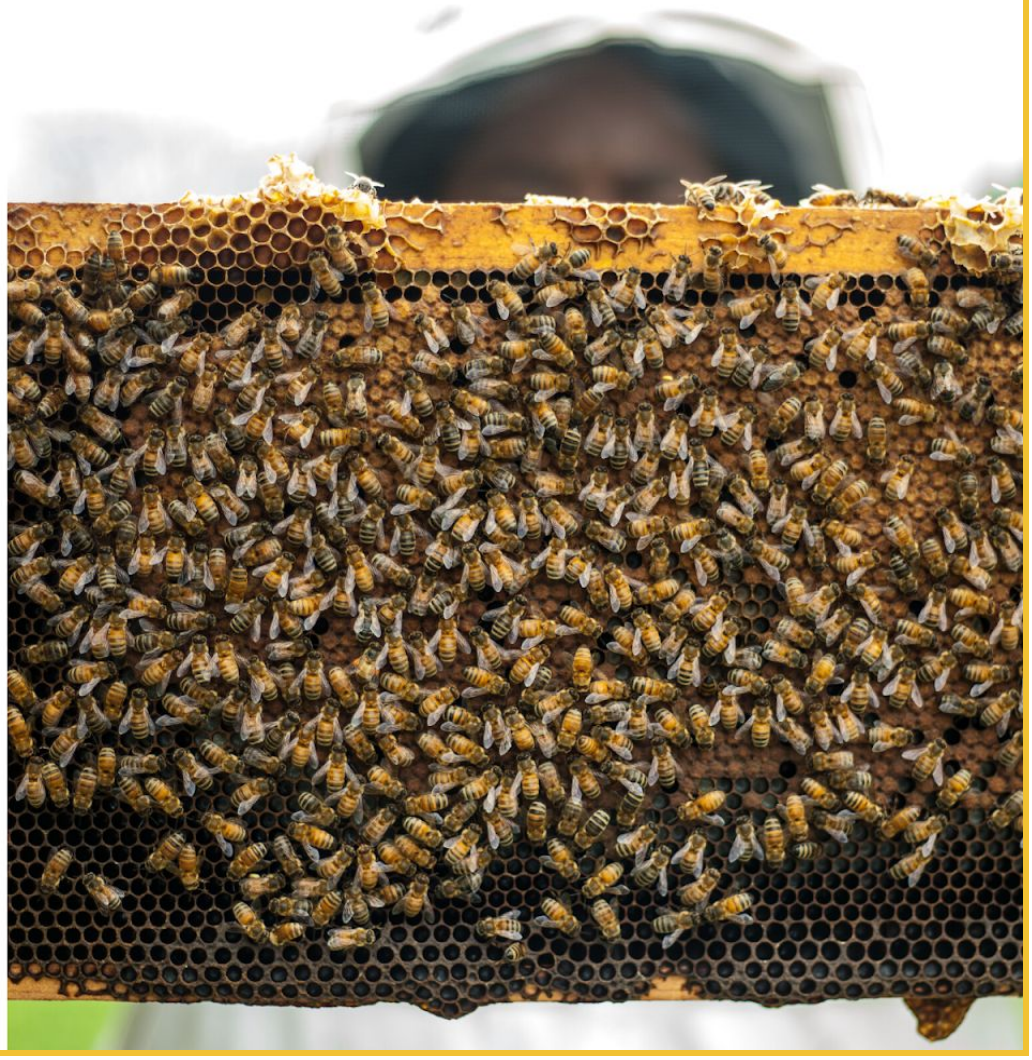
THE BUZZ ABOUT ETHIOPIA:

A LOOK AT SELF-RELIANCE, BEEKEEPING, AND LOCAL ECONOMIES

Sarah Green
Dr. Hilary Parsons Dick
International Studies
Department of Historical and Political Studies
Senior Thesis

MAY 2020



Arcadia University

TABLE OF CONTENTS

INTRODUCTION

Picture the last time you found yourself walking through a farmers market. Arrays of colorful fruits and vegetables, flower stands, and homemade jams and confections overwhelm the senses as you scan each vendor's arrangement for the most tempting indulgence. Situated among the local produce stands lies the beekeeper, selling honey and handmade beeswax candles. This sweet treat is alluring, as the mesmerizing labels of clover, wildflower, and sweet orange are tucked away in their own unique corner of the market. Local honey seems like a rare and satisfying find, as the commercialized honey bear bottles appear to have become the standard for day-to-day honey consumption. While the practice of local beekeeping may appear as a seasonal hobby, globally, the apicultural (beekeeping) market serves as an important contribution to rural income generation. In particular, sub-Saharan Africa is especially known for its rich cultural history of beekeeping. For many, this apicultural history has served as a base of income generation, supporting the livelihoods of rural communities throughout the region.

With a nearly 5,000 year history of beekeeping, Ethiopia, for example, is the number one honey producing country in Africa and number four globally, providing 2.5% of the world's marketed honey (Belay Daba and Oljirra Wolde 2016: 46; Nega and Eshete 2018: 7880; Teferi 2018:1). Home to over 7000 bee-friendly flowering plants, Ethiopia has about 1.9 million farm households with over 10 million bee colonies, producing over 45,000 tons of honey annually (Belay Daba and Oljirra Wolde 2016: 46; Berhe, Asale, and Yewhalaw 2016: 1; Koch and Appotive 2016: 10; Teferi 2018: 2; Yirga and Teferi 2010: 77). In comparison, Tanzania is the second largest honey producer in Africa, yielding 8,000 tons, followed by Kenya, Uganda, and

Rwanda, with an average of just 4000 tons (Koch and Appotive 2016: 10). It is estimated that only 10% of honey produced in Ethiopia is used within the beekeepers household while the remaining 90% is sold for income generation (Teferi 2018: 4). Within that 90% of sold honey, 99.8% is sold domestically while the remaining 0.20% is sold and traded internationally (Nega and Eshete 2018: 7880). Sudan is the number one importer of Ethiopian honey in terms of both value and volume, followed by countries such as Germany and Norway (Nega and Eshete 2018: 7880).

While Ethiopia has high standing in the global honey spectrum, this sector is not the most prominent in the country. According to the Food and Agriculture Organization of the United Nations, Ethiopia's agricultural sector plays a large role in upholding the livelihoods of rural Ethiopians ("Ethiopia at a Glance"). Over 12 million smallholder farms are responsible for 95% of the country's agricultural industry and account for about 85% of employment in Ethiopia (IBID). About 79% of the population lives rurally, suggesting that many rural Ethiopians are involved in the agricultural industry ("Rural Population"). While the majority of the country's employment lies in the hands of the agricultural industry, seasonal and annual income is not sustainable, putting the incomes of rural families at risk. Drought and over pastoralization throughout the past several decades has led to major land degradation, worsening with climate change (Biazin and Sterk 2013: 101; Belay, Beyene, and Manig 2005: 185,188; Gebru and Beyene 2012: 158). This makes agriculture economically unsustainable as steady incomes are not guaranteed with lessening crop yields (IBID). In response, the livelihoods of rural farmers are jeopardized as harsh environmental impacts on incomes destabilize opportunities for poverty reduction (Gebru and Beyene 2012: 158).

As agricultural practices are put at risk, rural communities are turning to alternative income sources in order to ensure the sustainability of their livelihoods (Belay, Beyene, and Manig 2005: 185; Gebru and Beyene 2012: 158). Self-reliant approaches to increase local economic development (LED) in times of agricultural stress have led rural communities to integrate beekeeping into their lives as a way to increase their diminishing incomes. While close to 30% of Ethiopia's rural population lives below the poverty line of less than $1.90 USD per day, beekeeping has been an integral practice in the reduction of rural impoverishment ("Ethiopia's Progress"). Apiculture not only provides alternative income sources for those in poverty, but improves agricultural practices through an influx of crop pollination and land restoration (Agera 2011: 28; Syampungani et al. 2009: 153). Although beekeeping's household economic benefits are abundant enough to pull families out of poverty, rural communities do not necessarily have the access to the relevant tools needed to reap the maximum apicultural income (Amulen et al. 2017: 10; Amulen et al. 2019:16). Non-governmental organizations (NGOs) have acknowledged the importance of beekeeping in increasing LED, and are providing apicultural technology and education to rural Ethiopians in order to elicit self-reliance among these communities.

As agricultural livelihoods are put at risk, the utilization of self-reliant development has allowed rural communities to target their economic needs. Ethiopia's high standing in the world's beekeeping spectrum has allowed these communities to tap into apicultural practices as a form of self-reliance in order to ensure income sustainability. I argue that beekeeping in Ethiopia fosters self-reliant development promoted by NGOs through the production of a fruitful cycle of economic and ecological diversification that stabilizes local economic development

(LED) by increasing household economies and sources of income and also by enhancing existing agricultural practices and plots. I develop this argument through the analysis of three data sources: case studies, NGO websites, and personal statements and interviews from Ethiopian beekeepers. This analysis shows that self-reliance is established with NGO stimulation of beekeeping initiatives, thus improving rural livelihoods through income diversification and agricultural enhancement.

The examination and analysis of case studies is crucial, as they provide detailed variables such as hive count and productivity that contribute to beekeeping initiatives. These include (Admassu et. al 2008: 79-83; Bareke and Addi 2019: 205-207; Reda, Shishay, and Gebremichael 2018: 66-78; Teamer Gebrehiwot 2015: 346-84) The examination of two supplemental case studies from South Africa and Zimbabwe will be provided to show that self-reliance and beekeeping as self-reliance are not isolated to Ethiopia. These supplemental case studies include (Binns and Nel 1999: 399-404; Illinger, Nel, and Robertson 1998: 358-9). As NGOs are argued to be crucial elements in the success of beekeeping as self-reliance in Ethiopia, I will analyze and discuss three prominent NGO programs: Bees For Development Ethiopia ("Modeling Integration" 2017; "Project Terminal Report" 2015; "Restoring Degraded Bee Forage" n.d.; "What We Do" n.d.), ASPIRE ("Apiculture and Rural Employment" n.d.; "Apiculture Scaling-up" n.d.; "ASPIRE" n.d: 1), and the YESH program ("Beekeeping" n.d,; "International Center" 2019: 57; "Young Entrepreneurs" n.d.). NGO websites and program reports provide detailed descriptions of organizational goals, outcomes, and the successes of beekeeping. Finally, personal testimonials regarding beekeeping as self-reliance and the support of NGOs will provide insight into first-hand economic and social effects of beekeeping. Examples of these

include ("Apiculture for income" n.d.; Girma 2019; "Project Terminal Report" 2015; Sawa 2016).

