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The Biofuel Rush: Beyond Operational Land Deals

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Declaration

I, Ingeborg W. Lislevand, declare that this thesis is the result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature.....

Date.....

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Table of Contents

Declaration	I
Acknowledgments	II
Abstract	VII
1.0 Introduction	1
2.0 The Biofuel Rush and the Production of Non-operational Land Deals	5
2.1 A Gold Rush Mentality Takes Hold	5
2.2 Biofuels and Land	6
2.3 With Gold Tinted Vision	8
2.3.1 The Case of Jatropha	9
2.4 Non-operational Land Deals: Failed but Successful	11
2.5 The Opportunity Cost	12
2.5.1 Empty Land?	13
2.5.2 From Empty to Full Land	13
2.5.3 The Case for Non-operational Land Deals	15
3.0 The Drama of the Commons	16
3.1 The Tragedy of the Commons and Related Work	16
3.2 From Models to Policy Prescriptions	18
3.3 The Tragedy of Model-based Policy Prescriptions	19
3.4 Beyond Tragedy	20
4.0 Theory	22
4.1 Common-pool Resource-related Concepts.....	22
4.2 Property Regime-related Concepts	25
4.3 Common Property Regime related-concepts	29
4.4 Relevant Critiques	30

5.0 Research Area and Framework	33
5.1 Research Area	33
5.2 Research Strategy	35
5.3 Ontology, Epistemology, & the Role of Theory in Research	36
5.4 Research Design	38
5.5 Sampling	38
5.6 Data Collection Methods, Instruments, and Analysis	40
5.6.1 The Interviews	40
5.6.2 Participant Observation	43
5.7 Ethical Considerations	44
5.8 Trustworthiness and Limitations to Trustworthiness	46
6.0 Setting the Stage	50
7.0 Altered Property Regimes	68
7.1 The Village Forest	68
7.1.1 Rights and Rules	68
7.1.2 Monitoring and Sanctioning	72
7.1.3 Revisions	73
7.2 The Mzungu Forest	74
7.3 Concluding Remarks	77
8.0 Altered Strategies and Outcomes	78
8.1 The Village Forest: Tragedy Averted.....	78
8.2 The Mzungu Forest: Tragedy Unfolding	81
8.3 Concluding Remarks	90
9.0 Discussion.....	91
9.1 The Village Forest.....	91

9.1.1 Effectiveness	91
9.1.2 Sustainable Resource Use	92
9.2 The Mzungu forest	93
9.2.1 (Lack of) Effectiveness: Changing Incentives?	93
9.2.2 Unsustainable Resource Use	95
9.3 Land Access Revisited.....	96
10.0 Conclusions	98
11.0 References	98
Appendices	106
Appendix 1 – Interview guide	106

Abstract

The biofuel policies of the early 2000s have left behind them a trail of non-operational land deals. As most of these land deals are located in regions and areas with high levels of poverty and a high dependence upon land-based livelihoods, their impact on access to land and land-based resource systems appears to be an issue of critical importance. Yet, the impact of these land deals in general, and on land access in particular, has received limited attention in the scholarly literature. Access may be understood as the ability to benefit from something, which includes but goes beyond property rights. Still, property rights are an important means by which people come to benefit from resources and to the sustainable use of resources. As no studies have been done on the impact of non-operational land deals on property regimes and the implications for resource use and outcomes, this thesis seeks to shed light on this understudied topic. To do so, qualitative research was undertaken in one of the eleven villages in Kisarawe, Tanzania that gave up land to a non-operational land deal initiated by the British-based company Sun Biofuels in 2009. Data was collected through approximately sixty interviews and through participant observations. In light of a relevant common-pool and property regime-related conceptual framework, the data was interpreted. The findings thereof indicate that the non-operational land deal has replaced a comprehensive common-property regime with an open-access regime, with major implications for resource use and resource outcomes. Under the common-property regime in place prior to the initiation of the non-operational land deal, most resource users would adopt coordinated strategies, the outcome of which was the preservation of the village forest once there and the many forest resources therein. Under the open-access regime currently in place, resource users pursue individual strategies, leading to rapid and ongoing degradation of the forest. Consequently, villagers have been, and continue to be, able to benefit from the forest but their ability to do so is increasingly threatened.

1. Introduction

Systems thinker John Sterman (2002) once argued that “there are no side effects – only effects” (pp. 505). The effects we thought of in advance, those we want to take credit for, those are the effects. The ones we did not think of, that we do not want to take credit for, those are the side effects. The only difference between side effects and effects, however, is where the boundaries of our mental models lie. When we point to side effects then, we are simply pointing to the limitations of our own mental models (Sterman, 2002).

When we fail to look beyond immediate effects, the many side effects of any given policy may greatly outweigh the intended ones. The biofuel policies of the 2000s are a pervasive example of narrow-minded policymaking, the side effects of which are still being uncovered. In the early 2000s, policies promoting investments in biofuels seemed to offer numerous advantages. Not only could such policies contribute to reducing greenhouse gas emissions and improving energy security but they could also boost the agricultural sector in developed countries and promote sustainable development in developing ones (Londo & Deurwaarder, 2007).

Given these apparent advantages, countries and economic regions such as the United States and the European Union adopted ambitious biofuel consumption targets. Under the 2003 Biofuel Directive, for instance, the EU adopted a biofuel consumption target of 5.75% of all transportation fuels to be met by 2010 (Londo & Deurwaarder, 2007). When examined from a systematic perspective, it is clear that the advantages of such policies cannot be taken on faith. While such policies might encourage socially and environmentally responsible investments, they might very well not. Yet, despite early warnings, it took until 2009 for the EU to adopt at least *some* sustainability criteria (Londo & Deurwaarder, 2007).

With policies that encouraged just about any type of investment in biofuels, the side effects mounted (Londo & Deurwaarder, 2007). Amongst other things, investments in biofuels were linked to land grabbing and exploitative labor arrangements; to make way for plantations, forests and pastures rich in carbon had been cleared; and the production of these fuels increasingly competed with food production for land and other scarce resources (Manik, Leahy & Halog, 2013; Widengård, 2011; Matondi, 2011).

Although the impacts of these policies have been the subject of attention for nearly two decades, some of their adverse effects are still being uncovered. Among them, are the effects of non-operational land deals. Eyeing lucrative investment opportunities but having to act fast, hastily and high-risk investments appear to have been made – or, investments were made simply to appropriate loans and subsidies (Borras, Franco, Moreda, Xu, Bruna & Demena, 2022; Gagne, 2020). Inevitably, many of these investments turned non-operational.

A troubling feature of this trail of non-operational land deals is that they are located in regions and countries with high levels of poverty and a high share of land-based livelihoods, in particular in Sub-Saharan Africa (Nolte, 2020). As investors can simply declare bankruptcy and pack up things and leave, the true risks of these investments seem to have been borne not by the investors, but by those who gave up land and land-based resource systems.

A particularly acute question then, seems to be how these non-operational land deals have altered access to land and land-based resource systems. Access may be understood as the ability to derive benefits from something, which includes but goes beyond property rights (Ribot & Peluso, 2003). Still, property rights are an important means by which people come to benefit from resources. Importantly too, property rights are often times important to the

sustainable use of resources, which is a prerequisite to deriving benefits from resources through time.

While it has been recognized that non-operational land deals can alter property rights and regimes, the particular ways in which they do so and the implications for resource use and outcomes have not been explored (Borras et al, 2022; Broegaard, Vongvisouk & Mertz, 2022). To shed light on this understudied topic, qualitative research was conducted in Kisarawe, Tanzania, where eleven villages gave up land to a non-operational land deal initiated by Sun Biofuels. Guided by a case study design, research was undertaken in one of these eleven villages.

Based on the research undertaken, this thesis sets out to answer the following two research questions:

RQ1: How has the non-operational land deal altered the property regime pertaining to the area acquired?

RQ2: How have the changes to the property regime altered the strategies of resource users and the outcomes obtained?

2.0 The Biofuel Rush and the Production of Non-operational Land Deals

2.1 A Gold Rush Mentality Takes Hold

When major energy consumers such as the European Union and the United States adopted biofuel consumption targets in the mid-2000s, new and exciting investment opportunities were presented to investors. Up until then, biofuels – with the exception of ethanol produced from sugarcane in Brazil – could not compete with conventional fuels (Sorda, Banse & Kemfert, 2010). All of a sudden, however, these biofuel consumption targets ensured guaranteed demand for biofuels, whether or not biofuels could compete with conventional petrol and diesel (Sorda, Banse & Kemfert, 2010).

This sudden and guaranteed demand for biofuels coupled with various financial incentives set off a commodity rush, more precisely a biofuel rush. Eyeing lucrative investment opportunities, interest and investment in biofuels exploded (IRENA, 2019). All of a sudden hundreds of investors rushed to the scene to grab a piece of the pie before it was too late. Even with non-scarce resources, a sense of urgency characterizes commodity rushes (Borras et al, 2022). Eventually, supply will suppress prices, markets will become saturated, and regulations will become tighter.

The combination of lucrative investment opportunities and the need to act quickly can easily lead to hastily and risky investments. It is not without reason that the term “gold rush mentality” was once coined. When gold was discovered in Northern California in 1848, thousands of people poured into the state with little regard for the risks involved or simply willing to accept these on the off chance that they might literally strike gold (Wagner, 2018).

Just like a gold rush mentality took hold amongst the thousands of people who made their way to California, it seems that a gold rush mentality took hold amongst at least some investors seeking to invest in biomass production. Due to the nature of the biofuels being produced at the time, biomass production to supply the emerging markets would necessarily implicate vast tracts of land (Dahiya, 2015; Khesghi, Prince & Marland, 2000). To see why that is, a quick introduction to biofuels is needed.

2.2 Biofuels and Land

Biofuels refer to liquid, solid, or gaseous fuels made from biomass (Dahiya, 2015). Biomass intended for biofuel production that has undergone some processing is known as biofuel feedstocks (Dahiya, 2015). Depending on the feedstock source and the associated technologies used to produce biofuels, multiple generations of biofuels have been identified. In the early 2000s and up until now, however, first-generation biofuels have been, and continue to be, the cheapest biofuels to produce (Dahiya, 2015).

First-generation biofuels such as ethanol and biodiesel are made from oil, sugar, or starch-rich feedstocks with fairly simple technologies (Dahiya, 2015). Feedstock sources include crops such as corn, sugar cane, wheat, but also jatropha (Dahiya, 2015). Through rather simple processes such as fermentation and transesterification, these feedstocks can be converted into biofuels (Dahiya, 2015). Because technologies are well established and feedstocks widely available, it tends to be cheaper to produce first-generation biofuels than other biofuels (Dahiya, 2015).

Without designated support for other types of biofuels, first-generation biofuels rose to prominence in the 2000s (IEA, 2008). As these biofuels are made from what are typically the

edible parts of crops, designated crops on designated *land* must be grown to make the feedstocks from which these fuels are made. Because of the way in which biomass derives energy, this necessarily means that vast tracts of land are needed to produce substantial amounts of energy.

The energy contained in biomass is derived from the sun. Through photosynthesis primary producers convert radiant energy from the sun into chemical energy in the form of biomass (Khesghi et al., 2000). Sunlight itself is a dilute source of energy – there is little energy in any given volume (Khesghi et al., 2000). In the case of biomass, this is made worse by the inefficiency of photosynthesis.

The maximum rate at which sunlight can be converted into biomass through photosynthesis is only about 3% for C3 plants and 7% for C4 plants (Khesghi et al., 2000). The rate at which sunlight is actually converted into biomass, however, is usually much lower because of limiting factors such as water, space, nutrients, and the like (Khesghi et al., 2000). On average, only about 0.3% of sunlight is stored as biomass (Khesghi et al., 2000).

Under intensive cultivation, the rate of conversion can be higher, but only a fraction of the total biomass produced through photosynthesis is harvested and used for the purpose of biofuel production (Khesghi et al., 2000). In the case of corn used for ethanol production in the U.S. for instance, about 0.6% of sunlight is stored as above-ground biomass but only about 0.2% is stored as corn kernel (Khesghi et al., 2000). Partly because sunlight is a dilute source of energy and photosynthesis inefficient, vast tracts of land are needed to produce substantial amounts of energy from biomass.

2.3 With Gold Tinted Vision

From the above it is clear that biomass production to supply the emerging biofuel markets would implicate vast tracts of land – but, not without risk. Just like farming in general, biomass production carries several risks. Since the development of farming nearly ten thousand years ago, risk has remained an inherent feature of the occupation (Pyman, 2021). Farmers face multiple and often times compounding risks. The variety of risks faced by farmers can be grouped in the following way: production risks, market risks, institutional risks, and financial risks.

