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Besvarelsen afleveres af
Iris Carlotta Jarre
wkh274@alumni.ku.dk

MALIHA JAHAN
npk680@alumni.ku.dk

Philippe Eric Masson
wnt387@alumni.ku.dk

Fabian Cristian Rengel
nfk423@alumni.ku.dk

Eksamensadministratorer
Ann Kjersgaard Meldal
Ann.meldal@ifro.ku.dk
+4535322621

Bedømmere
Mariève Pouliot
Eksaminator
mapo@ifro.ku.dk
+4535331990

Christian Pilegaard Hansen
Eksaminator
cph@ifro.ku.dk
+4535331735

Lisbet Christoffersen
Censor
lisbet.christoffersen@slu.se

Besvarelsesinformationer

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Fairtrade Coffee Certification & Sustainability in Gatugi, Kenya

Maliha Jahan

Iris Carlotta Jarre

Philippe Masson

Fabian Rengel

Cindie Andersen Ørnstrup

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Abstract

Small-scale coffee farmers in developing countries are finding it increasingly difficult to achieve a sustainable balance between their livelihoods and environmental conservation, in light of the globalisation of agricultural commodities and challenges posed by climate change. Certification schemes, such as Fairtrade, have emerged as a marketplace solution, offering consumers the choice of a more ethical product for a premium price. Farmers benefit by receiving higher prices for their coffee and educational training, which results in better farming practices and improves environmental sustainability. The objective is to investigate the impacts of Fairtrade certification on the social, economic, and environmental dimensions of small-scale coffee producers' livelihoods in Gatugi, Kenya. The goal of the report is to compare the intended outcomes of Fairtrade standards to what we observed in the field. Using an analytical framework, an assessment of our data will allow for discussion on the sustainability and interlinkages of Fairtrade's objectives. An interdisciplinary approach was adopted, making use of semi-structured interviews, a survey, soil sampling, biodiversity assessment, and NDVI trend analysis. Our findings showed that farmers were implementing Fairtrade standards, thereby improving their safety and land management practices. However, we found that Fairtrades' interaction with the cooperative greatly limits benefits reaching farmers. In particular, the financial security of farmers could be further improved, as well as standards promoting environmental sustainability. Our recommendations address the need for more robust institutions which first and foremost address the needs of farmers, in addition to stricter and more specific standards to ensure long-term environmental sustainability.

Acknowledgements

We would like to thank our partners and peers at the University of Nairobi and the Wangari Maathai Institute for Peace and Environmental Studies for their assistance and collaboration in our fieldwork. We are most grateful and appreciative for the kind people of Othaya who welcomed us into their community and the farmers who taught us so much about coffee and patiently answered our questions. We would like to specifically thank our hosts Mr. Joseph, Mama Anne, and Mama Lucy who opened their hearts and fed us with stories, laughter and warm food. Thank you to the incredible hard working civil servants, the Chiefs, and community leaders for their oversight and coordination, our work would have not been possible without your planning. Lastly, to our guides, Jacqueline and Daniel in addition to our drivers George, James, and Charles, thank you for your patience and showing us your home.

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Student Attestation

This report is original work created from data collected during fieldwork.

Maliha Jahan

Iris Carlotta Jarre

Philippe Masson

Fabian Rengel

Cindie Andersen Ørnstrup

Reference Sheet

Abbreviations Chart:	
AEO	Agricultural Extension Officer
FTA	Fair Trade Africa
GSI	Gini-Simpson Index
MCA	Member of County Assembly
NDVI	Normalised Difference Vegetation Index
OFCS	Othaya Farmers Cooperative Society
SHI	Shannon Index
Interview Code Chart:	
SSI AEO	Agricultural Extensions Officer
SSI CFM	Othaya Farmers Cooperative Society Factory manager
SSI TC	Othaya Town Chief
SSI CHM	Othaya Farmers Cooperative Society Head Manager
SSI MCA	Member of County Assembly
SSI GF	Coffee Farmer in Gatugi
SSI FTA	Fairtrade Africa representative

Chapter 1: Introduction

1.1 Background

The production of food and non-food cash crops like cocoa, bananas, tea, and coffee etc. are the primary means of earnings for millions of small-scale farmers in developing countries. Historically, the production of agricultural commodities has posed major obstacles in terms of environmental degradation, sustaining a livable income, and working conditions. Substantial attempts from government organisations, companies, and development societies have attempted to address these issues for the betterment of farmers (Grabs, 2017). Certification and labelling schemes for coffee products have emerged to resolve these issues by securing fair prices, and promoting sustainable farming practices (Arifin, 2010). The establishment of certification schemes is intended to guarantee efficient procedures in the manufacturing and distribution processes, providing consumers with a choice of a better product based on the specific ethical or environmental standards of the scheme (Muriithi et al., 2018). Certification acts as a form of buyer-driven regulation for coffee (Arifin, 2010). Fairtrade International has emerged as one of the largest produce certifying organisations. Fairtrade and other certifiers have common interests in raising consumer understanding of farmer safety and health issues, preventing pesticides and fertiliser damage, promoting sustainable farming practices, and preserving biodiversity among other objectives.

Kenya's economy is heavily influenced by coffee in terms of its role in export earnings, local farm revenues, job opportunities, food and nutrition security; nearly 3.5 million people are involved in Kenya's coffee industry (Okech, 2019). According to Kegode (2005), 60% of total coffee in Kenya is produced by small-scale farmers who produce for cooperative societies. The cooperatives receive coffee cherries from farmers for manufacturing and subsequent wholesaling. Kenyan farmers rely on the cooperative society for their administration, quality standards, improved markets, and good gross pay rates (Murumba, 2017).

Approximately 700,000 small-scale farmers in Kenya cultivate 60% of the nation's coffee, larger estates produce the remaining 40% (Okech, 2019). Since 1934, the Nairobi Coffee Exchange has been the main auction marketplace for growers and buyers of coffee. The auction system offers a platform for price negotiations between buyers and sellers, quality checks, cupping ratings, and additional standards for testing coffee quality (Wainaina, 2013). The auction system has been criticised for its lack of transparency, limited access and inefficiency (Shi et al., 2019).

Founded in 1997, Fairtrade International is a non-profit association, whose purpose is to certify and audit fair productivity (Raynolds & Bennett, 2015). Fairtrade's goals as outlined by the official standards are empowerment, sustainable farming practices, safe working conditions, market access and fair prices. FLOCERT, a third-party certifier, oversees and audits coffee farmers, traders and cooperatives. Fairtrade emphasises the advancement of cooperatives, democratic participation, and collaborative procedures. According to Fairtrade, the cooperative model is the best approach to aid small-scale farmers in obtaining certification, because it allows them to distribute the costs of certification and overcome their individual market risks. Additionally, the cooperative model enables farmers to design projects collectively to improve their communities and advocate for their policies and rights, using the money from Fairtrade Premium funds (Theyer, 2018). Fairtrade also provides a minimum price which sets "the lowest possible price that may be paid by buyers to producers for a product to become certified against the Fairtrade standards" (Fairtrade, 2019 pg.8), which "acts as a safety net aimed at covering costs of production" (Fairtrade Trader Standard, 2015 pg.28).

In Kenya, the cooperatives are tasked with implementing Fairtrade standards (Fairtrade, 2019). To obtain or to maintain Fairtrade certification, farmers and cooperatives must adhere to a number of social, economic, and environmental standards, the elements of which are summarised and presented in Table 1. These standards are implemented through training and education of farmers to promote more productive and sustainable farming practices. In Fairtrade reports, training for sustainable agricultural practices include climate adaptation, safe handling of hazardous materials, fertiliser use, water use, soil erosion and pest management (Fairtrade 2019; Fairtrade 2021).

Key Fairtrade Standards for Small-scale Farmers		
Social Criteria	**Environmental Criteria**	**Economic Criteria**
Empowerment	Biodiversity and Soil Fertility	Market Access
Safe Working Conditions	Agrochemical Usage	Fairtrade Premiums
Labour Conditions	Climate Change Resilience	Fairtrade Minimum Price

Table 1: An overview of the Fairtrade Standards, grouped into social, environmental, and economic criteria. Sources for material: Fairtrade Standards for Small-scale Producer Organizations (2019) and Fairtrade Standard for Coffee (2021).

1.2 Literature review

In Kenya, small-scale coffee farmers are challenged by climate change, social issues, and accessing markets for their produce (Collier and Dercon 2014;Van Rijsbergen et al. 2016; Wairegi et al. 2018). Sustainable coffee management and production is based on the well-being of the different actors along the value chain, access to the market, and preservation of the environment (Shi et al. 2019). For these reasons, to ensure sustainable coffee management and to overcome the challenges faced by the farmers, coffee cooperatives and certification organisations such as Fairtrade exist. The interaction of coffee farmers, cooperatives and certifiers also brings new challenges on how to design a sustainable, fair and economically viable system. The role of sustainability standards in global coffee markets is growing. Consumers believe that their choice to pay a premium for certified produce benefits small-scale farmers in developing countries and improves rural welfare through better market access and improved agricultural practices, but robust evidence is relatively thin (Chiputwa et al. 2015 & Van Rijsbergen et al. 2016).

The purpose of this report is to examine how Fairtrade certification affects the social, economic, and environmental aspects of small-scale coffee farmers in Kenya. Numerous studies have already investigated the impact cooperatives and certifiers have had on small-scale coffee farmers, but most existing literature focuses on Latin American coffee production.

There have been preliminary research studies which focus on East Africa and specifically Kenya. Wairegi et al. (2018) shows that sustainably improving Kenya's coffee production requires the participation of young farmers with diversified income. Bolwig et al. (2013) revealed that certification interventions underestimate the nature of the challenges faced and suggest that more selective support and better-tailored interventions are required to achieve tangible welfare outcomes. Research from Jena et al. (2012) on the impacts of certification on small-scale farmers' livelihoods in Ethiopia, showed that certified cooperatives contribute to higher incomes, but have a minimal influence on the livelihoods of small-scale coffee producers, due to low productivity, insignificant price premium, and poor access to credit and cooperative information. Chiputwa et al. (2015) analysed the impacts of three different sustainability oriented certifiers, including Fairtrade, on the livelihoods of small-scale coffee farmers in Uganda. The report's findings show that the Fairtrade certified coffee farmers increased household living standards by 30% and reduced their level of poverty. Riisgaard et al. (2009) compared the performance of different certification organisations in Uganda, Kenya, and Ethiopia and found only slight differences in crop quality and productivity performance and revenue outcomes. Van Rijsbergen et al. (2016) investigated coffee certification's role in coffee farmer welfare. Their samples included farmers who were either Fairtrade or Utz-Certified and used non-certified farms as a control group. Their results revealed that Fairtrade improved coffee yields, and led to more effective coffee processing.

The results of Van Rijsbergen et al. (2016), Riisgaard et al. (2009) and Chiputwa et al. (2015) show that certifiers can have different impacts on coffee farmers. These differences stem from the fact that certification schemes focus on different issues. Academic studies have been mainly focused on the economic and social impact of Fairtrade as opposed to environmental ones (e.g. Ruben and Verkaart 2012; Elder et al. 2013; Sellare et al. 2020). According to Ruben and Verkaart (2012), Fairtrade aims to promote coffee production of small-scale farmers by guaranteeing a minimum price for coffee and supporting the strengthening of cooperatives, but the organisation is less focused on addressing the emerging challenges of climate change and improving agricultural practices.

Numerous studies already show the challenges of climate change with regard to coffee cultivation in East Africa (e.g. Collier and Dercon 2014). But there are also studies that have examined the impact of Fairtrade certification for coffee farmers on the environment in Africa. Elder et al. (2013) examined the effects of Fairtrade certification on coffee practices, by analysing

the Fairtrade environmental standards in Rwanda through a comparison of Fairtrade certified cooperative farmers with non-certified cooperative farmers. Their results indicate the importance of cooperative farmer organisations in influencing agricultural practices via opportunities for training and access to inputs. They also state that Fairtrade certification may provide additional opportunities above and beyond cooperatives that influence farmer agricultural practices. They conclude that Fairtrade certification does not have a strong overall effect on farming practices.

Sellare et al. (2020) used data from farmers and rural workers in Cote d'Ivoire to analyse effects of agrochemicals, as well as environmental toxicity of Fairtrade farming. Their results show that Fairtrade standards may facilitate and incentivize elevated input intensities, leading to higher levels of toxicity. But their work also shows that certified cooperatives are more likely to offer training and other services related to the safe handling of pesticides, which can reduce negative externalities despite higher input quantities.

Vanderhaegen et al. (2018), investigated certified and non-certified coffee farms in Uganda, based on a combination of economic survey data and ecological field inventory data. They found standards improve either farm productivity and income or biodiversity and carbon storage, but there is a significant trade-off. To the best of our knowledge, no other literature has examined the impact of Fairtrade on the social, economic and environmental aspects of coffee farmers in a linked context. Furthermore, there are few studies on the impact of Fairtrade coffee certification on the environment.

1.3 Research Question

This report will focus on the case of Fairtrade certified coffee farmers located in Gatugi, Kenya. Our objective is to investigate the impacts of Fairtrade certification standards on the social, economic, and environmental dimensions of small-scale coffee producers' livelihoods. Our main research goal is to compare the intended outcomes of Fairtrade standards and the realities of what is happening in practice. Additionally, our research will attempt to identify potential challenges at the producer, cooperative, and certifier level which arise from certification.

Our research questions are:

1. What impact does Fairtrade certification have on the social well-being of coffee farmers, particularly their participation and knowledge?
2. What are the economic benefits and burdens of Fairtrade certification for coffee farmers?
3. What impact does Fairtrade coffee certification have on environmental sustainability, focusing on biodiversity, soil, and vegetation health?

Chapter 2: Analytical Framework

This chapter will introduce an analytical framework based on the three pillars of sustainable development as adapted from the Brundtland report (1987), which serves as the inspiration for Figure 1. The intent is to use the following three dimensions of sustainability, social, economic, and environmental to structure the research methods, analyse data, and broaden discussion about the impacts of Fairtrade.