ORGANIZATION OF THE ARGUMENT

The argument is structured into three sections. The first section, *Self Reliant Development: Why NGOs are Essential in Ethiopia's Local Beekeeping Development Initiatives*, explains the rationale behind self-reliant development. It expands on this by underscoring how and why beekeeping fits into the spectrum of self-reliant development and LED. Finally, it discusses the importance of NGO beekeeping initiatives, which I argue are essential for the stimulation and survival of self-reliance through the analysis of prominent NGO influence and a case study. The next section, *Beekeeping and Local Economic Diversification: The Stabilization of Local Incomes*, serves to support the argument that beekeeping poses as an alternative source of income by diversifying the derivation of household/local revenue. Providing a case study example as well as NGO program reports, it describes the increase of livelihoods through income growth. Lastly, *Beekeeping and Local Economic Stability: The Enhancement of Agricultural Practice*, argues that beekeeping improves agricultural practices through increased pollination and land regeneration. I note that while beekeeping serves as an alternative income source, it is important in the stabilization of existing practices. I conclude with a brief summary of the complete argument.

SELF-RELIANT DEVELOPMENT: WHY NGOs ARE ESSENTIAL IN ETHIOPIA'S LOCAL BEEKEEPING DEVELOPMENT INITIATIVES

As previously mentioned, the purpose of this thesis is to argue that beekeeping is a successful form of self-reliant development in Ethiopia. Self-reliance is a bottom-up approach to development, allowing for communities and individuals to engage in the social and economic process of meeting their essential needs, including food and safety, in order to improve their livelihoods long-term ("Handbook For Self Reliance" 2005). This engagement is often kickstarted and supported through the help of NGOs, which are argued essential to the survival of self-reliant development (Nel and Binns 2000: 367; Stevens and Morris 2001: 153; Takarinda Agere 1982: 20-21). This section aims to demonstrate the relevance of self-reliance in Ethiopia while highlighting the important role that NGOs play by providing the proper hive types for both new and existing beekeepers alike, while ensuring the relevant education needed for the highest possible honey and income yield.

WHY SELF-RELIANCE?

While it has been established in my claim that NGOs are essential elements of self-reliant development, it is necessary to unpack the literature regarding self-reliance to gain a full understanding of its importance in rural communities and how it differs from contrasting western developmental initiatives .

It is argued that self-reliant development is the only effective form of localized development, as it directly benefits those in need (Binns and Nel 1999: 390; Nel and Binns 2000: 368). Several forms of large-scale developmental aid focus on the world view of markets and short-term developmental policy, often hidden under the guise of westernization (Binns and Nel 1999: 391). Decades of Western developmental failure to provide poverty reduction and or increase livelihoods in sub-Saharan Africa, for example, have put into question the legitimacy of these Western attempts at creating a "global village" (Binns and Nel 1999: 390- 391). This concept of the "global village" encourages a universal narrative of the world's development while ignoring marginalized group's lack of access to western, and therefore "global", phenomena (Binns and Nel 1999: 389-391). Large scale external developmental initiatives fail to reach marginalized communities, as such initiatives cease to propagate structural change (Agere 1982: 13). This suggests that developmental initiatives should be viewed through a qualitative versus quantitative lens; rather than external, large scale developmental goals, there must be focus on small scale community based initiatives (Agere 1982: 13). Development initiated by the Global North tends to focus on the quantitative aspects through large scale investments and big business, relying on established agencies to set forth large developmental projects that are rooted in the western spectrum of progress (Binns and Nel 1999: 393).

Alternatively, community based initiatives to encourage self-reliance are attentive to the specific needs of communities, which, as as quoted from Blakey by Binns and Nel, "stimulate[s] local employment in sectors that improve the community, using existing human, natural, and institutional resources" (1999:392). The stimulation of local employment, prompting local economic development (LED), uses a qualitative framework to motivate the engagement with

localized social and economic processes (Binns and Nel 1999: 390). Rather than focusing on large scale investments, the utilization of existing resources within communities allows for collective involvement and representation, which is often missing in western quantitative-focused development (Agere 1982: 18). Using local resources, self-reliance becomes an empowering operation, which is argued to be the nucleus of successful developmental initiatives (Syokau Mwanzia and Strathdee 2010: 5; Stevens and Morris 2001: 154). Empowerment within self-reliant communities elicits LED through organized communal targets and cooperation, constituting the most effective and progressive development (Agere 1982: 18; Binns and Nel 1999: 392; Syokau Mwanzia and Strathdee 2010: 5; Stevens and Morris 2001: 154). LED is a palpable process when met with empowerment, providing cost-effective results and benefits for self-reliant communities (Binns and Nel 1999: 393). By engaging with local resources, fueled by empowerment, self-reliance turns to LED, thus directly targeting specific communities in need.

Using the example of sub-Saharan Africa, several self-reliant initiatives have taken place in order to support local communities, otherwise turning from the aid of external developmental regimes. Self-reliant and LED initiatives led in the Mpofu District of Ciskei, South Africa, to generate local income in the mid 1990s push for community based development (Binns and Nel 1999: 399-400). The formerly independent Ciskei Homeland which was expropriated from the Eastern Cape Province in the 1970s, faced increasing levels of poverty as the once-plentiful citrus and tobacco farms were left without irrigation, killing the region's agricultural industry (IBID). While previous farm owners left the region, laborers were denied the ability to use abandoned farmland without any concrete government policy, thus leaving the land uncultivated

and communities impoverished (Binns and Nel 1999:399). In the 1980's, the Ciskei Department of Agriculture led failed attempts at the privatization of state-wide tobacco and potato farming, excluding local communities from employment opportunities (IBID). Although Mpofu locals were left without work, their accumulated farming experience fashioned a base for localized self-reliant development (IBID).

When Ciskei was reincorporated into South Africa after the fall of aparteid in 1994, small communities began the push toward self-reliance and LED, utilizing resources from within (Binns and Nel 1999: 399-400). Three local development initiatives sprouted in the Mpofu District: The Philani Community Development Project, The women's Zamukphila Co-operative, and the Hertzog Agricultural Co-operative (HACOP), all which limited government intervention and support (Binns and Nel 1999: 400). The Philani Community Development Project, based out of Balfour, aimed to train locals in potato farming, bead making, and other communal skills in order to promote the region's niche rural tourism sector (Binns and Nel 1999: 401-02). After becoming registered as a non-profit organisation, the Philani Project was able to secure government loans in order to boost local training and business initiatives as well as recover tourist-rich historic sites and nature trails (IBID). The success of the Philani Project runs parallel to that of the HACOP, a former farm worker-initiated self-reliance project (Binns and Nel 1999: 402-404). The co-operative reached out to the local government and was granted 100 hectares of land for farming, after the chairman stated "they couldn't wait for the government because the people are hungry" (Binns and Nel 1999: 403). Taking the initiative to farm again into their own hands, the members of HACOP were given plots of land which in turn allowed a greater income generation for individuals and the community alike (IBID). Using initial loans to construct and

maintain irrigation systems, HACOP community members took on ploughing, harvesting, and other agro-initiatives to maintain the enthusiasm of self-reliance (IBID). Just two years after the initiation of the co-operative, each community member produced an average of 8000 cabbages per season, and the community as a whole produced 6000-10 kilogram bags of potatoes, generating a surplus of income for the HACOP community (IBID). The success of HACOP inspired neighboring Mpofu communities, generating promotion for development throughout the region (IBID).

The example of Ciskei shows that change can be made when the initiative to improve LED through self-reliant development is embraced by communities rather than the reliance on large government or private aspirations. The Ciskei regime's promotion of a privatized agro-industry did not take the lives of it's rural populations into consideration. Rather, community co-operatives used local resources such as historic sites, bead making, and obtainable agricultural plots as the first steps to improve and benefit their livelihoods. The instance of Ciskei's self-reliance shows that even in post-apartheid-era poverty, rural communities who were previoulsy ignored by large developmental efforts are able to improve their LED through the ability to focus on and improve community-specific concers. LED through the utilization of local resources and empowerment, under the initiative of self-reliance, acts as a catalyst for socio-economic change that can be regionally replicated and identified in rural communities throughout sub-Saharan Africa.

BEEKEEPING AS SELF-RELIANCE

As discussed, self-reliant development allows for the utilization of local resources, allowing communities to tend-to their own specific socio-economic needs while generating positive developmental outcomes. I will unpack the literature regarding beekeeping as a form of self-reliant development, while referring to the history of apiculture in sub-Saharan Africa and Ethiopia in order to prove its contribution to LED.

Contrary to today's modern view of beekeeping, traditional beekeeping in sub-Saharan Africa consisted of honey hunting: the practice of using traditional hollow log hives to contain wild swarmed bees (Muli et. al. 2011; Nel et. al. 2000:351). Through the discovery of rock carvings and paintings, beekeeping is thought to have a several-thousand year history in the sub-Saharan region (Crane 1999: 49). Predominantly thought to have been created by the Sans people of sub-Saharan Africa, these paintings depict bee hives and honey hunters on cave and rock walls where traditional hives were likely to have been hung (Crane 1999:49-50). These carvings have been found throughout the region in countries such as South Africa, Tanzania, Mozambique, and Zimbabwe, with over 160 carvings documented in Zimbabwe alone (Crane 1999:50; Illgner et. al. 1998:353). Journal entries from the early medieval ages recall Arab trader's accounts of beekeepers and traditional hives (Crane 1999:51). Travel entries from 1067 through 1352 recall the abundance of honey from Senegal to Mali, increasing in sum past "the southern edge of the Sahara" (IBID). This entry suggests that sub-Saharan beekeeping has been abundant for hundreds of years. A number of journal entries describe early honey hunters, as their records recall high tree-hives that were later collected by the local people (IBID). Arab

traders were not the only ones to write of early honey hunters, as 15th century Portuguese explorers recalled men carrying honey sacks for trade along the docks (IBID). Later explorers, such as the Dutch naturalist François Valentijn, wrote of the abundance of honey at Cape Province and the great number of hives and honey hunters in the nearby forests (IBID). As of the mid 1900's, honey hunting methods were still prominent in sub-Saharan countries such as Tanzania and Madagascar, where 80% and 90% of their marketed honey was recorded to be sourced using indigenous methods (IBID). While the number of traditional hives has decreased due to the introduction of modernized methods, indigenous beekeeping skills are still relevant in sub-Saharan culture as they are an essential aspect of both ancient and modern localized socio-economic development.

