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"Modern" farming and the transformation of livelihoods in rural Tanzania

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Abstract
This paper focuses on smallholder agriculture and livelihoods in north-central Tanzania. It traces changes in agricultural production and asset ownership in one community over a 28 year period. Over this period, national development policies and agriculture programs have moved from socialism to neo-liberal approaches. Using a combination of qualitative and quantitative methods, we explore how farmers have responded to these shifts in the wider political-economic context and how these responses have shaped their livelihoods and ideas about farming and wealth. This case study clearly debunks the idea that rural farmers are slow to respond to "modern" farming methods or that smallholder farming is stagnant and cannot reduce poverty. While changes overall are very positive in this rural community, challenges remain as land sizes are small and markets often unreliable. This research cautions against a shift in emphasis to large-scale farming as a strategy for national development. It suggests instead that increased investment in supporting smallholder farming is critical for addressing poverty and rural well-being.

Keywords Rural livelihoods · Smallholder agriculture · Agrarian change · Iraqw · Tanzania

Introduction: economic growth, agriculture and intensification

There has been considerable attention and debate, at a macro-level, on the changes taking place in agriculture across the African continent and whether these changes are or can result in poverty reduction and significant economic transformation (Barrett et al. 2017; Collier and Dercon 2014; Davis et al. 2017; Jayne et al. 2010; Binswanger-Mkhize and Savastano 2017; Christiaensen 2017; Christiaensen et al. 2011). Generally in Africa, economic growth has increased significantly particularly from 2000 onwards (Jayne et al. 2018; Binswanger-Mhkize et al. 2010; Djurfeld et al. 2018). GDP in the region has grown by nearly 35% between 2000 and 2014 (Jayne et al. 2018, p. 777). The drivers of growth vary but signs point to urbanization, infrastructural development and tourism (Barrett et al. 2017). Annual agricultural growth, by comparison, has been smaller, with a growth of just 4.6% between 2000 and 2016 (Jayne et al. 2018, p. 777, figures adjusted for inflation). Nevertheless, there are changes in this sector, with changing diets and growing urban populations demanding more food. Liberalized policies have led to an influx of new varieties of improved seeds

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and other agricultural inputs (Jayne et al. 2018; Reardon 2015). Barrett et al. (2017) suggest there is a wider structural transformation of rural economies taking place with traditional forms of agriculture becoming more productive.

These differing portrayals of rural affairs have quite different implications for our understanding of change in rural communities. The sober view of African agriculture portrays rural communities that are, economically, changing little compared to the other sectors. The more optimistic view suggests more dynamism. This paper provides a different perspective on these debates. Here we focus on the micro-level to explore how changes in the wider national economy have affected the lives and livelihoods of a rural community in Tanzania. This attention to the local level expands our understanding of the impact of change but complicates the picture constructed by macro accounts (Mashindano et al. 2011) that have described stasis, if not growing poverty, in the agricultural sector, because the forms of growth are not benefitting the rural poor. Östberg et al. (2018) and Brockington et al. (2018) provide similar accounts of changes in livelihoods in rural communities elsewhere in Tanzania.

We focus on the local level because, at the heart of the debate about change to rural economies in Africa and the agricultural sector is the question of intensification. In what circumstances have smallholder increased their productivity—and how readily have they done so. Yet, specifically with respect to intensification there is a particular deficiency of detailed studies that track communities and families over time. As Brockington et al. (2018) observe, the studies and data that inform these analyses draw upon data sets that do not provide adequate illustration of what is actually happening in rural communities. Drilling down to community level shows how varied and differentiated economic growth, agricultural productivity and changes in livelihoods can be (Djurfeldt et al. 2018). So, local level studies, to contextualize growth as Djurfeldt et al. (2018) argue, are important for assessing some of the conclusions that arise from the national and regional level data. This research aimed to understand growth and changes in livelihoods and agricultural production in a rural community in Tanzania over a 30 year period. We investigated the relationship between national trends, policy and local farming practices and outcomes at the local level in Mbulu District.

Tanzanian policies: smallholder farming and intensification

In Tanzania, as a result of economic liberalization policies in the 1980s and onwards, basic consumer goods became more available in the 1990s and the monopoly of state trading companies and co-operatives ended. Liberalization of input and output markets has had an impact, particularly on maize production which Cooksey states "has been one of the success stories of agricultural liberalisation in Tanzania" (2011, p. 561). In the 90s, overall macro-economic growth, as measured by GDP, was very slow. But, as Djurfeldt et al. (2018) note, growth picked up dramatically in the 2000s. This pattern in Tanzania matches change across the continent (Jayne et al. 2018).

More than 70% of Tanzanians depend on agriculture for their livelihoods (Msuya et al. 2018). While agriculture is critical to Tanzania's national economy, its share of GDP declined from 50% in 2000 to less than 24.7% in 2014 (Msuya et al. 2018, p. 139). This decline reflects growth in other sectors of the Tanzanian economy such as construction, mining and services. Within agriculture, growth can be traced to an increase in production of products like tomatoes, onions and potatoes and an increase in the staples of maize and rice (Coulson 2015). Various national policies from 2000 onwards have attempted to spur agricultural growth. The Agriculture Sector Development Programme (ASDP) which came out in 2001 had, as its goal, a 5% per annum increase in agricultural growth and to reach 10% by 2010 (Coulson 2015, p. 56). The focus of the ASDP was on production, rather than on marketing, which Coulson argues would have given more significant benefits to farmers.

In 2009, the Tanzanian government launched *Kilimo Kwanza* (Agriculture First) which highlighted public–private partnerships and emphasized investment in large-scale agriculture and outgrower schemes that smallholders would join. In parallel to *Kilimo Kwanza* was the launching of SAGCOT, The Southern Agricultural Growth Corridor of Tanzania. SAGCOT targets roughly 1/3 of the land area of Tanzania for large-scale agricultural investment, encouraging foreign direct investment and partnerships with smallholder producers who would produce on contracts (Coulson 2015, p. 60).