The objective of this report is neither to draw out a singular definition or idea of sustainability, nor to conduct a deeper theoretical discussion. Rather, analysis will draw upon findings and observations from the field to highlight the integrated impacts Fairtrade has to make a larger commentary about the sustainability of the certification scheme. The three dimensions of sustainability offer the ability to reflect on the case through an interdisciplinary approach without delving into the technical requirements of each discipline.

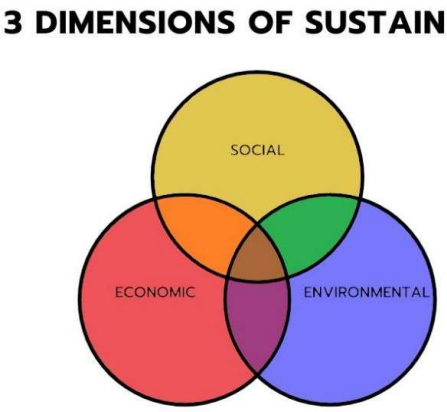

Figure 1: "3 Dimensions of Sustainability" Framework adapted from the Brundtland Report (1987)

Davis and Simonovic's (2011) work outlines and discusses an integrated model for social-economic-environmental systems and provides guiding examples. For example, how economic activities are embedded in social and ecological contexts, affecting employment, resource availability and pollution levels. Social systems influence economic and ecological systems, such as the link between population and economic growth, and climate change. Lastly, changes in the natural environment impact economic activity and social well-being.

Similarly, The UN Millennium Ecosystem Assessment is based on the concept that human and environmental conditions are intricately linked. According to Tallis et al. (2018) there is a need for development initiatives to attain environmental and social progress without negatively interfering. The authors acknowledge projects which achieve both environmental and economic gains are not necessarily easily attainable, and trade-offs occur. The report concludes that a scientific understanding of the interlinkages could improve the likelihood of successful completion of project objectives.

The pillars of sustainable development provide a rudimentary guiding model. As previously mentioned, Fairtrade's standards are portioned into the same areas of interest (Table 1), so naturally it makes sense to use the same approach in research and analysis. In all, the model will serve as a tool to assess the sustainability of Fairtrade and provide a framework for commentary on the interlinkages of the organisation's objectives as laid out by the standards.

Chapter 3: Methodology

3.1 Description of Study Area

Field research was conducted March 3rd-14th 2023, in Gatugi, a small village located in the south of Nyeri district, Central Kenyan Highlands. There are approximately 21,427 residents, predominantly from the Kikuyu tribe in nearby Othaya town ("Othaya" 2023). Annually, Othaya's average temperature is 15.1°C and total rainfall averages 1,581 mm. The majority of Gatugi residents are small-scale farmers who produce coffee, tea, avocadoes, macadamia nuts, livestock and dairy for sale and vegetables and fruit for their own consumption. In the Gatugi area, small-scale coffee farmers owning less than 2 acres belong to the Othaya Farmers Cooperative Society Limited (OFCS). The cooperative is Fairtrade certified and by extension so are its 15,000 active members (SSI TC).

3.2 Interdisciplinarity

Table 2 summarises our use of both social and natural science methods. Data was analysed and collected by sub-groups with a leader from each disciplinary background. A combination of different academic backgrounds structured our framework in a way which transcends the boundaries of individual disciplines, to address the groups' research objectives in a holistic and integrated manner.

Fieldwork Methodology Overview:	
Method	**Sample Size and Sampling Structure**
Survey	44 convenience sampled Fairtrade Farmers belonging to Othaya Cooperative
Semi-Structured Interview	7 purposively sampled interviews with the: AEO, Cooperative Factory Manager, Town Chief, Cooperative Head Manager, MCA, Coffee Farmer, Fairtrade Africa Representative
Biodiversity Assessment	2 Pitfall traps for each farm; 5 Fairtrade certified farms, 3 organic farms
Soil Sampling	1 mixed sample of 15 randomly sampled soil samples for each farm; 5 Fairtrade certified farms, 3 organic farms
NDVI Trend Analysis	Othaya sub-county, 250 m spatial resolution, 16-day temporal resolution from 1 March 2018 to 1 March 2023

Table 2: "Fieldwork Methodology Overview"

3.3 Participant and Field Observations

During our first days in Gatugi, we explored the surrounding area and coffee farms on informal visits with coffee farmers. We toured coffee farms, learned about coffee farming and held conversations about their lives as a coffee farmer in Gatugi. We also learned about the local conditions of Gatugi and Othaya from our hosts, who were knowledgeable about farming conditions. Our field observations to assess our environmental research goals were also dominated by visits to coffee farms, talking to farm managers, and observing the biodiversity, soil, and coffee trees. The unstructured participant and field observations gave us inspiration and filled the gaps in order to design our interview guides and survey, and provided details necessary for understanding farmer life and the field area.

3.4 Semi-Structured Interviews

We chose to interview participants (Table 2) to get different perspectives on the process of certification, the structure of the cooperative, and to get a general understanding of the challenges of the Gatugi farmers including their experience and awareness of Fairtrade. Before conducting the interviews, we talked about what information we hoped to receive and potential areas of participant bias.

In making the guides (Appendix) we tried to consider what knowledge the interviewee was able to provide us given their role and expertise. We recorded audio from each of the interviews with participant permission. Interviews were transcribed on Mygoodtape.com, and coded in Nvivo. Codes such as financial stability, participation, climate change and pesticide use, were grouped into social, environmental, and economic categories. These codes were derived based on Fairtrade standards, our research objective and analytical framework. Thereafter, a thematic analysis of the interviews was conducted to identify patterns which could then be linked to the results from other methods.

3.5 Survey

A survey (Appendix) was conducted to gather data on the effects Fairtrade certification standards have on social, economic, and environmental dimensions of coffee producers' livelihoods. We gathered data on demographics, awareness and participation, farmer knowledge, perceived benefits and burdens of certification among many other topics.

We piloted our test survey with five coffee farmers. The survey was thereafter modified and entered into SurveyXact. Our intention was to systematically select respondents, but given challenges finding participants we adjusted to a convenience sampling strategy, and surveyed the household heads who were available at their homes or farms. Two local guides, fluent in both Swahili and Kikuyu, assisted us with making contact and translating survey responses to be digitally recorded.

Survey data was analysed using both descriptive statistics (Microsoft Excel) and inferential statistics (RStudio). The Wilcoxon Rank Sum test (Wilcoxon, 1945) was used to assess whether there was a difference in responses to Likert-scale questions between two groups. The Chi-square

test (Pearson, 1900) was used to assess whether the difference between two categorical observations were not random. A 90% confidence level was used.

3.6 Biodiversity assessment

For the biodiversity and soil health assessment, data was collected from five Fairtrade certified farms and three organic farms. The organic farms were used as a baseline, because they don't use any non-organic pesticides or artificial fertilisers. The locations of the sampled farms can be seen in Figure 2.

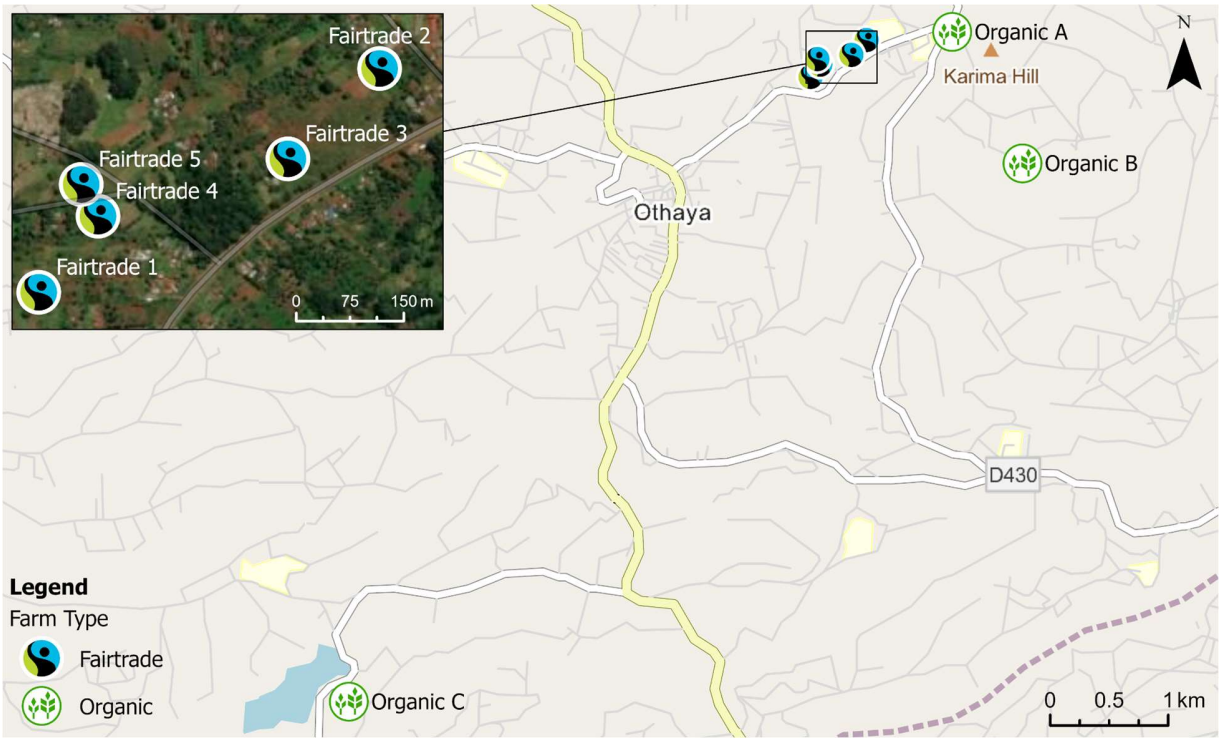

Figure 2: Locations of farms where biodiversity and soil samples were collected.

A pitfall trap is designed to catch ground-dwelling insects. Two plastic cups with a diameter of 10 cm, were buried at ground level to form the catch pit. To ensure insects caught in the trap could not escape, the cups were filled to 2 cm with a shampoo water mixture (1:10). The captured insects were counted according to their species and quantity. The collected data was used to calculate the species richness, the Shannon Index (SHI), and the Gini Simpson Index (GSI) as described by Jost, 2006 (Appendix). Reference Appendix for explanation of SHI and GSI.

The use of pitfall traps is the most popular method of collecting ground dwelling insects

(Spence und Niemelä 1994). Our research was limited by the catching success of the traps which were affected by the weather, biotic and abiotic environment, and selected positioning (Topping und Sunderland 1992).

3.7 Soil sampling

Ascertaining soil quality consisted of measuring soil respiration, soil organic matter content (SOM) and pH to understand the capacity of the soil to function within the ecosystem. Soil fertility focuses on measuring available plant nutrients. On all farms, 15 soil core samples (30 cm deep and 2 cm diameter) were randomly collected from the coffee field. These were mixed together to create one mixed sample representative of the farm.

The soil fertility nutrient analysis was completed offsite at the Agricultural Office of Othaya Municipality. Soil samples were analysed using the AgroCares Scanner F from AgroCares Ag, Wageningen, Netherlands. The accuracy of the rapid test results provided by the scanner should be scrutinised. The analysis of SOM, soil respiration and pH were performed in the laboratory at University of Copenhagen (refer to appendix for description of analysis protocols followed).

The statistical comparison of the data from Fairtrade and organic farms in terms of biodiversity and soil were performed with independent-samples T-test using IBM SPSS Statistics program Version 28.0.1.1 (14).

3.8 NDVI Trend Analysis

To assess changes in vegetation health over the last five years, Earth Observation data were used in order to cover the entire study area and assess changes over time, which would not have been possible from a single 10-day field visit. The Normalised Difference Vegetation Index (NDVI) is a spectral vegetation index commonly used to monitor seasonal and inter-annual changes in vegetation growth and activity (Jensen 2014) (Appendix).

For this purpose, NDVI calculated from images taken by the MODIS sensor on the Terra satellite was used (Didan et al. 2015), readily available in Google Earth Engine, where the analysis was conducted (Gorelick et al. 2017). Images from 1 March 2018 to 1 March 2023 were used

(Table 2), in an attempt to match the timeframe of 'the last 5 years' used in the survey questions (Appendix) as closely as possible.

In order to assess changes in NDVI within each pixel in the given timeframe, a Theil-Sen Median Trend (Sen 1968, Theil 1992) was computed. This non-parametric trend estimator was chosen as it is relatively resistant to outliers in the data (Eastman 2020). The resulting trends in NDVI were tested for statistical significance by calculating the Mann-Kendall significance for each pixel (Mann 1945, Kendall 1955). A 95% confidence level was used.

It was initially planned to use images taken by the Multispectral Instrument on board the Sentinel-2 satellites in order to calculate the NDVI trends. These images have a 10 m spatial resolution, which would have better facilitated a comparison between Fairtrade certified coffee farms and organic farms. However, frequent cloud cover in the study area created substantial gaps in the dataset, which were not possible to overcome due to technical limitations and time constraints. Thus, it was necessary to use data with a coarser spatial resolution.

Chapter 4: Results

4.1 Characterization of Farmers

The purpose of this section will be to characterise the sample of 44 farm household heads who were surveyed. Descriptive statistics of demographic characteristics can be found in Figures 3.1-3.4. The average farmer surveyed was 59 years old. These findings were corroborated by FTA who cites the average coffee farmer in Kenya as 55 years old, and the cooperative head manager who stated farmers are on average above 60 years old in our study area (SSI FTA, CHM). The majority of the farmers we surveyed were small-scale, farming less than an acre of coffee (Figure 3.3).