Ethiopia is not excluded from the rich history of apiculture in sub-Saharan Africa. A journal entry from 16th century traders describes Ethiopia as, "overflowing with honey" (Crane 1999: 261), showing that the practice has historical meaning in the country. Some claim that the Ethiopian region has the richest beekeeping traditions in "tropical Africa", as centuries-old Ethiopians are to credit for the development of the high standards of sub-Saharan beekeeping (IBID). Traditional hives found in Ethiopia are made of mud, wood, plant stems, and tree bark, fashioned together in a cylindrical shape (IBID). With removable holed-lids on both ends of the cylinder, bees are able to easily leave the nest while also providing simple access for honey hunters and beekeepers (IBID). These traditional hive standards are considered high among sub-Saharan countries, showing that Ethiopian apicultural practice possesses relevant cultural impact.

Understanding the cultural and historical significance of beekeeping in sub-Saharan Africa and Ethiopia insinuates its potential to be utilized as a local resource in self-reliant initiatives (Guyo and Legesse 2015: 201; Nel and Illinger 2004: 127; Ingram and Njikeu 2011). Beekeeping is a historically utilized method of income, making it a legitimate form of self-reliance, as it promotes both household and LED through the sale of bee products (Chazovachii et al. 2012: 125; Nel and Illinger 2004: 128-129). The Bondolfi Beekeepers Association (BBA) located in Bondolfi, Zimbabwe, is an example of beekeeping used as a way to boost LED through self-reliance. Developed in 1995, the BBA initiated several income opportunities for the rural Bondolfi community (Illinger, Nel, and Robertson 1998: 358-360; Nel et al. 2000: 30-33). Located in a semiarid zone, the BBA was created in response to the minimal agricultural opportunities in the region (Illinger, Nel, and Robertson 1998: 358-9). Through the production, local marketing, and sale of honey, members have been able to increase their livelihoods through community beekeeping, as each member directly cares for at least two hives in the community apiary (IBID). Beekeeping members of the BBA were not the only ones whose incomes were positively affected. Local craftsmen and seamstresses, for example, reaped benefits from the organization, as they were hired to craft hives and bee-protective headgear (IBID). The utilization of beekeeping traditions as a form of self-reliance allows communities to look within their own resources in order to motivate their own income generation and socio-economic development. The example of Bondolfi shows that this scenario is plausible, and that beekeeping does in fact have the ability to act as a form of self-reliant development.

THE IMPORTANCE OF NGOs IN SELF-RELIANT INITIATIVES

While beekeeping poses as a form of self-reliance thus fostering LED, rural communities do not always have the access or ability to initiate these developmental changes on their own. In contrast to large-scale developmental aid, NGOs and grassroots organizations are able to assist with the specific needs that communities have in order to carry self-reliance forward. As described in my claim, NGOs are an essential element of self-reliant development, as they provide the relevant technology needed for successful income generating apiarys.

Large-scale aid does not take into account the level of technology present within rural communities. Technology is not a neutral variable of development, as it reflects economic and or political interests (Agere 1982: 13). In the 1960's several independent African countries followed in the footsteps of advanced Western technology, using consultants trained in western-oriented development (Agere 1982: 14). Thought of as a trickle-down effect, the goal of western technology was to detribalize and modernize, as these western developmental methods were seen as elements in the necessary improvement of peoples' livelihoods (IBID). In actuality, the introduction of Western technology benefited the entrepreneurs and upper class as poor communities were driven out of work (IBID). In this case, technology mirrored the economic interests of those in places of power, creating increasing numbers of unemployment. Technology is an important aspect of development, but in order for it to be effective it must be relevant and functional for those in need (IBID).

Hives are essential pieces of technology in the apicultural world. There are three types of hives used for honey production, including traditional, which provides lower quality crude honey, transitional, which provides a mid-level quality of honey, and modern hives, producing

the highest quality honey (Berhe, Asale, and Yewhalaw 2016:1; Teferi 2018: 1;Yirga and Teferi 2010:78). As previously discussed, traditional hives are pieces of sub-Saharan and Ethiopian history, as they were the original hives used in honey hunting traditions. To recap: traditional hives are commonly made from hollow logs as well as mud and plant stems, and are used to contain swarmed bees (Muli et. al. 2011; Nel et. al. 2000:351. While traditional hives are remnants of the Ethiopia's culturally rich apicultural history, the small size, simplicity, and reliance on wild bees makes the honey yield of these low and difficult to manage in large-scale honey production (Beyene, Woldatsadik, and Chalchissa 2018, 13). Transitional hives are hand-made locally-sourced hives that give communities a more integrative approach to beekeeping (IBID). By using local materials and craftsmen, transitional hives are a more advanced approach to beekeeping than traditional hives, providing greater honey yields while keeping its regional significance (IBID). The Holeta Bee Research Center in Ethiopia has reported that bamboo, shembeko, eucalyptus, and other locally available materials have been successful as construction materials for transitional hives throughout the country, allowing a greater yield both in amount and quality of honey (IBID). While the transitional hive is a great advancement from the traditional hive, it does not provide the highest quality honeys due to its hand-crafted and basic nature. In contrast, the modern hive is the most advanced hive type, allowing combs to be built in individual frames or top-bars that can be removed without disturbing the rest of the hive (Adjere 1990; Kumar et. al. 2018:291; Richardson 2019). These hives are said to provide the highest qualities and yields due to their ability to home more wax and honey, the simplicity of extraction, and the overall greater quality of the hive itself (Adjere 1990).

Img 1: Traditional hives in Mudula

(McGill et al. 2016: 25)

Img 2: Transitional hives

(McGill et al. 2016: 27)

There are several types of modern hives, simply breaking down into top-bar versus frame (Adjere 1990). Top-bar hives provide a bar for bees to build their comb down into the hive, while frame hives provide a four-sided frame for the bees to build their comb within (IBID). Top bar hives are broken into three shape-categories, V shape, groove, and pointed starter, each with

varying costs, production, and difficulty levels (IBID). The most common top-bar hive is the Kenyan top-bar which is adaptable to more aggressive bee varieties (IBID). This version of the top-bar can be broken into the three shape varieties, but can also be adapted to fit different log-hive variations (IBID). While there are varying categories of top-bar hive as well as the basic frame hive, they all fall under the category of the modern hive.

Img. 3: Modern hives in Angacha co-op, used for communal honey production

(McGill et al. 2016: 26)

While modern hive types are the most advanced technique of keeping bees, this variety is not always the most functional. Supplying new beekeepers with modern hives is not always the most effective way of introducing the practice, as the initial utilization of traditional hives provides a base understanding of how to properly utilize apiculture as a form of self-reliance (Kumar et. al. 2018:336; Binns et. al 1999:368; Amulen et. al. 2019:1; Nel et. al. 1999, 26). NGOs are able to evaluate the levels of beekeeping knowledge in rural communities, thus integrating the most relevant hive technology. Bees For Development Ethiopia (BfDE) is an

NGO that provides apicultural education in order to improve the wellbeings of rural and marginalized families ("What We Do" n.d.). Providing "top-bar [modern] hive training only where appropriate", BfDE acknowledging the importance of traditional hives throughout Ethiopia (IBID). The organization also recognizes that extra expenditures are unnecessary, pointing to fountain sheets and extractors as auxiliary needs (IBID). This shows that BfDE has the community's needs in mind by imposing only the most relevant hive technologies.

Along with providing functional technology for rural Ethiopian communities, BfDE offers a three-step educational program and refresher training courses to established beekeepers in order to solidify the accessibility to apicultural education ("What We Do" n.d.). A developmental initiative in the Lake Tana Biosphere Reserve provides details on the extent of the three-step BfDE training course. With a group of 80 beekeepers, the organization provided training on areas such as the benefits of different hive types, the construction of top-bar hives using local materials, bee colony management, swarm control, harvesting techniques, and packaging and marketing ("Project Terminal Report" 2015). This project targeted Ethiopian youth who had little access to the agricultural sector in order to improve their livelihoods and income (IBID). A testimonial from Wubnesh Kindu, a 22 year old girl dependent on her family, describes the importance that BfDE has had in her life (IBID). If she had not been approached to become a member of the Lake Tana apicultural training group, she would have continued to "share in the agony of my [her] Mom's life...examining the way to my destiny, looking through ample of the openings of my closet aspirations" (IBID). The BfDE course gave Kindu a sense of pride as she has been able to create work for herself and plans to develop her beekeeping further (IBID).

While these courses are essential to train new groups of beekeepers, they also give beekeepers the opportunity to gain enough apicultural knowledge to begin instructing new beekeepers themselves. The Lake Tana project reported that direct work with communities lead to a "trickle down effect", initiating a wider communal interest in beekeeping ("Project Terminal Report" 2015). As reported, communities not directly in the realm of NGO participation became interested in apicultural initiatives, taking regard to the concept of self-reliance and LED (IBID). Through this, BfDE also acknowledges the importance of NGO distribution throughout Ethiopia, as more communities are likely to be impacted through the diffusion of new local knowledge (IBID). The Lake Tana Project is not the only example of diffused beekeeping knowledge in Ethiopia. BfDE trained beekeeper, Getahm from Wonjeta, revealed the legitimacy of his training, claiming, "My neighbour has seen how I have benefitted and they have asked me to train them. I am willing to do that - I can now do everything on my own and even train others" (IBID). Although his neighbor was not a member of the BfDE project, he was directly affected by their apiculture training initiatives, as Getahm was able to use his instruction to spread the knowledge of self-reliant beekeeping.

The varying BfDE projects throughout Ethiopia show that NGOs are essential in kick starting and circulating apicultural self-reliant practices throughout the country. Without their rural outreach, participants like Kindu would not have looked to beekeeping as a way to improve their livelihoods. Similarly, without the initial introduction of functional technology and education, peripheral communities would not have taken interest in the developmental aspects of beekeeping. The case of Getahm underlines this potential, as his BfDE training prepared him to share his knowledge with those outside of the beekeeping community. In contrast to the

beekeeping projects of BfDE, a case study focused on the Afar Regional State in northern Ethiopia shows that with the lack of NGO support, rural communities have not reached their potential LED through beekeeping initiatives. Using data from 120 beekeeping households with an average of 10.8 colonies per family in three Afar districts, this study observed personal apicultural initiatives in place of livestock and crop farming, as the area has an extended dry season (Reda, Shishay, and Gebremichael 2018: 66,69). An average of 10.12 hives per district were found to be empty, locally attributed to the region's drought (Reda, Shishay, and Gebremichael 2018: 69). Out of the total number of hives, the majority of them are recorded to be traditional, with data determining that all modern hives were empty (IBID). The vacancy of modern hives in alignment with the lack of regional NGO interference supports the idea that an absence of apicultural education has led to the omission of previously contained swarms. While locals attribute empty hives to drought, the variety in blooming flora throughout each season allows the region to harvest honey up to 6 times per year (Reda, Shishay, and Gebremichael 2018: 72). Other regions in Ethiopia have less opportunities to harvest, suggesting that drought is not the issue, but rather a lack of apicultural education (IBID).