These policy responses are the latest in a long search across many African countries for ways of improving growth in the agriculture sector. As is evident from the shift in national policy in Tanzania, large-scale agriculture and significant investment, often from foreign investors, is seen to be a key strategy to achieve growth. Others have argued that the smallholder sector in particular, because it supports most of Tanzania's rural population, deserves more investment and support. In his review of smallholder and large-scale farming in Tanzania, Coulson concludes:

> [O]verall, as it was for the Germans more than 100 years ago and for the British 60 years ago, the cheapest and quickest means to increase agricultural production in Tanzania is to support and trust small farmers by ensuring that marketing arrangements are in place that will give them fair prices for the crops they sell (2015, p. 66).

There have been several reviews of the contributions of small farms to overall development and poverty reduction in developing countries, and Africa in particular (Wiggins et al. 2010; Graeub et al. 2016; Lowder et al. 2016). Proponents of investing in large farms claim they have greater efficiency (in terms of output per person) and benefit from economies of scale. Those in favor of small farms argue to the contrary, suggesting that small farms have higher productivity per hectare. There is some consensus that, depending on agro-ecological conditions and access to inputs and other support, extremely small holdings are unlikely to secure livelihoods or reduce poverty (Harris and Orr 2014; Wiggins et al. 2010) Indeed, there is literature which suggests that for the very poor, off-farm income generating activities are more critical for their livelihoods and survival (Bryceson 2002). In terms of reducing poverty, Wiggins et al. indicate that there are still "few studies that directly compare the impact on poverty of agricultural growth from large farms to that from small" (2010, p. 1344). Arguments against the "unproductive" small farm are used to justify the promotion of large farms through foreign or national investment.

At the heart of the question of whether smallholders can sustain a transformation in productivity is the issue of intensification. There are two components to this—can more food be produced (to meet future needs and sustain growth) and can it be produced sustainably, without environmental degradation. Through "Sustainable Intensification", it is hoped that "yields are increased without adverse environmental impact and without the cultivation of more land" (Royal Society 2009, cited in Garnett and Godfrey 2012, p. 8). Development agencies and international agricultural research centers such as the Consultative Group on International Agricultural Research (CGIAR), increasingly focus on promoting an African Green Revolution involving increased inputs in the form of improved seeds, chemical fertilizer, irrigation, and mechanized agriculture. The approach of these programs is primarily technical and quantitative in the form of higher yields (Davidson 2012; Scoones and Thompson 2011; Ollenburger et al. 2019). While experts see intensification as the way forward for African agriculture, adoption of some of the recommended practices by smallholder farmers remains low. In part, low adoption rates reflect farmers' real concerns with the increased risks that come along with dependence on the market, with growing cash crops, with using inorganic fertilizer and with shifting cropping patterns. Diversification is more often the strategy that farmers follow as a response to the highly unpredictable environment in which they live.

Part of the problem in advancing this debate is the poor quality of data that are available. Measuring agricultural productivity is challenging in most Global South contexts as the data can be unavailable or unreliable. While Tanzania puts considerable effort into gathering credible statistics, farmer recall and estimates can be very challenging. Additionally, agricultural officers may feel pressed to report positive figures of growth (Coulson 2015). National level figures also mask the significant differences at the regional and local level. However, the lack of data does not stop the proliferation of truth claims. As Christiaensen observes of African agriculture "stylized facts drive research agendas and policy debates. They provide a sense of importance, help frame the inquiry and are used to galvanize resources" (2017, p. 1).

Defining poverty, or defining progress

Measuring poverty and changes in well-being is challenging. Anthropologists and other non-economist social scientists have pointed out the thorny issues involved in measuring, defining and discussing poverty in non-Western contexts. As Green (2006) and Green and Hulme (2005) point out, narratives around poverty serve as justifications and blueprints for the design of policy interventions and development projects. How poverty is defined and measured has considerable influence on interpretations of what is seen "on the ground" or what is designed to "bring people out of poverty".

In many contexts, measures of consumption, recorded in monthly, weekly and daily diaries, have largely dominated the analysis and definition of poverty. Measurements of consumption form the basis for the calculation of poverty lines that allow international comparisons to be constructed.

Consumption matters; yet poverty is about much more than that (Alkire et al. 2011). In Tanzanian contexts, Brockington et al. (2018) have shifted the focus away from consumption to an examination of assets as an important indicator of poverty and wealth—because they feature strongly in local understandings of these categories. This measurement provides another important lens for examining poverty and prosperity. Although we recognize, as Brockington et al. (2018), that assets can only provide insights into some aspects of economic change. They are not a catch all proxy—indeed the whole point of viewing poverty in multidimensional terms is that the value of proxies recedes. This paper will draw upon this elaboration in defining wealth and poverty but also will discuss the wider context of how rural members of an Iraqw community in north-central Tanzania view wealth and poverty and the changes in their lives over the last 28 years. In this setting, the wider national and global narratives about modernity and development shape local ideas.

Iraqw definitions of poverty are bound up with wider national and global narratives around development (Swahili: *maendeleo*). Most Iraqw define wealth as a combination of material assets, together with the ability to educate your children, take care of your family's health, and the ability to withstand shocks. Looking at data from across Tanzanian

sites, Brockington et al. (2018) have noted similar indicators used in defining wealth in other agricultural societies in Tanzania. Of course, the assets that count as valuable change over time (Green and Hulme 2005). Indeed, particularly when assets are considered, the measurements of wealth are constantly changing. For example, assets that people mention now as desirable and important to acquire include electricity (often solar), cell phones, sheet metal for roofing, bricks for building and motorcycles. Most of these were unattainable or unavailable in the 1990s. What enables them to acquire these assets varies from household to household but includes wage labor, selling crops, livestock and, significantly, tree products. Many respondents suggested that if you work hard, use improved seeds, apply manure to your field, and take care of your livestock, you will achieve *maendeleo*.

