivation of cash crops (i.e., khat) is not included and is a combined total of area planted in the Belg and Meher growing seasons, which allows for double counting and should not be confused with plot size. [2]Exchange rate as of January 2015 was 0.0459USD = 1 ETB.

Quantitative Instrument

Use of a structured questionnaire allowed for the collection of key demographic and agricultural data as well as information on the relationship between smallholders and extension personnel in each village. For the purposes of this analysis, descriptive statistics are reported (Table 2).

RESULTS

Labor Constraints

Several themes emerged as significant barriers to row planting (Table 2); tediousness, need for additional labor, land, or rather land size was a major issue for farmers, particularly in Boru Seyu. Labor is a particularly important constraint

TABLE 2. REASONS FOR NON-ADOPTION OF TEF ROW PLANTING AMONG FARMERS

THEMES	AXIAL CODES	OPEN CODES	COUNT
Labor	Labor constraints	Too old; not enough help; need to work cooperatively	9
	Tediousness	Tedious; heard it was tedious; time consuming; energy consuming	26
Land	Land size	Smallness of the land; land too small; need at least 2 timod; small farm size	5
	Shared land	Shared land	1
	Land fragmentation	Land fragmentation	5
Market	Debt	Loan for inputs has unbearable interest; tef production only for household consumption – not willing to borrow to purchase input; avoid debt; because not sell at market, unable to repay loan	15
	Resource allocation	Only use irrigation for vegetable (market) production; need irrigation for khat production; prefer to spend labor on income generating activities; uneconomic use for land	21
	Khat	Want to focus on khat production	8
Perceptions	Negative perceptions	Negative attitude toward row planting; believe conspiracy to make farmers more dependent on safety nets	8
Inputs	Input-general	No free seed or fertilizer; input ineffective – wag, selected seed and fertilizer very bad results	1
	Seed	Not using selected seed; seed clumping	3
	Fertilizer	Not use fertilizer because it damages the crop; fertilizer aggravate/cause wag* – refuse to purchase; fertilizer unaffordable; fertilizer bad for soil; use compost instead	21
	Irrigation	(no) irrigation; only just started using irrigation	11

NOTE: *wag is the local term for tef rust, Uromyces eragrostidis

given the additional labor required to plough rows and hand seed rows during a time of high-labor demand. This limits the ability for farmers to plant quickly, which can be devastating as these farmers are incredibly sensitive to agroecological constraints, particularly rainfall. In this region of Ethiopia there has been a documented increase in rain variability over the last two decades (Rosell and Homer 2007). This increased rain variability requires farmers to be able to plant quickly, and farmers noted during focus groups and in-depth interviews that row planting require an additional two to three days, even when labor was available.

The Heavy Cost of Compulsory Modernization

Historically, farmers have not regularly purchased inorganic fertilizer or improved seed in this region. Though improved seed, particularly for wheat is widely used, farmers often save seed from their own production. Few improved varieties of tef exist, and therefore improved tef is not widely used (Assefa et al. 2011). Previous studies reveal that lower purchases of fertilizer may be due to farmers' belief that it is not an appropriate part of their production scheme. Instead they prefer compost and animal litter (Cafer et al. 2015). Though farmers still find fertilizer to be inappropriate in their production practices, the newly expanded agricultural extension has pushed its use extensively.

Extension agents push fertilizer and improved seed as necessary components of a row planting system, and usually extension agents are the exclusive providers of improved seed and fertilizer. This seed and fertilizer are provided by the Government or government affiliated suppliers (Alemu 2012; Berhanu and Poultin 2014). In the South Wollo Zone improved seed is not a compulsory purchase for farmers using row planting. This is due in part to the heavy reliance by most Ethiopians on the informal seed systems and networks, a mechanism for reinforcing social connections and circumventing government management of important agricultural decisions (Alemu 2012). However, fertilizer, if brought to the village by "agricultural experts" (i.e., extension agents) is a compulsory purchase.