Over 50% of the surveyed beekeepers reported having caught their colonies as swarms in local forests and or mountains, which then 85.5% of the 120 households stationed close to the house (Reda, Shishay, and Gebremichael 2018: 70). The close proximity of hives to the household versus the creation of a seperate apiary once again suggests the importance of NGO apicultural education. Direct contact of colonies to the household leads to the diminishment of honey production, as bees are more likely to defend their hives than gather honey (IBID). While the average honey production was comparable to other regions throughout the country, such as

the Tigray region, the seasonal flora in the Afar region suggests that honey yield has the potential to be, and should be higher (Reda, Shishay, and Gebremichael 2018: 72). With the proper hive types and education for Afar communities, local beekeepers would have the potential to increase their honey yields and incomes. The case study shows that in fact, that poor services and lack of knowledge are some of the top causes for low honey yields in the Afar Region (Reda, Shishay, and Gebremichael 2018: 77). Concluding the study, it is suggested that the region's major drawbacks in apiculture are due to the lack of organizational and community education (Reda, Shishay, and Gebremichael 2018: 78). With organization intervention, increased education and the use of traditional knowledge, beekeeping holds the potential to be a form of self-reliance in the Afar Region (IBID).

By comparing BfDE and the case study in the Afar Region, it is clear that NGOs are essential in beekeeping developmental initiatives. Even though the Afar Region is abundant in their seasonal flora, rural beekeepers were not reaching maximum honey yield due to their lack of education on hive upkeep. Alternatively, BfDE trained beekeepers were not only able to improve their livelihoods through the introduction of beekeeping, but they were able to spread their knowledge through a modern take on traditional apicultural knowledge. These contrasting examples highlight the need of apicultural-focused NGOs as they provide relevant technology and education, proving to be essential in beekeeping self-reliance initiatives.

BEEKEEPING AND LOCAL ECONOMIC DIVERSIFICATION: THE STABILIZATION OF RURAL INCOMES

The diversification of rural incomes is one of the benefits of adopting beekeeping as a form of self-reliance. The agricultural sector is unsustainable for rural farmers, therefore a diversification of earnings is essential for livelihood sustainment and improvement of those affected. Case studies and NGO testimonials support the claim that beekeeping is a plausible form of self-reliance with organizational support by posing as an alternative form of income, therefore increasing LED. I will analyze a case study from the Tigray Regional State as it provides a laid out examination of beekeeping efforts in the region, supplying essential quantitative data to support the claim that beekeeping increases local household economies. I will then provide data from the organizations Bees For Development Ethiopia/ the ASPIRE program, and the International Center of Insect Physiology's YESH program for young beekeepers, to provide essential quantitative and qualitative data that highlights the programs' positive economic effects in their respective rural communities of focus. With this, I will provide testimonials to solidify the effectiveness of beekeeping in the improvement of LED.

CASE STUDY: TIGRAY REGIONAL STATE, NORTHERN ETHIOPIA

This case study took place in the Degua-Temben and Kilte-Awalo *woredas* (districts) of the Tigray Regional State in order to identify beekeeping's potential to contribute to poverty alleviation (Teamer Gebrehiwot 2015: 346-47). According to the study, several *woredas* in Tigray, specifically the two regions of focus, are well established in their apicultural practice and

have been utilizing it as a form of income generation (IBID). This fact makes these *woredas* essential to analyze, as beekeeping has already been absorbed as an inveterate income source. Degua-Temben houses approximately 11,709 colonies, made up of 7,263 traditional and 4,527 modern hives, while Kilte-Awalo has taken up beekeeping as a necessary income source and has 16,803 modern hives (Teamer Gebrehiwot 2015: 347). Apiculture in the region is primarily practiced by individual families/smallholders, co-operatives, and other groups such as church beekeeping associations (IBID). Within these *woredas*, ten *tabias* (municipalities) were selected for study: Debre-Nazret, Aynbirkekn, Adi-Azmera, Mahbere-Selassie and Melfa from Degua-Temben *woreda* and Aynalem, Hadnet, Debre-Tsion, Tsigereda and Tsadenale from Kilte-Awlaelo *woreda* (Teamer Gebrehiwot 2015: 348). 110 beekeepers were selected from the ten *tabia*s for study (IBID).

Each *tabia* was categorized as being a high, medium, or low potential area based off of the previous year's honey harvest (2014), number of both traditional and modern hives, and through a consultation with local beekeeping experts (Teamer Gebrehiwot 2015: 348-49). The figure below lists the ten sample *tabias* in order of highest potential to lowest potential. The highest potential areas have the most beekeeper respondents, which can be seen in the chart. This means that the highest percentage of the study consists of high potential regions.

Fig. 1: Number of Sample Respondents Based on Sample Woredas and Tabias

Sample Target Tabia	Frequency	Percent	Production categories
Degua-Temben, *Tabia* Debre-Nazret	24	21.8	High potential area
Kilte-Awlaelo, *Tabia* Aynalem	21	19.1	High potential area
Kilte-Awlaelo, *Tabia* Hadnet	17	15.5	Medium potential area
Kilte-Awlaelo, *Tabia* Debre-Tsion	12	10.9	Medium potential area
Degua-Temeben, *Tabia* Aynbirkekn	10	9.1	Medium potential area
Degua-Temben, *Tabia* Adi-Azmera	8	7.3	Medium potential area
Kilte-Awlaelo, *Tabia* Tsadenale	6	5.5	Low potential area
Degua-Temben, *Tabia* Mahbere-Selassie	4	3.6	Low potential area
Degua Temben, *Tabia* Melfa	4	3.6	Low potential area
Kilte-Awlaelo, *Tabia* Tsigereda	4	3.6	Low potential area
Total	**110**	**100.0**	

Sources: survey result, 2015

(Teamer Gebrehiwot 2015:349)

Looking at the chart, there are two high potential, four medium potential, and four low potential *tabias.* The high potential regions make up 40.9% of the study, while the medium and low *tabias* make up 42.8% and 16.3% respectively. While the low potential areas are a significantly smaller percentage of the study, this solidifies that beekeeping in the Degua-Temben and Kilte-Awalo *woredas* is an established practice as the medium and high potential areas contribute to 83.7% of the study.

The table below charts the honey production of the area's beekeepers, from both traditional and modern hives, chosen from each of the ten *tabias*.

Fig. 2: Honey production by the sample respondents by tabias

Sample *Tabias*	Total per hive honey production in kg from both traditional and modern beehive now				
	Below 10 kg honey production	In the range of 11 kg to 20 kg per hive	In the range of 21 kg to 30 kg per hive	In the range of 31 kg to 40 kg per hive	Total Frequency
	Frequency	Frequency	Frequency	Frequency	
Tabia Debre-Nazret	3	3	13	5	24
Tabia Aynbirkekn	1	2	5	2	10
Tabia Adi-Azmera	0	1	2	5	8
Tabia Mahbere-Selasie	0	0	2	2	4
Tabia Melfa	0	1	2	1	4
Tabia Aynalem	3	3	9	6	21
Tabia Hadnet	0	1	9	7	17
Tabia Debre-Tsion	2	2	7	1	12
Tabia Tsadenale	2	0	3	1	6
Tabia Tsigereda	0	0	3	1	4
Total	**11**	**13**	**55**	**31**	**110**
Percentage	**10%**	**12%**	**50%**	**28%**	**100%**

Sources: survey result, 2015

(Teamer Gebrehiwot 2015: 351)

Looking at figure 2, 10% of beekeepers produced below 10kg of honey, 12% produced 11-20kg of honey, 50% produced 21-30kg of honey, and 28% produced 31-40kg of honey. Modern hives are said to produce an average of 20-30kg of honey per hive, so seeing a 78% production of 20kg+ honey is in alignment with the fact that the two *woredas* have a total of 21,330 modern hives (Yirga and Teferi 2010:84).

As of figure 1, the Debre-Nazret *tabia* was the highest potential region, made up of 24 out of 100 participants, or, 21.8%. When looking at figure 2, *tabia* Debre-Nazret remains the highest potential region with a frequency of 24 productions of honey. While the high potential and end production of *tabia* Debre-Nazret was an accurate estimate, this alignment of honey production in figure 2 to *tabia* potential in figure 1 does not stay in sequence throughout the remaining nine regions. Below, figure 3 compares the original potential of each *tabia* to their production outcome.

Fig. 3: Comparison of estimated potential to product outcome by tabias

Sample *Tabias* in order of estimated potential	**Frequency**	**Estimated Potential**	**Sample *Tabias* in order of production outcome**
Tabia Debre-Nazret	24	High Potential	*Tabia* Debre-Nazret
Tabia Aynalem	21	High Potential	*Tabia* Aynbirken
Tabia Hadnet	17	Medium Potential	*Tabia* Adi-Azmera
Tabia Debre-Tsion	12	Medium Potential	*Tabia* Mahbere-Selasie
Tabia Aynbirkekn	10	Medium Potential	*Tabia* Melfa
Tabia Adi-Azmera	8	Medium Potential	*Tabia* Aynalem
Tabia Tsadenale	5.5	Low Potential	*Tabia* Hadnet
Tabia Mahbere-Selassie	4	Low Potential	*Tabia* Debre-Tsion
Tabia Melfa	4	Low Potential	*Tabia* Tsadenale
Tabia Tsigereda	4	Low Potential	*Tabia* Tsigereda

Comparing “Sample *tabias* in order of estimated potential”, to, “Sample *tabias* in order of production outcome” shows that not all of the potential estimations were correct. For example, *tabia* Aynalem, estimated as a high potential area with a frequency of twenty one, was the sixth

most productive region, while *tabia* Mahibere-Selassie, estimated as a low potential area with a frequency of four, was the fourth most productive region. This is important to note, as production leads to income generation. Estimated low potential areas are still able to yield high honey production, therefore increasing incomes. While estimated high and medium potential areas are also displaced in estimation of productivity, this does not mean that these *tabias* face concern with honey production. High potential *tabias* account for a higher percentage of the study group, and are therefore more likely to have a larger range of production outcome, spanning from below than 10kg to 40kg per hive.