Production risks stem from uncertainties in the production of agricultural produce (Komarek, De pinto, & Smith, 2020). Such uncertainties can be related to the weather or to other natural factors such as pests and diseases that can undermine both the quantity and the quality of the produce obtained (Komarek et al., 2020). Market risks stem from uncertainties related to costs, prices, and market access (Komarek et al., 2020). Sources of uncertainties may include lowered prices for finished produce, higher input prices, and restricted market access due to protectionism or liberalization (Komarek et al., 2020).

Institutional risks include uncertainties arising from changing policies and regulations that affect the agricultural sector (Komarek et al., 2020). Sources of such risks include changes in subsidies or tax regulations (Komarek et al., 2020). Lastly, financial risks are any additional uncertainties owing to fixed financial obligations (Komarek et al., 2020). Sources of financial risk then, include changes in interest rates, credit conditions, and credit availability (Komarek et al., 2020).

While some of the risks faced by farmers are systematic, others are unsystematic. Systematic risks are those that pertain to the entire sector; unsystematic risks are those risks specific to a crop or location for instance (Pyman, 2021). Importantly, systematic risks cannot be controlled, but unsystematic risks can be controlled (Pyman, 2021). For instance, while all farmers face production risks such as the risk of drought, farmers in areas without the potential for irrigation face additional, investment-specific risks.

While investments in biomass production in general carry systematic risks, additional risks can be minimized but also maximized from one investment to another depending on the unsystematic risks an investor is willing to incur. With gold-tinted vision, it is apparent that at least some investors were willing to incur substantial risks on the off chance that they would make it big – or, that they had no intention of farming at all (Borras, 2022; Gangne, 2020).

2.3.1 The Case of Jatropha

Some of the riskier investments appear to have been those related to jatropha cultivation. The allure of Jatropha was undeniable: the oil is highly suitable for biodiesel production; it grows fast and is quick to bear fruits; the seed is even storable making it suitable for cultivation in remote areas (Brittaine & Litaladio, 2010). The major selling point, however, seems to have been that it could be grown cheaply. Goldman Sachs touted jatropha as the cheapest feedstock source of them all (Maltitz, Gasparatos & Fabricius, 2014). Unlike many other feedstock crops that require significant amounts of input and prime farmland, jatropha requires neither.

Since the crop could be grown for next to nothing, investors could hit the jackpot if decent yields were obtained (Brittaine & Litaladio, 2010). While there certainly was a potential to

make a profit, the risks were high: seed and oil yields were highly variable. *Jatropha* is essentially a wild plant, it has undergone little improvement (Brittaine & Litaladio, 2010). While other crops have been purposefully bred for decades and even centuries to ensure stable, high-yielding varieties, *jatropha* has not (Wieczorek & Wright, 2012; Brittaine & Litaladio, 2010).

In studies undertaken well before the biofuel rush, scholars had reported highly variable seed yields (Brittaine & Litaladio, 2010). In one study published in 1996, Heller reported yields between 0.1 and 8.9 tons per hectare. In another study, published a few years later, Openshaw (2000) reported yields between 0.4 and 12 tons per hectare. Making matters worse, such figures were often times accompanied by little to no information about the age of trees, propagation methods, pruning practices, tree spacing, soil type, and so on (Brittaine & Litaladio, 2010).

Seed yields obtained from individual trees were also highly variable (Brittaine & Litaladio, 2010). Henning (2008) reported seed yields for nineteen individual trees, which ranged from zero to 850 grams of dry seed per tree. On top of variable seed yields on an area, and on a tree basis, Heller (1996) found that the oil content of seeds could vary from around 18 to 42%.

From the above, it is clear that investments in *jatropha* cultivation would involve additional production risks to any farm operation. The crop could perform well, but it could also perform *very* poorly. Making matters worse, not enough research had been done to specify exactly what would have to be done to make it perform well (Brittaine & Litaladio, 2010).

Regardless of whether yields are low or high, however, employees must still be paid wages, land rent must still be paid, and machines must be bought and repaired.

2.4 Non-Operational Land Deals: Failed but Successful

Just like many gold miners once failed, so did many of those looking to strike gold in the biofuel rush (Nolte, 2020). The reasons for failure reported are many but they reflect different types of risks. Some of the reasons reported such as the financial crisis, higher oil prices, and changing biofuel policies witnesses of systematic risks (Gagne, 2020). These are likely to have affected feedstock producers around the world to some extent.

Other reasons witness of unsystematic risks. Some of these reasons include thin capitalization, mega-projects (>20.000 ha), an underappreciation of the difficulties inherent in agriculture, a lack of experience in the agroclimatic zone of investment, a lack of thorough financial analyses, political instability in certain countries, and rural resistance in certain locations (Gagne, 2020). Importantly, some of these risks can be difficult to predict, but a lack of due diligence and/or a lack of certainty is a risk too.

It seems that the differentiation between reasons that give rise to systematic and unsystematic risks can help explain the high rate of failure for certain crops and in certain locations where unsystematic risks loom large. For instance, based on the land deals that have been recorded by the Land Matrix that were undertaken between 2000 and 2010 to produce biomass, the rate of failure for jatropha is 29%, while the rate of failure for oil palm is 5%. Similarly, the rate of failure in Africa is 34% while the rate of failure in Eastern Europe and Latin America is zero.

Even where feedstock production fails, investors have not necessarily failed – in fact, they may not have failed at all. What has failed is the particular contractual arrangement between an investor and an investment prospector (typically a state) (Borras et al, 2022). Yet, investors can still have succeeded in obtaining bank loans and subsidies (Borras et al., 2022). Similarly,

the investment prospector can have succeeded in claiming control over land, which can be leased to yet other investors (Borras et al., 2022).

Moreover, in some instances, investors may not have had any intention of developing the investment prospect as stated in the business plan or development license at all. Rather, they may have invested simply to obtain bank loans, appropriate subsidies, or speculate on the future price of farmland (Broegaard et al, 2022; Borras et al, 2022, Gagne, 2020). The term “failed land deal” has been favored in the scholarly literature, but the term non-operational land deal will here be used instead (Borras et al., 2022).

Following the work of Borras and colleagues (2022), non-operational land deals will here be taken to mean “deals that were concluded but later abandoned or contract expired, attempted deals that conclusively ended and failed, and ongoing deal-making that are not (yet) concluded” (Pp. 2). By contrast, operational land deals are those land deals “that were concluded and are in various stages of the operationalization, which include concluded deals where actual operations are yet to start” (Pp. 2).

2.5 The Opportunity Cost

2.5.1 Empty Land

Given the added risks of obtaining land and operating farms in contexts of political instability, a lack of infrastructure, and the like, it is not surprising that many non-operational land deals are found in Sub-Saharan Africa. What makes these deals particularly problematic is the opportunity cost of land in a region with high levels of poverty and a high share of land-based livelihoods.

The vast majority of the rural population in Sub-Saharan Africa depends upon land-based livelihoods (Hall & Paradza, 2010). Against a background of high levels of poverty, access to land and land-based resource systems is of critical importance to the survival of households across the continent. Yet, some widely circulated claims make it appear like the opportunity cost of these land deals is zero – that there is an abundance of unused land, which investors target (Cotula, 2013).

Claims that much African land is empty and underused have been widely circulated. In the report *Awakening Africa's Sleeping Giant* published by the World Bank in 2009 for instance it is claimed that “although not all of the African Guinea Savannah zone is suitable for agriculture, clearly it represents one the of world's largest underused agricultural land reserve” (pp. 2). However, such claims are often times made on the basis of satellite images that fail to capture certain land uses such as shifting cultivation and pastoralism (Hall & Paradza, 2010; Cotula, 2013).

Even where land is known to be used, it can still be recorded as wasteland or idle. These terms often times reflect productivity as opposed to the existence of current land uses (Hall & Paradza, 2010). All land deals recorded for Ethiopia for instance are classified as involving “wastelands” (Hall & Paradza, 2010). Yet, a number of case studies have shown the extent to which these deals have led to the displacement of farmers and pastoralists (Hall & Paradza, 2010).

2.5.2 From Empty to Full Land

While unused land certainly can be found in Sub-Saharan Africa, investors frequently target already used land. For obvious reasons, most investors favor areas with fertile soils, adequate

rainfall, and areas in close proximity to transport infrastructure and urban centers (Hall & Paradza, 2010). Yet, these are amongst the areas most prized by small-scale farmers who supply both themselves and large parts of the population across the continent with food (Hall & Paradza, 2010).

Aside from land used for farming and grazing, forests are frequently targeted too (Nolte, 2017). Almost two-thirds of the population in Sub-Saharan Africa depend upon forests for their livelihoods (World Bank Africa Region, 2017). The most direct way in which forests support the lives and livelihoods of people is through the provision of forest resources (Miller, Mutta, Mansourian, Devkota, & Wildburger, 2021).

Forest resources can be used for both income generation and subsistence. Particularly where there are high levels of poverty, access to forest resources can allow households to meet basic needs while reducing pressure on already stretched incomes (Miller et al., 2021). Importantly, where local people depend upon forests, forests play a key role in maintaining current consumption levels (Miller et al., 2021).

Forests are important to maintain consumption levels in general but in particular in the face of uncertainties and shocks. As forest-related activities often times allow households to diversify their livelihoods, forests play an important role in mitigating risks and coping with shocks (Miller et al., 2021). For instance, by combining farming and forest-related activities, forest-related activities can allow households to generate income in the event that yields fail (Miller et al., 2021).

Although vitally important, competition for land and land-based resource systems is growing. There are multiple competing land uses such as between small-scale farming and forest-related activities on the one hand and large-scale farming, conservation, mining, livestock ranching, and so on, on the other hand (Hall & Paradza, 2012). Amidst competing land uses, many rural areas are already densely populated and populations are growing rapidly (Nolte, 2017).

2.5.3 The Case for Non-Operational Land Deals

Against this background, attention to the way in which non-operational land deals impact land access appears to be an issue of critical importance. These non-operational land deals implicate millions of hectares of land in areas where land is far from empty; it is often times full. Being able to benefit from land and land-based resource systems not just now but through time, however, often times depends on the existence of effective property regimes. In the case of some of our most prized land-based resource systems – such as forests and pastures – this is particularly true.

3.0 The Drama of the Commons

Forests and pastures belong to a particular class of goods known as common-pool resources. These resources are characterized by the difficulty of excluding users on the one hand, and the subtractable nature of resource units, on the other. As the non-operational land deal looked into in this case implicates what used to be, and what is, a forest, the modern debate on common-pool resources deserves a few pages.

3.1 Tragedy of the Commons and Related Work

The modern debate on common-pool resources was ignited by the publication of *The Tragedy of the Commons* by Garrett Hardin. In this infamous article, Hardin (1968) asks the reader to imagine a pasture open to all. It is expected that each herdsman will try to keep as many cattle as he can. Hardin argues that this can work reasonably well as long as diseases, wars, and the like keep the number of herdsman and cattle below the carrying capacity of the pasture. Eventually, however, a day will come when social stability becomes a reality. According to Hardin (1968), “at this point, the inherent logic of the commons remorselessly generates tragedy” (pp. 1244)

As rational beings, each and every herdsman seeks to maximize his gains. Subconsciously or consciously, each herdsman asks himself “What is the utility *to me* of adding one more animal to my herd?” (Hardin, 1968. Pp. 1244). The utility of adding one more animal has one positive and one negative component (Hardin, 1968). The positive component is the profit made from the sale of the animal. Since all the profit goes to the individual herdsman, the utility is nearly +1 (Hardin, 1968). The negative component is the inconvenience of additional overgrazing, but because all herdsman share the inconvenience of additional overgrazing, the disutility is only a fraction of -1 (Hardin, 1968).

When the rational herdsman adds together the utility and the disutility, the only sensible thing he can do is to add another animal to his herd – and another one, and another one (Hardin, 1968). As each herdsman arrives at the same conclusion, the outcome is inevitably tragedy. As argued by Hardin, “each man is locked into a system that compels him to increase his herd without limit – in a world that is limited. Ruin is the destination toward which all men rush ... freedom of the commons brings ruin to all” (Hardin, 1968. pp. 1244).

It did not take long before this fictional story was conceptualized as a prisoner’s dilemma game by Dawes (1973) amongst others. A few features of the prisoner’s dilemma game can be worth noting. Unless stated otherwise, it is a noncooperative game, meaning that communication between players is impossible or forbidden; it is a one-shot game, meaning that it is only played once; and all players possess complete information, meaning that they possess complete information about the structure of the game and the payoffs attached to all outcomes (Ostrom, 1990).