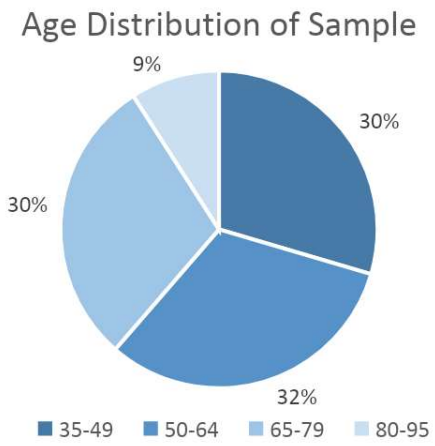

Figure 3.1: Answers to question 4 "Participant Age"

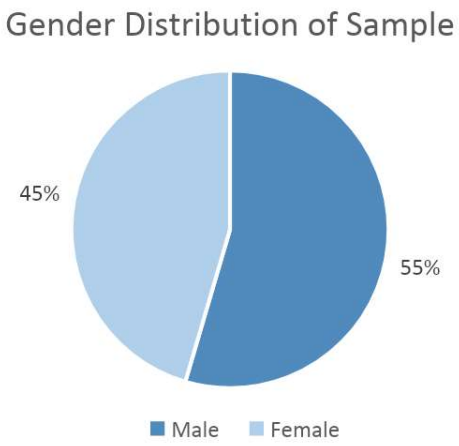

Figure 3.2: Answers to question 2 "Participant Gender"

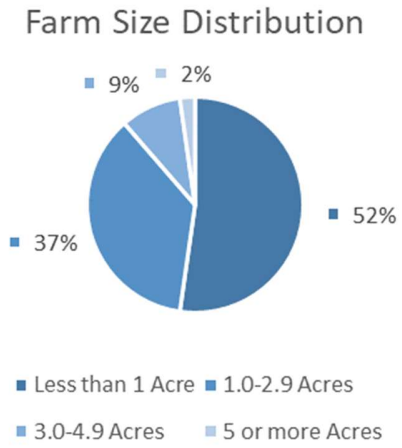

Figure 3.3: Answers to question 9 "What is the size of this coffee farm?"

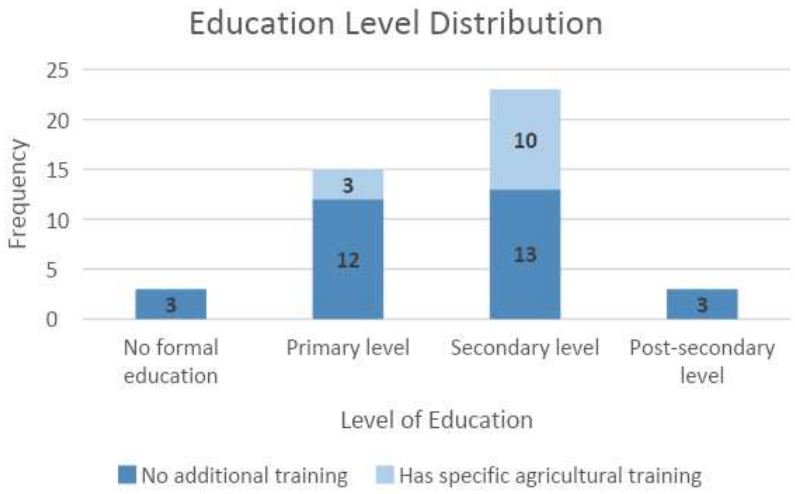

Figure 3.4: Answers to questions 6 "What is your highest level of education?" & 7 "Do you have specific formal agricultural production training?"

4.2 Fairtrade Awareness

Of all the farmers surveyed, 25% were aware of Fairtrade. Of those that were Fairtrade aware, only 72.7% knew that their cooperative and farm were Fairtrade certified (Survey Data). Of the Fairtrade aware group, 82% were male and 18% female ($p < 0.1$).

In one case, a farmer we interviewed was aware their coffee was certified but did not have any specific knowledge about certification, other than the cooperative using the Fairtrade label as a marketing technique to get higher bids. This story was common, yet still surprising since farmers had 28 years of coffee growing experience and were members of the cooperative for 23.5 years on average (Survey Data). This raises a critical issue which is that knowledge of what it means to be Fairtrade certified is relatively limited, even for those who are aware and regularly attend training and meetings held by the cooperative. In fact, only 14% of respondents had explicit knowledge on the rules and regulations of Fairtrade.

Our observations revealed farmers were unknowingly practising Fairtrade standards through rules imposed by the cooperative. Farmers were knowledgeable on a multitude of criteria including: the usage of PPE, allowable pesticides and the proper amount, timing, and instructions of application, child labour and minimum wage laws, and the disposal of hazardous waste materials (Survey Data). This suggests that even though the majority of the coffee farmers sampled were unaware of Fairtrade, and even those who were aware lack in-depth knowledge of Fairtrade,

farmers are still practising and therefore benefiting from Fairtrade's standards which are promoted through cooperative directives.

4.3 Social Impacts of Fairtrade Certification

In the following section, our observations and findings will be compared to Fairtrade standards for the purpose of assessing the influence certification has had on improving farmer participation, social welfare, and knowledge to answer our research question.

4.3.1 Cooperative participation

Survey findings revealed 79.5% of farmers participated in cooperative society meetings. Moreover, 72.7% of farmers participated in the election of cooperative leadership (Survey Data). These findings run counter to the narrative of the CHM who said meeting attendance reaches quorum but is not as high as the cooperative would like (SSI CHM). We found a statistically significant ($p < 0.1$) difference between the groups of farmers who did and did not participate in cooperative meetings in the last year, regarding their perception of how much they benefit from being a member of the cooperative (Survey Data). The majority of those who participated in cooperative meetings in the last year agreed or were neutral that cooperative management is effective, and those who did not participate disagreed (Survey Data). FTA points out that attending cooperative meetings is an essential form of farmer involvement which enhances decision-making power (SSI FTA). Yet, we did not observe Fairtrade having an active hand in encouraging farmer participation in cooperative meetings.

4.3.2 Community Premium Fund Usage

Premium fund allocation is integral to Fairtrade's mission of socially empowering and economically improving the livelihoods of farmers, as stressed by FTA (SSI FTA). The cooperative holds annual elections in accordance with Fairtrade's standards, whereby farmers elect committee members responsible for allocating Fairtrade premiums (SSI CHM). The process as explained by FTA is written out in official Fairtrade reports to direct the cooperative on the following "an elected committee, while not mandatory, ought to draw out a development plan, and

present it to the general assembly for the farmers to make amends and give final approval" (SSI FTA).

In Gatugi, we observed Fairtrade Premium funds being used towards improving the community through the construction of a new factory wet mill, drying racks, and other infrastructure development projects (Survey Data; SSI CHM, GF). Additionally, funds were used as a source of local monetary aid distributed in the form of school fees, funding for food banks and helping the needy, and supplementing the salaries of factory workers (Survey Data). We did not observe any direct social or economic benefits to farmers. There was consensus that improved communal infrastructure and aid brought about by premiums were a proper use of money, but respondents were uncertain of the benefit received by investments made and retained at the cooperative level (Field Observations). Fairtrade is not doing enough to ensure that premiums are reaching the producer level and promoting community advancement and services to farmers where the impact of funds would be most felt.

We found 48% of farmers sampled were aware of premium funds. Of those who were aware of premium funds, only 47% participated in the decisions regarding the allocation of premiums (Figure 4). We found a statistical significance ($p < 0.05$) between the group of farmers involved in allocating premiums and those uninvolved regarding their perceived level of benefit received from cooperative membership. We found 70% farmers who participated in allocating premiums believed they benefited from cooperative membership and only 9% of farmers who were uninvolved believed they benefited ($p < 0.01$) (Survey Data). Fairtrade falls short in ensuring farmers are equitably participating in the decision-making process with their current committee structure.

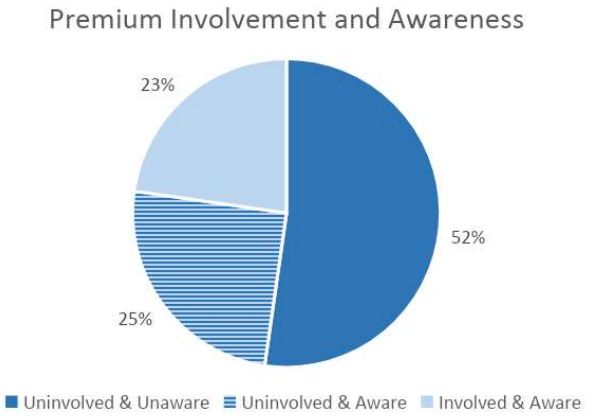

Figure 4: Answers to questions 31 "Are you aware of certification premium funds?" & 32 "How are premiums utilised by the cooperative?"

4.3.3 Improving Farming Knowledge

According to FTA, educational training is a key benefit of being certified (SSI FTA). Fairtrade disseminates information about its standards and purposes to farmers through cooperative training. Our SSIs taught us that cooperative training is valuable and helpful in educating farmers on safety and improving the quality of coffee beans and increasing production yields (SSI MCA, CHM, GF). Our survey results reveal the main sources of information and training for coffee production were received from the AEO, the cooperative, and from radio, TV, and newspaper (Figure 5).

Though most farmers have received training on coffee husbandry, land management practices, and health and safety precautions (Figure 6), 45% of farmers have been either unsatisfied or extremely unsatisfied with the extension services (Survey Data). Our evidence suggests farmer education is insufficient, since farmers were unaware of the quality of their coffee beans, soil conditions, and rules and regulations (Figure 7). These findings reveal a gap between Fairtrade's claim it is improving the knowledge of farmers, and the reality that farmers feel unsatisfied with extension services. In all, the educational benefits and knowledge from Fairtrade do not seem to have a considerable influence on farmers, and Fairtrade is having no observable impact improving the availability of extension services.

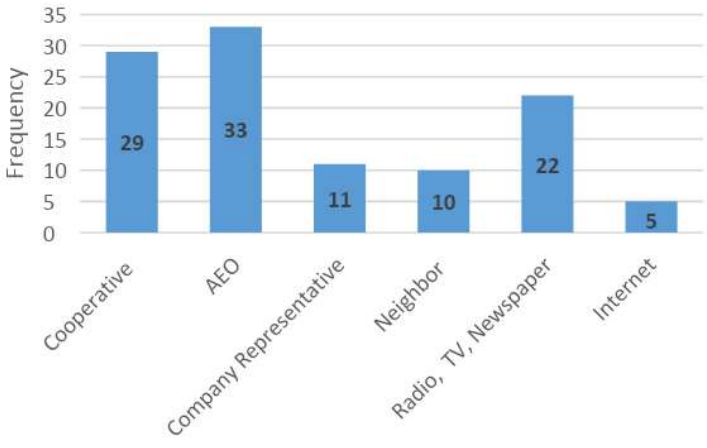

Figure 5: Answers to question 34 "Select any sources of information and training on coffee production:"

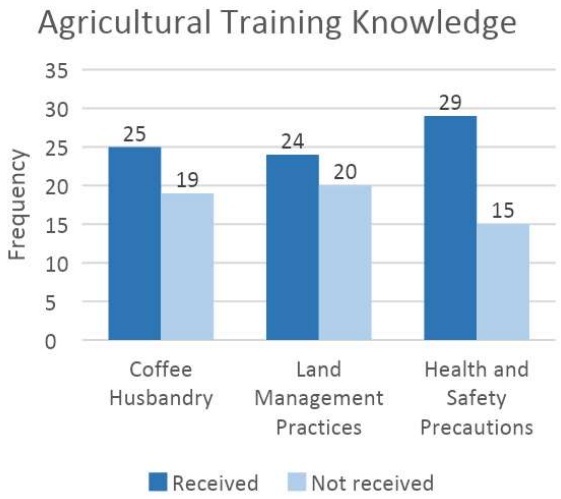

Figure 6: Answers to question 36 "Have you or someone else in your household received training from the cooperative about:"

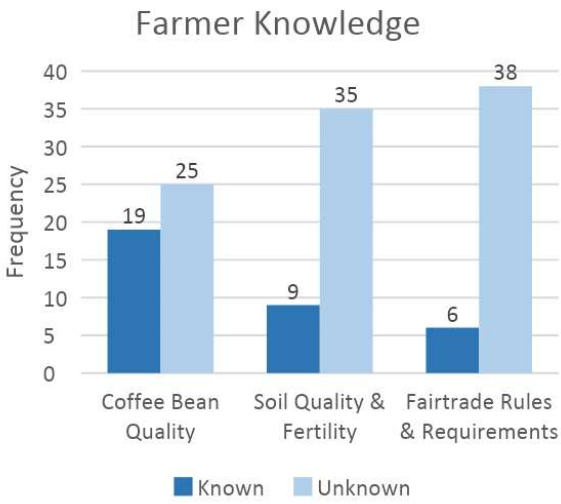

Figure 7: Answers to question 37 "Have you or someone else in your household received information about:"

4.4 Economic Benefits and Burdens of Fairtrade Certification

This section will highlight key findings on economic benefits and burdens felt by farmers to illustrate how Fairtrade standards address farmers' financial security. Specifically we will report how Fairtrade has been involved in overcoming production barriers and has attempted to remedy financial insecurity.

4.4.1 Addressing Financial Insecurity

50% of respondents believed their financial conditions had improved over the last five years, yet 77% reported that coffee income alone was not able to cover their basic household needs (Survey Data). We found that coffee is harvested twice a year and coffee farmers diversify their livelihoods to smooth out their income stream. 82% of farmers surveyed were involved in supplemental income generating activities (Figure 8). Initiatives to reduce the burden of agricultural capital costs were scarcely observed or mentioned by farmers.

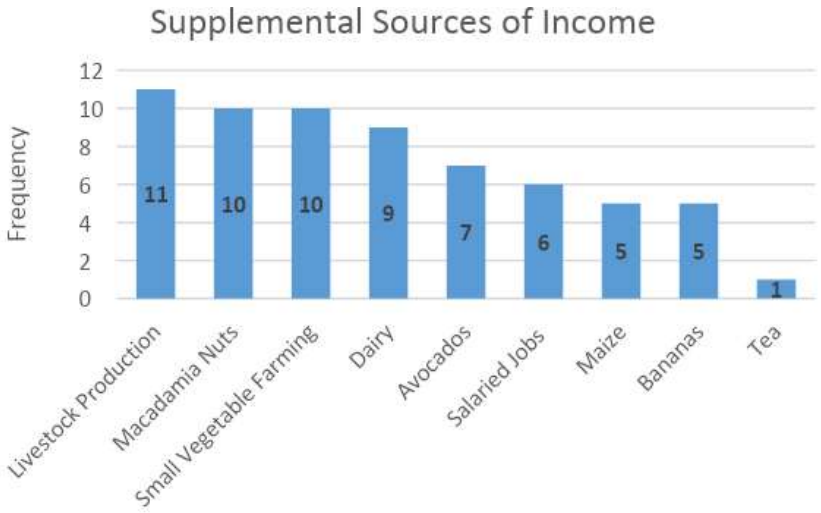

Figure 8: Answers to question 14 " List your 3 main sources of cash income in the past 1 year:"

91% of respondents cited the cost of inputs as a large burden in the coffee production process. Fairtrade projects to help mitigate costs have been limited to encouraging the cooperative to provide low cost coffee seedlings to farmers (SSI FTA). Fairtrade does nothing to alleviate the cost of fertiliser or pesticide inputs. Farmers have the option to purchase their agrochemical inputs from the cooperative on credit, and have costs deducted from their final payment (SSI CFM, CHM). When the cost of inputs is deducted from profit, farmers were often unaware of their expected final payout (Field Observations). Farmers who were able to afford the upfront capital costs told us they preferred purchasing inputs from private suppliers rather than from the cooperative for transparency reasons (Field Observations).