The adaptation of more modern beekeeping technology over time is essential in long-term apicultural practice, as modern hives, for example, produce larger honey yields, therefore greater income generation (Yirga and Teferi 2010:84). As discussed previously, the use of relevant technology when first adopting beekeeping is important as it allows rural communities to gain the necessary education over time in order to update their practice and increase their LED through income generation. Figure 4 below compares beekeeping ownership and production from the beginning of the participants apicultural journey until the time of the study throughout all ten *tabias*.

Fig 4: Comparison of ownership of beehives and production of honey and wax products at the beginning and now

Beekeeping ownership and production	Beginning			Now		
	Sum	Mean	Std. Deviation	Sum	Mean	Std. Deviation
Total of traditional beehive	130	1.18	.706	318	2.89	2.348
Total number of modern beehive	244	2.22	2.975	1,004	9.13	14.062
Total number of both traditional and modern beehive	374	3.40	3.395	1,322	12.02	15.669
Average purchase value of traditional beehive in Birr	1500	13.64	62.776	.00	.0000	.00000
Average purchase value of modern beehive in Birr	50,202	456.38	344.816	164,066.0	1491.5091	361.88532
Average purchase value of colony in Birr	62,340	566.73	300.367	167,310.0	1521.0000	220.63690
Average per hive honey production in kg from traditional beehive	859	7.81	4.357	913.00	8.3000	3.88729
Average per hive wax production in kg from traditional beehive	47	.43	.795	42.50	.3864	.84433
Average per hive honey production in kg from modern beehive now	1032	9.38	8.774	1971.00	17.9182	8.28188
Average per hive wax production in kg from modern beehive	42	0.38	2.685	15.50	0.1409	0.51528

Sources: survey result, 2015

(Teamer Gebrehiwot 2015: 354)

As of figure 4, from the beginning of the study participant's adoption of beekeeping now, the number of traditional hives increased by 188, from 130 to 318 hives. In comparison, the number of modern hives increased by 760, from 244 to 1,004 hives. Within the same amount of time, the average honey yield per traditional hive increased by 54kg, from 859kg to 913kg of honey. The average honey yield per modern hive increased by 939kg, from 1032kg to 1971kg of honey. This is a total increase of 993kg of honey since the beginning of the participants'

beekeeping practice. On average, the price of honey in the Tigray Region ranges from 90 Ethiopian Birr (ETB)/kg to 130 ETB/kg, depending on its color (Teamer Gebrehiwot 2015: 344). Tigray white honey is the most valuable in Ethiopia, and therefore reaches prices of 130ETB, whereas yellow honey sells at a lesser price (IBID). Between the production of traditional and modern hives, the average honey yield is a total of 2,884kg. Using Tigray's average honey prices, the average income generated from the collective income generation of the participants "now" can range from 258,560 to 374,920 ETB in total. This is an average increase of 170,190 to 245,830 ETB, as the "before" income generation would have ranged from 170,190-245,830ETB. The "now" income generation is equivalent to $7,834 USD to $11,360 USD. For reference, the international poverty line lies below $1.90USD/day, which is equivalent to $66 ETB/day.

The increase in income generation shows that apiculture has posed as an alternative income form for rural beekeepers in the Tigray Region. While honey production depends on the type of hive and the number of hives, when adopted as a form of income generation, this case study shows that on average beekeeping has increased local economies through the diversification of income. At the end of the case study, the participants were asked if beekeeping had improved their livelihoods, of which 90% responded yes (Teamer Gebrehiwot 2015: 362). The income generated was recorded to contribute to the access to livestock, loan repayment, and the building of better homes (IBID). Looking at the example of livestock access, beekeeping has allowed rural families to invest in other sources of income, as livestock products can also contribute to household economies.

This case study supports the claim that beekeeping as self-reliant development increases income generation. By analyzing beekeeping's potential production in comparison to the production outcome, it became apparent that correlation did not stay in sequence. *Tabias* in all three levels of potential production were displaced after totalling their honey production results, as shown in figure 3. This means that areas of estimated low beekeeping potential were able to yield high honey production levels, which in turn contributes to income generation. The analysis of the number of hives and production "before", versus, "now" highlighted the average increase in both traditional and modern hives, leading to an increase in honey production. By using the average honey sale price in Tigray to determine the range of income generation, the increase of household revenue was revealed, proving that beekeeping as self-reliance improves LED and household economies. This was confirmed with the 90% positive feedback from study participants, claiming that their livelihoods have improved through beekeeping. As this case study analysis reveals, beekeeping as self-reliance diversifies rural income, thus increasing household profits and livelihoods.

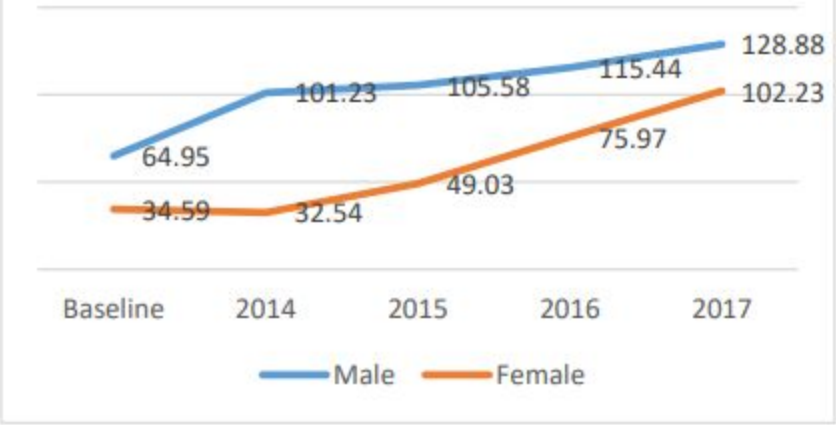
ANALYSIS OF NGO EFFECTS ON INCOME GENERATION THROUGH BEEKEEPING

NGOs are essential to the success of beekeeping as self-reliance, as they provide the necessary technology and education to stimulate effective income generation. Bees For Development Ethiopia, as previously discussed, is an organization that focuses on beekeeping education in order to improve the livelihoods of rural Ethiopian beekeepers. One aspect of the organization's work is to improve rural incomes through a partnership with the Apiculture

Scaling-up Programme for Income and Rural Employment (ASPIRE) program ("Apiculture and Rural Employment"). From 2012-2017, the goal of the ASPIRE program was to create a sustainable apiculture sector in Ethiopia that would contribute to poverty alleviation ("ASPIRE" n.d: 1; "Apiculture Scaling-up" n.d.). ASPIRE focused on 52 *woredas* in the Tigray, Amhara, Oromia, and Southern Nations, Nationalities, and Peoples Region (SNNPR) (IBID). There were three main goals of the project: to work with 30,000 beekeepers with the goal that each participant would earn €360 (8,400 ETB) per year, to establish a honey exporter within Ethiopia, and to diffuse apicultural practice to 30,000 smallholder beekeepers through their interest in ASPIRE participants (IBID).

The construction and upkeep of hives was one of the main training regiments offered to ASPIRE participants ("ASPIRE" n.d: 4). Using local resources, participants were trained to construct transitional hives with the initiative to later upgrade to modern hives (IBID). 25,591 participant beekeepers created 67,006 transitional hives, of which 44,471 were colonized and began honey production (IBID). Through training and gained beekeeping experience, 14,971 beekeepers later integrated 31,279 frame (modern) hives into their apiaries, of which 26,376 were colonized (IBID). As a direct result, the production of honey increased over the span of the four year program (IBID). Below, figure 5 shows the increase of honey production for both male and female beekeepers throughout the four *woredas*.

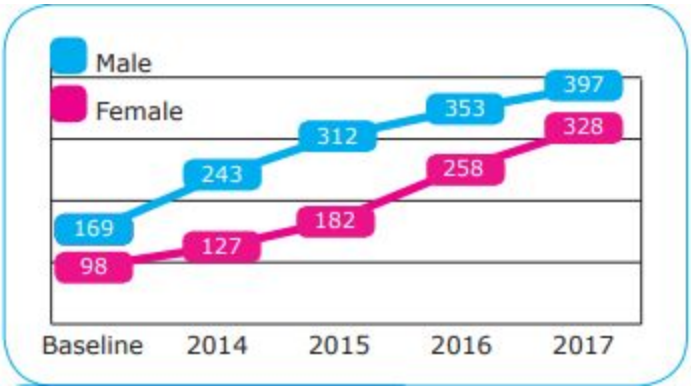
Fig 5: *Honey Production Trend (kg)*



("ASPIRE" n.d: 4)

Looking at figure 5, male beekeeper's average honey production rose from 64.96kg to 128.88 kg, for a total gain of 63.93kg. Female beekeeper's average honey production rose from 34.59 kg to 102.23 kg, for a total gain of 67.64kg. The increase in production is due to the average number of hives, as well as better hive production as a result of increased experience ("ASPIRE" n.d: 5). This increase in production directly resulted in the increase of income (IBID). Figure 6 shows the income increase trend in both male and female beekeepers from the combined *woredas*.

Fig 6: Income Increase Trend



(Inclusive n.d.)

Looking at figure 6, male beekeeper's income increased from €169 (5,059 ETB) to €397 (14,770 ETB), and female beekeeper's income increased from €98 (3,646 ETB) to €328 (12,203 ETB) over the four year programme period. This figure directly shows the increase in income since the introduction of beekeeping as development within the four target *woredas*.

The ASPIRE programme overshot its goal by directly affecting 31,376 new beekeepers in their target regions, rather than 30,000 ("ASPIRE" n.d: 4). With that, 32,290 "copy" beekeepers benefitted from the programme through the teachings of ASPIRE trained beekeepers by the end of the programme period (IBID). That means that 64,666 new beekeepers were created in Ethiopia through the ASPIRE programme alone, thus increasing the incomes of over 60,000 rural families, surpassing the initial goal.

A follow-up interview with BfDE/ASPIRE participant, Eneyew Abie, gives a personal account of the positive changes that beekeeping has offered due to increased income. A 29 year old father living in Mehal Mender, Eneyew was living in poverty with no usable land for crop subsistence agriculture ("Apiculture for income" n.d.). After joining the program, he was able to produce 50kg of honey, earning 4,800 ETB and increasing the family's annual income by 56% (IBID). Eneyew stated, "I used the money to purchase corrugated iron sheets for my house. Also nails. It also helped me pay for someone to herd my cows. The income I get from beekeeping is very promising. Compared to crop production, the effort and time required to do beekeeping is less. I am now planning to increase my apiary by five hives" (IBID). This personal account shows the direct effects that beekeeping has had on programme participants by increasing livelihoods. By having an increase in income, Eneyew was able to afford essential home improvements while setting his cattle herds up for better production.