To explore these various themes on poverty, agricultural development and smallholder intensification, this paper will focus on one farming community from 1990 to the present. It traces the factors influencing farmers' decisions and their assessment of the changes in their livelihoods. This study is part of a longitudinal one that has been investigating change in this rural community for nearly three decades and is also part of a larger project tracing livelihood change in Tanzania more broadly (Brockington et al. 2019).

The setting and research methods

This paper focuses on smallholder agriculture and livelihoods in what the Iraqw refer to as their homeland. Author 1 has been carrying out research for nearly three decades, for long and short periods, in this area. Authors 2, 3, 4 and 5 have grown up in the homeland and 4 and 5 still reside there. Author 6 has long-term research experience in Tanzania in neighboring zones, including with the Iraqw. The study combined qualitative (focus groups and interviews) and quantitative methods and compared data across two household surveys, one carried out in 1995, the other in 2017.[1] Over 20 individuals were interviewed, including farmers, extension officers, government officials, timber sellers, maize traders and input sellers. Six focus groups were held with women, men and youth (separately). Long-term experience in one farming community allows for a unique perspective not only on specific indicators of change, such as production or the increase in assets, but also affords insight into the meanings attached to these changes and the social dynamics that such changes affect.

[1] Informed consent was obtained from all individual participants included in the study.

The Iraqw are an agro-pastoral, southern Cushitic-language speaking people who live throughout Arusha and Manyara Regions in northern Tanzania. This research focuses primarily on Kainam and Murray wards in Mbulu district Tanzania. Mbulu District sits between Lake Manyara and Lake Eyasi and has a population, as of the 2012 census, of 320,279 people, up from 237,280 in 2002. Both Kainam and Murray wards were sub-divided more recently to create two new wards, Nambis and Nahhasey. With the subdivision of the original two wards come further resources from district government, in the form of schools and health facilities. This research includes these new wards.

This highland homeland ranges in elevation from 1500 to 2300 meters and is densely populated at over 186 per sq km. The total population of this area is 36,362, up from 19,048 in the 1988 census. The Iraqw name for this area is *Irqwa Da'aw* or Mama Issara in Swahili. Migration out of the homeland has been taking place since the colonial era and now Iraqw are found throughout Arusha and Manyara regions and, more recently, are moving as far away as Kilindi and Handeni near the coast, a distance of over 500 km.

Mama Issara is well watered with springs and streams running year round. Rainfall is bimodal and averages 1000 mm a year. In the cold dry season, mist accumulates in this highland area making cultivation of wheat and other crops possible on the hillsides. Dry season cultivation also takes place in the valley bottoms where irrigation, primarily by buckets or furrows, is often used.

In the homeland, farmers cultivate small plots of land (average is 2 acres) by hand hoe. Cultivation with ox plough is impossible as the slopes are too steep and the valley bottom soils too dense and often waterlogged. Agricultural production focuses on maize and beans (which are both staples and sold for cash), sweet potatoes, Irish potatoes, wheat, sorghum, millet, leafy greens, bananas, onions and tomatoes. Some crops grown in the 1990s, such as finger millet, appear not to be grown today. Crops grown specifically for cash include tobacco, pyrethrum and coffee. For a brief period in the early 2000s, farmers planted artemisia when a foreign investor came with seeds and agreed to buy the harvest. This project went well for a couple of years (though some farmers complained the plants, which are used to cure malaria, brought mosquitoes) but then the investor disappeared and farmers uprooted the plants. Coffee has gone through many vicissitudes according to global prices and local marketing issues, but is now on the upsurge again with farmers planting new varieties.

Colonial era agricultural officers held up the Iraqw as model farmers, extolling their sophisticated soil management practices (Snyder 1996). Archival documents reported on labor-intensive bench terraces, cut-off drains, contour planting, mulching, crop rotation and intercropping. The Iraqw farming system in the homeland has attracted much

Table 1 Land management practices from household survey for 2017

Practice	% Households
Terraces	15
Ridging	10
Cut-off drains	14
Grass strips	31
Tree planting	99

N = 180. Unfortunately, the 1995 survey did not include data on soil conservation practices

attention over time, both from colonial agricultural extension officers and from scholars interested in intensive agriculture (Börjeson 2007). From the colonial era to the present, there has been considerable change in land-use practices as farmers respond to national and global markets and as population pressure changes how they use their limited land resources. According to oral history and colonial reports, Iraqw farmers in the homeland produced enough food to meet their needs in the colonial era and, in times of drought, were able to supply neighboring, drier areas with food.

Findings

Changes to agriculture

In the 1990s, some of soil management techniques were on the decline and youth complained they were old-fashioned practices from colonialism (Snyder 1996, p. 327). Today, fewer people have terraces and they have instead adopted less intensive soil conservation practices as indicated in Table 1. Intercropping and crop rotation are still widely practiced. Tree planting is widespread but, according to our sources, is carried out less for soil erosion control than for income generation.

In the 1990s, surplus production had declined considerably and many (90%) relied on buying food, or exchanges with relatives and friends (*kuhemea*) to meet their needs (the majority of farmers reported only meeting 62% of their needs). In the 2017 survey, production appears to have increased and 90% of farmers surveyed reported that they were able to meet their food needs through their production (Tables 2 and 3). Today, farmers still seek maize elsewhere, but most purchase (92%) the needed maize rather than exchange within social networks (44%). A large proportion also "beg" for food from neighbours (67%). Respondents indicated that purchasing food through social networks is usually cheaper than on the market and can have added benefits in the present and future (such as information or help with school placement for children, loans, market price information, etc.). It may involve costs later as reciprocity of some kind will be expected.