> "The government fetches [fertilizer]. It fetches it to the kebele. The kebele distributes it to each village…Of course, we're collecting this one from the government because it's a must" Shimeles (Boru Seyu, February 24, 2015)

> "…the agricultural people/government would like to sell fertilizers to the farmers in order to push them to use row planting…" Tedessa (Kuty, February 5, 2015)

> "It's [referring to fertilizer] compulsory…or else his land will be confiscated….Because [the land] belongs to the government; because

> you've got a land owned by the government. He's afraid of that, [so] he pays" Dejene (Amemo, February 2, 2015)

Farmers who refuse to purchase the fertilizer are threatened with confiscation of their land. Though this threat of confiscation is not a formal law, extension typically shares office space with the local land authorities, and sometimes decides who has access to more productive plots, or for those who do not make the required input purchases, who is relegated to more marginal areas.

The money to be paid for the fertilizer is collected immediately upon its disbursement. This often requires cash-poor farmers to liquidate assets—often smaller livestock, which are used in this region as insurance against shocks such as poor production related to increased rain variability/drought (Little et al. 2004). Often farmers are not producing tef for the market and so will have no potential for monetary return on their investment.

> "It's just like this...by selling sheep…particularly if they oblige us to buy [fertilizer]. One with some wood...[or] like a cow, sells it and pays by obligation…. The fertilizer is an obligation! Boru Seyu focus group (January 24, 2015)

> "We harvest…barely enough for the family, not enough for trade" Temaw (Kuty, February 5, 2015)

> "We would prefer to buy the same fertilizer from the market and some few shops where we find it affordable, [rather] than that of the agricultural/extension people." Adem (Kuty, February 4, 2015)

The extension of credit to increase fertilizer purchases has been a hallmark of the dominant discourse (Holden and Shiferaw 2004). Advocates of this solution proposed that increased grain production would increase household food security and hence a household's overall welfare. To this end, the Organization for the Rehabilitation and Development in Amhara (ORDA) developed the Amhara Credit and Savings Institute (ACSI). ORDA is a local NGO established in response to drought and war in 1991 (Brislin and Dlamini 2006). ACSI is a registered micro finance share company, with the primary mission of improving access to financial services among poor rural people (Brislin and Dlamini 2006). However, the loans for purchasing agricultural inputs secured through this institution have a hefty interest rate of 18 percent. Until recently, farmers also had the option of securing interest free loans from other local and international NGOs (interview with *kebele* administration February 19, 2015 and PSNP personnel January 26, 2015).

However, new policies on the roles and capability of NGOs in Ethiopia have forced many to discontinue services in the country or limit their services. In the Amhara region, particularly around Dessie Town, NGOs operated to provide no-interest loans to farmers. These NGOs were forced out of Dessie leaving farmers the ACSI, associated with local political elite, as the only means of financial refuge. This high interest was one of the top five reasons farmers in the study area refused to adopt new technologies tied to fertilizer purchases.

> "…reserved from borrowing money from the [ACSI] because we know it brings a lot of interest; aware that those already involved are desperate and hopeless, finding themselves unable to repay" Seid (Kuty, February 4, 2015)

> "…there is loan but with unbearable interest. [A]lready loaded with interest we can't cover any time in our life. Government pushed us to be more dependent on the safety nets and provide us some 8000 birr" Kedege (Kuty, February 5, 2015)

A third, and more permanent option for meeting the demands for purchasing expensive inputs is a shift, or at least a partial shift, to cash crop production. In this region, several farmers have focused attention on the production of *khat* sold as a legal narcotic in the local urban market town of Dessie. Though traditionally used in a variety of religious ceremonies, khat has seen a marked increase in recreational use, and is consistently one of Ethiopia's top five exports. This plant requires a great deal of irrigation, but is also an incredibly lucrative crop for smallholders.