The BfDE/ASPIRE programme is not the only apiculture-focused organization in Ethiopia. The Young Entrepreneurs in Silk and Honey (YESH) program, backed by the International Center for Insect Physiology and Ecology (icipe), aims to support Ethiopian youth employment through the training of silk worm management and beekeeping in order to access financial services through increased income ("Young Entrepreneurs" n.d.) Looking at beekeeping from a developmental point of view, YESH's goal is to support beekeeping market chains for Ethiopian rural youth development (Beekeeping n.d.). While the program is still underway and no final reports have been released, icipe's 2018 annual report records the progress of the YESH program in its third year ("International Center" 2019: 57). In 2018, YESH enrolled new 4000 youth into its apicultural agenda which took place in eleven training sites (IBID).

While no final reports are available, YESH program participant testimonials advocate for beekeeping as an income generator. Ayenalem Kataya, a 22 year old farmer from Jimma in southwestern Ethiopia, is a member of the YESH-supported Boter Boro apicultural co-operative (Sawa 2016). The co-operative shares fifty beehives, of which Kataya produces 60kg of honey per season (IBID). Through the income generated from beekeeping, she has been able to purchase a dairy cow, several sheep and goats, and a solar power system which was installed on her home (IBID). Admitting, "I have benefited a lot from using a modern beehive", Kataya plans to open her own honey shop where she can sell her honeys to a larger market (IBID). Kataya's personal achievements and future plans are due to her involvement in the YESH program and the adoption of beekeeping into her life. Having an alternative source of income allowed Kataya to purchase livestock, giving her the opportunity of an even larger influx of income. Her future

prospects are bright, as opening a honey shop would unlock even greater income generation. This shows that the diversification of income through the introduction of beekeeping is possible, as it has allowed beekeepers like Kataya to invest in their future.

Kataya is not the only ASPIRE trained beekeeper who has economically benefited from the program's beekeeping initiatives. Wude Aymiro from the rural Awabel district, East Gojjam Zone of the Amhara State, grew up as an animal herder who was not able to attend upper-level schooling (Girma 2019). Having no source of income for two years, Aymiro relied on family support and the occasional job of washing and folding clothes to survive (IBID). Aymiro claims that the discovery of the YESH program was "life changing", and now has the opportunity to become one of the most successful women in her region (IBID). As a member of a small co-operative, Aymiro helps take care of twenty two modern hives which produce up to 45kg each (IBID). This generates 200,000 ETB per season for the co-operative from bee products (IBID). This income generation has improved the lives of Aymiro and other beekeepers alike, as she was able to build her and her family a new house from beekeeping revenue (IBID). Regarding her years without income, she describes her life as being "very disgusting and painful" (IBID). With YESH's introduction of beekeeping, Aymiro's life has changed for the good. She claims, "The YESH project has provided financial and material supports for many unemployed youths… In general, the project afforded us unlimited supports, which transformed our life from a gloomy to a brighter one" (IBID). Aymiro's livelihood increased when she was able to make an income for herself. Before YESH, Aymiro had no income and relied on her family for support. After joining the project, she made enough income to build her family a new home, thus improving their livelihoods.

Quantitative data from the BfDE/ASPIRE program supported the claim that beekeeping acts as an alternative source of income for rural Ethiopians. Through visible increases in honey production and income, it is obvious that beekeeping has been able to pose as a legitimate alternative and diversifying income source. Alternatively, NGO beekeeping programs like the YESH program provide qualitative data through personal testimonials of the effects of beekeeping and income generation. Reaching tens of thousands of rural Ethiopian's, apicultural NGOs have allowed communities to access new forms of income generation through both personal and co-operative beekeeping, increasing personal revenue and future opportunities. By looking at an analysis of NGO effects on income generation as well as the analysis of the Tigray Region, it can be said that beekeeping does in fact act as a form of self-reliance as it poses as an alternative form of income for rural communities.

BEEKEEPING AND LOCAL ECONOMIC STABILITY: THE ENHANCEMENT OF AGRICULTURAL PRACTICES

The agricultural industry employs 85% of Ethiopians, made up of an estimated 12 million smallholder farms ("Ethiopia at a Glance"). Due to decades of drought and overpasturalization, the risk of barren land jeopardizes farmers' potential income (Biazin and Sterk 2013: 101; Belay, Beyene, and Manig 2005: 185,188; Gebru and Beyene 2012: 158; "Quick Facts" 2019). While beekeeping provides an alternative income source for farmers and rural communities, it also has the potential to improve these existing agricultural practices. Through the introduction of contained bees, beekeeping provides essential pollination to struggling crops (Bareke and

Addi 2017: 205). This increases potential crop yield, thus improving the practice and income generation of agricultural operations. In the case of infertile land, the practice of beekeeping rehabilitates essential environments that are needed for agricultural endeavors (Teferi 2018: 5; Yirga and Teferi 2010: 77). This in turn supports fruitful land that can be used to enhance agricultural practices. Using data from crop-specific studies, I will analyze the effects that honeybees have had on crop production in order to show that the adoption of beehives will increase crop yield and income. I will then analyze a case study of honeybees on Allium Cepa var Adama Red (shallot) crops in order to further support the claim that the adoption of beekeeping supports existing agricultural plots and practices. Lastly, I will discuss BfDE's forest restoration project to support the claim that beekeeping supplements essential environments that contribute to agricultural practice.

OVERVIEW OF HONEYBEE POLLINATION BENEFITS ON ETHIOPIAN CROP PRODUCTION

The introduction of controlled honeybees to crop farms has played a significant role in production, as increased pollination heightens crop yield and quality (Bareke and Addi 2019: 205). Nationally, several crops have been recorded to have increased in yield after honeybees were introduced to agricultural plots (IBID). While it is known that bee pollination is essential to crop production, the study of beekeeping's impact on crop production is relatively new (IBID). With that being said, this new focus of research has shown that several crops have increased in yield since the adoption of beekeeping.

Guizotia abyssinica (Niger), an oilseed crop, is ranked the third most abundant in Ethiopia (Bareke and Addi 2019: 206; Fikado 2019: 177). Niger is not a self-pollinating crop, therefore it relies on pollinators like bees to insure its reproduction (Bareke and Addi 2019: 206). It is recorded that niger seed yield has increased from 45-80% throughout the country with the controlled introduction of beekeeping and honeybees (Bareke and Addi 2019: 206; Teferi 2018: 4). The Holeta Region's maximum seed yield was about 600kg/hectare, while the Tigray Region showed a 16,700kg/hectare seed yield with the introduction of honeybees, representing the 45-80% variance in yield (Bareke and Addi 2019:6). This difference in yield increase is said to be related to geography, as the Holeta Region lies within drier lands of central Ethiopia (IBID). While there is a 16,100kg/hectare difference in increase between the two regions, their environmental variances make their respective growth rates significant.

Malus sylvestris (apple) is an important cash crop in the highlands of Ethiopia (Bareke and Addi 2019:6). Similarly to niger, most apple varieties do not self-pollinate, therefore they rely on insect pollinators for production (IBID). Honeybees have shown to be especially important to apple production, as their absence has shown to decrease apple production in the highlands (IBID). When contained beehives were introduced to apple orchards and farms, there was a 50% increase in fruit yield (Bareke and Addi 2019: 206; Teferi 2018: 4). The average apple yield per tree is 2.2kg, but is shown to increase to 3.2kg/tree when exposed to caged bees (Bareke and Addi 2019: 206-07). It has been recorded that after the introduction of honeybees, apple prices rose by $136 (4,487 ETB) per one hundred apple trees due to higher quality, increasing the incomes of apple farmers (Fikado 2019: 177).

Vicia faba (faba bean) is the second most abundant crop in Ethiopia (Fikado 2019: 177). High in protein and relatively cheap, it is an essential crop in the diets of poor Ethiopians (Bareke and Addi 2019: 207; Teferi 2018: 4). Faba beans are both self-and-cross pollinating, but rely on insect pollination for the most productive crop yields (Bareke and Addi 2019). Honeybees are the most dominant pollinators of faba beans, as their pollen is sticky and tends to attract them specifically (Bareke and Addi 2019: 207). After the controlled introduction of honeybees, faba bean yields were recorded to increase by 33.5% (IBID).

This short overview of the pollination benefits of honeybees on common Ethiopian crops supports the argument that the adoption of beekeeping supports existing agricultural practices and plots. The introduction of honeybees to niger, apple, and faba bean crops resulted in the increase of each of the crops' yield. This suggests that with the adoption of beekeeping, farmers will increase their crop potential. As agriculture does not provide stable income generation, the increase of crop yield insures an increase in revenue. As previously discussed, beekeeping provides an alternative source of income. While this argument has been supported, it is important to sustain agricultural income generation in agro-economies, as this sector is still the most prominent in rural communities.

CASE STUDY: HONEYBEE POLLINATION EFFECTS IN THE RIFT VALLEY

This case study observed the effects of honeybee pollination on Allium cepa vas Adama Red (shallot) in the Upper Awash Valley in Ethiopian Rift Valley region between 2000-20001 (Admassu et. al 2008: 79, 81). This observation took place at the Melkasa Agricultural Research Center in order to understand the importance of honeybees in shallot pollination and yield

(Admassu et. al 2008: 79). Shallots are cross-pollinated and require insect pollination for production (Admassu et. al 2008: 80). There were three scenarios which were replicated three times: caged plots with honeybee exposure, plots exposed to other regional insects including honeybees, and plots deprived of honeybee pollination (Admassu et. al 2008: 79, 81).

The scenario in which plots were caged with just honeybees had the greatest yield of 17.3 quintales (q) per hectare (Admassu et. al 2008: 79, 81). This was followed by the plots visited by all insects with a yield of 9.5q/hectare, and finally the plot that excluded honeybees with a yield of 5.4 q/hectare (IBID). This outcome shows that honeybees are essential to the pollination of shallots. Shallot yields nearly triple when completely exposed to honeybees, versus yields in which they are deprived. In the scenario in which plots were open to all insects and honeybees, it was recorded that honeybees were the most common pollinator (Admassu et. al 2008: 83). Out of all of the potential insect pollinators, honeybees contributed to 38.4% of the pollination (IBID). The succeeding pollinators were stingless bees (23.07%) and flies (19.2%), then followed by wasps, butterflies, and carpenter bees (IBID).