Table 2 Household farm size and cropping patterns

Mean farm size	1995 2.5 acres	2017 2 acres
% Households selling crops	47	71
% Hhs with food deficit	47	10
% Hhs growing maize	100	100
% Hhs growing beans	78	91
% Hhs growing sorghum	57	8
% Hhs growing millet	57	12
% Hhs growing sweet potato	66	78
% Hhs growing Irish potato	26	35
% Hhs growing wheat	66	22

N = 150 (1995), N = 180 (2017)

Table 3 Average annual harvest data of principal crops across households

Crop	Harvest (kg) 1995	Harvest (kg) 2017	% Selling 1995	% Selling 2017
Maize	748	1621	5	39
Beans	76	164	10	54
Irish potatoes	124	306	17	90
Sweet potato	802	761	na	na
Wheat	401	134	na	na

N = 150 (1995), N = 180 (2017)

While staple crops grown have remained constant over time, cash crops shift according to the market. As is evident from the table above, productivity of maize, beans, and Irish potatoes have increased significantly at the household level. According to farmers, this increase reflects both the use of improved seeds, pesticides and practices, but market demand. Maize, beans and potatoes are sold frequently, with potatoes, in high demand from urban markets, sold by almost all families growing them. Wheat is no longer a favoured crop and is now mostly consumed in the household, as are sweet potatoes.

The type of seeds that farmers choose to plant has changed dramatically since the 1990s. Then, elders were skeptical of improved hybrid seeds believing them to be less resistant to pests and weather conditions. Additionally, they indicated the taste of the food from improved seeds was not as good. In the 1990s, farmers also planted up to 15 seeds in one hole and had spacing of about two feet between each hole. They used this technique to foil cutworms that were a serious problem in the area in drier years (Snyder 1993). Extension agents regularly admonished farmers to let go of

Table 4 Input use

Input	1995	2017
Improved seeds	0	83%
Pesticides	71%	83%
Inorganic fertilizer	0	0

N = 150 (1995) N = 180 (2017)

these "traditional" practices and adopt "modern" ones of two seeds per hole and spacing of about a foot between holes.

In 2017, in focus groups and interviews, farmers all claimed to have adopted improved seeds (*mbegu bora*) as well as "modern" planting practices. They attributed their greater maize production to these changes. The reservations that elders expressed in the 90s about being overly dependent, and thus vulnerable to markets (and the rise and fall of prices), have largely been abandoned by this next generation of farmers. While farmers have embraced improved seeds, some still plant local varieties as well. One woman noted that local varieties are important for pregnant women who like to chew on the stalk of young maize plants as they would sugar cane. She said "you can't do this with improved varieties". They also continue with local varieties to reduce risk as they think these varieties better adapted to local conditions. In sum, production has shifted notably to improved maize seeds. In addition, farmers now regularly apply pesticides to their crops to combat cutworm and stalk borers, which has helped them maintain their harvests.

Most respondents said that when market prices are good, they are able to make some small profits. However, if crop prices drop on the market, even breaking even can be a challenge, given the cost of labor and input purchases (Table 4).

While farmers have adopted the new and "modern" farming practices of improved seeds and planting practices, they have not been so keen on adopting chemical fertilizers. Most farmers who we encountered on this survey, and indeed, in many years of working and living in this region, believe that chemical fertilizers ruin the soils and if you start using them, you will be dependent on applying them forever. As one man commented, "If you use chemical fertilizers the soil dries out and is ruined. You will then have to use fertilizer all the time to get any harvest." They link the application of chemical fertilizer with causing further soil fertility decline. As noted in Snyder (1996), farmers continue to apply and rely on livestock manure to enhance their soils. As manure can be scarce, they usually apply it only in the planting hole (Table 5).

From the table above, we can see some interesting shifts in labor patterns. Reliance on paid labor has increased significantly, even in labor exchanges with neighbors. When discussing cooperative labor, many respondents spoke about the past when you could just brew beer, cook some food and

Table 5 Labor patterns

Labor	% Households 1995	% Households 2017
Day labor (*vibarua*)	23	48
Help from neighbors	71	88
Exchange with neighbors	2	61
Payment to neighbors	0	45
Provide beer	77	10
Provide food	71	1

N = 150 (1995), N = 180 (2017)

people would come. These days, as one man emphasized, "You have to pay cash".

In the 90s, there was a certain scorn about working as a day laborer. So, farmers often imported labor from neighboring communities like the Ihanzu or Wanyiramba. Today disdain for day labor has gone and young men and women, who have no plots of their own or other ways of making money, regularly take up day labor on local farms. One middle-aged woman explained that, while young men work as day laborers, they rarely save their money, "Young men will work as *vibarua* in the morning till around midday, get paid and then head out to *kijiwe*[2] to drink for the afternoon. The next day, they do it over again. They don't ever manage to save any money though". Young people may hire out their labor as individuals but, as some respondents suggested, they also form labor groups.

The division of labor has been a topic of discussion for some time in Mama Issara. In the past, as many respondents observed, men and women had clearly defined responsibilities. Men were responsible for clearing the land and then men and women shared the work of planting and weeding. Women apply manure to the fields and harvest the crops. From the 90s onwards, women have complained that men do less and less labor on the farm and more falls to them. Government officials have raised the issue in local village meetings and have admonished men to spend more time on the farm (Snyder 1996). The term *vijiwe* was not in use in the 90s and there were far fewer shops and cafes around.

Livestock

Livestock have always been central to the Iraqw economy and culture. In the pre-colonial era and after independence until the mid-1990s, livestock were the major indicator of wealth for Iraqw. Their rituals, to honor the dead or

[2] A *kijiwe* (*vijiwe* plural) is a gathering place with a small shop or a collection of shops and small tea stalls where people hang out, play cards, and drink tea, coffee or beer.

Table 6 Livestock holdings

Livestock type	Mean no. 1995	% Households (1995)	Mean no. 2017	% Households 2017
Traditional cattle breed	5.4	84	5	77
"Modern" cattle breed	n/a	n/a	2	9
Goats	5	52	5	36
Sheep	4	48	5	59
Pigs	2	73	3	87
Donkeys	2	4	2	2

N = 150 (1995), N = 180 (2017)

to appease the earth spirits, involve sacrificing animals. The Iraqw have a complex system of livestock loans that establish and strengthen networks and bonds between individuals and households across the landscape and beyond to other agro-ecological zones (Snyder 2002, 2005).