In a prisoner’s dilemma game, the dominant strategy for each player is to defect. Meaning that each player is always better off choosing to defect regardless of the strategy chosen by the other players (Ostrom, 1990). When all players choose to defect, however, they obtain the worst possible outcome (Ostrom, 1990). In a simplified version, it can go something like this: two herdsman graze their animals on a shared pasture that can support eight animals per herdsman (Ostrom, 1990). The cooperate strategy is therefore for each herdsman to keep eight animals. The defect strategy is for each herdsman to keep twelve animals (Ostrom, 1990).

The herdsmen know that if they both choose the cooperate strategy, they will receive eight units of profit each (Ostrom, 1990). If both choose to defect, they will receive zero units of profit each (Ostrom, 1990). If one chooses to defect but the other does not, however, the one who defects will receive nine units of profit while the one cooperating will receive minus one unit of profit (Ostrom, 1990). Although the herdsmen would receive the greatest total profit if they both chose to cooperate, the dominant strategy for each herdsman is to defect (Ostrom, 1990). After all, if a herdsman chooses to defect, he can either get nine units of profit if the other chooses to cooperate or zero units of profit as compared to minus one unit of profit if the other chooses to defect (Ostrom, 1990).

3.2 From Models to Policy Prescriptions

Based on the Tragedy of the Commons and related work, it would appear that a group of resource users using a shared common-pool resource are utterly incapable of averting tragic outcomes (Dietz et al., 2002; Ostrom, 1990). Two types of policies have therefore commonly been prescribed: the first type of policies centers on centralization and strong state control, the second type centers on privatization and a strict private property system (Dietz et al., 2002; Ostrom, 1990).

Among those calling for state control were Carruthers and Stoner (1981). In a working paper for the World Bank, they argued that “Open access to exploitable communal resources without public control means eventually losses for all involved, whether it is in the form of less or more costly irrigation and drinking water from underground, overgrazing, and soil erosion of communal pastures, or less fish at higher average cost.” (pp. 29). They concluded then, that “common property resources require public control if economic efficiency is to result from their development” (pp. 29). Often times, those calling for public control would

call for increasingly powerful governments. Writing about population growth, Heilbroner (1974) for instance argued that the “rise of “iron” governments, probably of a military-socialist cast” could be needed (p. 37).

Among those calling for privatization was Hardin (1968). To him, the choice was between “mutual coercion mutually agreed upon” or a strict form of private property (Hardin, 1968). As the responsibility for mutual coercion would have to be delegated to the state, however, a key problem remained. Who will watch the watchers themselves? (Hardin, 1968).

Privatization was therefore his preferred approach. Robert J. Smith seemed to have reached the same conclusion, arguing that “the only way to avoid the tragedy of the commons in natural resources and wildlife is to end the common-property system by creating a system of private property rights” (Ostrom, pp. 58). He emphasized that “it is by treating a resource as a common property that we become locked in its inexorable destruction” (Ostrom, pp 58).

3.3 The Tragedy of Model-Based Policy Prescriptions

Where these policy prescriptions were set to life, extensive research has demonstrated the disastrous consequences they sometimes had on the very resources they were intended to protect (Ditez et al., 2002; Ostrom, 1990). During the 1960s and 70s, for instance, many developing countries transferred ownership over common-pool resources such as forests from previous owners to the state (Ditez et al., 2002)

Often times, the nationalization of forests was justified on the grounds that local people were incapable of managing these resources sustainably (Ostrom, 1990). Even though public bodies developed elaborate regulations concerning their use, they were rarely able to employ enough foresters to enforce the regulations formulated (Ostrom, 1990). In localities where villagers

had owned and managed such forests, nationalization essentially created open-access resources where limited-access resources had existed (Ostrom, 1990).

3.4 Beyond Tragedy

Following the publication of *The Tragedy of the Commons*, criticism of the empirical validity and the theoretical adequacy of the work of Hardin and others mounted (Dietz, Dolsak, Ostrom & Stern, 2002). A key challenge came from researchers with extensive experience with common property institutions from the field (Dietz et al., 2002). They argued that Hardin and others had confused the concepts of common property and open access – a situation in which no rules exist to limit access and use of a resource (Dietz et al., 2002).

Where common-pool resources were subject to common property, researchers stressed that resource users often times developed extensive property regimes (Dietz et al., 2002). While few would argue that all common property regimes were perfectly efficient or fair, the specifics of these property regimes nonetheless had to be examined before assuming that resource users were caught in some inescapable trap (Dietz et al., 2002).

Another challenge came from game theorists. Game theorists had found that Hardin's predictions held under certain conditions: where the prisoner's dilemma game is played only once and where players are not allowed to communicate (Dietz et al., 2002). However, his predictions did not necessarily hold where the game is repeated and where communication between players takes place (Dietz et al., 2002).

Rather than facing some prisoner's dilemma game, it was argued that games besides the prisoner's dilemma game often times were more appropriate to capture the situations that

resource users found themselves in. Among these games, were the game of chicken and the assurance game. In these games, there are multiple equilibriums so that no player has a dominant strategy (Dietz et al., 2002). Consequently, players benefit from coordination (Dietz et al., 2002).

Carlisle Ford Runge even suggested that resource users in many settings face a repeated coordinated game (Dietz et al., 2002). Writing about common-pool resources and resource users in developing countries, Runge pointed out that resource users often times live in the same village that their families have lived in for generations and where their descendants will live for generations to come (Dietz et al., 2002).

Partly because of high levels of poverty and a heavy reliance upon natural resources, Runge argued that it is implausible to assume that the dominant strategy of resource users is to defect (Dietz et al., 2002). Rather than facing a one-shot prisoner's dilemma game then, he suggested that resource users in these settings face a repeated coordinated game (Dietz et al., 2002). In such situations, resource users would all prefer to find ways to limit their use as long as all others commit themselves to doing the same (Dietz et al., 2002).

4.0 Theory

The work of those who raised their eyebrows to the claims made by Hardin and others has resulted in a comprehensive body of concepts and theories, some of which will be drawn upon here. The concepts that will be covered in the following and which will form the conceptual framework for this thesis include common-pool resource-related concepts, property regime-related concepts, and common property regime-related concepts.

4.1 Common-pool Resource-related Concepts

Four types of goods and resources

On the basis of the two attributes of excludability and subtractability, four types of goods and resources have been identified: private goods, public goods, club goods, and common-pool resources (Ostrom, Gardner & Walker, 1994). Private goods such as food and clothing are goods for which exclusion is easy and subtractability is high (Ostrom et al., 1994). By contrast, public goods such as information and national defense are goods for which exclusion is difficult and subtractability is low (Ostrom et al., 1994).

Club goods such as cable television share with private goods an ease of exclusion and with public goods a low degree of subtractability (Ostrom et al., 1994). Common-pool resources are the opposite of club goods: these goods share with public goods a difficulty of excluding potential users and with private goods, a high degree of subtractability (Ostrom et al., 1994). As these goods are defined by, and differ from, other goods on the basis of excludability and subtractability, some attention to these two attributes is needed (Ostrom et al., 1994).

Excludability and subtractability

The goods and resources that people value in this world differ in their degree of excludability (Ostrom et al., 1994). Excludability concerns the ease at which potential beneficiaries can be excluded from consuming goods and resources. The ease at which this can be done is a question of both economic and legal matters (Ostrom et al., 1994). It follows then, that excludability hinges on both the physical attributes of goods and resources and the institutions pertaining to these within a particular jurisdiction (Ostrom et al., 1994). The physical attributes and institutional arrangements combined, determine excludability.

The goods and resources that people value also differ in their degree of subtractability. Subtractability concerns the degree to which the benefits derived by one person subtract from the benefits available to everyone else (Ostrom et al., 1994). Subtractability hinges on the nature of the benefits being derived from goods and resources (Ostrom et al., 1994). Certain benefits are simply not subtractable (Ostrom et al., 1994). One person's use of the weather forecast will not subtract from the information that is available to everyone else, but one fisherman's catch of fish will detract from the ton of fish available to all other fishermen.

Common-pool resources: excludability and subtractability

Common-pool resources are a unique class of goods for which exclusion is difficult and joint use involves subtractability (Ostrom et al., 1994). For legal and/or economic reasons, excluding potential users from using common-pool resources is nontrivial (Ostrom et al., 1994). In some instances, the cost of fencing off a common-pool resource system is prohibitive, in other instances, the additional benefits of doing so are estimated to be less than the additional costs, and in yet other instances, basic constitutional rules prevent exclusion

(Ostrom et al., 1994). The difficulty of excluding potential users in turn leads to common-pool resources being used by multiple individuals (Ostrom et al., 1994).

When using the resource, each user subtracts from the benefits available to everyone else. It can here be useful to distinguish resource stocks and resource units (Ostrom et al., 1994). A forest from which timber is harvested can be thought of as a stock of timber from which units of timber are derived (Ostrom et al., 1994). The distinction between resource stocks and units can be particularly helpful in regard to renewable resources (Ostrom et al., 1994). As renewable resources regenerate, the stock of units will persist as long as the rate at which units are subtracted is equal to, or lower, than the regeneration rate (Ostrom et al., 1994).

Under-provisioning and over-appropriation

Because of the difficulty of excluding potential users and the subtractable nature of resource units, common-pool resources are prone to under-provisioning and over-appropriation (Ostrom et al., 1994). Provisioning activities are often times needed to maintain or improve common-pool resources (Ostrom et al., 1994). Such activities may range from monitoring the activities of users of a forest to repairing an irrigation system. As those providing for the resource bear the full cost of doing so, while everyone shares the benefits, users of common-pool resources might face a temptation to free-ride on the efforts of others. Free riding in turn may lead to under-provisioning of the common pool resource in question.

Because resource units are subtractable and multiple people use common-pool resources, users may also face an incentive to over-appropriate (Ostrom et al., 1994). As described by Hardin in *The Tragedy of the Commons*, subtracting resource units has one positive and one negative component. The positive component is the value derived from the resource unit

harvested, while the negative component is the loss of that resource unit from the resource stock. Because it is difficult to exclude potential users and multiple individuals therefore use common-pool resources, the negative component is shared amongst multiple individuals while the value derived pertains only to the user deriving it.

4.2 Property Regime-related Concepts

Without effective property regimes, under-provisioning and over-appropriation may lead to the demise of common-pool resources. A definition of property regimes that will be employed here is “the arrangements that define rules, distribute rights, and delineate roles with respect to some particular resource” (León, 2016). From this definition, it is clear that the concepts of rules, rights, and roles deserve some attention in the following.

Rules

A key component of property regimes is rules. Following the work of Ostrom (1990), a particular understanding of rules is here adopted: one that equates rules with the rules-in-use. Like all rules, the rules-in-use contain prescriptions that permit, require, or forbid certain actions. However, the rules-in-use are the rules actually used, monitored, and enforced. They are the dos and don'ts that actually structure action situations (Ostrom, 1990).

This implies that the rules-in-use are common knowledge and that they are enforced (Ostrom, 1990). In other words, all or most of those to whom the rule applies know of the rule, and they know that others know of the rule as well (Ostrom, 1990). They are also enforced, at least to some extent. In any repetitive situation then, individuals will come to know through approximations, the level of enforcement (Ostrom, 1990).

The rules-in-use can come from various sources (Ostrom, 1990). Formal law is a major source of the rules-in-use, but in many common-pool resource settings, the rules-in-use can differ considerably from legislative regulations. Depending on the source of these rules, a distinction can be made between de jure and de facto rules.

Rights and property rights

As rules contain prescriptions that permit, require, or forbid certain actions, rules prescribe rights. Rights then, may be understood as authorized actions (Schlager & Ostrom, 1992). Of particular concern here are property rights. Five property rights are commonly recognized, these include the right to access, to withdrawal, to manage, to exclude; and to alienate (Schlager & Ostrom, 1992).

The right to access authorizes right-holders to enter a defined physical property (Schlager & Ostrom, 1992). Rules specify what criteria someone must meet to exercise the right to access (Schlager & Ostrom, 1992). For instance, someone might have to reside in a specific village to exercise the right to access a village forest (Schlager & Ostrom, 1992).

The right to withdrawal authorizes right-holders to harvest resource units from a particular resource (Schlager & Ostrom, 1992). Once again, rules specify what criteria someone must meet to exercise this right, such as where, how, and when someone can withdraw resource units (Schlager & Ostrom, 1992).