These results support the argument that beekeeping contributes to the success of existing agricultural plots. As this case study reveals, honeybees are the largest contributor to pollination, accounting for 38.8% of mixed-insect pollination. The scenario with solely honeybee pollinators produced the largest shallot yield, thus proving that honeybees improve agriculture practice. It is to be expected that these numbers would vary by crop. With this being said, the overview of honeybee pollination production shows that other important crops such as niger, apple, and faba beans, increase in yield with increases with honeybee pollination. With the introduction of beekeeping, rural beekeepers are able to enhance their agricultural plots as honeybee pollination

increases crop yield. Beehives placed in agricultural fields will contribute to the crop yield of smallholder farmers due to increased honeybee pollination, thus improving income generation.

REGENERATING FORESTS: THE ROLE OF BEEKEEPING ON LAND RESTORATION IN THE AMHARA REGION

After years of overgrazing and intense use, areas of the Dangila, Amhara region of Ethiopia have lost nearly all vegetation ("Restoring Degraded Bee Forage"). Implemented by BfDE and the Critical Ecosystems Partnership Fund, a local Dangila community (Gult Abishkan Kebele, Agintta Village) restored their local ecosystem by planting 18,000 native seedlings on 47 hectares of barren land ("Modeling Integration" 2017). Provided with transitional hives and apicultural training, forty participants initiated the practice of beekeeping on the reserved land in order to support vegetation growth (IBID). The goal of the forest restoration project was to initiate the sustainability of both the land and of communities through beekeeping (IBID).

The selected beekeeping participants previously had no form of income, as the land was barren and could not be used for revenue generation ("Modeling Integration" 2017). Major environmental restoration was recorded after beekeeping initiatives were underway, as the seedlings were left untouched by locals (IBID). Images 4 and 5 below show the improvement of land after the project duration from 2015-2016.

Img 4: Degraded Land in the Gult Abishkan Kebele, Agintta Village Before Beekeeping Land Restoration Project

("Modeling Integration" 2017)

Img 5: Environmental Restoration in the Gult Abishkan Kebele, Agnitta Village After 1 year of Beekeeping

("Modeling Integration" 2017)

These images support the claim that beekeeping helps to restore essential land, as vegetation regrowth was underway after one year of beekeeping. Klipspringers are aardvarks were recorded to have returned to the area, highlighting the increase in biodiversity to the once degraded land (IBID). Increases in biodiversity such as vegetation and animal habitation contribute to land

restoration, increasing the fertility of soil (IBID). The availability of fertile land is essential to local communities, as livelihoods depend on the ability to access usable agricultural plots. With access to fertile land, the participants who were once without income can now acquire revenue through sustainable agricultural practices. The introduction of beekeeping was a major contribution to the fertilization of local land, allowing the integration of agricultural practices to flourish with newly-fruitful ecosystems.

Beekeeping not only supports existing agricultural plots, but enhances essential ecosystems that support agricultural practices. The three examples of essential crop yield improvement, shallot yield, and land restoration support the claim that beekeeping supports and enhances agricultural plots and practices. With the introduction of bees, essential crop yields increase, allowing for gains in agricultural income. In areas of degraded land, beekeeping initiates vegetation growth, thus spurring the growth of biodiversity which enriches the soil to be used for agricultural endeavors. Agriculture is necessary to sustain the livelihoods of rural Ethiopians. The increase of cultivation income generation through essential pollination and land restoration improves LED by improving agricultural yield and revenue.

CONCLUSION

Beekeeping in Ethiopia poses as a form of self-reliant development through the initiatives of NGOs, by diversifying income generation and by supporting existing agricultural practices and plots. The utilization of beekeeping as self-reliance in Ethiopian communities enhances LED, contributing to the sustained livelihoods of rural peoples. NGOs provide essential and

relevant technology to ensure that beekeepers are able to sustain maximum benefit from their apicultural practices while creating a sense of communal empowerment. Through this, rural ethiopians have utilized beekeeping as an alternative source of income, as farming does not guarantee sustainable monetary generation. While income is generated through the sale of honey, apiculture also supports agricultural practices through increased pollination and land restoration, increasing the sustainability of crop production. This diversification and sustainability of income generation fuels empowerment, as communities and co-ops are able to improve their livelihoods as a collective.

There is an old Ethiopian proverb that puts the concept of self-reliance into perspective: "When spider webs unite, they can tie up a lion" (ድር ቢያብር አንበሳ ያስር) (McGill et. al 2019). When working together from within, communities can take control of their fate; enhancing the prospect of their own livelihoods. Beekeeping has fostered self-reliant development through the production of a fruitful cycle of economic diversification that has allowed rural communities access to better incomes, empowering families and communities to use the power of beekeeping to create a better life.

BIBLIOGRAPHY

S Adjere , Stephen O. “Beekeeping in Africa.” *Beekeeping in Africa*. Rome, Italy : Food and Agriculture Organization of the United Nations , 1990.

S Agera, S. I. N. “ROLE OF BEEKEEPING IN THE CONSERVATION OF FORESTS.” *Global Journal of Agricultural Sciences* 10, no. 1 (2011): 27–32.

S Agere, Samuel Takarinda. “Conceptual Frame Work On Self-Reliance in Community Development in Zimbabwe.” *International Social Work* 25, no. 4 (October 1982): 13–22.

S Amulen, Deborah Ruth, Marijke D'Haese, Eline D'Haene, James Okwee Acai, Jacob Godfrey Smagghe, and Paul Guy Cross. “Estimating the Potential of Beekeeping to Alleviate Household Poverty in Rural Uganda.” *PLoS ONE* 14, no. 3 (March 27, 2019): 1–19.

S Amulen, Deborah Ruth, Marijke D'Haese, Elizabeth Ahikiriza, Jacob Godfrey Jacobs, Franz J de Graffe, and Dirk C. Smagghe. “The Buzz about Bees and Poverty Alleviation: Identifying Drivers and Barriers of Beekeeping in Sub-Saharan Africa.” *PLoS ONE* 12, no. 2 (February 24, 2017): 1–14.

“Apiculture and Rural Employment .” Bees For Development Ethiopia , n.d. http://www.beesfordevelopment.org/partner-organisations/ethiopia/what-we-do/apiculture-for-income-and-rural-employment/.

“Apiculture for Income and Rural Employment .” Bees For Development Ethiopia. Bees For Development , n.d. http://www.beesfordevelopment.org/partner-organisations/ethiopia/what-we-do/apiculture-for-income-and-rural-employment/.

“Apiculture Scaling-up Programme for Income and Rural Employment ASPIRE: Reducing Poverty through Beekeeping Business.” SNV. SNV, n.d. https://snv.org/cms/sites/default/files/explore/download/eth_aspire_0.pdf.

“ASPIRE Apiculture Scaling-up Program for Income and Rural Employment.” Final Narrative Report (01 December 2012 – 01 December 2017): Kingdom of Netherlands, n.d.

S Bareke, Tura, and Admassu Addi . “Effect of Honeybee Pollination on Seed and Fruit Yield of Agricultural Crops in Ethiopia.” *MOJ Ecology & Environmental Sciences* 4, no. 5 (2019): 205–9.

"Beekeeping in Ethiopia: Icipe-EU Partnership." icipe, n.d. http://www.icipe.org/news/beekeeping-ethiopia-icipe-eu-partnership.

S Belay Daba , Fenet, and Alemayehu Oljirra Wolde. "The Significance of Honey Production for Livelihood In Ethiopia ." *Journal of Environment and Earth Science* 6, no. 4 (2016): 46–53.

S Berhe, Abade, Abebe Asale, and Delenasaw Yewhalaw . "Community Perception on Beekeeping Practices, Management, and Constraints in Termaber and Basona Werena Districts, Central Ethiopia." *Advances in Agriculture* 2016 (n.d.): 1–9.

S Beyene, Taye, Mekonnen Woldatsadik, and Girma Chalchissa. "Demonstration of Transitional Locally Made Beehive Around Protected Areas in Central Rift Valley of Oromia, Ethiopia ." *Asian Journal of Social Science Studies* 3, no. 4 (October 25, 2018): 12–17.

S Biazin, Birhanu, and Geert Sterk. "Drought Vulnerability Drives Land-Use and Land Cover Changes in the Rift Valley Dry Lands of Ethiopia." *Agriculture, Ecosystems and Environment* 64 (2013): 100–113.

S Binns, Tony, and Etienne Nel. "Beyond the Development Impasse: The Role of Local Economic Development and Community Self-Reliance in Rural South Africa." *The Journal of Modern African Studies* 37, no. 3 (September 1999): 389–408.

S Chazovachii, Bernard, Maxwell Chuma, Alimos Mushuku, Leonard Chirenje, Leonard Chitongo, and Raphael Mudyariwa. "Livelihood Resilient Strategies through Beekeeping in Chitanga Village, Mwenezi District, Zimbabwe ." *Sustainable Agriculture Research* 2, no. 1 (November 10, 2012): 124–32.

S Crane, Eva. "Honey Hunting in Africa South of the Sahara." In *The World History of Honey Hunting*, 49–61. New York, NY: Routledge, 1999.

"Ethiopia at a Glance | FAO in Ethiopia." Food and Agriculture Association of the United Nations. Accessed 1AD. http://www.fao.org/ethiopia/fao-in-ethiopia/ethiopia-at-a-glance/en/.

"Ethiopia's Progress Towards Eradicating Poverty." Paper to be presented to the Inter-Agency Group Meeting On the "Implementation of the Third United Nations Decade for the Eradication of Poverty (2018 – 2027)". Addis Ababa, Ethiopia, April 18, 2018.

S Fikado, Zekiros. "The Contribution of Managed Honey Bees to Crop Pollination, Food Security, and Economic Stability: Case of Ethiopia." *The Open Agriculture Journal*, 2019, 175-181.

S Gebru, Gebrehiwot Weldegebrial, and Fekadu Beyene. “Rural Household Livelihood Strategies in Drought-Prone Areas: A Case of Gulomekeda District, Eastern Zone of Tigray National Regional State, Ethiopia.” *Journal of Development and Agricultural Economics* 4, no. 6 (March 2012): 158–68.

Girma, Zelalem. “‘Beekeeping Transformed My Gloomy Life to Brighter One.’” Ethiopian Press Agency , October 28, 2019. https://www.press.et/english/?p=14862#

S Guyo, Seid, and Solomon Legesse. “REVIEW ON BEEKEEPING ACTIVITIES, OPPORTUNITIES, CHALLENGES, AND MARKETING IN ETHIOPIA .” *Journal of Harmonized Research* 3, no. 4 (2015): 201–14.

“Handbook For Self Reliance .” *Handbook For Self Reliance* . Geneva , 2005.