The Perceived Dangers of Inputs

> "[We are] not using fertilizer because commonly known it is partially dangerous for tef." Assefa (Kuty, February 5, 2015)

> "[I] tried modern fertilizer but unfortunately I believe it attracted 'wag', [the] red one, and decided not to use it. [I] depend on compost …no side effects." Kedega (Kuty, February 4, 2015)

> "[We] think that fertilizer could aggravate 'wag'…" Kuty focus group (February 4, 2015)

> [I] am not using fertilizer with tef because it kills the plant—first the tef seedling appears to be flourishing; later it collapses and gets unproductive." Dawit (Kuty, February 5, 2015)

Beyond the heavy cost of fertilizer and the associated interest in loans needed to make the purchase, there is an endemic perception that fertilizer causes, or at the very least aggravates a *tef* disease farmers call '*wag*.' Wag is the common term for *tef* rust [*Uromyces eragrostidis*], a fungal infection of *tef* leading to 10-40% yield losses in production (Dawit and Andenew 2005). This was the second most commonly described reason farmers refused to adopt row planting—which they believe or have been taught, requires fertilizer. These responses reflect similar findings from previous work in these villages where farmers often lamented the damage fertilizer did to crops (Cafer et al. 2015). They described the fertilizer as "burning the crop" or "not suitable for their land" or their kind of production, which is mainly rain-fed.

Farmers in the study area explained that in the absence of rain within days of application, fertilizer simply burned the soil and crop and there was a reduction in production for that particular growing season, a finding supported by previous work (Cafer et al. 2015). In support of this finding, many farmers who utilized irrigation, did not offer up the "burning" of crops or soil as a reason for their hesitancy to use fertilizer. Further probing into how fertilizer is used, dispersed on the field, and the rates of application revealed farmers have very little practical knowledge about appropriate amounts of fertilizer to use or rates of application, highlighting critical gaps in extension services.

A POLITICAL PROBLEM IN AN ECOLOGICAL CONTEXT

In the current Ethiopian AKIS, extension has been saddled with the responsibility of increasing purchases of agricultural inputs to modernize smallholder agriculture and improve on-farm performance. This dual role of extension as both a source of agricultural information and agricultural retailer undermines the former duty. Additionally, this dual role combined with the coercive power of extension within local governance culminates in an antagonistic relationship between farmers and extension in two of the three villages surveyed. Threats of land seizure and subsequent indebtedness from input purchases exacerbate the growing problems of poverty, increasing population, and environmental degradation.

Furthermore, this tension also means farmers are unable to communicate their on-farm observations properly to extension and receive the appropriate information. In this sample farmers experienced increases in episodes of *tef* rust, yet there has been very little research on the potential impacts of fertilizer application on *tef* rust and farmers felt as though they were not receiving appropriate current information. In some extreme cases, the manifestation of this tension is farmers' outward appearances of compliance – simply make a show of using the new technology to

keep the extension agents at bay. An enumerator made a noteworthy observation of farmer behavior and with further probing established:

> "They are using row planting on a much smaller piece of land only to avoid being detected by the government people and labeled as trouble makers; instead, they are using broadcasting much more regularly and on a much bigger piece of land." Eyob Gebremehdin (February 4, Kuty field visit)

This ultimately reduces the likelihood of adoption of sustainable intensification practices meant to mitigate the rapidly degrading natural resource base in Ethiopia, and in many ways limits farmers' abilities or desires to invest in their land or innovate.

CONCLUSION AND RECOMMENDATIONS

This study helps shed light on how a politicized extension system, working with a marginalized population, not only fails to achieve national and international development goals, but promotes active resistance to that system. While the national government and extension system promote agricultural modernization as part of the nation's strategic economic plan, farmers are navigating an increasingly volatile system – environmentally, economically, and politically. As such, production in the Ethiopian highlands is hardly the idyllic agrarian past time portrayed by the government through their national and international media campaigns. Rather, farming has become a life of coerced modernization and shrinking means of production. To support agrarian livelihoods and improve farmer investment, Ethiopia must reconsider their current implementation of agricultural modernization policies and instead consider avenues to more strategically and systematically including smallholders into AKIS.

The first, and perhaps most important recommendation, is that the dual role of the current extension system as information supplier and input retailer be discontinued. Farmers in this sample are more than willing to seek inputs in the market and regional governance should place an emphasis on strengthening these markets in South Wollo. Extension workers should not be extending credit or accepting payment for agricultural inputs. This clearly creates conflicts of interest, and increases farmers' distrust of the system.