The right to manage authorizes right-holders to devise withdrawal rights (Schlager & Ostrom, 1992). Those who hold the right to manage a resource have the authority to devise rules concerning when, where, and how harvesting may take place, and by extension, whether and

how the resource may change (Schlager & Ostrom, 1992). For instance, a group of fishers may limit certain fishing activities in certain areas of a fishing ground to maintain or increase the fish stock.

The right to exclude authorizes right-holders to devise access rights (Schlager & Ostrom, 1992). Those with a right to exclude have the right to define what criteria someone must meet in order to access a resource (Schlager & Ostrom, 1992). For instance, a group of fishers may limit access rights only to those who reside in a particular area and who use a particular type of gear (Schlager & Ostrom, 1992).

The remaining right, the right to alienate, authorizes right-holders to transfer the right to manage and/or the right to exclude (Schlager & Ostrom, 1992). Those with a right to alienate have the right to sell or lease the right to manage and/or exclude. Alienating these rights means that the former rights-holder no longer holds, and can therefore no longer exercise, these rights (Schlager & Ostrom, 1992).

Property rights and incentives

Property rights produce certain incentives. Two key rights in this regard are the rights to exclude and to alienate. The right to exclude produces incentives to undertake current investments in a resource. Because the right to exclude gives the right to decide who can, and who cannot, enter a resource, those with the right to exclude can capture the benefits of making such investments for themselves (Schlager & Ostrom, 1992). In other words, they can be reasonably sure of being rewarded for the costs incurred by undertaking such investments (Schlager & Ostrom, 1992). Such investments often times take the form of devising withdrawal rights that restrict the withdrawal of resource units, and access rights that allow

someone to capture the benefits produced by devising withdrawal rights (Schlager & Ostrom, 1992).

The right to alienate produces incentives to undertake long-term investments in a resource (Schlager & Ostrom, 1992). Such long-term investments often times take the form of exercising the right to manage (Schlager & Ostrom, 1992). Through exercising the right to manage, someone can maintain or increase the productivity of a resource (Schlager & Ostrom, 1992). Through the sale or lease of all, or some, property rights, someone can then capture the benefits of making such investments (Schlager & Ostrom, 1992). However, if someone applies a high discount rate, they may still overexploit or destroy a resource (Schlager & Ostrom, 1992). The right to alienation is therefore no guarantee against tragedy (Schlager & Ostrom, 1992).

Ownership and property types

The bundle of property rights that someone holds determine their position in relation to some resource. For instance, a non-authorized user holds none of the rights; an authorized user holds the right to access and to withdrawal; while an owner typically holds all five rights (Schlager & Ostrom, 1992). Compared to non-authorized and authorized users then, property owners hold particular rights, from which particular incentives arise.

Depending on the type of property owner, four types of property are commonly recognized. Private property is property owned by a private individual or company. Public property is property owned by the state. Common property is property owned by a private group of co-owners. Open access is property for which no owner has been identified.

4.3 Common Property Regime-specific Concepts

Common-pool resource dilemmas

It is now widely acknowledged that property regimes based on common property – or common property regimes – can indeed avert tragic outcomes. But even where comprehensive common property regimes work reasonably well, over-appropriation and under-provisioning may lead to common-pool resource dilemmas if circumstances change. For a common-pool resource situation to amount to a common-pool resource dilemma, two conditions must be met (Ostrom et al., 1994):

Condition 1: Suboptimal outcome

The condition of suboptimal outcome is met when the strategies of individual users of the commons lead to suboptimal outcomes from the perspective of the group of users.

Condition 2: Institutionally feasible alternatives

The condition of institutionally feasible alternatives is met when at least one set of coordinated strategies are more efficient and institutionally feasible.

(Ostrom et al., 1994)

Overcoming dilemmas

To overcome such dilemmas, a group of owners may alter the property regime in place and thereby ensure that resource users adopt new and more appropriate coordinated strategies or that more users adopt coordinated strategies. A coordinated strategy can be defined as “a feasible strategy adopted by appropriators regarding (a) how much, when, where, and with

what technology to withdraw resource units and/or (b) how much and/or when to invest in supply or maintenance inputs to the CPR facility or stock” (Ostrom et al., 1994. Pp. 16).

Two types of coordinated strategies have commonly been observed in the field (Ostrom et al., 1994). The first type of strategy is one that evolves over time: through learning, users of a common-pool resource come to adopt “individual strategies that increase joint (and individual) payoffs relative to problematic outcomes” (Ostrom et al., 1994. Pp. 17). An example of such a strategy is when individual users of a common-pool resource communicate with one another and through communication, agrees to follow a particular strategy as long as others follow the same strategy (Ostrom et al., 1994).

The second type of strategy involves changing the structure of the situation. By changing the structure of the situation, the incentives of individual users can be altered and the outcome can be improved (Ostrom et al., 1994). An example of such a strategy is when users of a common-pool resource not only agree to adopt certain rules concerning use but also agree upon rules concerning monitoring and sanctioning (Ostrom et al., 1994).

4.4 Relevant Critiques

The concepts related to common-pool resources and common property regimes have not been received without critique. A number of critiques have been made. Covering them all would therefore be too extensive of an undertaking, but some relevant critiques will be covered in the following to provide an idea of the limitations of this body of concepts.

One critique is that both resources and scarcity are defined far too essentially (Forsyth & Johnson, 2014). The outcome of which can be that the way in which resources and resource

scarcity is meaningful to people is ignored (Forsyth & Johnson, 2014). In a study of irrigation tanks in India for instance it was found that tank users were not only limited to those who saw tanks as storages of water (Forsyth & Johnson, 2014). Rather, the significance of these tanks lied in their social roles, including caste, social standing, and cultural interaction (Forsyth & Johnson, 2014). Consequently, common property regimes may not only develop to avoid the depletion of scarce physical resources but also to mediate social relations (Forsyth & Johnson, 2014).

Another critique pertains to the narrow focus on rules and property rights in the management of natural resources (Quintana & Campbell, 2019). Critics have argued that successful common-pool resource management systems are embedded in, and the result of, political and historical contexts rather than some appropriate fit between resources and institutions (Quintana & Campbell, 2019). These critics therefore question the explanatory and the predictive power of common-pool resource theory (Quintana & Campbell, 2019).

Campbell and colleagues provide an example of this. Having examined communally managed pastures and woodlands in Zimbabwe, they found that decentralization – motivated in part by traditional theoretical work on common-pool resources – had undermined effective resource management (Quintana & Campbell, 2019). Due to decentralization, local institutions had proliferated making already complex systems of management increasingly complex (Quintana & Campbell, 2019). Moreover, decentralization had been accompanied by a cut in public grants (Quintana & Campbell, 2019). The combined effect of this had been that power had been devolved to communities whose capacity to manage these resources was increasingly hampered (Quintana & Campbell, 2019).

A further critique is that this body of theoretical work ignores the power dynamics underlying resource management (Quintana & Campbell, 2019). Such a critique draws attention to the interests that produce and maintain the institutions pertaining to resources (Quintana & Campbell, 2019). These critics argue that regardless of resource outcomes, power structures are important. Power structures can, and often times does, uphold hierarchal systems and maintain unequal power structures (Quintana & Campbell, 2019). It can and has been argued that no analysis of natural resource management is complete without attention to winners and losers (Quintana & Campbell, 2019).

5.0 Research Area and Framework

Having established the conceptual basis, the research area and framework will be covered in the following. Put quite simply, the purpose of research is to discover the answer to some question (Lune & Berg, 2017). Such a question may arise when a gap in the literature is noticed or when some new development in society takes place (Bryman, 2012). However, we all attempt to answer questions in our everyday lives – so what sets research apart from such everyday endeavors? Research is a structured and systematic attempt at arriving at answers that are trustworthy. More specifically, it is an attempt at generating *knowledge*.

5.1 Research Area

Research for this thesis was undertaken in a village in Kisarawe, Tanzania. Tanzania is located along the coast of East Africa. It borders Kenya and Uganda in the north; Rwanda, Burundi and the Democratic Republic of the Congo in the west; and Zambia, Malawi, and Mozambique in the south. In the east, it borders the Indian Ocean.

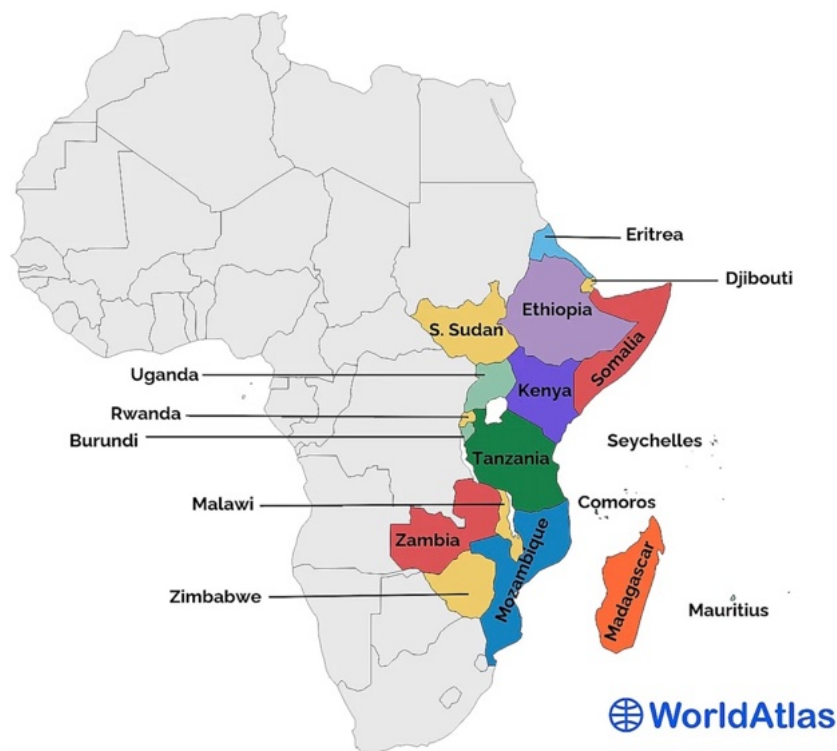


Figure 1: Map of Africa (World Atlas, 2021)

Kisarawe is a district within the region of Pwani – one of the thirty-one administrative regions of the country. Both the district and the region border the region of Dar es Salaam, where the city of Dar es Salaam – the economic capital of the country – is located. According to Google Maps, the village in which the fieldwork was undertaken is located roughly 80 kilometers outside of the city.



Figure 2: Map of Tanzania (ICAP, ND)

The village borders directly the area that was acquired for the non-operational land deal in question. To protect the identity of respondents, the name of the village and therefore the land use plan of the village will not be disclosed. However, the area given up was, and is, located on the outskirts of the village. Depending on where within the village someone lives, it takes at least an hour to reach the area by foot.

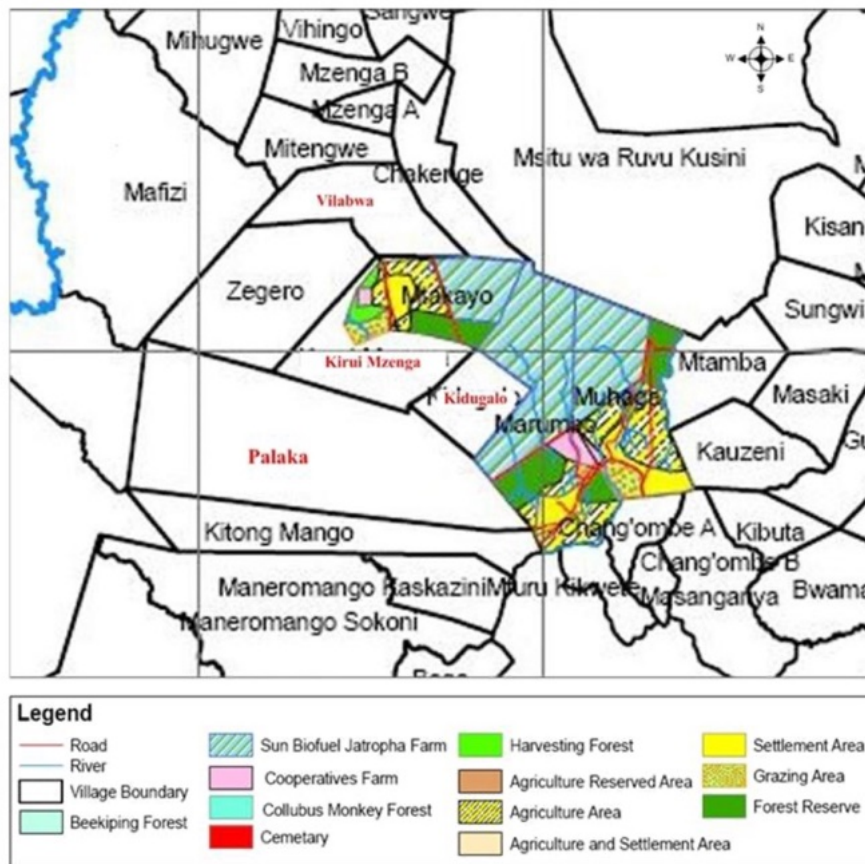


Figure 3: Map of Investment area and surrounding villages (Zemda, 2010)

5.2 Research Strategy

This thesis builds upon qualitative research. Qualitative research is a particular research strategy, that is; a general approach to conducting research. As the name implies, qualitative research is concerned with the *quality* of things (Lune & Berg, 2017). Quality refers to the what, when, how, where, and why of things (Lune & Berg, 2017). Qualities are a bit like smoke: we can see them and they are real but they will not stand still for us or form some straight line that we can measure (Lune & Berg, 2017). A question then, is whether we can really study them? The answer is yes; qualities can be studied as collections of meanings, but not as precise and solid objects (Lune & Berg, 2017).