4.4.2 Delay of Payment Issues

In conducting our surveys, issues related to delays in payment were often stressed by farmers. The cooperative manager attributed delay in payment to two exogenous factors: middlemen and price fluctuations. Delays in payment pose a considerable economic burden on 93% of surveyed farmers. It takes between 6 and 9 months for farmers to receive payment after delivering cherries for processing (SSI GF, CGM).

The cooperative sells the coffee beans to middlemen who sell in bulk to larger exporters. This is problematic because it is difficult finding buyers and accessing markets and there are large lags of time between when middlemen pay the cooperative, and when the cooperative pays its farmers. Additionally, only 28% of the coffee produced in Kenya is sold internationally with the Fairtrade label, the remaining coffee is sold conventionally, and farmers do not receive the premium mark-up (SSI FTA). Farmers ultimately have limited bargaining power in terms of controlling the coffee prices (SSI CHM, GF, TC). FTA stressed finding markets and buyers to be a key challenge and limit for the premium product (SSI FTA)

One of the main benefits of being Fairtrade certified, is that Farmers improve their chances of higher bids on Kenyan coffee auctions for their produce (SSI FTA). The international coffee market is highly volatile and fluctuating prices result in the factory waiting to sell coffee until prices are competitive. Fluctuating coffee prices posed a significant issue to the farmers and key informants we talked to. Of the farmers surveyed who believed their household's financial condition has worsened over the past five years, 63% attributed their financial insecurity to declining market prices. Volatile coffee markets over the past five years have meant that farmers received an average lowest price of 44.52 Ksh/kg and a highest price of 112.23 Ksh/kg (Survey Data). Fairtrade's solution to price fluctuations is the minimum price standard. However, according to the FTA, the minimum price should cover production costs but does not guarantee farmers a livable income (SSI FTA). Thus, the minimum price should be seen as a safety net for farmers against market price volatility. In some cases, we discovered the safety net failed due to price fluctuations so low that farmers were not able to break even on their cost of production (SSI TC).

The cooperative's solution to financial uncertainty and insecurity caused by volatile market prices, as well as infrequent and delayed payments, has been to provide advances. 50% of farmers received advances from the cooperative, and 56% of farmers took out loans to facilitate coffee

production (Survey Data). There was a statistically significant ($p < 0.1$) difference between farmers who do and do not borrow loans from the cooperative, when it comes to farmer perception on the economic burden caused by delay of payments. Farmers who do not take loans to facilitate coffee production strongly believe that delay of payments poses an economic burden. To our knowledge neither Fairtrade nor the cooperative has been able to resolve the burden posed by delays in payments, since advances and loans do not address the fundamental issues.

In conclusion, financial insecurity among coffee farmers is due to several factors including delayed payments, volatile market prices, and costly agricultural inputs. Improving market access and prices, providing better guidance on inputs, and supporting the transition to more sustainable practices could help alleviate some of the financial burden experienced by farmers. But, it is unclear if Fairtrade is economically benefiting farmers to the extent the organisation claims.

4.5 Environmental Impacts of Fairtrade Coffee Certification

This section will present the results of three aspects that were assessed to investigate the environmental impacts of Fairtrade coffee certification: soil quality, biodiversity and vegetation health.

4.5.1 Environmental Challenges and Pesticide Use

Climate change has brought about many new challenges for farmers such as prolonged droughts and flooding, increased diseases and pests, extreme temperature variability, and many other problems which have a great impact on the social and economic spheres of farmers. Farmers expressed that they have struggled greatly in the last two harvest seasons with lower outputs and not being able to pick berries as early as they used to (SSI GF). Our survey results revealed 14% of farmers felt their household was financially worse-off now than it was five years ago. All respondents who felt financially worse-off attributed the decline to harsh environmental conditions (Survey Data). Farmers ranked their most challenging environmental issues faced as drought, pests, disease and erosion (Figure 9). FTA explained that Fairtrade attempts to aid farmers to deal with the problems caused by climate change through training in various areas such as agricultural practices, sustainable land use management and integrated pest management (SSI FTA).

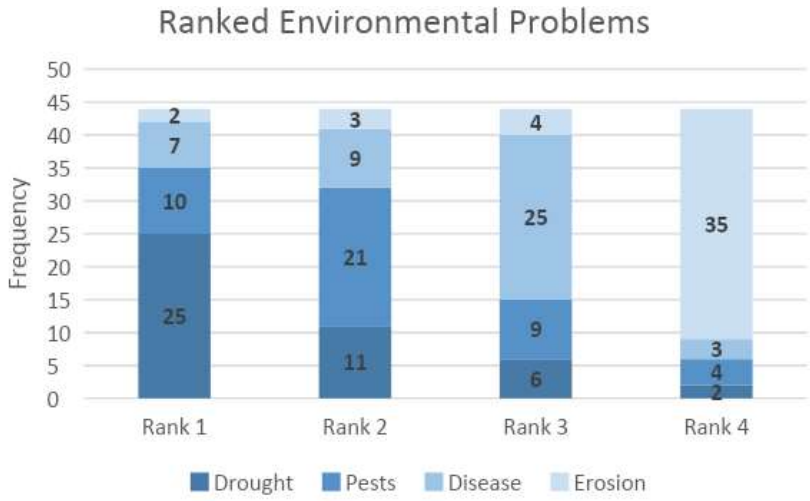

Figure 9: Answers to question 43 "Rank the following environmental issues which most impact your coffee farming:"

One of the Fairtrade's standards (Table 1) aims to minimise the use of pesticides since these are known to have negative impacts on the environment. Since pesticides can directly affect biodiversity, soil quality, and vegetation health these three indicators were chosen to assess the environmental impacts of Fairtrade coffee certification. Agrochemical inputs which are barred from use on Fairtrade products due to their toxic effects on the environment, as well as those which may be banned soon, are listed on the Prohibited Materials List (2014) (SSI FTA).

Fairtrade expects cooperatives to know what pesticides are being used on their member farms, and to have a list of these pesticides to check against the Fairtrade International hazardous substances list (SSI FTA). Cooperatives are tasked with tracking and ensuring that the people involved in spraying operations are managing the chemicals in a way that maintains biodiversity and soil quality (SSI FTA).

The Othaya Coffee Cooperative only procures chemicals that are in accordance with Fairtrade standards, and trains farmers on the safe disposal of hazardous chemicals (SSI CHM). 66 % of the farmers received training on health and safety precautions regarding the application of chemicals and hazardous waste disposal (Figure 6). Thus, we see that training of Fairtrade about pesticide use takes place. But it is then also important that the farmers comply with the guidelines and the learned knowledge. The survey shows that 80% of the surveyed farmers can list at least one Fairtrade criteria regarding pesticide use and 57% can list at least one Fairtrade criteria about proper waste disposal. Thus, it can be said that the intentions of Fairtrade to raise awareness among farmers about the topic are being met in this regard.

We did not collect any data on whether and how the farmers apply pesticides in compliance with the standards, but we found that on average pesticides are being applied 6.75 times per year on the Fairtrade certified coffee farms (Survey Data). Furthermore, 57 % of surveyed farmers have increased or greatly increased their pesticide use over the last five years. Only 16 % of the surveyed farmers have reduced their pesticide use over the last five years. The observed increase in pesticide use is not aligned with the goals of Fairtrade.

In response to questions on whether the consequences of increased pesticide use were taken into consideration given Fairtrade's restrictions, the FTA responded that this is a great challenge (SSI FTA). The reality of climate change is that as temperatures rise, diseases and pests like the coffee berry borer (Hypothenemus hampei), will become increasingly common (SSI FTA). In Kenya, beetle infestations have already affected farmer yield and quality loss (SSI MCA). In turn, farmers have become increasingly dependent on pesticides. The use of pesticides is often the easiest, cheapest, and most effective way to control the vast majority of diseases and pests (SSI FTA). Fairtrade and the cooperative are trying to counteract this by providing training on alternative methods to control pests and diseases, integrated pest management, farm hygiene and sustainable agricultural practices (SSI FTA, CHM).

In the Othaya region, the lack of resources has been the main reason implementation of sustainable agricultural systems and practices are still lacking (SSI FTA, MCA). Fairtrade recognizes it ought to do more in terms of environmental sustainability yet remains constrained due to the lack of funding to make projects more sustainable and to reach more farmers and cooperatives (SSI FTA).

4.5.2 Biodiversity

No significant differences (95 % confidence level) between Fairtrade certified farms and organic farms were found in species richness, GSI or SHI (Table 3). However, the average GSI for all organic farms is 0.50 ± 0.08 (average ± standard error) while the average GSI for all Fairtrade certified farms is 0.45 ± 0.05. Thus, the biodiversity measured in terms of GSI is numerically slightly higher, though not statistically significant, on organic farms than on Fairtrade certified farms.

The average SHI for all organic farms had a value of 0.96 ± 0.15 compared to the average of 0.89 ± 0.1 for the Fairtrade certified farms. This means that the biodiversity measured in terms

of SHI is numerically slightly higher for organic farms than for Fairtrade certified farms, though not statistically significant.

In terms of species richness, the Fairtrade certified farms have an average value of 5.10 ± 0.73,compared to the average value for the organic farms of 4.80 ± 0.8. Thus, the biodiversity as measured by species richness is numerically slightly higher on the Fairtrade certified farms than on the organic farms.

In general, the results of the biodiversity assessment potentially indicate that Fairtrade does not fail to meet its intentions and standards for maintaining biodiversity as set out in the Fairtrade Climate Standard (2015), as no significant difference was found between the Fairtrade certified farms compared to the organic farms.

Measurement	Farm	Mean	N	Std. Error	P value
Gini Simpson Index	***organic***	**0.50**	5	0.08	0.571
	fairtrade	0.45	10	0.05	
Shannon Index	***organic***	**0.96**	5	0.15	0.700
	fairtrade	0.89	10	0.10	
Species richness	*organic*	4.80	5	0.8	0.805
	fairtrade	**5.10**	10	0.73	

** bold values mean a better value for the environment and sustainability of the environmental system of the studied region.*
N = Number of samples

Table 3 Overview of the biodiversity measurements for the two farms types compared; organic and fairtrade certified. The species richness is given in the number of species

Observations in the field support the numerically measured trends for the GSI and SHI, as more insects, birds, bird calls and animals were observed on the organic farms than on the Fairtrade certified farms. Of the surveyed farmers, 64 % observed decreasing or strongly decreasing biodiversity (insects, birds, and animals) over the last five years. On the other hand, only 9 % of surveyed farmers observed an increase in biodiversity over the last five years. The reason for the observed decrease in biodiversity on Fairtrade certified farms has not been uncovered. However, the observed increase in pesticide use can be reconciled with the decrease in biodiversity observed by the farmers over the last five years (Survey Data), since insects, birds and animals can be sensitive to certain pesticides. Other factors influencing the observed decrease in biodiversity

could be climate change and rising temperatures, or even the ongoing drought, because insects, together with the whole ecosystem, can react extremely sensitively to very small abiotic changes. Considering the survey data on pesticide use and biodiversity together, it can be said that Fairtrade may not quite be where they want to be in terms of their goals for biodiversity conservation, pesticide use and managing climate change.

4.5.3 Soil Fertility and Soil Quality

Both the Fairtrade Climate Standard (2015) and the Fairtrade Standard for Coffee (2021) mention that farmers should be informed by the Fairtrade cooperatives as well as the production organisations on how to care for their soil and how to maintain healthy soil with the right farming practices (SSI FTA). Measures from Fairtrade to support sustainable farming systems regarding soil include helping farmers with fertility training, composting, mulching, planting shade trees, and recommendations for maintaining soil moisture (SSI FTA). The results of the survey show that 55 % of the farmers received training about land management practices such as soil conservation (Figure 6). Considering that knowledge of land management practices is a prerequisite for healthy soil, this percentage is not particularly high. We thus note that Fairtrades' intentions in terms of knowledge transfer and training of agricultural practices regarding soil is not fully achieved.

However, apart from the training provided, getting information about soil quality is still up to the coffee farmers themselves, so it is not a Fairtrade requirement(SSI AEO). According to the AEO, the county government offers soil analysis for a subsidised price of 300 Khs per sample (SSI AEO). The survey results show that 80 % of farmers have not received information about their soil quality (Figure 7). We are unaware of any programs implemented by Fairtrade which provide soil testing to farmers.

Soil Fertility

In terms of soil fertility, 37 % of surveyed farmers rated their soil fertility as high or very high and only 14 % of farmers stated that their soil was poor or very poor. This shows that the majority of coffee farmers surveyed consider their soil to have a good level of plant-available nutrients in the soil. The farmers' self-assessment of soil fertility can only partially be reconciled with the soil data collected. Figure 10 shows the results of the soil fertility analysis performed

using the SoilCares scanner in Kenya. For all sampled farms, the nitrogen and carbon content in the soil is adequate to high. The phosphorus content in the soil is low for all farms. The pH value is low for all farms, except Fairtrade farms 4 and 5. Soil pH affects the amount of nutrients that are soluble in water, and therefore the amount of nutrients available to plants.