The second recommendation is, to support NGO efforts to provide low interest loans to farmers. Currently the ACSI interest rate of 18% forces farmers, who are often not selling their agricultural products in the market, to liquidate other assets to pay back loans used to purchase fertilizer. Liquidating assets increases these households' vulnerability and increases their potential for food insecurity, by reducing their ability to withstand environmental or economic shocks.

Lastly, given the commercial and nutritional importance of tef in Ethiopia, funding priority be given to research on improved tef varieties, with particular regard to tef rust. There should also be an examination of the relationship between fertilizer application and tef rust. Currently there is a significant research gap in developing improved varieties, pest resistance, and agronomic performance (Vandercasteelen et al. 2014).

REFERENCES

Abegaz, Berhanu. 2013. "Political Parties in Business. Rent Seekers, Developmentalists, or Both?" *The Journal of Development Studies* 49(11):1467–83.

Alemu, Dawit. 2012. "The Political Economy of Ethiopian Cereal Seed Systems: State Control, Market Liberalisation and Decentralisation." Future Agricultures Policy Brief 048. Retrieved April 12, 2016 (http://www.future-agricultures.org/policy-engagement/policy-briefs/1529-the-political-economy-of-ethiopian-cereal-seed-systems-1/file).

Alemu, D and C. Demese. 2005. "The National Extension Intervention Program (NIEP) and Sustainable Agricultural Development: An Exploratory Study to Steer the Debate on ADLI. In Reversing Vulnerability of Rural Livelihoods in Ethiopia: Options for Sustainable Development." Proceedings of the 7th Annual Conference of the Agricultural Economics Society of Ethiopia, Addis Ababa, Ethiopia.

Assefa, Kebebew, Sherif Aliye, Getachew Belay, Gizaw Metaferia, Hailu Tefera, and Mark Sorrells. 2011. "Quncho: The First Popular Tef Variety in Ethiopia." *International Journal fo Agricultural Sustainability* 9(1):25–34.

Assefa, Yoseph, Johnnie Van Den Berg, and Des E. Conlong. 2008. "Farmers' perceptions of sugarcane stem borers and farm management practices in the Amhara region of Ethiopia." *International Journal of Pest Management* 54(3):219–26.

Awulachew, Sleshi Bekele, Aster Denekew Yilma, Makonnen Loulseged, Willibald Louiskandl, Mekonnen Ayana, and Tena Alamirew. 2007. "Water Resources and Irrigation Development in Ethiopia." International Water Management Institute, Working Paper No. 123.

Belay, Kassa. 2002. Constraints to Agricultural Extension Work in Ethiopia: The Insiders' View. *South African Journal of Agricultural Extension* 31(1):63–79.

Belay, Kassa and Degnet Abebaw. 2004. "Challenges Facing Agricultural Extension Agents: A Case Study from South-western Ethiopia." *African Development Review* 16(1):139–68.

Berhanu, Kassahun and Colin Poulton. 2014. "The Political Economy of Agricultural Extension Policy in Ethiopia: Economic Growth and Political Control." *Development Policy Review* 32(S2):s197–s213.

Biggs, Stephen. 1990. "A Multiple Source of Innovation Model of Agricultural Research and Technology Promotion." *World Development* 19(11):1481–99.

Biggs, Stephen and Edward Clay. 1981. "Sources of Innovation in Agricultural Technology." *World Development* 9(4):321–36.

Brislin, Neil and Phetsile Dlamini. 2006. *Amhara Credit and Savings Institutions: Ethiopia. USAID AMAP Fianacial Services Knowledge Generation—State Owned Retail Banks*, microReport #58.

Cafer, Anne, Mary Willis, Shimelis Beyene and Marth Mamo. 2015. "Growing Healthy Families: Household Production, Food Security, and Well-Being in South Wollo, Ethiopia" *Culture, Agriculture, Food and Environment* 37(2):63–73.

Campbell, Donald and Donald Fiske. 1959. "Convergent and Discriminant Validation by the Multitrait-Multimethod Matrix." *Psychological Bulletin* 56(2):81–105.

Chambers, Robert and Janice Jiggins. 1987. "Agricultural Research for Resource-Poor Farmers Part I: Transfer-of-Technology and Farming Systems Research." *Agricultural Administration and Extension* 27(1):35–52.