Qualitative research provides a means by which to study qualities. Qualitative research seeks to understand the experiences, perspectives, and opinions of social actors and thereby the meanings they attribute to some phenomena. To adequately grasp the meanings that social actors attribute to something, qualitative researchers seek to see through the eyes of social actors. This is done by generating in-depth and rich data in fairly naturalistic settings, often times without prior theoretical commitments (Bryman, 2012).

5.3 Ontology, Epistemology, and the Role of Theory

Underpinning the qualitative research strategy chosen are particular views on ontology, epistemology, and the role of theory in research. The research has been underpinned by a constructionist ontology, an interpretivist epistemology, and an inductive approach. Because of the associated implications for how research is to be conducted and what research can do, each feature will be explored in some more depth in the following (Clark et al, 2021).

Ontology

Ontology is the study of reality: what is real and what exists? For social scientists, a key question related to ontology is whether social phenomena confront us as external facts beyond our reach of influence or whether social phenomena are created by, and therefore dependent upon, us – the people creating them (Bryman & Bell, 2019; Bryman 2015). Those who agree with the former will usually identify with the ontology of objectivism while those who agree with the latter will usually identify with the ontology of constructionism (Bryman & Bell, 2019; Bryman 2015).

This thesis is underpinned by a constructionist ontology. According to this ontological stance, social actors create social phenomena (Bryman & Bell, 2019; Bryman 2015). Social

phenomena then, do not have an existence of their own nor are they beyond the reach of influence of social actors (Bryman & Bell, 2019; Bryman 2015). Rather, because social actors create them, their existence is intimately dependent upon the social actors creating them (Bryman & Bell, 2019; Bryman 2015). This in turn holds of implications for what we can know and how we can come to know it – that is, epistemology.

Epistemology

Epistemology is the study of knowledge – what can, or should be, considered acceptable knowledge? (Bryman & Bell, 2019; Bryman 2015). For social scientists, a key question related to epistemology include whether the social sciences should imitate the methods of the natural sciences in the acquisition of knowledge or whether other methods are needed (Bryman & Bell; Bryman). Those who agree with the latter will usually identify with positivism, while those who agree with the former may identify with interpretivism.

For this thesis, an interpretivist stance has been taken. Interpretivists emphasize the interpretation – or, empathetic understanding – of social phenomena (Bryman & Bell, 2019; Bryman 2015). This in turn requires distinct methods that allow the social scientist to gain access to the common-sense thinking of the people they study to understand the social world, from their point of view (Bryman & Bell, 2019; Bryman 2015).

The Role of Theory

Given the epistemological orientation, an inductive approach to research followed naturally. As interpretivism emphasizes the interpretations of social phenomena, generating knowledge is about exploring more so than explaining. An inductive approach to theory allowed me to

generate rather than test theories based on the particular understandings uncovered (Bryman & Bell, 2019; Bryman 2015).

Rather than starting off with a theory from which I came up with a hypothesis that the data collection was geared to confirm or reject, an inductive approach allowed me to start off with a general area of interest. Data was then collected according to this area of interest before the data was interpreted followed by conceptual and theoretical reflections that led to the discovery of a theory that could help explain the findings.

5.4 Research Design

In light of the above, the research design choices made can be better understood. A research design is essentially the framework guiding the collection and analysis of data to answer the research questions (Clark et al, 2021). A case study design was chosen in this case. A case study design entails an in-depth examination of a single case (Merriam & Tisdell, 2016). A case in turn is a bounded system; an entity or unit around which boundaries can be drawn – such as a person, a family, or as in this case, a village (Merriam & Tisdell, 2016).

5.5 Sampling

Sampling a case

To sample a case, a combination of convenience and purposive sampling was employed. Convenience sampling, sometimes called availability sampling, involves sampling a case that is easily accessible or close at hand (Berg & Lune, 2017). By contrast, purposive sampling, sometimes called judgmental sampling, involves the researcher using his or her special knowledge to handpick a case (Berg & Lune, 2017).

Since there was only one lodge in the area where the eleven villages were located, the villages in reasonable proximity to this lodge were the starting point when sampling a case. Based on informal conversations with village leaders and villagers in each of these villages, one village was eventually sampled based on the seeming level of impactedness. Consequently, a combination of convenience and purposive sampling was employed.

Sampling informants

To sample informants, both purposive sampling and snowball sampling strategies were employed. Two criteria were particularly important in guiding the purposive sampling of research participants: variation and information. Assuming that different sub-groups of the village could have unique and interesting views, it was important to include these in the sample. Efforts were therefore undertaken to purposively sample research participants of different age and gender. However, not all villagers had relevant information to offer. All villagers sampled then, were purposively sampled because they did possess such information.

Sometimes, snowball sampling, or chain referral sampling, was employed to locate potential participants with special attributes. Snowball sampling usually involves sampling a small group of research participants, before asking them for referrals to other potential participants who possess the same attributes as themselves (Berg & Lune, 2017). Snowball sampling was particularly useful to locate female charcoal makers. Female charcoal makers did not present themselves to us too often, so by sampling a few female charcoal makers, these referred us to other female charcoal makers.

5.6 Data Collection Methods, Instruments, and Analysis

5.6.1 The interviews

The main data collection method employed was interviewing. An interview may be defined as “a conversation with a purpose” (Merriam & Tisdell, 2016. pp. 108). As a data collection method, the interview was chosen because it is ideal to grasp the way in which respondents have perceived something, why they perceived it that way, and so on. Certainly, the interview only provides perspectives on, and stories about, phenomena, but it is the interpretations, not the phenomena themselves, that are of primary concern to the qualitative researcher.

After choosing the interview as a data collection method, the level of standardization was determined. In this case, the semi-standardized interview was chosen. Semi-standardized interviews typically involve the researcher raising a set of questions or fairly specific topics, but he or she may change the sequencing and formulation of questions and topics and may also raise new questions in a responsive manner (Berg & Lune, 2017; Bryman & Bell, 2019).

A semi-standardized interview format was chosen because it allows for both comparability and flexibility. As the interview guide includes fairly specific topics and questions, it is possible to compare the answers given by different respondents. Among other things, this can be helpful to assess negative cases. However, it also allows for some degree of flexibility. In part, this is beneficial because of the inductive approach that underpins qualitative research. After all, the goal is not to test a theory but to build one: it is about exploring, not explaining. Consequently, being able to pursue new topics that may (or may not) prove to be relevant later on is beneficial.

With few exceptions, all interviews were carried out in the respondents' own homes. As pointed out by Crang and Cook (2007), careful consideration should be paid to where an interview is conducted. Conducting interviews in the participants' own homes can offer several advantages. By conducting the interviews in the safety of the respondents' homes, the respondents may feel more comfortable than they otherwise would (Crang & Cook, 2007).

Similarly, the home of respondents may serve as a reminder of their day-to-day lives (Crang & Cook, 2007). This would often times prove to be the case. For instance, when talking about charcoal making, one respondent looked around himself and pointed towards various objects therein stating something like: nothing you see here is paid for by charcoal making.

Approximately fifty interviews lasting between thirty and ninety minutes were conducted. The aim was to complete enough interviews to reach saturation: that is, when new drops of information are few and far between. When reaching about sixty interviews, this was very much the case. These interviews lasted between thirty and ninety minutes, but most interviews lasted for about an hour.

The interview guide

To guide the interviews, an interview guide was used. To develop the interview guide, all broad themes or categories of interest were outlined. Questions relevant to each of these themes were then formulated. After having formulated the questions, the wording and sequencing of the questions were assessed and adjusted. The sequencing was assessed and adjusted to allow participants to "ease into" the interview and ensure a logical flow. For instance, demographic questions were put on top of the interview guide, and the remaining questions were grouped according to major themes.

Although the process of developing the interview guide might have come across as straightforward, it did involve continual adjustment in the beginning. Even though the questions were carefully formulated, not all questions ensured sufficient clarity when put into practice. The phrasing and wording of questions then were continually adjusted in the beginning.

Data analysis

The first step to analyzing the data generated from the interviews was to transcribe the interview recordings and gain a firm overview of the resulting data. When transcribing the interview recordings, the recordings were transformed into written text. Both during and after transcribing the recordings, I read through the transcriptions to gain an overview of the material. Once I felt as if I had somewhat of a firm overview, I began developing some initial codes. That is, broad categories or topics identified in the data set (e.g., “rules & regulations”). I then coded the data, meaning that I deconstructed the interviews according to the codes that I had developed.

After having coded the data, conceptual and theoretical ideas were considered in relation to the coded material. This implied linking the codes and coded material to relevant conceptual and theoretical ideas. After reviewing what seemed to be relevant concepts and theories, common-pool resource-related concepts, seemed to align closely with the material. After these concepts were discovered and reviewed, the codes were linked to these concepts. Codes such as “users” and “rules & regulations” for instance were transformed into “resource users” and “institutions”.

5.6.2 Participant Observation

To complement the interviews, another research method employed was participant observation. Participant observation may be defined as a form of “deep hanging out” (Crang & Cook, 2007). Through participant observations, researchers seek to understand “the world views and ways of life of actual people in the contexts of their everyday lived experiences” (Crang & Cook, 2007. pp. 37).

Participant observation differs from, and complements, interviews in at least two ways (Merriam & Tisdell, 2016). First, it takes place in the setting where the phenomenon of interest naturally occurs rather than in a location designated for the purpose of data collection (Merriam & Tisdell, 2016). And second, the resulting data is based on a firsthand encounter with the phenomenon of interest rather than a secondhand account obtained through interviews (Merriam & Tisdell, 2016).

The participant observations mainly involved going to, and working in, the area acquired for the cancelled investment with various charcoal makers at various stages in the charcoal making process. I felt compelled to take on a more active role for two reasons. One of these was to better understand the nature of the work. With no comparable experiences, I felt that it was necessary to actively participate to adequately grasp the challenges faced by charcoal makers. The second reason was to build rapport.

During the participant observations, a notebook was used to make some cryptic jottings: that is, brief statements and short notes taken while still in the field (Berg & Lune, 2017). Such jottings were made to serve as a memory trigger of particularly interesting or important information obtained. Most notes, however, were made when returning to the lodge. The notes

included detailed descriptions (e.g., clothing, tools, setting), more analytic notes (e.g., charcoal maker looking bored), along with subjective reflections (e.g., feeling exhausted, surprisingly rapid destruction).

To analyze the resulting data, I began by reading the field notes carefully. After I had read the field notes and felt that I had a firm overview, I began searching for themes therein. Examples of themes included “cutting”. These themes came to serve as my codes. I then linked the codes and coded material to conceptual and theoretical ideas and transformed the codes (e.g., from “cutting” to “selecting trees”). According to these codes, I deconstructed the material.

5.7 Ethical Considerations

Ethical concerns have been at the forefront of my mind throughout the research process. One set of ethical concerns has centered on the ways in which my research may harm the people it involves, the second has centered on a more general matter of professional conduct (Berg & Lune, 2017). Regarding the first set of ethical concerns, the notion of “first, do no harm” has been a guiding star. This notion implies that inflicting no physical or emotional harm upon the people involved in the research has to take priority over anything else, including the acquisition of knowledge (Berg & Lune, 2017). To avoid such harm, the two ethical principles of informed consent and confidentiality played a key role.

Informed consent implies that informants make an informed decision to participate in a study (Bryman & Bell, 2019; Bryman 2015). Before any potential informants were enrolled in the study then, they were presented with an informed consent form. Among other things, the consent form covered the purpose of the study, what it would entail to participate, and the participant’s rights. To ensure that an adequate consent form was developed, the consent form

was guided by the recommendations made by the Norwegian Center for Research Data and it was later also approved by the Norwegian Center for Research Data.