S Illgner, Pete M., Etienne L. Nel, and Mark P. Robertson. “BEEKEEPING AND LOCAL SELF-RELIANCE IN RURAL SOUTHERN AFRICA .” *Geographical Review* 88, no. 3 (July 1998): 349–62.

“Inclusive Apiculture Business Development through Enhancing Private Sector Roles: Lessons from ASPIRE.” SNV. SNV, n.d. https://snv.org/cms/sites/default/files/explore/download/inclusive_apiculture_business_development-ilovepdf-compressed.pdf.

International Center of Insect Physiology and Psychology. (2019). *Annual Report 2018*. Nairobi, Kenya: icipe. http://www.icipe.org/news/beekeeping-ethiopia-icipe-eu-partnership

S Koch, Lisa, and Kimberly Appotive. “The African Bee-Keeping Story .” *Cultivate* 10 (2016): 10-12

S Kumar , Virendra, Narayan Sahu, and S.K. Dhruw. “BEEKEEPING AS A LIVELIHOOD FOR RURAL PEOPLE OF DISTRICT DANTEWADA.” *International Journal of Research and Analytical Reviews* 5, no. 4 (October 2018): 291–95.

S Mcgill, Eugina, Yiyi Dong, Kwadwo Frimpong, Robel Haile, Min Liu, Anna Mary Schaffer, and Lucas Valentin da Costa. “Final Report for WEEMA International.” Rep. *Final Report for WEEMA International*, May 9, 2016. https://static1.squarespace.com/static/57be2f5e893fc0b6f3592200/t/58209844c534a5888d1ad4bf/1478531149930/Final+Report+-+WEEMA+International.pdf.

S Muli, Elliud, and Maryann Frazier. “Beekeeping: Indigenous Knowledge Lost and Found.” Department of Entomology. PennState College of Agricultural Sciences, February 8, 2011. https://ento.psu.edu/news/2011/beekeeping-indigenous-knowledge-lost-and-found.

“Modeling Integration of Biodiversity Management and Sustainable Livelihoods Through Beekeeping.” Evaluation Bulletin. Dangilla Woreda, Gult Abishkan Kebele, 2017.

S Nega, Tekeba, and Yeshitela Eshete. “Review of Ethiopia’s Global Position in Honey and Other Bee Products Production and Marketing: Analysis of Sectoral Opportunities and Limitations.” *Biomedical Journal of Science and Technical Research* , October 29, 2018, 7879–83.

S Nel, Etienne, and Tony Binns. “Rural Self-Reliance Strategies in South Africa: Community Initiatives and External Support in the Former Black Homelands.” *Journal of Rural Studies* 16, no. 3 (July 2000): 367–77.

S Nel, Etienne, Peter M. Illgner, K. Wilkins, and M.P Robertson. “Rural Self-Reliance in Bondolfi, Zimbabwe: The Role of Beekeeping.” *The Geographical Journal* 166, no. 11 (March 2000): 26–34.

“Project Terminal Report 'Developing and Marketing of Regional and National Products: Honey Production and Processing in Lake Tana Biosphere Reserve.” The Nature and Biodiversity Conservation Union , December 2015.

S Reda, Gebrehaweria Kidane, Shishay Girmay, and Belets Gebremichael. “Beekeeping Practice and Honey Production Potential in Afar Regional State, Ethiopia.” *Agriculture and Environment* 10 (2018): 66–82.

“Restoring Degraded Bee Forage in Dangila, Amhara.” Bees For Development Ethiopia , n.d. http://www.beesfordevelopment.org/partner-organisations/ethiopia/what-we-do/restoring-degraded-bee-forage-in-dangila-amhara/.

“Rural Population (% of Total Population) - Ethiopia.” The World Bank, 2018. https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=ET.

Sawa, Pias. “Modern Beekeeping Offers Ethiopian Youth a Sweeter Future.” Reuters, March 22, 2016.https://www.reuters.com/article/ethiopia-youth-agriculture/modern-beekeeping-offers-ethiopian-youth-a-sweeter-future-idUSL5N16U2UQ.

S Syampungani, Stephen, Paxie W. Chirwa, Festus K. Akinnifesi, Gudeta Sileshi, and Olyuede C. Ajayi. “The Miombo Woodlands at the Cross Roads: Potential Threats, Sustainable Livelihoods, Policy Gaps and Challenges.” *National Resources Forum: A United Nations Sustainable Development Journal* 33, no. 2 (May 2009): 150–59.

"Quick Facts: How We're Fighting Hunger in Ethiopia." Mercy Corps , June 27, 2019. https://www.mercycorps.org/blog/fighting-hunger-ethiopia.

Richardson, Heather. "The Untapped Potential of Africa's Honey Bees." BBC Future, May 27, 2019. https://www.bbc.com/future/article/20190507-honey-bees-africas-untapped-resource.

S Stevens, Kris, and John Morris. "STRUGGLING TOWARD SUSTAINABILITY: CONSIDERING GRASSROOTS DEVELOPMENT." *Sustainable Development* 9 (2001): 149–64.

S Syampungani, Stephen, Paxie W. Chirwa, Festus K. Akinnifesi, Gudeta Sileshi, and Olyuede C. Ajayi. "The Miombo Woodlands at the Cross Roads: Potential Threats, Sustainable Livelihoods, Policy Gaps and Challenges." *National Resources Forum: A United Nations Sustainable Development Journal* 33, no. 2 (May 2009): 150–59.

S Syokau Mwanzia , Josephine, and Robert Craig Strathdee. "Theories and Models of Participatory Development and Empowerment." In *Participatory Development in Kenya*, 1st ed., 13-38. Farnham :Ashgate Publishing, 2016.

S Teamer Gebrehiwot, Nahhusenay. "HONEY PRODUCTION AND MARKETING: THE PATHWAY FOR POVERTY ALLEVIATION THE CASE OF TIGRAY REGIONAL STATE, NORTHERN ETHIOPIA." *International Journal of Business Economics & Management Research* 5, no. 6 (June 2015): 342–65.

S Teferi , Kenesa. "Status of Beekeeping in Ethiopia- A Review ." *Journal of Dairy and Veterinary Sciences* 8, no. 4 (December 2018): 1–12.

"What We Do." Bees For Development Ethiopia , n.d. http://www.beesfordevelopment.org/partner-organisations/ethiopia/what-we-do/.

S Yirga, Gidey, and Mekonen Teferi. "Participatory Technology and Constraints Assessment to Improve the Livelihood of Beekeepers in Tigray Region, Northern Ethiopia ." *Momona Ethiopian Journal of Science* 2, no. 1 (2010): 76–92.

"Young Entrepreneurs in Silk and Honey - YESH." icipe, n.d. http://www.icipe.org/research/environmental-health/beneficial-and-commercial-insects/projects/young-entrepreneurs-silk.

IMAGES

Image 1: Mcgill, Eugina, Yiyi Dong, Kwadwo Frimpong, Robel Haile, Min Liu, Anna Mary Schaffer, and Lucas Valentin da Costa. "Final Report for WEEMA International." Rep. *Final Report for WEEMA International*, May 9, 2016. https://static1.squarespace.com/static/57be2f5e893fc0b6f3592200/t/58209844c534a5888d1ad4bf/1478531149930/Final+Report+-+WEEMA+International.pdf.

Image 2: Mcgill, Eugina, Yiyi Dong, Kwadwo Frimpong, Robel Haile, Min Liu, Anna Mary Schaffer, and Lucas Valentin da Costa. "Final Report for WEEMA International." Rep. *Final Report for WEEMA International*, May 9, 2016. https://static1.squarespace.com/static/57be2f5e893fc0b6f3592200/t/58209844c534a5888d1ad4bf/1478531149930/Final+Report+-+WEEMA+International.pdf.

Image 3: Mcgill, Eugina, Yiyi Dong, Kwadwo Frimpong, Robel Haile, Min Liu, Anna Mary Schaffer, and Lucas Valentin da Costa. "Final Report for WEEMA International." Rep. *Final Report for WEEMA International*, May 9, 2016. https://static1.squarespace.com/static/57be2f5e893fc0b6f3592200/t/58209844c534a5888d1ad4bf/1478531149930/Final+Report+-+WEEMA+International.pdf.

Image 4: "Modeling Integration of Biodiversity Management and Sustainable Livelihoods Through Beekeeping." Evaluation Bulletin. Dangilla Woreda, Gult Abishkan Kebele, 2017.

Image 5: "Modeling Integration of Biodiversity Management and Sustainable Livelihoods Through Beekeeping." Evaluation Bulletin. Dangilla Woreda, Gult Abishkan Kebele, 2017.

FIGURES

Figure 1: Teamer Gebrehiwot, Nahhusenay. "HONEY PRODUCTION AND MARKETING: THE PATHWAY FOR POVERTY ALLEVIATION THE CASE OF TIGRAY REGIONAL STATE, NORTHERN ETHIOPIA." *International Journal of Business Economics & Management Research* 5, no. 6 (June 2015): 342–65.

Figure 2: Teamer Gebrehiwot, Nahhusenay. "HONEY PRODUCTION AND MARKETING: THE PATHWAY FOR POVERTY ALLEVIATION THE CASE OF TIGRAY REGIONAL STATE, NORTHERN ETHIOPIA." *International Journal of Business Economics & Management Research* 5, no. 6 (June 2015): 342–65.

Figure 3: Teamer Gebrehiwot, Nahhusenay. "HONEY PRODUCTION AND MARKETING: THE PATHWAY FOR POVERTY ALLEVIATION THE CASE OF TIGRAY REGIONAL STATE, NORTHERN ETHIOPIA." *International Journal of Business Economics & Management Research* 5, no. 6 (June 2015): 342–65.

Figure 4: Teamer Gebrehiwot, Nahhusenay. "HONEY PRODUCTION AND MARKETING: THE PATHWAY FOR POVERTY ALLEVIATION THE CASE OF TIGRAY REGIONAL STATE, NORTHERN ETHIOPIA." *International Journal of Business Economics & Management Research* 5, no. 6 (June 2015): 342–65.

Figure 5: "ASPIRE Apiculture Scaling-up Program for Income and Rural Employment." Final Narrative Report (01 December 2012 – 01 December 2017): Kingdom of Netherlands, n.d.

Figure 6: "Inclusive Apiculture Business Development through Enhancing Private Sector Roles: Lessons from ASPIRE." SNV. SNV, n.d. https://snv.org/cms/sites/default/files/explore/download/inclusive_apiculture_business_development-ilovepdf-compressed.pdf.