Cochrane, Logan and Davin O'Regan. 2016. "Legal Harvest and Illegal Trade: Trends, Challenges, and Options in Khat Production in Ethiopia." *International Journal of Drug Policy* 30:27–34.

Cook, T.D. 1985. "Postpositivist Critical Multiplism." Pp. 21–62 in *Social Science and Social Policy*, edited by R. Lance Shotland and Melvin M. Mark. Beverly Hills, CA: Sage.

Dar, William and Stephen Twomlow. 2007. "Managing Agricultural Intensification: The Role of International Research." *Crop Protection* 26(3):399–407.

Davis, Kristin, Ephraim Nkonya, Edward Kato, Daniel Ayalew mekonnen, Martins Odendo, Richard Miiro, and Jackson Nkuba. 2012. "Impact of Farmer Field Schools on Agricultural Productivity and Poverty in East Africa." *World Development* 40(2):402–13.

Davis, Kristin, Burton Swanson, David Amudavi, Daniel Ayalew Mekonnen, Aaron Flohrs, Jens Riese, Chloe Lamb and Elias Zerfu. 2010. *In-Depth Assessment of the Public Agricultural Extension System of Ethiopia and Recommendations for Improvement.* IFPRI Discussion Paper 01041. Washington, DC: International Food Policy Research Institute. Retrieved April 13, 2016 (http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/7610).

Dawit, Woubit and Yeshi Andenew. 2005. "The Study of Fungicides Application and Sowing Date, Resistance, and Maturity of *Eragrostis tef* for the Management of Teff Rust [*Uromyces eragrostidis*]." *Canadian Journal of Plant Pathology* 27:521–7.

Denzin, Norman K. 1978. *The Research Act: A Theoretical Introduction to Sociological Methods.* New York: McGraw-Hill.

Dercon, Stefan and Ruth Vargas Hill. 2009. "*Growth from Agriculture in Ethiopia: Identifying Key Constraints.*" Paper prepared as part of a DFID study on Agriculture and Growth in Ethiopia.

Dessalegn, Temesgen. 2012. *Yemeles Amilko* [Worshipping Meles]. Addis Ababa, Mastewal Printing and Advertising.

Egziabher, Kidanemariam, Erik Mathijs, Jozef Deckers, Kindeya Gebrehiwot, Hans Bauer, and Miet Maertens. 2013. "The Economic Impact of a New Rural Extension Approach in Northern Ethiopia." University of Leuven: Geo-Institute, Dept. of Earth and Environmental Sciences, Division of Bioeconomics, working paper 2013/2. Retrieved October 10, 2016 (http://ageconsearch.umn.edu/bitstream/146558/2/BioeconWP_2013_2.pdf).

Engeda, Ermias and Todd Benson. 2013. "The Impact of Increased Teff Production on Ethiopia's Economy." IFPRI-ESSP-II/EDRI Conference on "Improved Evidence Towards Better Policies for Teff Value Chain, October 10th, 2013. Available at (http://www.slideshare.net/essp2/the-impact-of-increased-teff-production-on-ethiopias-economy?qid=fe21ce86-169f-4866-9a58-79faca29cef3&v=qf1&b=&from_search=5).

Ethiopian Agricultural Transformation Agency (ATA). 2013a. "Initiatives: Technology Access and Adoption." Retrieved January 9, 2014 (http://www.ata.gov.et/initiatives/technology-access-adoption/).

_____. 2013b. "Results of 2012 new Tef Technologies Demonstration Trails Draft Report." Addis Ababa, Ethiopia.

Ethiopian Economic Association. 2005. Report on the Ethiopian Economy, vol. IV. Addis Ababa: Rohobot Printers. Retrieved July 20, 2016 (http://www.eeaecon.org/sites/default/files/publications/REPORT%20ON%20THE%20ETHIOPIAN%20ECONOMY%20_%20Volume%20IV%20_2004_05_Transformation%20of%20the%20Ethiopian%20Agriculture_0.pdf).