To ensure that the information presented through the consent form would be accessible to informants, the form was translated into Swahili. Some informants, however, could not read and some suffered from poor eyesight. In these cases, my translator would read the consent form out loud. Whether potential informants read the form themselves, or it was read out loud to them, I encouraged them to take the time needed to fully understand the content of the form and to ask any questions that might arise. I would then take the time needed to sufficiently explain the content and answer the questions. Not until the informant gave a go-ahead, would the data collection begin.

Confidentiality implies that any information that might make a participant identifiable will remain undisclosed to anyone outside of the research team (Bryman & Bell, 2019; Bryman 2015). To ensure confidentiality, several steps were taken. The real names of participants were not included in the research records or the resulting thesis. Because of the small size of the village, the name of the village was not included either. Interview recordings and transcriptions were also stored in a safe and secure manner in accordance with the recommendations made by the Norwegian Center for Research Data.

Up until now, ethical considerations concerning the protection of participants have been considered, but ethical considerations concerning the conduct of the researcher are important too. Integrity, honesty, and the responsible reporting of data are all necessary components of ethical research (Berg & Lune, 2017). After all, “research is about answering research questions. It is not about finding the answers that we are hoping to find” (Berg & Lune, 2017).

pp. 63). While this is often times related to concerns about putting research and the research community in a bad light, I think it is also about respecting participants. If participants trust you, as a student conducting fieldwork, you ought to honor your commitments.

5.8 Trustworthiness and Limitations to Trustworthiness

Before finishing this section, some reflections on trustworthiness are required.

Trustworthiness is concerned with how trustworthy findings are on the basis of the *research process* from which they resulted (Bryman, 2012). The important part here is the emphasis upon the research process. Arguably, knowledge is always partial and situated. Complete, and completely objective, knowledge claims can therefore never be made. However, if this is the case, how can knowledge claims be trusted? When arrived at through rigorous research, such claims can be trusted on the basis of the research from which they emerged.

Four criteria are commonly proposed to assess trustworthiness, including credibility, transferability, dependability, and confirmability. Credibility is concerned with how believable the research findings are (Bryman, 2012). One way to ensure the credibility of a study is through triangulation; through incorporating more than one source of data, one researcher, or one data collection method. By doing so, one can ensure that the findings obtained are not simply an artifact of a single source, researcher, or method. As more than one data collection method was incorporated as part of the research, this is believed to enhance the credibility of the findings.

Another way to enhance the credibility of research findings is through assessing their theoretical adequacy (Crang & Cook, 2007). This involves assessing one's research findings against the findings of others in similar research settings (Crang & Cook, 2007). As the

findings obtained do bear resemblance to those obtained by other researchers in similar settings, this too is believed to enhance the credibility of the findings. Certainly, no other studies have looked into the impact of non-operational land deals on property regimes and the implications for resource use and outcomes, but studies have been done in settings where comparable changes have taken place and where comparable outcomes have come about.

A potential limitation to the credibility of the findings is the use of a translator. As I did not speak Swahili myself and few, if any, respondents spoke English, a translator was employed to translate all the interviews. This means that what respondents attempted to communicate was interpreted first by my translator and then by me. This of course includes added risks that meanings will be distorted and/or lost along the way. One way to ensure that whatever respondents had attempted to communicate had in fact not been distorted or lost could have been through incorporating respondent validation (Bryman, 2012). By presenting the research findings to respondents, it would be possible to confirm whether or not I had understood them correctly (Bryman, 2012). Unfortunately, there was not enough time to include respondent validation even though I did want to include it.

Another criterion is transferability, which is concerned with whether or not the research findings apply in other contexts (Bryman, 2012). As qualitative researchers are concerned with depth over breadth, the preoccupation of qualitative researchers is not to arrive at some generalizable findings, but context-specific findings (Bryman, 2012). Transferability is therefore applied by readers as opposed to researchers. To allow for transferability, however, sufficient detail must be provided (Bryman, 2012). As a background section will be provided in the following and it covers some context-relevant variables such as livelihoods, employment, and the like, this is believed to enhance transferability. Still, the transferability is

believed to be limited. More details than are provided would be needed to ensure transferability with full confidence it seems.

Moreover, because of the specificity of case studies, the transferability of case studies in general is believed to be poor (Bombina, 2022). Often times, case studies involve small samples, sampled from highly specific contexts (Bryman, 2012). One way to overcome such a limitation is to choose a multiple-case study design. Due to time and resource constraints, however, it would simply not have been feasible to adopt such a design. Even where more than one case is being studied, each case should be studied in its entirety (Gaya & Smith, 2016). This would necessarily mean that more time and resources would be needed, which there was simply not enough time or resources for.

The next criterion is confirmability. Recognizing that complete objectivity is an impossibility, confirmability is concerned with whether a researcher has let her or his values intrude to a large degree (Bryman, 2012). One strategy to enhance confirmability, which was incorporated throughout the research process, is that of reflexivity. Reflexivity may be understood as a particular attitude adopted by researchers throughout the research process (Bryman, 2012). Such an attitude includes acknowledging and examining any preconceptions and biases that the researcher might hold. In practice, this included attempts to critically examine any unfounded assumptions that I found myself making so to become aware of these and prevent their influence throughout the research process.

The last criterion is dependability, which is concerned with whether or not the findings are consistent with the research process (Bryman, 2012). In other words, if another person conducted the research, or looked over the research process, would he or she arrive at the

same findings or at least agree with the findings arrived at? One way to ensure dependability is through an auditing approach, whereby complete records of all parts of the research process are kept and peers act as “auditors” to assess the degree to which proper procedures have been followed and the findings are warranted. As this is incredibly demanding for both researchers and auditors, and sometimes impossible to protect the identity of informants, this approach is rarely adopted. Consequently, such an approach was not adopted here either, but complete data records for instance have been kept.

6.0 Setting the Stage

To situate the findings of the research within their wider context, this section will provide a brief introduction of the village in which the fieldwork was undertaken and a brief history of villagers' experiences with the non-operational land deal. While I have debated to remove this section due to relevancy, I do believe that this section can counter some of the critiques made of the conceptual framework while enhancing transferability, and thereby add value.

The village

The village in which the fieldwork was undertaken is located fairly close to Dar es Salaam, but there is little that reminds of Dar es Salaam in this small village. The village is located in between hills and valleys covered in farm fields. In this beautiful rural area, the village sits along the one dirt road that connects the villages in the area to one another and to the outside world.

In the heart of the village is the village settlement. The settlement is made up of small houses most of which are made from clay and wood with metal roof sheets. Some have concrete floors while others have no floors at all. It is notable that many of the houses are in a poor condition; they have cracks and holes in the roofs and ceilings.

In front of most houses, large fruit trees such as mango and durian trees can be found. In the shade created by these trees, villagers will usually put out some sisal mats or plastic chairs, where they will sit, talk, eat, and rest. On particularly hot days, resting in the shade of these trees – with a breeze blowing every now and then if you are lucky – is a great little escape from the scorching sun.



Personal photo: pictures from a similar-looking, nearby village

Most villagers are Muslims. On Fridays, you will see the men walk along the dirt road that runs through the village wearing long, white shirts and hats, on their way to the Mosque. On all other days, however, you will see them wearing worn-out t-shirts and trousers with holes in them and marks.

Often times, you will see relatives walking along the road together. In the village, whole families are living within walking distance of one another. Grandparents, parents, grown children, grandchildren, brothers, and sisters live only a few minutes away from each other.

There is plenty of humor in the village, but life in the village is hard; the health of the elders is a testament to this. There are only a few surviving elders in the village, but disabilities such as eye diseases are common among them. These eye diseases seem to witness of the thousands of hours spent in farm fields with no protection against the bright shining sun.

As many villagers have had to tend to farm fields rather than homework, many of them are illiterate. When respondents were presented with the consent form then, my translator would often times have to read the form out loud and they would have to sign with their fingerprints. Some respondents seemed ashamed about the fact that they were illiterate, but some of the illiterate respondents I met are still among the quickest and wittiest people I have met to date.

Livelihoods

The main source of livelihood in the village has been, and continues to be, farming (#1.1, #3.1) (#X.X signifies interviews undertaken early on with more emphasis upon context).

Some of the crops grown include cassava, maize, rice, and beans, along with fruits such as mangos and oranges (#1.1, #3.1). Of these, cassava is the main cash crop while the remaining crops tend to be grown for subsistence (#1.1, #3.1, #4.1, #6.1).

The type of farming practiced may best be described as small-scale, traditional farming.

Villagers are farming small plots of land, with little to no modern inputs such as fertilizers and pesticides (#1.1, #4.1, #6.1). With the exception of a few vegetable farmers who make use of bucket irrigation, most farmers rely on the rain to irrigate their fields (#1.1).

To overcome some of the challenges associated with the type of farming practiced, villagers have traditionally practiced shifting cultivation (#3.1, #4.1, #6.1, #1, #8, #22) (#X signifies interviews undertaken later and with less emphasis upon context). They have farmed one plot of land for one or a few seasons before leaving it fallow for years to come (#1). Among other things, shifting cultivation helps restore the nutrient content of the soil and prevents the build-up of diseases.

Although farming has been, and continues to be, the main source of livelihood, villagers have typically combined farming and forest-related activities (#1.1, #2.1, #5.1, #6.1, #11.1, #12.1). By combining farming and forest-related activities, villagers have been able to overcome some of the inherent risks of farming (#3, #4, #7, #34, #36). Farming takes time and it is volatile. From seeds are put into the ground until crops can be harvested, months can pass by. And in the event that crops fail, the farmer may be left with no produce at all.

In the event of urgent financial difficulties, or in the event that yields fail, forest-related activities have played a key role in allowing villagers to generate income. Forest-related activities have not only allowed villagers to generate income but such activities have also allowed villagers to meet certain other needs. Most houses in the village for instance have been built with timber derived from surrounding forests (#8, #38).



Personal photo: pictures of landscape

The first encounter with Sun Biofuels

As villagers have been dependent upon forest produce to supplement farm activities, it is perhaps no surprise that concern spread among villagers when they learned back in 2005 that someone wanted to buy their only remaining forest. Their concern, as one respondent explained, was “Where will we have our area where we can do our activities and get our income because we were depending on that area to get firewood, to get charcoal...” (#42).

One day that year, representatives of a company called Sun Biofuels appeared in the village for the first time (#1.1). Accompanying them was a high-standing Member of Parliament (#1.1, #5.1, #9.1). This Member of Parliament told villagers that the company wanted to acquire the Village Forest along with areas from another ten villages.

This Member of Parliament reassured villagers that the company would provide employment along with a range of other benefits to make up for the loss of the Village Forest (#1.1).

Among other things, villagers were told that the company would provide water wells, schools, health clinics, and new roads, along with technology and know-how that farmers could make use of (#1.1, #2.1).

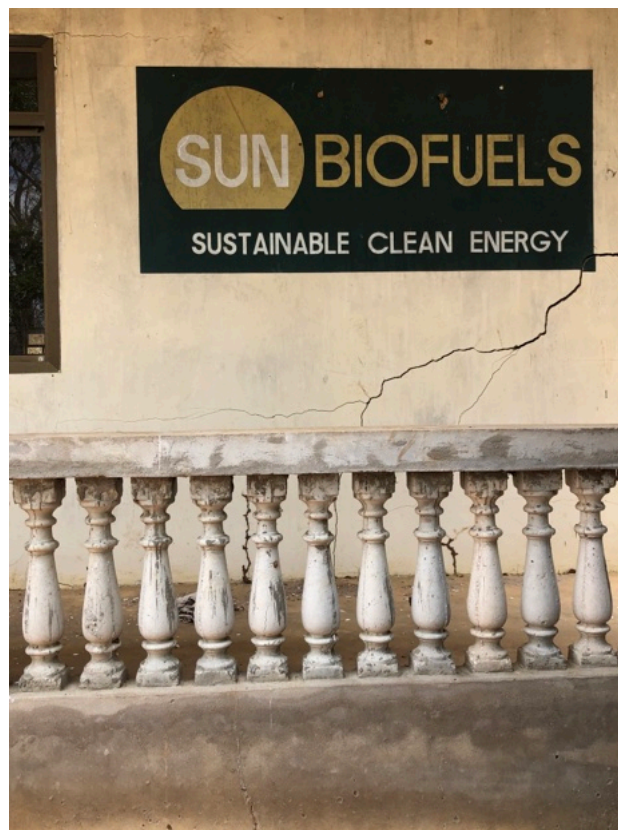
Aside from the many promises made, this high-standing Member of Parliament also made use of some cheap sales tricks. For instance, he told the villagers that all other villages had agreed to give up land to the company and that their village was the last one to do so (#1.1, #9.1).