How community members in Mama Issara view livestock and its importance has changed significantly. According to respondents in interviews and focus groups, cattle are far less important today and many claimed that their numbers have dramatically declined. They noted lack of pasture as the main reason for the reduction in numbers. As one older man said: "There is no pasture today. People are cultivating everywhere." Some farmers have decided to keep fewer cattle and stall feed them. Decreasing pasture has given rise to the practice of planting grass for fodder. Farmers can also sell grass to other livestock keepers. This shift is noticeable across the landscape. Planted grass strips are evident along the hillsides (31% of households reported having them) where they were rare in the 90s, when pasture was still more available.

The decline in pasture has increased in the last few years as grazing land is converted to farmland. Local government has encouraged these shifts by urging farmers to produce more agricultural crops (Snyder 1996). Livestock keeping was often talked about as "the ways of the past" and "not modern". Projects to introduce, promote and expand the use of stall-fed "modern cows" began in Mama Issara in the 90s and have re-surfaced in recent years.

Given local narratives about the decline in cattle numbers, it was surprising to find the 2017 survey results in Table 6 below showing little change in average "traditional" (local breeds) cattle holdings. Collecting accurate information about livestock numbers is always challenging as farmers are reluctant to give this information and, for the Iraqw, they loan cattle out and receive loans as well. Thus, one's cattle may be spread out over the district and beyond depending on the loan and the individual's social network (Snyder 2002).

Table 7 Percentage of households with specific tree species

Species	1995% of Households	2017% of Households
Have trees on farm	83	99
Pinus sp.	22	49
Grevillea robusta	94	88
Eucalyptus sp.	12	93
Cupressus sp.	48	30
Black Wattle (*Acacia mearnsii*)	80	50
Banana	82	38
Orange	71	41
Avocado	28	71
Lemon	82	56
Guava	71	56
Pear	70	14
Coffee	25	5

N = 150 (1995), N = 180 (2017)

Goats are not well suited to the cold temperatures of Mama Issara and do better in the lowlands. Pigs are very popular because there is a reliable market for them and they reach maturity quickly and eat a wider variety of food. Most households keep chickens (82%).

Farmers still participate in livestock loans of traditional breeds of cattle, though they are not as prevalent as they were in the past. In the 1995 survey, 56% had cows on loan. From the 2017 survey, only 7% had cows on loan but 27% had cows loaned out to others. The social implications of this decline in the livestock loaning system are hard to interpret. Livestock were important for bride wealth, and cementing social relationships across the region. Loans allowed farmers to manage the risk of disease wiping out their herds by distributing their stock across a wider landscape. Additionally, reducing the number of stock on your compound helps ease the demand on household labor and resources for feeding.

Agroforestry

A notable change across the landscape of Mama Issara is the increase in tree cover. Tree planting was on the increase in the 90s, but at that time, the strategy was to plant and harvest after 15 years or so to meet cash needs, often for school fees. Farmers referred to trees as a "bank account" (Snyder 1996). Continuous planting and planting after harvesting was less a pattern then. Now however, traveling through the homeland, trees cover many of the hillsides. In focus groups and conversations with farmers, they explained that, in some cases, the soils on the hillside plots are so exhausted from continuous use that they are more suitable to growing trees than food crops.

Fueling the interest in tree planting is the growing demand for timber and other tree products, particularly with a rise in construction in Mbulu, the district capital some 15–30 km away. Farmers can sell planks of grevillea and eucalyptus for about TZS 3000 per plank and the price for pines and cypress species is 3500 per plank, (roughly $1.30 and $1.50 at 2017 exchange rates). This demand has led farmers to prioritize fast growing timber species like eucalyptus, pines, grevillea and cypress. Tree holdings from both the 1995 and 2017 surveys are in Table 7.

A total of 99% of survey respondents claimed they had trees on their farms and the average was 227 trees. The changes in species composition primarily reflects changes in local markets and in the costs of producing products (fruit trees like orange, lemon and pear require more pesticide purchase). The demand for avocado has grown significantly along with its price over the last several years. Several respondents remarked, when asked why so many people are planting trees, "Today, trees are our cows". While trees may have replaced cattle as a form of wealth, they do not serve the same social function as livestock. As described in Snyder (2002) exotic species such as those in the list above, are considered private resources in ways that indigenous species are not (or were not in 1995). Farmers purchase seedlings and trees are considered an investment, so they are not freely given for firewood, help with building materials, or for other household uses. Additionally, timber species tend to be the property of men and harvesting them is often the work of young men, who pursue this as a day labor job. Women are more in control of produce from fruit trees that they sell in local markets. In focus groups and the household surveys, respondents assert that farm resources are for the entire family. However, in practice, each household has its own system of access, use and control that tends to run along gender and generational lines. Trees are also very useful ways to mark farm boundaries that is increasingly important in times of land scarcity and competition (Snyder 1996).

Farmers consider trees an excellent investment, enough so that land that would otherwise be farmed is being turned into woodlots, particularly on plots where the soil fertility is perceived to be low. Households reported several uses for their on-farm trees including firewood (44% of households), timber sales (32%), own construction purposes (7%), fruit sales (25%), and charcoal production (8%). Black wattle, introduced in the colonial era, is the favored species for charcoal. It has declined significantly since the 90s largely because of heavy exploitation for charcoal production and the expansion of timber species. Turning land over to tree production is made possible only by expansion into new areas or by intensifying production on other plots. Thus, each household possibly pursues intensification, de-intensification, extensification, altogether on their farm.

Table 8 Asset ownership from household survey for 2017

Asset	% households
TV	6
Motor bike	8
Solar panels	17
Bicycles	28
Radio	59
Sheet metal roofing	71
Cell phones	76

N = 180. Data on assets such as these in this table were not collected in the 1995 survey because they were not evident at all or they were so few

Assets

While trees and livestock are certainly valuable assets that can be turned into cash, Iraqw households now own assets that were not present during the 1990s. Indeed, the 1995 survey did not even ask about ownership of many of the assets currently counted today (Table 8).