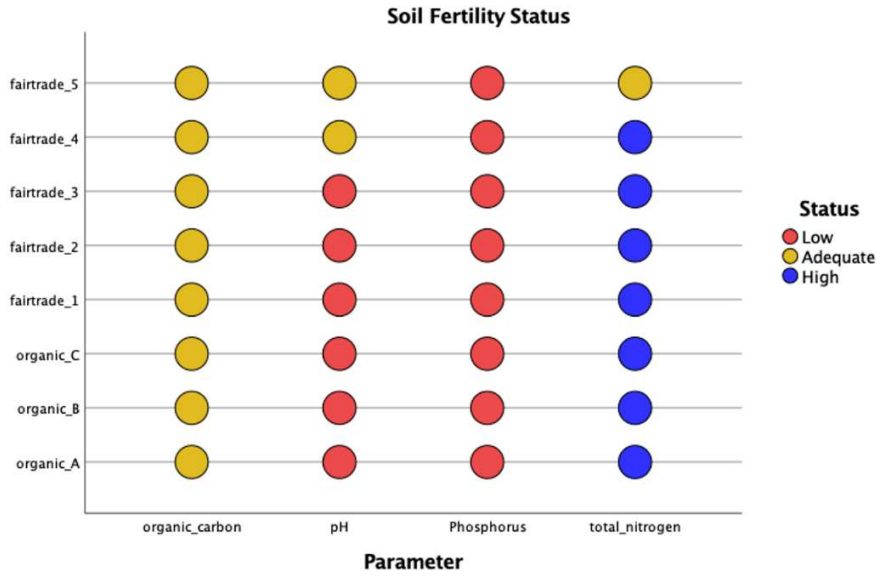

Figure 10: Results of the soil fertility status testing performed by the agriculture office in Othaya, Kenya. Soil Fertility status tested with the "Agroscares Nutrient Scanner" by AgroCares.

This observed difference between the farmer soil fertility assessment and the measured soil fertility can be attributed to the fact that this information is not provided by Fairtrade, respectively the cooperatives. As soil fertility is an important indicator for farmers to determine the amount of needed fertiliser, and this, in turn, has an influence on sustainable and environmentally friendly coffee cultivation, Fairtrade should consider providing free analysis of soil samples to the farmers. In this way, the environmental goals of Fairtrade could be achieved efficiently.

Soil Quality

The results of the survey show also that 34 % of the farmers rated their soil quality as high or very high and only 9 % of surveyed farmers rated their soil as poor or very poor. This shows that the majority of coffee farmers surveyed consider their soil to be generally healthy.

No significant differences (95% confidence level) in soil respiration, soil organic matter (SOM) and pH were found between Fairtrade certified farms and organic farms (Table 4). Soil respiration on the Fairtrade certified farms had an average value of 72.42 ± 8.3 mg CO_2 compared to an average value of 56.1 ± 9.21 mg CO_2 for the organic farms. Soil respiration can be used to draw conclusions about the biomass of microorganisms and thus about the activity of microorganisms in the soil. The results therefore indicate that there is potentially a higher biomass and activity of microorganisms in the soil of Fairtrade certified farms compared to organic farms, although not statistically significant.

Measurement	Farm	Mean	N	Std. Error	P value
$_{(mg)}$ CO_2 - C_{kg}^{-1} soil	*organic*	56.10	5	9.21	0.254
	fairtrade	**72.24**	10	8.30	
SOM %	*organic*	3.80	3	0.62	0.258
	fairtrade	**4.43**	5	0.16	
pH	***organic***	**4.83**	6	0.16	0.59
	fairtrade	4.73	10	0.10	

** bold values mean a better value for the environment and sustainability of the environmental system of the studied region.*
N = Number of samples
$_{(mg)}$ CO_2 - C_{kg}^{-1} soil = the amount of respired CO_2 in the sample
SOM = Soil organic matter

Table 4: Overview of the soil analysis measurements for the two farms types compared; organic and fairtrade certified

The average SOM content for Fairtrade certified farms is 4.43 ± 0.16 %, compared to the average SOM content of 3.80 ± 0.62 % for organic farms. This could contribute to the numerically higher soil respiration found on the Fairtrade certified farms compared to the organic farms. Soil respiration can be dependent on the SOM content, since SOM is a food source for microorganisms. When microorganisms are present and active, soil respiration tends to be higher. When SOM is absent or low, there is less decomposition and thus lower soil respiration.

The average pH value is 4.73 ± 0.1 for the Fairtrade certified farms, while the average pH value is 4.83 ± 0.16 for the organic farms. This means that the soil on the Fairtrade certified farms is numerically slightly more acidic than on organic farms, though not statistically significant.

The collected data and the results about the perception of the farmers regarding their soil quality, except the pH value, do not point in different directions. Based on these results, comparing

the Fairtrade certified farms to the organic farms, Fairtrade does not fail to meet its intentions and criteria for maintaining healthy soils as set out in the Fairtrade Climate Standard (2015).

4.5.4 Changes in Vegetation Health

The vegetation health assessment focused on the results from the survey, and the computation of NDVI trends from satellite data. The aim was to find out whether the efforts regarding training in sustainable land management and pesticide use as well as the restriction of permitted pesticides and fertilisers by Fairtrade have an effect on the vegetation health.

Regarding vegetation health, the results of the survey show that 39 % of farmers rank their coffee plant health as healthy or very healthy, while 20 % of farmers rate their coffee plant health as unhealthy or very unhealthy. The farmers' assessment on the health of coffee plants over the past five years exhibits a similar result. Of the farmers surveyed, 48 % say coffee plant health has improved over the past five years, and 30 % say coffee plant health has worsened over the past five years. The assessments of vegetation and coffee plant health are surprising when we consider that in March 2023 Othaya was experiencing a prolonged drought. On the basis of the farmers' self-assessment (Survey Data), and the training and restrictions undertaken by Fairtrade (SSI FTA) regarding land management and pesticide use, despite participation and knowledge results, one could conclude that the vegetation health is being sustained. However, this cannot be reconciled with the results of our field observations and NDVI trend analysis presented below.

Our field observations showed some general differences between Fairtrade farms and the organic farms we visited. All three organic farms were equipped with drip irrigation and sprinklers, in contrast to the five Fairtrade farms which were rainfed. Coffee plants on the organic farms appeared greener, healthier and more vital compared to those on the Fairtrade certified farms, due to the differences in irrigation systems (Photos 1A & 1B compared to Photo 2). The non-irrigated Fairtrade certified farms had visibly dry soil and coffee plants were suffering from the water shortage (Field Observations). The absence of synthetic pesticides and artificial fertilisers on the organic farms could be another reason for differences in plant health observations.

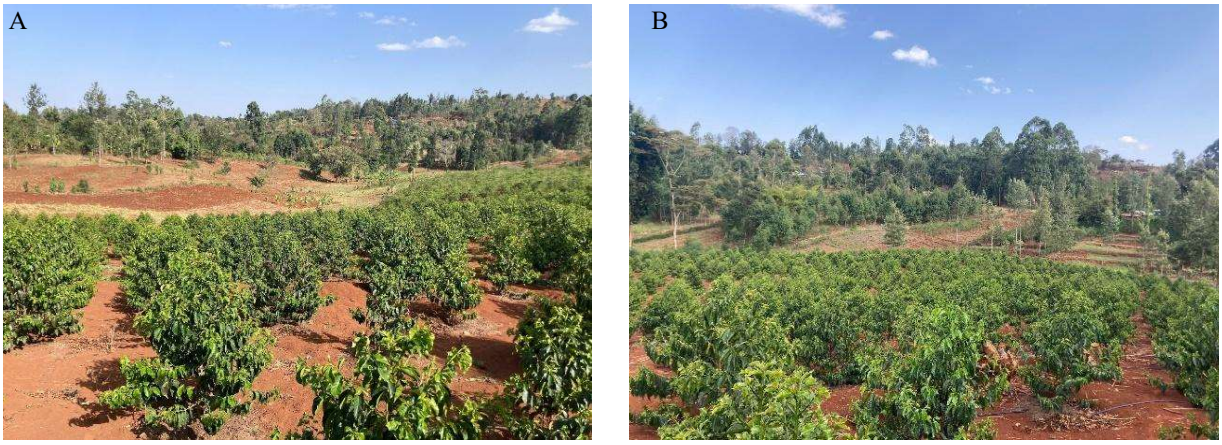

Photo 1A and 1B: Organic coffee farm with irrigation system in "Matitu" in Gatugi, Kenya

Photo 2: Fairtrade certified coffee farm in Gatugi, Kenya

In addition to our field observations, and contrary to the perceptions of farmers that their coffee plant health has improved in the last five years, trends in the Normalised Difference Vegetation Index (NDVI) for the area of Gatugi show a statistically significant ($p < 0.05$) strong decrease in vegetation greenness over the last 5 years (Figure 11). This suggests a decrease in vegetation density and/or vegetation health in the Gatugi area over the last 5 years. These changes can, for example, be caused by climatic conditions such as drought, as well as other factors that affect vegetation health, such as pests and diseases or poor soil quality and fertility.

The eastern region of Othaya sub-county exhibits predominantly negative trends in NDVI. This region is dominated by small-scale farming practices, including coffee, which are particularly sensitive to climatic variability. In contrast, the western region of Othaya sub-county show statistically significant ($p < 0.05$) positive trends in NDVI. These occur in the Aberdares National Park, which is dominated by woody vegetation, and thus indicate an increased vegetation density and/or plant health in the forest. This may be a result of, for example, previously sparse, low vegetation being replaced by tree cover, or a higher resilience to climatic variability as the forest matures.

Thus, our field observations and the NDVI trends analysis both show that, despite Fairtrade's efforts, vegetation and coffee plant health is a problem. The training and knowledge of farmers must therefore be intensified and made more effective in order to strategically and sustainably adapt coffee production to climate change.

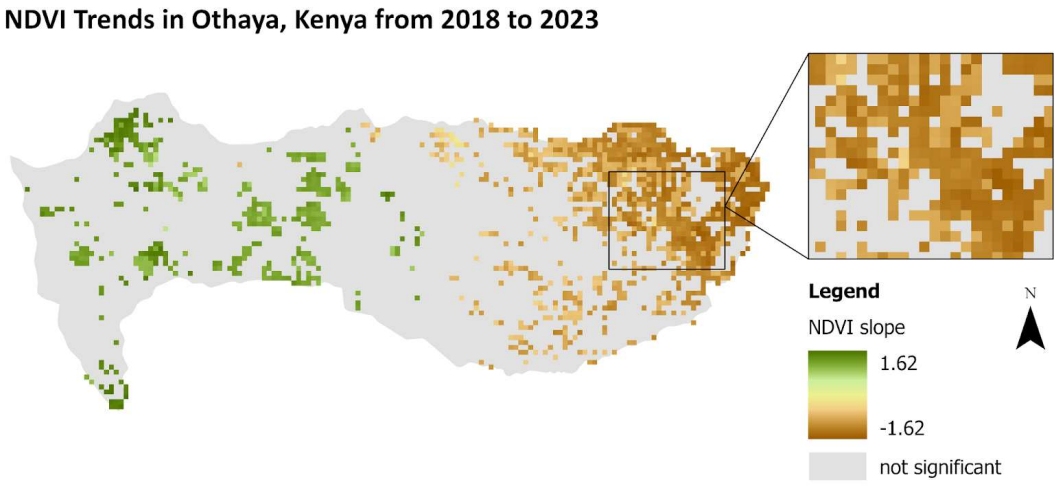

Figure 11: NDVI trends in Othaya sub-county from 2018 to 2023. Non-significant pixels (95% confidence level) are masked out in grey. The insert highlights the study area of Gatugi.

Chapter 5: Discussion

5.1 Findings in light of existing literature

Our results suggest that some of the Fairtrade standards are not implemented by the cooperative sufficiently. Agricultural training for instance, is considered very important by Fairtrade to live up to their criteria, but its quality is lacking according to the farmers. Bolwig et al. (2013) and Jena et al. (2012) similarly conclude that Fairtrade certified cooperatives provide unsatisfying information and training to farmers. We believe the clear lack of awareness of Fairtrade suggests that certification is not reaching its full potential for multiple reasons. Firstly, Fairtrade and the cooperative lack financial resources. Secondly, cooperative management and elected leaders may lack the qualifications and knowledge to recognise the benefits of increasing awareness about Fairtrade. Finally, cooperative structure prevents equitable inclusion of farmers and weakens their decision-making power. Equal participatory decision-making based on gender and age is also likely to be an issue according to our results, which goes against Fairtrade's goals for no discrimination. Wairegi et al. (2018) emphasises the importance of younger generations of farmers participating, especially to improve national productivity and sustainability. In order to make the certification process and the participation of farmers more transparent, we believe that there should be a larger emphasis from the cooperative and Fairtrade to have effective meetings and elections. More robust meetings and farmer involvement would also remedy issues related to the distribution of Premiums, to ensure farmers have access to the funds.

In general, it is difficult to point to the institution of Fairtrade directly when assessing the benefits and challenges of certification, since it is the OFCS who implements the standards. One of the important conclusions of Jena et al. (2012) is that the benefits of certification can only be attained if the institutions implementing the certification standards are efficient. Their work also found that the economic benefits of certification schemes were not received due to the poor implementation of standards from the cooperative level.

When researching trade-offs between socio-economic and environmental sustainability in certification schemes, Vanderhaegen et al. (2013) found significant trade-offs. The authors observed cases where certification schemes provided economic benefits and had adverse environmental effects, and vice versa. Fairtrade is not known for emphasising environmental sustainability as much as Rainforest Alliance and UTZ (Van Rijsbergen et al, 2016; Vanderhaegen et al, 2013).

We discovered that pesticide use and reliance has increased substantially for farmers, which will likely have long term consequences on biodiversity and soil quality. Sellare et al. (2020) showed pesticide use was higher in Fairtrade certified farms than non-certified farms in Cote d'Ivoire, likely due to access and availability of subsidies for agrochemicals provided by the cooperatives. On the other hand, Elder et al.'s study (2013) in Rwanda, where subsidies were provided by the government, found no significant differences. Nevertheless, we believe that Fairtrade may not prioritise these issues enough if they want to address sustainability and the biodiversity crisis. It may be worth considering if Fairtrade should have more specific restrictions on agrochemical use than they do now. However, more research needs to be conducted to link environmental consequences to Fairtrade standards and the cooperative model.