However, when the villages created a joint task force to claim compensation later on, the villagers came to learn that villagers from all the different villages had been told the very same thing: that their village was the last village to agree to give up land (#9.1).

Not knowing what they know now, the villagers eventually decided to give up the Forest. It seems that the villagers felt pressured to do so, but that they also expected the benefits of giving up the Forest would outweigh the costs (#2.1, #9.1). After all, a regular – albeit low – wage did represent an improvement of life in the time to come.

Operations

After having acquired land from all the eleven villages, Sun Biofuels began its operations in 2009. As the stated intent of the company had been to grow jatropha, a jatropha plantation was established. In the area where the plantation is located, the company also built various water sources such as deep wells and ponds and some buildings that have been used as offices. In more recent times, the later investors have also put up some animal enclosures in this part of the area.



Personal photo: picture of Sun Biofuel's sign on buildings used

None of the respondents seemed to know the exact size of the plantation, but the plantation might be one square kilometer or so. On the plantation, hundreds of jatropha trees have been planted in neat rows. As the trees have little value to any of the current resource users, the plantation appears to have been left completely untouched since Sun Biofuels left.

It is not a small plantation, but compared to the entire area acquired, the planted area is tiny. As the company only managed to cultivate a fraction of the area acquired during the one-and-half years that the project was ongoing, it is a bit of a mystery why all trees throughout the ten-thousand-hectares large area were cleared as part of their operations. After all, trees regenerate.

One possible reason might have been to harvest and sell timber. During an informal conversation with the CEO of an established agricultural company operating in Tanzania and other Sub-Saharan African countries, I mentioned my theory, and to my horror, this CEO had heard about a company just the week before that had been able to acquire a large piece of land by pretending to be interested in farming, only to harvest timber.



Personal photo: picture from of Jatropha plantation

Employment

Around 700 people from surrounding villages were employed by Sun Biofuels when operations were ongoing (#1.1, #2.1, #4.1, #10.1). Most of them seem to have been employed to work on the plantation, where they would plant, prune, and spray the jatropha (#4.1). It seems that all of them were hired on 18-month contracts and given a low wage of no more than 150 to 200,000 Tanzanian shillings (tzs) a month – or, between 60 and 80 US dollars (#2.1, #4.1).

For those working on the plantation, the working hours were long and the working conditions were harsh. According to a respondent and former employee, the working hours were from five in the morning until six or seven in the evening (#4.1). During this span of time, workers did not have access to toilets, kitchen facilities, or a designated area to eat (#9.1). Among

other things, this meant that workers had to cook and eat outside, exposed to all kinds of weather.

Perhaps even more worrying, the company did not provide workers with any type of safety training or protective gear (#10.1). One special group of workers who were spraying pesticides had been given some protective gear, but there was not enough gear for everyone to go around when more workers were put on the task of spraying (#10.1). As more workers were put on the task of spraying then, several workers had to spray without any training or protective gear (#10.1).

A respondent and former employee was one of the workers who had to spray without any training or protective gear (#10.1). He, and the group of workers he worked with, had originally refused to spray without the gear, but the managers insisted that they had to spray even without the gear (#10.1). As one group member after another gave in, the whole group eventually gave in and started spraying (#10.1).

One day, when the respondent was spraying, the pesticides came into contact with the exposed skin on his leg (#10.1). The pesticides burned off the skin, leaving him with a large scar and what seems to be permanent nerve damage. Like himself, others working without protective gear have been left with scars, wounds that will not heal properly, eye problems and chest pains (#9.1, #10.1).

Despite the many downsides to the work offered, it seems that many villagers would have wanted to continue working for Sun Biofuels. It seems that the regular – albeit low – wages

paid by the company did improve the lives of most villagers (#4.1). However, this might say more about the alternatives left behind than the employment itself.

Abandonment and suspicion

After about two years, Sun Biofuels announced that there was a shortage of water and the work came to an end (#4.1, #9.1). The company might have blamed a shortage of water, but according to former employees, there was no such shortage (#4.1, #10.1). According to a former employee who had been in a group tasked with digging for water, there was in fact plenty of water when the company left (#10.1).

This obvious lie fueled suspicion among villagers as to what the intentions of the company had actually been but the suspicion was not entirely new. When operations were still ongoing, new holes would appear in the ground overnight (#9.1, #10.1, #11.1, #4, #42). As one respondent explained, “We left in the evening and when we came back in the mornings, there were always new holes” (#10.1).

It seems that the holes had been dug with some of the large digging machines owned by the company. During an informal conversation, one villager said that no one ever saw or heard the machines being used and that no villagers were hired to operate them. Yet, three machines broke down and had to be replaced. It seems then, that the machines only were used before and after normal working hours and that those hired to operate them came from elsewhere.

Based on the foregoing, several respondents had suspected that the company had quite different intentions than those stated: namely to dig for minerals (#9.1, #10.1). They believe that the company either found or did not find the minerals they were looking for and therefore

left (#10.1). One respondent sees the poor treatment of workers as indicative of this hidden agenda (#9.1). As she explained, “the way they were treating workers showed that they were not intending to keep them long-term” (#9.1)

Since it is harder to obtain permission to mine than to farm, respondents believe that the jatropha project was simply a façade (#9.1, #10.1). As one respondent explained, “Sun Biofuels did not intend to farm ... when they came, they started clearing the forest and building the buildings just so that no one would suspect that they were doing anything else” (#10.1).

New investors

After Sun Biofuels left, several respondents seem to believe that the company kept the leasehold to the area (#4, #6, #25, #28). Still, there is significant uncertainty surrounding the leasehold. For instance, one respondent seems to believe that the leasehold is held by the District Council while another respondent seems to believe that it is held by the National Government (#8, #1).

As most respondents believe that the leasehold is held by Sun Biofuels, they believe that the more recent investors have sub-leased the area from Sun Biofuels (#2, #28). It seems that the area was sub-leased by a company called Mtanga Foods in 2019 and then by someone dubbed the Arab in 2021 (#57). Aside from the fact that both Mtanga Foods and the Arab have been engaged in cattle ranching, respondents know little about their operations.

The operations of these later investors have had quite a limited presence throughout the area. It seems that their operations have been confined mainly to the area in and around the offices

built by Sun Biofuels (#5). Compared to the size of the entire area, however, this area is tiny. As no official activities took place in the area up until these more recent investors arrived and only in a small part of it after they arrived, the area has generally been considered idle ever since Sun Biofuels left (#3, #5, #12, #39).



Personal photo: the animal enclosures put up by the new investors

The struggle for compensation

After Sun Biofuels left, the villages that had given up land to the company began a lengthy process of claiming some form of compensation. The villages now created a joint task force, consisting of villagers from all the affected villages (#1.1). According to a former task force member, the task force worked on the issue for about a year before the district authorities eventually said that they would take care of it (#5.1).

Soon thereafter, the villages were notified by the district authorities that the company had agreed to pay a compensation. A total of 550 million tzs was to be paid and distributed between the eleven villages (#2.1). The village in which the fieldwork was undertaken expected the sum to be distributed equally between the villages so that each village would receive 50 million tzs (#1.1).

It seems that the District Office was responsible for distributing the money, but the way in which the money was distributed was highly confusing. It was neither distributed equally nor according to the size of the areas given up by each village (#2.1). For one reason or another then, some villages received far more than fifty million while others received far less (#2.1). The village in question was one of the unlucky villages and received tens of millions less than expected.

Rather than providing the villages with money directly, the District Office decided to retain the money and instead pay for projects that the villages could pick themselves. As the village in question had expected to receive 50 million tzs, they had planned to construct a medical center, a deep well, and improve the road (#1.1). However, they now had to choose between the three projects. In the midst of a dry spell, they eventually decided to construct a deep well (#1.1).

After having chosen to construct a deep well, the village reached out to a contractor. It seems that the contractor was able to locate a suitable water source, approximately 150 meters below the ground (#1.1). Although the village wanted to hire the contractor, they decided to meet with yet another contractor that had been recommended to them by the District Office.

When the contractor recommended by the District Office came, he told villagers that the water source located by the first contractor was no more than a hundred meters below the ground (#1.1). Thinking that the first contractor was lying about the depth of the water source to get more money, the village began doubting the first contractor.

As the village began doubting the first contractor while the second contractor sent by the District Office assured villagers that he could reach the water source, the second contractor was hired by the village and paid by the district authorities (#1.1). Before he reached the water source, however, the money he had been paid ran out (#1.1). As all of the money earmarked for the village had already been paid to the contractor, the village was left with neither the money nor the water well.

The demise of farming

Aside from the sudden loss of jobs and the inadequate compensation provided, the canceled project has had a detrimental impact on the main source of livelihood in the village: farming. After the area acquired by Sun Biofuels was cleared as part of the company's operations, the village has been receiving less, and more irregular, rainfall (#7, #8, #12, #16, #19, #23, #34). As villagers depend upon rainfall to irrigate their fields, this has been leading to low and declining yields (#7, #12, #16, #34).

Moreover, as the company purchased the village's last major source of land amidst population growth, villagers have been forced to abandon shifting cultivation (#3.1, #11.1). With no more available land, there is simply nowhere to shift (#3.1, #4.1). As a key strategy to prevent the buildup of diseases and soil depletion, respondents seem to believe that this is yet another cause of declining yields (#3.1, #4.1).

Without any available land, a growing number of villagers have also been excluded from farming. In the past, the village would give away up to 2 acres of land for free to any man or woman in need of such land to ensure that the younger generations could enter farming (#2.1, #3.1, #7.1) However, with no more available land, this practice has now been discontinued. Young villagers therefore have to purchase or inherit land, but neither option tends to be readily available.



Personal photo: pictures depicting dryness in areas surrounding the villages

The rise of charcoal-making

With farming performing poorly and a growing number of villagers being excluded from farming, it is perhaps no surprise that forest-related activities are more important than ever before. However, villagers no longer have any forest of their own. As the area once given over to Sun Biofuels is the only “free” forest, many have turned to this area but due to the changes

incurred by Sun Biofuels and later resource users, villagers only conduct charcoal making in the area – a job that most villagers despise.

Making charcoal involves several steps. The charcoal maker first has to cut down trees, prune the trees, and then cut the trees into smaller pieces. These smaller pieces must then be collected and, at least when smaller trees are used, arranged into a pyramid-like formation. The formation must then be covered in grasses and sand to limit the amount of oxygen that finds its way into the formation. After having covered the formation, the wood inside is put on fire. The wood is then left to burn slowly at high temperatures until the wood has been turned into charcoal. During this time, the charcoal maker often times makes follow-ups to ensure that the wood is burning properly.

A simple description of the steps involved might make the process sound easy, but making charcoal is a physically demanding job. Collecting the trees for instance involves lifting and carrying heavy loads of wood from one point to another. Female charcoal makers in particular complain about aches and pains from the workload (#14, #19). The process is also lengthy and filled with risks. It takes about a month to prepare one batch of charcoal yet the charcoal maker is never guaranteed any finished produce. When the wood is left to burn for instance there is also always the risk that too much oxygen will make its way into the formation so that the wood will simply burn up.

Aside from the physical strain and risks involved, charcoal making is considered an inferior job by some. When asking respondents what they do for a living, many of them would only mention farming. Only when asked specifically if they engaged in charcoal making, would they say that they engage in charcoal making as well. When asked why that is, a female

charcoal maker stated the following “It is a job that gives us income, but mentioning it... you cannot be proud of being a charcoal maker” (#19). When asked if she could expand on that, she explained “Some people, they do not respect that job, that job has a bad reputation ... It is happening, some of the people that went to Dar es Salaam, when they come back and they find out that you are making charcoal they do not respect you” (#19).



Personal photos: photos showing a few stages of the charcoal making process depicted

7.0 Altered Property Regimes

To explore and answer the first research question “How has the non-operational land deal altered the property regime pertaining to the area acquired?”, the property regime that pertained to the Village Forest prior to the initiation of the non-operational land deal will first be explored. Then, the property regime pertaining to the Mzungu Forest, which the Village Forest came to form part of, will be explored. Lastly, some concluding remarks will be made.

7.1 The Village Forest

Under the ownership of the village, villagers had developed and devised a rather comprehensive common property regime. The regime was revised in some significant ways in the 1980s, but it seems more likely than not that minor changes were made now and then as needed. Still, given the close match between respondents’ descriptions of the regime, it seems that the major components of the system remained intact. In the following, I will first present the original property regime in place, then I will present the revisions that were made.