In the 90s, Snyder knew of only one house that had a motorbike and no one owned a television, solar panel or a cell phone and very few houses had sheet metal roofs. Electricity came to Mbulu town in 2000 and has only more recently made its way to Mama Issara through the government's rural electrification program and through the spread of solar panels, many of which are leased from companies. When looking at assets such as these, it is interesting to remember a remark by a respondent back in the 1990s who said, "During Nyerere's time, there was nothing in the shops. Today, there are many things in the shops but we do not have the money to buy them". It appears that more people are able to obtain the cash to buy commodities today. Several of those in the survey who have purchased solar panels, televisions or motor bikes have access to off-farm income in the form of salaried wages. Others may be receiving remittances from children who have migrated out but in the household survey, no household reported receiving remittances. Household members may be brewing beer, selling handicrafts, have a small shop or engage in some other informal income generation to meet cash needs. However, there are certainly households that appear to earn cash to purchase these assets from their on-farm activities, through either the sale of maize, beans and potatoes, livestock sales or the sale of tree products. These assets indicate a household's success, but unlike cows and trees, they do not reproduce themselves and create more resources. Disease and climate related challenges pose risks to livestock and trees so they are by no means an easy and certain investment.

Table 9 Local definitions of wealth in Mama Issara

Wealth category	Land	Cropping patterns	Education	Livestock	Other
Wealthy (10%)	3–4 acres of farm land	Planted both cash and food crops; Many trees on farm	Education level of household head (HH); Has one or more educated children and/or employed children	At least ten head of cattle plus pigs and or chicken	Can provide for needs of family; educate children; pay for necessities; Have small businesses; and a good house with iron sheet roofing and bricks
Average (60%)	2 acres	Some trees	Education level of HH head; At least one child in school or employed	At least 5–6 cattle plus pigs	Good house with iron sheet roofing sometimes with trees or bricks
Poor (30%)	1 or less than 1 acre		Education level of HH head	One or no cow at all and nothing else	Cannot provide for family; thatch roof on house

Data from focus groups held separately with men, women and youth in Mama Issara wards in 2017

Table 10 Wealth information from household survey for 2017

Farm size	No of HHs	% of HHs	Cattle	No of HHs	% of HHs
3 acres or more	39	22	10 head or more	19	11
2 acres	57	32	5 to 9 head	40	22
Under 2 acres	84	46	Under 5	121	67

N = 180

Wealth and poverty

In Mama Issara, social differentiation, while present, is not extreme. In focus groups, respondents used the criteria in Table 9 below to define wealth categories and measure their community's status.

Aligning the household survey data on farm size and cattle ownership with the wealth categories from the criteria in the focus groups proved difficult. For example, of the 19 households who had 10 or more cows, only 9 of them had 3 acres of land or more. The household with the most cattle (18) had 4.75 acres of land. As is evident in the table below, by using these two criteria, the majority of households would be classified as poor (Table 10).

The meaning of wealth has changed over time as various resources have become available. Sheet metal roofs were expensive and out of reach for most households in the 1990s. Small businesses were few and secondary schools came into Mama Issara in the mid-90s, one in each ward at that time. Now, there are four operating secondary schools and one in the final stage of construction in the homeland so significantly more students are going beyond primary level. Most of the households that fall in the wealthy category have sources of off-farm income, either through salaries from employment as civil servants, teachers, health officers, or through off-farm businesses. The very poor are often widows, those with physical disabilities or female-headed households.

The wider context

The availability of transport and inputs makes agricultural activities more profitable and attractive to many today. In the 90s, bicycles and foot travel were the main means to reach Mbulu town. Transporting maize in and out of Mama Issara was challenging and relied almost entirely on donkeys. There was no public transportation until after 2002.

In the last 5 to 6 years, the availability of transportation has increased dramatically. Today, Landcruisers and minibuses ply the route daily from Mama Issara and back and people use public transportation to carry out their business in Mbulu and to transport their produce. Women, who regularly sell charcoal, particularly appreciate this change: "We used to carry it on our backs all the way to Mbulu. Now we can put it in a vehicle and get to Mbulu, sell the charcoal, run our errands and return quickly".

Transportation and improved roads have also made stocking shops and small businesses easier. There are a number of shops in Mama Issara and in Mbulu town that sell hybrid seeds and other agricultural inputs. In addition to small shops, there are many more small restaurants selling coffee, beer and tea than there were in the 90 s. These developments

suggest there is more cash in circulation today. These developments are not exclusive to Mbulu District but instead reflect patterns throughout Tanzania. As Green (2015) observes for Ulanga District in southern Tanzania, improvements in infrastructure and increased demand for agricultural products from urban areas have spurred economic transformations. She describes the rise of a middle class, based primarily in urban centers, who increase demand for food crops and milk, pork, and chickens resulting in "innovation in the local agricultural economy" (Green 2015, p. 304). In addition to infrastructural and market changes, Tanzania's decentralization policy has resulted in an expansion of government offices and staff to accommodate new administrative units (villages, wards). As a result, as Green (2015) notes, there is an increase in government officers in rural areas. There are more people now with salaries living and working in these rural areas which has also influenced improvements in agriculture and led to an increase in local businesses.

Electricity has come to Mama Issara and continues to expand, resulting in more lights in people's homes and less reliance on kerosene. It has also allowed some small businesses to start up, providing access to television in particular. Watching football matches and foreign soap operas are popular at the *vijiwe*. Other small businesses like maize grinding mills and welding have also sprung up in Mama Issara.