The interconnectedness of environmental, and economic dimensions of sustainability is evident, e.g. the use of pesticides not only has environmental consequences but also affects the economic well-being of the farmers. Ideally, the farmers would be able to address pests and diseases through sustainable farming practices, but due to the lack of economic resources and insufficient training on natural pest management, this is not a realistic scenario for the farmers. Underpinning the farmer's lack of capital are fluctuations in coffee prices and delays of payment, and it is uncertain how much Fairtrade standards are alleviating these burdens. The Fairtrade minimum price is recognised as a safety net, but the price is too low according to Jena et al. (2012) and insignificant to farmers. Hypothetically, Premium funds could be used as direct cash incentives to alleviate financial troubles, whereby payments would be given to farmers who comply with guidelines, reduce their agrochemical input usage, and participate in training, meetings, and elections.

This would not resolve underlying issues of financial insecurity which we believe might fall outside of the scope of Fairtrade and the cooperative's work. Systemic issues are caused by the auction system, global trade, middlemen, government, and corruption. In all, it is not necessarily Fairtrade's responsibility, nor do they have the power to fix these issues, because there is a limit to how much consumers are willing to pay and restrictions on institutional structures. The transition to sustainable agricultural practices is thus dependent on national context and policies (Elder et al., 2013).

5.2 Methodology and Methods Chosen

The interdisciplinary approach adopted in this research project has been facilitated by the diversity in academic disciplines of the authors. The chosen methods were made possible by, and reflect, the diversified expertise in both the social and natural sciences. A major advantage of the interdisciplinary approach was the possibility to attempt to gain a more holistic understanding of sustainability, across the three dimensions presented in the analytical framework. This section seeks to highlight how the chosen methods and their application may have affected the results presented, as well as weaknesses in the data. General limitations of the study will also be presented.

In the field, there was a language barrier since the authors of this report do not speak Swahili nor Kikuyu, and not all locals spoke English. This predominantly affected the surveys, which were carried out with translation help from the guides and Kenyan counterparts. Alternative translations of specific English terms may have made some of the survey questions and the farmers' responses unclear. Furthermore, much background knowledge obtained in between survey questions was often not translated, and was thus lost on the authors.

In addition to the language barrier, survey results will also have been affected by the question design. When analysing the results, it became clear that it may have been more beneficial to phrase some questions differently or use a different type of question in order to better answer the research questions of the project. Furthermore, it cannot be ignored that survey responses may have been influenced by our position as foreign researchers. Respondents may have been hesitant to answer truthfully as a result of cultural norms and/or unsure of the intentions with the survey. On the other hand, respondents may also have answered what they believed was desired by the authors. This introduces bias that is difficult to assess and thus not possible to correct for.

A general constraint of using surveys is that the close-ended questions and multiple-choice responses are unable to capture detailed answers. Thus, semi-structured interviews were conducted for better accessibility and utilisation of data collected from the survey. Further in-depth questions were asked during interviews to supplement the comprehensive data that the survey had not been able to capture. However, the respondents of the survey were all coffee farmers, while most interview respondents were key informants. Ideally, interviews would have been conducted with more farmers who are members of the cooperative, and thus Fairtrade certified. However, the combination of survey and semi-structured interview methods revealed interesting results when triangulated, particularly regarding cooperative management. Conducting focus groups with

farmers, as initially planned, would have provided another perspective, but this was not possible due to time constraints.

A general limitation of this study is sample size, as for all methods conducted in the field it would have been beneficial to have a larger sample size. Some statistical significance was found in the survey results, but more survey respondents would have given a more representative picture of the population. Both the biodiversity assessment and soil analysis results were severely limited by the lack of statistical significance. In order to expand on this initial explorative study, more samples should be collected in order to draw more reliable conclusions.

The application of biodiversity assessment methods in particular also affected the results obtained. The cups were placed at different times of the day for different farms, which may have affected the results as insect activity varies depending on time of day and associated weather conditions. Some cups were also removed by children before the collection time, which resulted in different sample sizes for those farms. Arguably, the most significant limitation regarding the application of the method was that the cups were not all left for exactly 24 hours. The difference in time was not corrected for, as it is difficult to determine whether the increased length of time just affects the counts of each species, or whether it also affects the number of species found. Ideally, this would have been avoided, but due to transport and other practical constraints, it was not possible.

The baseline chosen to facilitate the soil analysis and biodiversity assessment of Fairtrade certified farms also affected the conclusions that can be drawn from this study. Organic farms are considered the 'gold standard' in terms of environmentally sustainable farming practices. In order to assess the impact of Fairtrade, it would be beneficial to also compare Fairtrade certified farms with farms that make use of traditional farming practices. This would enable an assessment of whether Fairtrade farming practices offer an improvement in environmental sustainability compared to traditional farming practices. However, since all small-scale coffee farms in the study area belong to the Othaya Coffee Co-operative, and are thus certified, it was not possible to assess traditional farms due to practical and time constraints.

Finally, it should be mentioned that, although this study adopted an interdisciplinary approach in order to assess social, economic and environmental sustainability, there are many more indicators for each dimension, and arguably also more dimensions, that were beyond the scope of

this study. The limitations of the project, particularly in time, make this an explorative study and the results and conclusions should be interpreted with this in mind.

5.3 What We Learned From Our Work and Experience

Working together with our Kenyan counterparts in the field introduced cultural differences that made the research experience interesting but challenging. We felt our counterparts had different attitudes and understandings of respect for authority figures, punctuality, time management, and work ethic compared to us. We had to first learn about each other to find a common consensus and way of working that suited both groups. A lot of time and energy was spent negotiating and compromising on research, which could have been spent in the field.

Our group also succumbed to the long working days during fieldwork, and climatic conditions which demanded a lot of physical endurance and discipline. Fieldwork was also hindered by illness and fatigue. Pivoting back to work in Denmark required significant re-adjustment. Our group faced challenges compromising on interdisciplinary subjects regarding data analysis and report writing. In all, this experience has taught us the value of Kenyan patience, Hakkuna Matata!

In hindsight, our group agrees more structure, thought, and research were necessary pre-departure. Our group communication and meetings could have been made more efficient. We are very satisfied with our overall performance as a group as well as with our ability to come together to meet deadlines.

Chapter 6: Conclusion

By focusing on the social, economic, and environmental dimensions, the main goal of this research was to evaluate the effects of Fairtrade certification on the livelihoods of small-scale coffee farmers in Gatugi, Kenya. From the social perspective, results revealed the majority of the farmers are unaware of Fairtrade certification and their farms being Fairtrade certified. Within their existing broad framework, Fairtrade falls short of guaranteeing that farmers are aware of certification, educated on best farming practices, and fairly represented in the decision-making process. The study results also demonstrated that, although farmers are likely to be benefiting from Fairtrade Premium funds, their influence over the utilisation of the funds is constrained.

From the economic perspective, the study results indicate that Fairtrade has not done enough to address the financial insecurity caused by fluctuation in coffee prices and the delay in payments. Farmers' safety net against price volatility, the Fairtrade minimum price, has proven to be ineffective to the point where farmers were unable to afford their cost of production. Fairtrade initiatives to reduce production costs have been limited by the cooperative to give farmers coffee seedlings at a lower cost, and Fairtrade has not taken any effective measures to reduce the cost of agrochemical inputs.

From the environmental perspective, it seems that farmers are sufficiently aware of the Fairtrade standards on proper waste disposal and safety guidelines for using fertiliser and pesticides. However, we question the long term sustainability of Fairtrade farming practices since we observed farmers using more agrochemical inputs, which we believe will lead to poorer soil quality and biodiversity. These concerns are not receiving adequate attention from Fairtrade, and their standards may not be sufficient to deal with these issues, especially in light of increasing challenges as a result of climate change.

In conclusion, our research has identified areas where Fairtrade certification has improved the social and economic well-being of farmers as well as environmental conditions. However, we also identified areas where Fairtrade is still lacking and not fully achieving their goals and farmers' needs. Our report has provided some recommendations for improving Fairtrade standards to be more sustainable in all three dimensions covered. In all, this is an explorative study and further research should be conducted.

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Appendix

A1 Survey Questions

1. Identification Number

_____

2. Participant Gender
(1) m Male
(2) m Female

3. Participant Name

_____

4. Participant Age

_____

5. How many members of your household are you? Including yourself.

_____

6. What is your highest level of education?
(1) m No formal education
(2) m Primary level
(3) m Secondary level
(4) m Post-secondary level

7. Do you have specific formal agricultural production training?
(1) m Yes
(2) m No

8. Please specify which training

_____

9. What is the size of this coffee farm?
(1) m Less than 1 Acre
(2) m 1.0-2 .9Acres
(3) m 3.0-4.9 Acres
(4) m 5 or more Acres

10. How many coffee trees do you have?

_____

11. What variety of coffee trees do you have?

_____
_____
_____
_____
_____
_____

12. How did you acquire this farm?
(1) m Inheritance
(2) m Purchased
(3) m Leased

13. How many years have you been growing coffee on this farm?
_____

14. List your 3 main sources of cash income in the past 1 year:
(1) q Source 1 _____
(2) q Source 2 _____
(3) q Source 3 _____

15. Please list the highest and lowest price for coffee your received in the past 5 years?
Highest Price
_____
Lowest Price
_____

16. How long have you been a member of Othaya Farmers Cooperative Society? (In years)
_____

17. Have you participated in any cooperative society meetings the past 1 year?
(1) m Yes
(2) m No

18. Did you participate in the last election of cooperative leadership?
(1) m Yes
(2) m No

19. On a scale of 1-5, would you agree that cooperative management is effective?
(1) m Strongly Agree (2) m Agree (3) m Neutral (4) m Disagree (5) m Strongly Disagree

20. On a scale of 1-5, how much do you benefit from being a member of a coffee cooperative? (1=least;5=most)
1 ——⊖—— 5

21. How long does it take on average to receive payment from the factory after your coffee is delivered?
(1) m Less than 30 days
(2) m 31-60 days
(3) m 61-90 days
(4) m 91 days or more

22. On a scale of 1-5, would you agree that delay in payment poses an economic burden on your household?
(1) m Strongly Agree (2) m Agree (3) m Neutral (4) m Disagree (5) m Strongly Disagree

23. Do you receive any advances for coffee production from the cooperative?
(1) m Yes
(2) m No

24. Do you borrow any loans to facilitate coffee production from the cooperative?
(1) m Yes
(2) m No

25. On a scale of 1-5, how dependent are you on agricultural inputs from your cooperative? (1=not at all dependent; 5= very dependent)

1 ———⊖——— 5

26. List all farming requirements from your cooperative:

(1) q Health / Safety _____
(2) q Pesticide Use _____
(3) q Labor Conditions _____
(4) q Wages _____
(5) q Waste Disposal _____

27. Select any burdens you have trying to conform to cooperative requirements:

(1) q Waste Disposal
(2) q Labor Regulations
(3) q Health and Safety
(4) q Costs of inputs

28. Are you aware of fairtrade certification?

(1) m Yes
(2) m No

29. Do you know if your cooperative is fairtrade certified?

(1) m Yes
(2) m No

30. On a scale of 1-5, would you agree that certification has improved:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Income	(1) m	(2) m	(3) m	(4) m	(5) m
Working conditions / safety	(1) m	(2) m	(3) m	(4) m	(5) m
Farming knowledge	(1) m	(2) m	(3) m	(4) m	(5) m
Health / Diet	(1) m	(2) m	(3) m	(4) m	(5) m
Environmental Conditions	(1) m	(2) m	(3) m	(4) m	(5) m
Coffee Productivity	(1) m	(2) m	(3) m	(4) m	(5) m

31. Are you aware of the certification premium funds?

(1) m Yes
(2) m No

32. How are the premiums utilized by the cooperative?

_____

33. Are you involved in decisions regarding how premiums are utilized?

(1) m Yes
(2) m No

34. Select any sources of information and training on coffee production:

(1) q Cooperative
(2) q Agricultural Extension Officer

(3) q Company Representatives
(4) q Neighbor
(5) q Radio / TV / Newspaper
(6) q Internet

35. On a scale of 1-5, how satisfied are you with extension services from the coffee cooperative? (1=extremely unsatisfied; 5=extremely satisfied)
1 ——⊖—— 5

36. Have you or someone else in your household received training from the cooperative about:

	Yes	No
Coffee Management (Planting, weeding, grafting, pruning, capping)	(1) m	(2) m
Land Management Practices (Tilling, Water and Soil Conservation)	(1) m	(2) m
Health and Safety Precautions (Chemical application, Hazardous waste disposal)	(1) m	(2) m

37. Have you or someone else in your household received information about:

	Yes	No
The quality of your coffee beans?	(1) m	(2) m
The quality of your soil? (type, Ph, NPK)	(1) m	(2) m
The rules and regulations governing fairtrade certification?	(1) m	(2) m

38. On a scale of 1-5, how would you rank the soil quality on your farm? (1= very poor quality; 5= very high quality)
1 ——⊖—— 5

39. On a scale of 1-5, how would you rank the soil fertility on your farm? (1= very poor fertility; 5= very high fertility)
1 ——⊖—— 5

40. On a scale of 1-5, how would you rank the change in the biodiversity (insects/birds/plants) on your farm in the last 5 years? (1=significantly decreased; 5= significantly increased)
1 ——⊖—— 5

41. On a scale of 1-5, how would you rank the plant health on your farm? (1=very unhealthy; 5= very healthy)
1 ——⊖—— 5

42. On a scale of 1-5, would you agree that the health of your crops has been improving over the last 5 years?
(1) m Strongly Agree (2) m Agree (3) m Neutral (4) m Disagree (5) m Strongly Disagree

43. Rank the following environmental issues which most impact your coffee farming:

	1	2	3	4
Pests	(1) m	(2) m	(3) m	(4) m
Disease	(1) m	(2) m	(3) m	(4) m
Drought	(1) m	(2) m	(3) m	(4) m
Erosion				