Federal Democratic Republic of Ethiopia: Ministry of Agriculture and Rural Development (MARD). 2010. *Ethiopia's Agricultural Sector Policy and Investment Framework (PIF) 2010-2020.* Draft Final Report, 15 September 2010. Retrieved October 1, 2016 (http://gafspfund.org/sites/gafspfund.org/files/Documents/Ethiopia_5_of_6_CAADP_Post_compact_Investment_Plan_(PIF)_0.pdf).

Feed the Future. 2013. "Country Profile: Ethiopia." Retrieved October 17, 2016 (http://www.feedthefuture.gov/country/ethiopia)

Gebremedhin, Berhanu, D. Hoekstra, and Azage Tegene. 2006. "Commercialization of Ethiopian Agriculture: Extension Service from Input Supplier to Knowledge Broker and Facilitator." Working Paper No. 1, Improving Productivity and

Market Success of Ethiopia Farmers Project, International Livestock Research Institute: Nairobi, Kenya.

Gebremedhin, Berhanu, Moti Jaleta, and Dirk Hoekstra. 2009. "Smallholders, Institutional Services, and Commercial Transformation in Ethiopia." *Agricultural Economics* 40(s1):773–87.

Greenberg, James and Thomas Park. 1994. "Political Ecology." *Journal of Political Ecology* 1:1–12.

Greene, Jennifer C., Valerie J. Caracelli, and Wendy F. Graham. 1989. "Toward a Conceptual Framework for Mixed Methods Evaluation Designs." *Educational Evaluation and Policy Analysis* 11(3):255–74.

Gudina, Merera. 2003. *Ethiopia: Competing Ethnic Nationalisms and the Quest for Democracy 1960-2000*. Addis Ababa: Shaker Publishing, reprinted by Chamber Printing House.

Hall, Andrew, Geoffrey Bockett, Sarah Taylor, MVK Sivamohan, and Norman Clark. 2001. "Why Research Partnerships Really matter: Innovation Theory, Institutional Arrangements and Implications for Developing New Technology for the Poor." *World Development* 29(5):783–97.

Holden, Stein and Bekele Shiferaw. 2004. "Land Degradation, Drought and Food Security in a Less-Favoured Area in the Ethiopian Highlands: A Bio-Economic Model with Market Imperfections." *Agricultural Economics* 30(1):31–49.

International Food Policy Research Institute. 2013. "Perception on the Impact of Improved Teff Technologies by Exposed Farmers." IFPRI-Ethiopian Development Research Institute (EDRI) presentation, May 27th 2013. Available at (http://www.slideshare.net/essp2/perceptions-on-the-impcat-of-improved-teff-technologies-by-exposed-farmers?qid=fe21ce86-169f-4866-9a58-79faca29cef3&v=qf1&b=&from_search=2).

Little, Peter, Abdel Ahmed, Michael Carter, Michael Roth, and Workneh Negatu. 2002. "Building Assets for Sustainable Recovery and Food Security." BASIS Brief, 5. Madison: University of Wisconsin

Little, Peter, Priscilla Stone, Tewodaj Mogues, Peter Castro, and Workneh Negatu. 2004 "Churning" on the Margins: How the Poor Respond to Drought in South Wollo, Ethiopia." BASIS Brief, 21. Madison: University of Wisconsin.

Little, Peter, Priscilla Stone, Tewodaj Mogues, Peter Castro, and Negatu Workneh. 2006. "'Moving in Place': Drought and Poverty Dynamics in South Wollo, Ethiopia." *Journal of Development Studies* 42(2):200–25.

Mark, Melvin M. and R. Lance Shotland. 1987. "Alternative Models for the Use of Multiple Methods." In *Multiple Methods in Program Evaluation: New Directions for Program Evaluation 35*, edited by Melvin M. Mark and R. Lance Shotland. San Francisco: Jossey-Bass.

Negatu, Workeneh and Ashok Parikh. 1999. "The Impact of Perception and Other Factors on the Adoption of Agricultural Technology in the Moret and Jiru *Woreda* (District) of Ethiopia." *Agricultural Economics* 21(2):205–16.

Peet, Richard and Michael Watts. 1996. *Liberation Ecologies: Environment, Development, Social Movements*. London: Routledge.