Discussion

Contrary to reports of stagnation in the agricultural sector for the continent as a whole (Diao et al. 2006), in assessing longitudinal change in Mama Issara, it is evident, comparing household farm production from 1995 to that of 2017, that agricultural productivity has increased, due to the use of hybrid seeds, pesticides, more standardized planting practices and the expansion of farming into what was formally grazing land sides. Additionally, in the northern part of the homeland, farmers, ignoring the restrictions on cultivating up the mountain, have expanded fields to the top of the slopes. While expansion of agriculture into areas previously uncultivated such as mountains may increase production, it is less clear whether, over the longer term, it is sustainable as natural resources are being degraded in the process. In focus groups, respondents expressed concern about these patterns, claiming, "People do not listen to elders today." Many said this generation of elders has less knowledge concerning land-use restrictions of the past and that they have little authority over the youth. One main concern was that water sources, primarily springs that used to run all year round, have dried up. Respondents further linked the drying up of water sources to land use changes including planting of water thirsty trees such as eucalyptus in water catchments. Many farmers are cultivating close to water sources in an effort to obtain every inch of available soil. The expansion onto the steep slopes in the north has not been accompanied by the "traditional" soil and water management practices that were in place in the colonial era, in part because these fields are not considered secure as they were not granted to farmers by local government or through inheritance.

While respondents stated that the shift to hybrid seeds has led to a considerable improvement in their livelihoods, this change is not without its risks. In 2018, the government, in an effort to ensure national food security, banned the sale of maize outside of the country and farmers in Mama Issara were already feeling the effects. Prices for their maize dropped significantly making it difficult to cover the costs of labor and inputs. One farmer remarked, "With the prices of maize being so low on the market because the border to Kenya is closed, I will not be able to cover all the cost of labor and inputs from selling my maize". Maize traders also were suffering. With the price of maize so low on the market and the inability to export, particularly to Kenya, traders struggled to cover their costs and faced significant risks of pest damage while storing maize to wait for prices to rise.

In addition to maize seed hybrids, we also see a shift away from some "traditional" crops like millet and sorghum. In part, this reflects the greater market demand for maize but also the difficulty in finding enough labor for crops like millet, that require constant vigilance to scare birds away.[3] The demand for Irish potato, due in part to changing tastes and the proliferation of small restaurants in Mbulu, has increased. Chips, once a special treat, have become far more common in local restaurants. Finally, beans have also become an important cash crop and prices on the market have been consistently attractive to farmers. Interviews and focus group participants frequently mentioned the rise in production and sale of horticultural crops like tomatoes, leafy greens, and onions (this is not captured in the surveys). With improved transport, these crops have become far easier to sell in Mbulu, specifically for women. As one Mbulu market vendor said, "all our produce comes from Mama Issara".

Trees are a critical component of rural livelihoods in Mama Issara. Farmers earn cash from charcoal, timber and fruit. Trees on farms are often overlooked in research and assessments of farm productivity. National policies concerning trees tend to focus on forest reserves and forestry and agricultural departments often do not collaborate. Tree products can be crucial to rural livelihoods as they serve as important sources of cash in times of need (Place and Garrity 2015). Miller et al. (2018), in their review of national household survey data, found that 54% of rural smallholders

[3] Labor that used to be provided by children who are now in school.

have trees on farms in Tanzania, with 18% having timber species and 25% with fruit trees. In Mama Issara, the demand for timber, first documented by Snyder (1996) in the mid-90s, has continued and expanded. Timber buyers in Mbulu explained that demand from Mbulu town but also Babati, the regional capital, and even Arusha is stimulating the market. They also said "In Mbulu, most of the timber we buy comes from Mama Issara". Snyder (1996) observed that tree planting represented a less intensive land-use practice as, after the initial investment, labor and capital needs decrease substantially. More recently, farmers are taking whole hillsides, which they see as too degraded for successful crop production, and turning them into woodlots.

In the 90s, farmers relied more on exchanges, livestock sales and cash purchase to meet their food needs. Today, the adoption of hybrid seeds and other inputs and practices, such as greater investments in hired labor, marks a process of intensification on agricultural fields that has resulted in both greater food security and in greater participation in the market. When farmers convert degraded land to tree production, they must either expand their crop production into areas previously used for grazing, or they must intensify production on other remaining plots in usually highly productive, valley bottom land. Valleys, over the past several decades, have increasingly been converted to agricultural plots, where they used to be reserved for thatch grass and for grazing.

Pig production has held steady since the 90s and the number of households keeping pigs has increased. The market for pork ties farmers in Mama Issara not only to consumption in Mbulu but as far away as Moshi town in the north and Dar es Salaam in the south. Pig production has both a fairly high and rapid rate of return, if compared to other livestock. Farmers rely on pigs, timber, staple crops, horticultural crops and fruit sales for cash to purchase any food deficits.

Off-farm income generating activities, either through salaried work as a schoolteacher or health worker, or through day labor, or owning and running small businesses are also quite common in Mama Issara and underline the importance of off-farm work. However, while de-agrarianisation may be occurring in other parts of Tanzania and the continent (Bryceson 2002), the evidence from Mama Issara suggests a continued reliance on agriculture for local livelihoods and an increased investment in intensification on specific farm plots. This pattern is similar to that found in Djurfeld et al. (2018) work on re-agrarianisation. As in many rural systems, diversification of livelihoods appears to be essential to make a living and weather the risks of any economic activity (Ollenburger et al. 2019).

In the mid-90s, maintaining social networks, through food exchanges and through livestock loans were important for sustaining livelihoods and getting access to resources. Today, with market improvements, farmers rely more on cash, for purchasing food, hiring labor, and obtaining livestock. Indeed, as one man said, "You can't get someone to help you carry a bucket of water 100 m if you don't pay them today". However, social networks are still maintained through food exchanges and livestock loans, though they almost always involve cash. Neighborhood groups have become an important feature of the local landscape today and manage a variety of social needs, such as providing help for medical care (transport of sick person, hospital costs), weddings and other events through pooling of cash contributions. In the 90s, young men from a neighborhood carried sick people to Mbulu town. Today, neighbors simply hire a vehicle for transport. These neighborhood groups address conflicts, mediate disputes and sometimes serve as revolving loan groups.