(1) m (2) m (3) m (4) m

44. On a scale of 1-5 would you agree that you have increased your pesticide use over the last 5 years?
(1) m Strongly Agree (2) m Agree (3) m Neutral (4) m Disagree (5) m Strongly Disagree

45. How many times did you apply the following in the past 1 year?
(1) q Fertilizer _____
(2) q Manure _____
(3) q Pesticides _____
(4) q Limestone _____

46. On a scale of 1-5, would you agree that coffee income over the past 1 year covered what you consider to be the basic needs of your household?
(1) m Strongly Agree (2) m Agree (3) m Neutral (4) m Disagree (5) m Strongly Disagree

47. How financially well-off is your household today compared with your situation 5 years ago?
(1) m Worse-off now
(2) m About the same
(3) m Better-off now

48. If worse-off, select 3 reasons for the change:
(1) q Reduced education & trainings
(2) q Limited marketing or trade
(3) q Declining market prices
(4) q Increased pests and diseases
(5) q Reduced land area for coffee production
(6) q Poor governance or corruption
(7) q Declining crop productivity
(8) q Harsh environmental conditions
(9) q Unsafe work conditions

49. If better-off, select 3 reasons for the change:
(1) q Remittances
(2) q Cooperative membership
(3) q Favorable rules and regulations
(4) q Increased education and trainings
(5) q Wider markets and trading opportunities
(6) q Higher market prices
(7) q Increased land area for coffee production
(8) q Political support and good governance
(9) q Increased crop productivity
(10) q Favorable environmental conditions
(11) q Improved safety and working conditions

A2 Interview Guides

Agricultural Extension Officer Interview Guide

1. Can you start by introducing yourself and tell us a little bit about yourself?
2. How many coffee farmers are in the area?
3. What is the process of Fairtrade coffee certification?
4. How many coffee farmers are Fairtrade certified in Gatugi? Are there other certification schemes in the area? Which?
5. What is the partnership between the certification organization(s) and MoA, how do you meet and how do you interact?
6. What are the benefits and challenges of Fairtrade coffee certification for the farmers?
7. How many coffee cooperatives are in the ward/county? How many farmers are in the cooperative in the Gatugi area?
8. What is your partnership with the Othaya Co-operative Society? How do you interact with them, and what are the biggest challenges working with them? Do you know what is the average coffee yield per acre, each season?
9. What is the average price of the coffee? Minimum price and premiums?
10. What kind of challenges do you face working with the coffee farmers?
11. What kind of policies and laws govern the coffee production and certification?
12. What kind of training and information do you provide the farmers? How many trainings do you organize for farmers per year?

Cooperative Factory Manager Interview Guide

1. Can you start by introducing yourself and tell us about the work you do?
2. How many coffee farmers sell their coffee to your factory?
    - How are they paid and how often? How much is bought? Average price per. kg? Minimum price?
    - Can you tell us about the Premium funds?
2. How are the coffee beans being bought, processed and sold from the factory side?
    - Which actors are involved in the supply chain?
2. What is the process of coffee certification, and the requirements for Fairtrade?
    - What are the benefits and challenges of certification?
2. What does the factory do to meet/comply with the requirements?
3. How is your partnership with Fairtrade?

Town Chief Interview Guide

Can you start by introducing yourself and tell us a little bit about yourself?

- What kind of work do you do?
- How long have you been working as a chief in this Gatugi?

2. What do you believe are the general challenges of being a coffee farmer in the Gatugi area?
3. Can you give us an interview of how the Othaya Coffee Cooperative Society functions?
    - Do you believe the coffee farmers in general are satisfied or dissatisfied with the cooperative? Why?
2. Are you aware of Fairtrade coffee certification and what it entails?
    - [If he answers yes] What is the process of coffee certification?
    - What are the requirements of certification for the different levels?

2. What are the challenges of coffee certification?
    . What are the biggest benefits of certification?
2. What are other challenges of being a part of the cooperative?
3. How does the coffee certification impact…
    . Health?
    . Income?
    . Crop productivity
    . Safety?
    . Working conditions?
    . Biodiversity? Other environmental conditions?
2. [if he is aware of Fairtrade] Are you aware of any other certifications for coffee (eg. organic or Utz certified) and its implications for coffee farmers?
3. Are you aware of the premium funds from the coffee certification?
    . Are you aware of how the premiums are used?
    . Are you aware of how/whether the farmers are involved in the process of selecting what the money from the premiums goes to?
2. How many coffee farmers are in Gatugi and how many are in the cooperative?
3. How many coffee factories are in the area?
4. What are the challenges of Fairtrade certification?
    . Are there any significant challenges for farmers to live up to the requirements?

Cooperative Head Manager Interview Guide

How long have you been working at the OFCS?

1. Can you give us an overview of how the Othaya Coffee Cooperative Society operates?
2. Can you give us an overview of how elections are conducted?
3. How many meetings do you hold with farmers and what are some of the key issues which are discussed
4. What do you believe are the general challenges of being a coffee farmer in the Gatugi area?
5. How are the market prices of coffee determined?
    . What does the cooperative do to stabilize and increase market prices?
    . What are the reasons for the fluctuating market price of coffee?
        . Reasons beyond environmental issues, incl. climate change?
    . Auctions?
2. How does politics influence coffee production and marketing in the Gatugi?
3. What is the process of Fairtrade certification?
    . What are the requirements of certification for the different levels?
    . How are the farmers audited, to make sure they comply with the requirements?
2. Are the farmers aware that they are Fairtrade certified?
    . What do you do to make farmers aware of the certification and its requirements?
2. What are the challenges of Fairtrade certification?
    . Are there any significant challenges for farmers to live up to the requirements?
2. What are the biggest challenges facing the cooperative?
3. What do you believe are the biggest changes to the cooperative since it became Fairtrade certified?
    . For the farmers? For the factories? For the cooperative organization?
2. How is your partnership with the county government?
3. How does the Fairtrade coffee certification impact…

- Health?
- Income?
- Crop productivity
- Safety?
- Working conditions?
- Biodiversity? Other environmental conditions?

2. Can you explain the process of premium funds from the Fairtrade coffee certification?
    - How are the premiums used and how are the farmers involved in the process of distribution
2. How long does it take for the farmers to get paid for the coffee on average?
3. Do the farmers get advances and loans on their payments? How?
4. Do the farmers get information about the quality of their coffee?
5. What do you believe are the biggest benefits of Fairtrade certification?
    - What do you believe are the biggest challenges of Fairtrade certification?
2. What are the limitations in regards to improving social welfare and environmental protection?
3. Are you aware of any other certifications for coffee in the area (eg. organic or Utz certified) and its implications for coffee farmers?
    - Why has the cooperative society chosen to cooperate with Fairtrade as opposed to other certification schemes?

Member of County Assembly Interview Guide

1. Can you start by introducing yourself and tell us a little bit about yourself?
2. What is the position of the county assembly on Fairtrade certification?
3. What policies does the ward have to address problems faced by farmers who are concerned with
    - Market prices
    - Delay in payments
    - Labour and safety conditions
    - Environmental issues
2. What is on your political agenda to bring relief to the farmers
3. What are the county policies in place for coffee farming, production and marketing?
4. What is the process of coffee production from the farmers to the consumers?
5. What does the county do to stabilize and increase market prices?
    - What are the reasons for the low market price of coffee?
        - Reasons beyond environmental issues, incl. climate change? (
2. What are the challenges of coffee certification?
    - What are the biggest benefits of certification?
2. How does the coffee certification impact…
    - Health?
    - Income?
    - Crop productivity
    - Safety?
    - Working conditions?
    - Biodiversity? Other environmental conditions?

2. Are you aware of how the premium funds for the Fairtrade certification are used?
    . Are you aware of how/whether the farmers are involved in the process of selecting what the money from the premiums goes to?

Gatugi Farmer Interview Guide

1. Can you start by telling a little bit about yourself and what background you have?
2. How long have you been farming coffee?
    . Size of your farm? Coffee trees?
2. Which crops do you grow beyond coffee?
    . Any other sources of income?
2. Can you tell us about how you operate the farm?
3. Who do you sell your coffee to and who are you involved with in order to sell your coffee?
4. How do you protect your plants from pests? Do you use pesticides on your farm?
5. How are you paid for the coffee you sell? How much do you earn, and at what times do you get paid?
6. What is the duration between coffee delivery and payment?
    . Do you find this duration reasonable?
2. We understand that you used to be part of the Othaya Farmers Cooperative, but now work as a private farmer. Can you tell us about the reasons why you decided to leave the cooperative?
    . Which benefits did you receive when you were part of the cooperative?
        . Were you an active participant of the cooperative, eg. did you participate in meetings on a regular basis and the elections of the leadership?
    . (If he doesn't mention them, then ask about the premiums and trainings)
2. Do you receive training on coffee production? By whom?
3. Are you familiar with Fairtrade certification?
4. What do you believe are the biggest challenges of coffee farming?

Fairtrade Africa Representative Interview Guide

1. Can you start by introducing yourself and tell us a little bit about yourself, and what kind of work you do?
2. What do you believe are the main benefits for small-scale coffee farmers to be Fairtrade certified in Kenya?
    1. In regards to environmental protection and biodiversity? Resilience to climate change?
    2. In regards to financial stability and well-being?
3. As far as we understand, small-scale coffee farmers in Kenya are required to be part of a farmer's cooperative in order to be Fairtrade certified. What are the reasons for this, and what do Fairtrade do to ensure farmers are part of the decision-making processes?
    1. What are the challenges in working through a cooperative, and other intermediaries throughout the supply chain?
        1. We understand that you are using a third-party certifier to audit the coffee farmers in complying with Fairtrade requirements. What are the challenges in delegating the responsibility of auditing?

4. We've observed from our surveys from our field study, that coffee farmers are generally not aware that they are Fairtrade certified. How is Fairtrade responding to this, and in general working to ensure transparency about the certification?
5. What are the Fairtrade requirements for biodiversity and environmental conservation, and what are the challenges in living up to the standards?
    1. What are your Fairtrade requirements for pesticide use, and what do you believe are the benefits and limitations of these requirements?
    2. We have observed from surveys that farmers are increasing their pesticide use, which may decrease their soil quality and output from coffee production over time, thus their income. Is that a consideration from Fairtrade when setting standards on pesticide use?
    3. Are you aware of any future goals to further restrict pesticide use?
6. We believe that there are some concerns that the premium funds are not making their way to the coffee farmers. What do you believe could be done to overcome these challenges?

0. We understand that the market prices of coffee in Kenya (and globally) are fluctuating quite significantly, and that farmers are experiencing significant delays in payments. How is Fairtrade responding to this?
    1. Do you believe that the Fairtrade minimum prices are sufficient for coffee farmers to meet their needs?
    2. What national and county governments policies in Africa are relevant in developing and complying to Fairtrade standards?

A3 Additional Methodology Documentation

Gini Simpson Index (GSI) and Shannon Index (SHI)

The SHI measures how difficult it is to predict what species you will pick if an individual is picked randomly. An SHI of 0 indicates that a single species was captured and the higher the SHI, the better the biodiversity. Thus, the more species captured in the cup and the more proportionate the captured species are, the higher the SHI. The GSI on the other hand gives the probability that two insects randomly picked from the sample do not belong to the same species. The GSI can take values between 0 and 1. A value of 0 means that all individuals are of the same species. The closer the value of the GSI is to 1, the better the biodiversity index.

Soil Sampling

For the determination of SOM content, 75 mg of the soil mixed sample was weighed for each farm, and then the total carbon percentage and total nitrogen percentage was determined using a soil incinerator. Using the carbon content, the SOM was then calculated.

For the calculation of soil respiration, 20 ml of H_2O was added to each of the soil samples (50g) with an average moisture content of 14.78%. The soil samples were then incubated in a jar to measure the CO_2 output of the microorganisms. The method was run twice for each soil mixed sample of every farm. The incubation of the soil lasted 112 hours. The incubation, as well as the calculation of the soil respiration in terms of respired CO_2, was performed according to protocol. The pH value was measured twice for each soil mixed sample for every farm according to the protocol

Soil Respiration Protocol

Determination of CO_2 respiration
Materials needed for titration of NaOH in base traps

- Plastic shot glass, 25 ml
- NaOH-solution, 1.0 M
- HCl, 0.20 M
- Burette, with 0.05 ml accuracy
- Saturated BaCl2-solution
- Phenophphtalein indicator
- Magnet stirring plate
- Magnet

Determine the amount of absorbed CO_2 in the traps as follows:

1. To practice your titration, do a couple of test titrations first (step 1a-1c before proceeding with the real samples (step 2.-5.).
    a. Fill a new plastic shot glass with 2.0 ml 1.0 M NaOH-solution with a pipette
    b. Apply 0.5 ml saturated $BaCl_2$-solution and app. 3 drops of phenophtalein indicator (the solution turns purple red).
    c. Titrate with 0.2 M HCl from burette while stirring magnetically until the color shifts from purple red to colorless (there might be a white precipitate of $BaCO_3$).
    d. After a couple of test runs proceed with step 2.
2. Take 2.0 ml NaOH-solution with a pipette from the NaOH trap and transfer to a new plastic shot glass. Apply 0.5 ml saturated BaCl2-solution and app. 3 drops of phenolphtalein indicator (the solution turns purple red).
3. Titrate with 0.2 M HCl from burette while stirring magnetically until the color shifts from purple red to colorless (there might be a white precipitate of BaCO3).
4. Note the amount of 0.2 M HCl used (if you used more than in step 1. there is probably something wrong!)
5. Cleaning: the BaCl2-containing titration samples need to be discarded in a special waste container, as we need to declare this as toxic waste – DO NOT pour the pink liquids down the sink! Empty plastic shot glasses from alkali traps have to be thrown out into the regular waste bin.
6. Remember to put new NaOH traps in Incubation A on the first lab exercise day!

4. Calculations

Calculation of microbial respiration

Note that for each unit of produced CO_2, two units of NaOH are used!