Planel, Sabine. 2014. A View of a Bureaucratic Developmental State: Local Governance and Agricultural Extension in Rural Ethiopia. *Journal of Eastern African Studies* 8(3):420–37.

Robbins, Paul. 2004. *Political Ecology: A Critical Introduction*. Malden, MA: Blackwell Publishing Ltd.

Rivera, William. 1997. "Agricultural Extension into the Next Decade." *European Journal of Agricultural Education and Extension* 4(1):29–38.

_____. 2001. "Whither Agricultural Extension Worldwide? Reforms and Prospects. Knowledge Generation and Technical Change." *Natural Resource Management and Policy* 19:291–311.

Rosell, Staffan. 2011. "Regional Perspective on Rainfall Change and Variability in the Central Highlands of Ethiopia, 1978–2007". *Applied Geogrpahy* 31: 329–38.

Rosell, Staffan and Björn Holmer. 2007. "Rainfall change and its implications for belg harvest in South Wollo, Ethiopia." *Geografiska Annaler Series A: Physical Geography*. 89:287–99.

Spielman, David, Derek Byerlee, Dawit Alemu, and Dawit Kelemework. 2010. "Policies to Promote Cereal Intensification in Ethiopia: The Search for Appropriate Public and Private Roles." *Food Policy* 35:185–94.

Spielman, David, Kristin Davis, Matha Negash and Gezahegn Ayele. 2011. Rural Innovation Systems and Networks: Findings from a Study of Ethiopian Smallholders. *Agriculture and Human Values* 28(2):195–212.

Spielman, David, Dawit Kelemework Mekonnen, and Dawit Alemu. 2012. "Seed, Fertilizer, and Agricultural Extension in Ethiopia." Pp. 84–122 in *Food and Agriculture in Ethiopia: Progress and Policy Changes*, edited by P. Dorosh and S. Rashid. Philadelphia: University of Pennsylvania Press.

Stallknecht, Gilbert, Kenneth Gilbertson, and J. L. Eckhoff. 1993. Teff: Food Crop for Humans and Animals. New Crops. Wiley, New York 5:231–4.

United Nations Food and Agriculture Organization (FAO) and United Nations Educational, Scientific and Cultural Organizations (UNESCO). 2003. *Securing Food for a Growing Population. In* The World Water Development Report. UNESCO and Berghahn Books.

Vandercasteelen, Joachim, Mekdim Dereje, Bart Minten, and Alemayehu S. Taffesse. 2013. "The Impact of the Promotion of Row Planting on Farmers' Teff Yileds in Ethiopia." Ethiopia Strategy Support Program II, Research Note #27. Retrieved October 22, 2016 (http://citeseerx.ist.psu.edu/viewdoc/

download;jsessionid=A4CA5714F4AB45F6B7C03EA901CAF0A7?doi=10.1.1.637.3163&rep=rep1&type=pdf).

_____. 2014. "Perceptions, Impacts, and Rewards of Row Planting of Teff." LICOS Discussion Paper #350. Retrieved October 10, 2016 (https://feb.kuleuven.be/drc/licos/publications/dp/dp-350).

Walker, Peter. 2005. "Political Ecology: Where is the Ecology?" *Progress in Human Geography* 29(1):73–82.

Wale, Melaku, F. Schulthess, E. W. Kairu, and C. O. Omwega. 2006. "Cereal Yield Losses Caused by *Lepidopterous* Stemborers at Different Nitrogen Fertilizer Rates in Ethiopia." *Journal of Applied Entomology* 130(4):220–9.

Webb, Eugene, Donald T. Campbell, Richard D. Schwartz, and Lee Sechrest. 1966. *Unobtrusive Measures* (Chapter 1), Chicago: Rand McNally.

Wolf, Eric. 1972. "Ownership and Political Ecology." *Anthropological Quarterly* 45:201–5.

World Bank Group. 2007. "World Development Report 2008: Agriculture for Development." World Bank.

_____. 2013. "World Bank Data: World Development Indicators and Global Development Finance." Retrieved July 27, 2016 (http://data.worldbank.org/).