Returning to the debate on smallholder versus large-scale farms, the long history of farming in Mama Issara shows where and how small farms can be successful through diversification and responding to markets. It also points to the potential limitations of small farms, particularly the constraints presented by their overall size and resource base. Overall, farmers state that their livelihoods have improved in Mama Issara, largely through farming. However, this improvement has been dependent on wider economic changes in the economy. As Davis et al. (2017) study of agriculture across 22 countries in sub-Saharan Africa shows, farming is still the sector where most households make a living. In Mbulu District, farming is the main livelihood of most of the population. Agricultural productivity is in part stimulated by the growth of off-farm economic activities, most of which, as Davis et al. (2017) have also found, are linked to agriculture and natural resources. Small restaurants rely on local produce, youth become agricultural traders or woodcutters to make a living when the lack of farmland pushes them to seek other opportunities, timber traders stimulate land-users to plant more timber, which also results in the growth of small-scale tree nurseries. Finally, road improvements, the expansion of the transportation sector and the arrival of electrification have also supported greater investment in agriculture.

Because of limited farm size and topography, agricultural production in Mama Issara may not result in an economic transformation that ensures greater long-term security or a significant increase in income and assets from what is seen today. However, it is clear that over the last 28 years significant improvements in people's lives have occurred. More children are going to and completing school, there are more opportunities in the informal sector for trade and small businesses, the timber trade continues to expand and demand remains high. These positive trends are also evident elsewhere in Tanzania (Östberg et al. 2018; Brockington et al. 2018) and in some other countries in the continent such as Ghana (Houssou et al. 2018). Overall, however, throughout Tanzania, off-farm income-earning activities still remain few

and lack of capital a considerable constraint, both for starting businesses and for further on-farm investment. In focus groups and interviews, respondents often mentioned the lack of access to capital as a major constraint to their livelihoods.

While the changes in livelihoods in Mama Issara indicate signs of some aspects of poverty reduction, we would qualify what is perceived to be poverty in the local imagination. Residents of Mama Issara may not recognize a decline in poverty because they did not think themselves to be poor originally. Author 1 was conducting research in Mama Issara in the 1990s, when the results of a World Bank report on global poverty (and Tanzania's low ranking globally) were announced on Tanzanian national radio. A group of young men with whom she was talking, when hearing of Tanzania's poor ranking, looked puzzled and said "We can't be that poor. We feed ourselves, send our children to school and have decent houses. Why are we thought to be poor?" At that time, many of the assets available today were not available then and the availability of transport or electricity was low or non-existent. A thatched roof house was considered perfectly decent housing and sending your children to primary school was viewed as sufficient.

With wider shifts in development and exposure to a globally interconnected world, the goals and aspirations of Mama Issara residents have changed. It is a common perception that young people today appear to have little desire to pursue farming. Their parents claim that now that they have had an education, their children no longer want to farm but only want office jobs. Indeed, that, they suggest, is what drives them to waste time at the local *vijiwe*. However, in focus groups with youth, they asserted that they do want to farm but that their parents do not give them land to cultivate and the work they do on the land contributes to the household but does not help them build up independent resources, ones they could use to marry and start life on their own. Thus, they pursue farm labor jobs, odd jobs for shopkeepers, transport and a variety of other small jobs.

Iraqw have a long history of migrating out to search for other employment opportunities or for land on which to farm and raise livestock. This pattern continues today but it is unclear, given population growth in Tanzania more broadly, if these strategies will be sustainable in the future. Today, young people are moving to areas far more distant than they did in the 90s and the many decades before that when migration focused on contiguous zones. In Mama Issara, given the size of household land holdings that will no doubt continue to decrease if out-migration declines, it is unlikely that intensification alone can meet consumptions demands. Iraqw farmers in the homeland are quick to respond to market opportunities, either in new cash crops, the revival of old cash crops (pyrethrum, tobacco, coffee), demand for pork or for tree products. These diversified land-use strategies have served farmers well and have enabled them to invest in assets and their children's educations. As prices on the market for food crops such as maize and beans rise and fall, this diversification strategy is important for weathering these sometimes steep ups and downs of the market that are affected by national and regional trade policies.

As this and other studies of local farming systems demonstrate (Östberg et al. 2018; Brockington et al. 2018, Houssou et al. 2018; Whitfield 2017), it is important to ground truth national and international narratives that underscore the stagnation of rural smallholder farming systems and rural poverty. Local-level studies often provide a very different picture which is clear in Whitfield's (2017) review of Netting's (1993) seminal work on smallholder farmers in Nigeria and its relevance for studies of rural farming in sub-Saharan Africa today. Understanding the complexity and diversity of small-scale agricultural systems is of continued relevance. He concludes that

> The values of smallholdings as laid out by Netting—that they are adaptive, flexible and innovative—similarly encourage a rethink of dominant policy and research and innovation models that have sought to intervene, in a topdown way, within smallholder systems (1993, p. 262).

This assertion is particularly important today as national policies and international agencies increasingly turn away from smallholder agriculture in favor of large-scale investment. Additionally, agricultural research centers such as the Consultative Group on International Agricultural Development (CGIAR) and the Alliance for a Green Revolution in Africa (AGRA) focus on a technocratic "impact-at-scale philosophy" (Whitfield 2017, p. 260) that may not fit well with the diversity of small-scale farming systems across the continent (Ollenburger et al. 2019).

While the Comprehensive Africa Agriculture Development Programme (CAADP) of the African Union, which calls for a commitment of 10% of national annual budgets to agriculture, is an important step in increasing investment, its implementation has been inconsistent across the continent. Tanzania has signed up to the CAADP agreement but funds allocated to the Ministry of Agriculture are often only sufficient for paying salaries and administrative costs. At the level of the districts, agricultural staff have few funds available for operational costs. Furthermore, district budgets tend to prioritize education, health and infrastructure over agriculture.[4]

Regardless of these challenges, the myth that Christiaensen (2017) exposes, that smallholder farmers are slow to respond to "modern" farming methods, is obviously a myth in Mama Issara. This study has shown that farmers there and

[4] Interviews with district staff in multiple districts in Tanzania.

undoubtedly throughout the country have done an impressive job at improving their farms, raising agricultural productivity and their households' livelihoods with little support from the government especially after implementation of Structural Adjustment Programs. Before shifting investment to focus on large-scale farming, more direct investment in smallholder agriculture and the markets that support it, might have a bigger impact on more people.

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