Calculate the amount of respired CO_2-C in the sample from the equation:

$$mg\ CO_2 - C\ kg^{-1} soil = \frac{(B - X) \cdot M \cdot M_W C \cdot V \cdot 1000}{v \cdot m_{soil} \cdot 2}$$

where,

B: average ml HCl used for titration of blank samples.
X: ml HCl used for sample.
M: molarity of HCl (see burette).
$M_W C$: molar weight of C, g/mol
V: volume of NaOH solution (7.5 ml)
v: volume of NaOH used for titration (2 ml)
m_{soil} mass of soil (50 g dw)

Protocol for measuring Soil pH

- Measurement of pH in a 1:5 soil:water solution.
- Add 5g soi lto a 50 ml test tube
- Add 25 mL of milliQ water
- Shake for 10 minutes on the shaker
- Leave for 20 minutes
- Measure the pH in the suspension immediately after having shaken the tube by hand again using the pH meter

Pitfall Traps Detailed Methods Information

The position of the cups within the coffee plantation was always selected the same. One cup was positioned near the center of one half of the coffee field and one cup in the other half always in the center surrounded by four coffee trees. The distances from the plastic cup to the coffee trees were always between 1m and 2m. Care was also taken to ensure that a similar amount of organic material was always found on the ground. The cups were each filled to 2cm with a shampoo: water mixture (1:10). This causes the insects caught in the trap to drown in the liquid and not be able to escape. Cups were positioned each time between 10 am and 2 pm in the same weather conditions (sunny and hot) and collected after 24h.

Normalised Difference Vegetation Index (NDVI) Explanation

NDVI is calculated as the normalised difference between the reflectance in the near-infrared portion of the electromagnetic spectrum (which chlorophyll strongly reflects) and the reflectance in the red portion of the electromagnetic spectrum (which chlorophyll strongly absorbs). NDVI values range from -1 to 1, where negative values indicate e.g. water or clouds, low values indicate bare soil or little green vegetation, and high values indicate dense green vegetation.

A4 Final Synopsis

1. Introduction

Coffee is one of the most valuable and widely traded tropical agricultural products. Kenya's economy is heavily influenced by coffee in terms of its role in export earnings, local farm revenues, job opportunities, food and nutrition security (Nyoro, 2002). More than 60% of coffee in Kenya is produced by smallholder Kenyan farmers who produce the cash crop for cooperative societies (Kegode, 2005). The coffee industry in Kenya consists of 800,000 households comprising 535 cooperatives and 4,000 estates (Muriithi, 2018). The coffee sector is largely reliant on cooperatives which provide administrative structure, standardise production quality, extend market reach, and are responsible for payment to farmers (Murumba, 2017).

Many coffee farmers are struggling to survive at subsistence levels for a variety of reasons, farmers lack coping mechanisms for fluctuating production levels and markets market prices, and often have inadequate access to inputs or insufficient technical training to combat pests and diseases(Mugendi et al., 2015; Okech, 2019). Moreover, Kenya's fertile highlands are suffering from the ongoing effects of climate change and compounding land degradation from unsustainable farming practices (UNCCD & the Government of Kenya, 2020; Mulinge et al. 2016). As a result many farmers have switched to other farming projects (World Bank, 2006).

Certification schemes such as Fairtrade International, Organic farming, and Rainforest Alliance among others have become an increasingly popular way to address environmental, social and economic burdens (van Rijsbergen et al, 2016). Fairtrade coffee certification has shown promise as an alternative strategy for farmers struggling with the above mentioned problems.

Founded in 1997, Fairtrade International is a non-profit association, consisting of 22 membership organisations. The organisation aims to certify, audit, and market the fair production of agricultural products (Fairtrade International, 2023; Raynolds & Bennett, 2015). Fairtrade International publishes official standards for small-scale producers regarding certification requirements with the intention of increasing the social and economic well-being of farmers while protecting the environment.

Our investigation of coffee farmers in Gatugi Kenya will examine farmers belonging to the Othaya Farmers Co-operative Society Limited (OFCS). OFCS has a total membership of 11,000 farmers which are all Fairtrade certified (OFCS, 2017).

There is a large body of academic literature which has examined whether certification schemes like Fairtrade have led to a measurable increase in environmental, social, and economic conditions improving for farmers per the organisation's aims (Mulinge et al, 2016; Arnould et al., 2009; CIDIN, 2014). Literature has pointed to challenges within the Fairtrade regime including uncertainties about whether the premium prices paid by consumers reaches farmers pockets, and if power remains concentrated in the hands of cooperative representatives against the intentions of the scheme (van Rijsbergen et al, 2016). Moreover, Fairtrade outlines vague environmental requirements with few limitations on pesticide use, counter to their aims to support environmental stewardship.

Yet, literature on the impact Fairtrade has had on small-scale coffee farmers in Kenya has been limited because it has not taken an interdisciplinary approach to measuring the sustainability of environmental, social, and economic dimensions and their interconnectivity.

Therefore, this report seeks to address the gap in literature by connecting natural science methods which compare the impacts Fairtrade and Organic farming certification scheme practices' are having on the environment. These findings, in combination with social science methods measuring the influence Fairtrade certification has on social, economic, and environmental conditions will allow us to make an assessment of the holistic impacts Fairtrade certification has on small-scale coffee farmers.

1.1 Research objective

Our overall objective is to investigate how Fairtrade certification impacts the environmental and socio-economic sustainability of small-scale coffee production in Gatugi, Kenya. This has led us to produce the following research questions:

- What are the environmental impacts of Fairtrade coffee farming practices?
- What influence has Fairtrade certification had on the social and economic condition of coffee farmers?

2. Theoretical Framework

As a way of answering these questions we will use an analytical framework which synthesises the three core aspects of sustainability, integrated with the theoretical perspectives of the relationship between ecosystems and human well-being. These three pillars in which sustainable development is achieved were first mentioned in the Brundtland report in 1987 (Rinalducci, 2022), which has been an inspiration for our framework. For the purposes of our study we will combine the social and economic dimensions as one. The diagram below illustrates the intersection of each dimension, and the indicators we have chosen to focus on.

Many aspects of sustainability have strong overlaps, such as income, health, resilience and ecosystem services, though they can sometimes be in contrast to each other. For example, where increased pesticide use results in higher incomes and reduces poverty. According to Zhen et al. (2014) we must account for non-monetary dimensions in assessing poverty because a higher income may not necessarily lead to higher overall well-being, especially in consideration of environmental health. Zhen et al. (2014) argues that there is a causal relationship between poverty

reduction, environmental protection and ecosystem services. Similarly, Tallis et al suggests that "conservation and development projects should be able to achieve both ecological and social progress [because] the human is tightly linked to environmental conditions (2008: 9457)."

3. Methodology

This project aims to have an inter- or supradisciplinary approach in which disciplines collaborate on developing some common perspective of the environmental and socio-economic impacts of Fairtrade certification, to understand the relationship between the different aspects of sustainability. (Krishnan, 2009). This requires a sustained effort of integrating knowledge from various disciplines in order to potentially change and enrich the disciplines concerned (Krishnan, 2009). Qualitative and quantitative methods from both natural and social science disciplines will be used to investigate the research problem. Our research design matrix in accordance with Chougill's (2005) recommendations highlights our methodologies to provide a clear understanding of which variables we intend to measure along with which techniques will be conducted in field research. The matrix (appendix 5.1) touches on what outcomes we expect to observe. Moreover our preliminary time schedule (appendix 5.2) for field work outlines our planned activities.

3.1 Proposed methods

The Fairtrade Climate Standard (2020) aims to promote environmental sustainability and mitigate climate change by listing universal standards for small scale producers. To facilitate the study of the environmental impact of Fairtrade coffee growing practices, three environmental indicators will be assessed: soil quality, biodiversity, and vegetation health. Through these three aspects, we aim to obtain and analyse the state of the environment to comment on the long-term sustainability of current coffee farming practices. We have chosen to focus our methods to examine parameters that may be affected by the use of pesticides. In order to gain insightful comparison to Fairtrade farming, we will use Organic coffee production as a baseline comparison. Organic coffee farms, unlike Fairtrade certified farms, prohibits the use of non-organic pesticides. We do not expect the organic coffee farms to be in the same geographical location (different altitude, different soil etc.), and will account for any differences that may arise and include them in our research so that they are comparable to the Fairtrade certified coffee farms.

3.1.1 Biodiversity assessment

Biodiversity is another important indicator used in determining the long-term sustainability of an ecosystem. Insects, soil invertebrates and soil microorganisms have been shown to be particularly sensitive to pesticide application, thus the biodiversity of these will be assessed. 5 samples from both farm types will be collected. All methods are tested on site first.

In order to assess the biodiversity and abundance of insects, pit-fall traps will be used. This involves filling a yoghurt cup with a small amount of liquid (ethyl alcohol/ soap water) that is deadly to the insects. The cups are then buried in the ground at ground level to capture insects which fall into the trap. The positioning of the samples is non-random. To ensure comparability, the location of the trap is selected so that the position within the farm, as well as the vegetation and natural features (such as stones, wood remains, organic material) within a radius of r = 3m are as similar as possible. After 48 hours, the captured insects are counted. The vegetation and natural features within r = 3m are also sampled.

For soil invertebrates, the number of earthworms will be counted. A soil sample of 40cm^2 and a depth of 20cm is taken. The holes are dug in the same place of the farms whenever possible (non-random). The vegetation and natural features are as similar as possible within a radius of r = 3m. The earthworms contained in the soil are then counted by hand. The vegetation and natural features within r = 3m are also sampled.

Soil respiration will be assessed as a proxy for soil microorganism diversity and biomass. 10 random soil samples will be taken at each of the farms and mixed together into one representative sample for each farm. These mixed samples (50g) will be stored in a cool place (not dried) and transported back to Copenhagen for lab analysis. Soil samples will be activated to measure the amount of CO_2 released.

3.1.2 Soil quality assessment

Soil quality is an important factor of environmental sustainability, since it determines both the short-term and long-term ability of the ecosystem to support crop growth. Soil pH is a decisive factor for nutrient availability to plants. Soil organic matter (SOM) content is one of the most important properties for the soil's ability to store and supply nutrients for plant growth. Many studies have shown that pesticides have a toxic effect on microbial soil organisms. The microbial soil organisms further decompose organic material into humus (SOM). The lower the microbiological activity in the soil, the slower the decomposition from organic material into humus.

In order to assess soil pH and SOM content, 5 samples from both farm types will be collected to draw comparison between Fairtrade and baseline Organic farms. As for the soil respiration, 10 random samples will be taken at each farm and mixed together to create a representative sample for each of the 5 farms. The samples will be taken to a depth of 10cm (after removal of organic material), so that the SOM content is not influenced by surface leaf litter etc. The soil samples will be dried after collection, and transported back to Copenhagen for lab analysis. Soil pH will be measured on a 1:5 soil:water solution using a pH metre. SOM content will be estimated by the Loss in Ignition (LOI) method, whereby the weight of the soil sample is measured before and after heating to a temperature of at least 350°C. The difference in weight before and after ignition is the assumed SOM content.

3.1.3 Vegetation health assessment

Analysis of vegetation trends from Earth Observation (EO) data provides powerful methods for monitoring changes in vegetation health and productivity over time and space. This provides information regarding the condition of the environment, and results can be compared with other methods in the study to facilitate a deeper understanding of spatio-temporal patterns. The Normalised Difference Vegetation Index (NDVI) is widely applied in agricultural research for monitoring crop health, and annual variation of NDVI may be a good indicator of plant stress caused by climate change (Alves et al., 2016). Furthermore, studies conducted in South America have shown promising results in detecting pests and diseases such as coffee rust from remotely sensed vegetation indices (e.g. Cortez et al., 2020).

A per-pixel trend analysis will be conducted on NDVI values calculated from Sentinel-2 MSI imagery from 2017 to 2022, covering Othaya sub county with a 10 km spatial resolution. The analysis will be performed in the Google Earth Engine cloud computing environment.

3.2 Transect walk

At the beginning of the field trip, a transect walk with a local guide or willing farmers will be done to gain an overview of the study area. This walk serves the purpose to orient the research group in the area, as well as to gain insight into perspectives in the field that may not be revealed through surveys and interviews alone. Furthermore, a GPS will be used to track the walk and locations of interest, to facilitate comparison with results from other geo-spatial methods.

3.3 Questionnaire, interviews, and focus groups

To understand the influences Fairtrade certification has had on the social conditions of farmers we have chosen to focus on cooperative institutional structure and the resulting access farmers have to information and their ability to make decisions. Additionally we will measure perceptions of well-being namely welfare and health from farming practices. To reveal the economic effects we will focus on measuring indicators linked to perceived financial security and barriers Fairtrade certification imposes on farmers. Lastly, environmental indicators include farmer perceptions of pesticide use and vegetation health.

Questionnaires and interviews will be administered to coffee farmers with their obtained prior informed consent. Participants will be educated on the purposes of this study and will not be compensated for their participation. Information gathered will remain confidential and respondent identities will be pseudonymised as outlined in our data management plan (see appendix). Our questionnaire will be piloted with a test group of 5 farmers to ensure that questions are relevant and understandable. Comprehensive descriptive statistics will be used to analyse the data collected from 40 respondents who were selected through systematic sampling of every third household. The questionnaire will include questions related to the socio-economic and environmental research themes (see appendix 5.3).

Semi-structured interviews and focus groups are intended to tease out the underlying reasons and motivations for farmers' attitudes, preferences, and behaviour with respect to sustainability in both research themes. Semi-structured interviews will be conducted with selected farmers chosen via stratified sampling, representatives from the Othaya Coffee Co-operative and the Fairtrade International will be purposively chosen. The interview questions will cover topics related to both the socio-economic and environmental research themes (appendix 5.4), but will particularly focus on the socio-economic data, including institutional structures and general quality of life of the farmers. Focus groups with farmers will be led by the Kenyan students, with the UCPH students observing.

In consideration of the requirements for the successful execution of a research project our group must assess the resources available for research and our collective expertise and experience for the chosen methodology. Through extensive background research we have familiarised ourselves with the study methods required and plan to ensure recording techniques and training are collectively standardised. Prior to departure various scoping exercises will ensure that personnel are sufficiently trained and equipment is functioning. We intend to define sampling

protocol and design field data sheets along with survey and interview questions in conjunction with our Kenyan counterparts. Our group will further reflect on the sampling and data limitations and ethical considerations of our methodology (see appendix 5.1).

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