7.1.1 Rights and Rules

Under the common property regime in place, use rights were assigned to villagers and non-villagers (hereafter: outsiders) that met certain criteria. A number of rules had been developed to specify what criteria users would have to meet in order to obtain and/or exercise use rights. To reiterate, rules are prescriptions that permit, require, or forbid certain actions. Some rules pertained only to villagers, others applied to outsiders, and yet others applied to both.

All villagers were permitted to use the forest without obtaining permission beforehand (#11, #42, #38, #37). As one respondent explained, “This was according to the regulations and rules. We agreed that if a villager wants to use the forest, he can use the forest without asking

for a permit but if someone comes from outside, he has to apply for a permit” (#37). Villagers were also permitted to harvest as much forest produce as they liked (#42, #24, #13, #11). In the words of another respondent; “it only depended on your requirement ... you have to decide yourself” (#42).

When asked why there was no need for restrictions, one respondent explained that “the forest was so big, so the thought was that villagers could never finish the forest” (#24). Along similar lines, another respondent stated that “the forest was so big, so if we could keep on harvesting, only the natives, we could still have that forest up until now” (#13). Compared to the size of the forest then, villagers’ use of the forest was considered modest.

The modest use of the forest by villagers was attributed to at least two different factors. For one, the village owned another forest closer to the village settlements up until the 1990s, which many villagers would rather make use of (#11, #25). Depending on where within the village someone lived, it would take at least an hour to reach the forest given over to Sun Biofuels by foot. Many villagers would therefore simply not go there (#11). Secondly, as farm activities were performing well back then, demand for forest produce was not as pressing as it is today. As one respondent explained, “They were getting enough crops, so it was difficult for people to concentrate much on the forest” (#8).

After having harvested forest produce, villagers were exempt from paying taxes (#42, #38, #13, #28). It seems that villagers were exempt from paying taxes because villagers would spend the revenue obtained within the village and because villagers were the ones who participated in development projects (#13, #38). When the village had certain development projects, such as building a new school or hospital, villagers would participate in these (#13).

Unlike villagers, outsiders were required to obtain a permit to use the forest (#13, #23, #27, #28, #37, #38, #41). Outsiders would therefore have to seek out the entity responsible for issuing permits and explain the work they wanted to do (#27, #37, #38). The responsible entity would then decide whether or not to issue a permit. No instance of any outsiders being denied a permit was ever mentioned, so this rule might have been more important in ensuring that the following two rules could be upheld.

As the permit would specify the amount of forest produce outsiders were allowed to harvest, outsiders were required to stay within this limit (#1, #26, #27). Based on the description of the work they wanted to do, the village would grant outsiders the right to derive a certain amount of forest produce. If an outsider had indicated that he or she wanted to make a certain amount of charcoal for instance, the permit would specify the number of bags of charcoal that the outsider was permitted to make (#26).

After having completed their activities, outsiders were also required to pay taxes to the village (#1, #8, #13, #23, #24, #28, #30, #42). Based on the type and amount of forest produce harvested, outsiders would be taxed by the village (#13). The rationale, as one villager explained, was that “people from outside, they were cutting charcoal just with the intention to go and sell outside this village and they were getting money. And the money they were getting, they used outside of this village, so that is why” (#38).

The specified limit seems to reflect in part the need to tax outsiders, but it might also reflect outsider’s more extensive use of the forest. Compared to villagers, it seems that at least some outsiders would harvest large quantities of forest produce. Members of one tribe in particular

would make large quantities of charcoal whenever they were allowed to use the forest. As one villager explained, “When you allowed them to go there and make charcoal, they will cut so many trees and prepare charcoal in so many places” (#28).

When conducting activities in the forest, villagers and outsiders alike were required to follow certain other rules. Among other things, it was forbidden for all users of the forest to cut trees in certain areas, such as in and around the water sources (#15, #16, #28, #37). It seems that the areas in and around the water sources were protected to protect the water sources themselves. For instance, by reducing runoff and evaporation.

It was also forbidden for all users of the forest to cut the smallest trees (#23, #38, #42).

Because the smallest trees tend to be the youngest ones, these were preserved for future use.

As one respondent explained, “Trees are just like human beings; the larger ones are the oldest ones, so these are already on their way out, but the smallest ones are the youngest ones, so these should be left to grow up” (#38).

It was also forbidden for all users of the forest to cut trees of certain species, locally known as Mkenge, Mkongo, and Mninga (#38, #37, #28, #41). As trees of these species grew particularly tall, they were important to attract rainfall (#40, #41). Only when they grew old, would the village harvest them and use them for certain village projects such as building a new school (#2, #41). As explained by one respondent, if the village wanted to build a new school, the district level would provide the village with metal roof sheets but not with timber (#2).

7.1.2 Monitoring and Sanctioning

To ensure compliance with the rules, villagers and the Village Council followed by a designated Committee would monitor the Village Forest and the activities therein. Villagers would keep an eye out for any illegal activities whenever they were working in the Forest (#13, #42). As explained by one villager, “Because the villagers are the ones working there, most of the time, in that forest ... they were acting like security guards themselves” (#13).

If villagers saw or heard about any illegal activities, they would go to the Village Council to report such activities (#13, #42). One respondent gave the following example of what this would entail: “If you saw someone you were not sure of, you had to go to the Village Council and tell them: there is someone there and I am not such sure he has that permit” (#42). The Village Council would then go to the forest to confirm or reject whether the person had, or had not, obtained a permit (#42).

No instances of villagers breaking the rules were ever mentioned, but outsiders would at times break the rules. Whenever the village caught someone breaking the rules, they would sanction the individual. Usually, the village would demand the person to pay a fine or hand over some of the finished produce (#1, #37, #41, #42). It seems that the size of the fine to be paid or the quantity of forest produce to be handed over was based both on the severity of the rule violation and the dialogue between the rule breaker and the village (#8, #41).

If someone refused to pay the fine, the village would either claim money from the buyer of the illegally obtained forest produce or bring the case to the district authorities (#1). If the rule violator had made charcoal, the village would know all the charcoal buyers and therefore tell the buyers to pay them what the person owed them (#24). However, if the rule violator had

made something other than charcoal, the village would bring the case to the district authorities (#1, #2, #25, #41, #42).

7.1.3 Revisions

Sometime during the 1980s, some changes were made to the property regime pertaining to the Village Forest. Up until then, the Village Council had been the entity responsible for the Village Forest. In the 1980s, however, a designated Committee on environmental conservation was created and made responsible for the Forest. Unlike the Village Council, the Committee was concerned only with the forest and members were elected on the basis of knowledge of the forest. As one of the first-ever committee members explained: because we did not have any formal education, we selected those amongst ourselves who had learned about the forest from our parents and grandparents and who had experience from the forest (#2).

As the Committee was given prime responsibility for issuing permits to outsiders, a few new rules could be implemented. When outsiders came to see the Committee and explained the work they wanted to do, committee members would know where within the forest suitable trees could be found and how many trees would be needed (#2). The committee members would therefore show outsiders where they were permitted to conduct activities and tell them how many trees they were permitted to harvest (#2, #28).

Aside from establishing the Committee and implementing these new rules, the village would monitor the forest more frequently than had done up until then. Up until then, a few members of the Village Council had gone to the forest to monitor the forest and the activities therein every so often. One respondent seemed to recall that the Village Council went to the forest once a week, every Saturday (#1). Another respondent seemed to recall that the Village

Council hardly ever went to the forest; “I cannot say that the village government was going to visit the forest. Because they were just waiting for information from villagers telling them that there is destruction ... that is when they took action” (#27).

According to one of the first-ever committee members, the Committee would monitor the forest up to three times a week (#6). When monitoring the forest, it seems that the Committee was concerned with a few different things. They would follow up on the work of outsiders, look for invaders, and look for any instances of recent destruction so that these areas could be protected in the time to come (#2).

7.2 The Mzungu Forest

Under the private property regime in place now, villagers only have knowledge of one rule: that no one aside from the investors are allowed to use the Forest, now known as the Mzungu Forest. Had the rule been enforced, this rule would assign use rights to the investors only but effective enforcement has been lacking.

Presumably, to enforce the rule, security guards have remained in the area ever since Sun Biofuels left and it appears that the guards monitor the area on a daily basis. As one respondent explained, “So, I can say, they are there every day. They have that routine of going through the area” (#3). It seems, however, that the guards are unable to monitor the entire area in a single day. As the same respondent later added then, “They cannot finish the whole area in one day, so they just start somewhere and where they finish today, they will start tomorrow” (#3).

Given the size of the area and the small number of guards, it appears that the guards' capacity to monitor the Forest is limited. According to another respondent, the number of guards has declined from about twenty guards in the early years to three guards as of now. Even when divided between twenty guards, however, a 10,000-hectare area is huge. Some respondents then, have never even seen the security guards. As one respondent stated, "To be honest, I have never seen the security guards. I have been going there, making charcoal and coming back, and I never met them" (#38).

As the guards tend to stick to the small roads that run through the area, it is considered easy to hide from the guards even if one happens to cross their path. Since the guards monitor the area by motorcycles, they usually stick to the roads (#3, #39). This means that one can easily hide from the guards by working in the interior of the Forest. As one of the respondents explained then, "If you want to hide, you just go to the interior of the forest where they cannot see you" (#4).

It seems that the limited capacity of the guards to monitor the area and the ease at which people can hide can help explain the rare occurrence of being caught by the guards. When asked how often they have been caught by the security guards, a notable number of respondents who have been working in the area on a regular basis for years said that they have never been caught (#3, #4, #38).

Even if the guards catch someone, there appear to be no formal sanctions in place. If the guards know the person they have caught, the guards sometimes just warn them to not work in the area. In the words of one respondent, "Because I used to work there, for Sun Biofuels, we know each other. So, when they catch me, they just tell me "Don't stay here because others,

when they see you entering the forest, they will come too” (#7). Along similar lines, another respondent explained that “When they find you, and you know each other, they will just greet you and tell you that the owner doesn’t want you here” (#15).

Although the guards sometimes just warn those they catch, they will more typically ask for bribes (#3, #4, #5, #11, #12, #15, #21 #24). As explained by one respondent, “If they found you, making charcoal for instance, they do not take you to court, they make you pay them if you have money, or if you have charcoal you give them charcoal, and you can continue with your activities ... if they get money they will leave you, if they get charcoal, they will leave you” (#9).

It seems that the bribes serve as a payment against staying in the Forest. As another respondent explained then, “We have been giving those bribes with the agreement that during inspections, the security guards will not come in our direction, they will go in another direction. So, we will be free to conduct our activities ... so if you bribe them, you can do whatever you like” (#24).

Although the guards typically ask for bribes, the guards have at times confiscated the charcoal made by charcoal makers working in the Forest. In the words of one respondent, “The way they were doing it, it was hurting a lot. They took our charcoal to their buildings and after taking it, they called buyers that came and bought the charcoal” (#5).

To avoid having their charcoal confiscated, it seems that some charcoal makers have been threatening to fight the guards. As the same respondent later added, “If they say that they have to confiscate your charcoal and you allow them to take it without fighting, they will take it.

However, if you show them that you want to fight, they will not take it. They know that it will bring lots of conflicts” (#5).

7.3 Concluding Remarks

From the foregoing, it is clear that the non-operational land deal has incurred major changes to the property regime pertaining to the area that was acquired from the village. Prior to the non-operational land deal, a fairly comprehensive common property regime pertained to the Village Forest. In the aftermath of this non-operational land deal, no effective property regime has been in place. Under the ownership of Sun Biofuels and later investors, only one rule seems to have been in place: that no one aside from the investors has been allowed to use the area – but without effective enforcement, this can hardly be considered a rule. Without any rules in turn, the area is now subject to an open-access property regime.

8.0 Altered Strategies and Outcomes

To explore and answer the second research question “How have the changes to the property regime altered the strategies of resource users and the outcomes obtained?”, the strategies adopted and the outcomes obtained by resource users using the Village Forest will first be explored. Then, the strategies adopted and the outcomes obtained by resource users using the Mzungu Forest will be explored. Lastly, some concluding remarks will be made.

8.1 The Village Forest: Tragedy Averted

Under the common property regime devised by villagers, most resource users would adhere to the rules in place and thereby adopt coordinated strategies. No instances of any villagers ever breaking the rules were mentioned, but outsiders would at times invade the forest and conduct activities without following the rules in place (#1, #6, #8, #37). Initially, this did not lead to any major suboptimal outcomes but when the number of invaders grew during the 1980s, this became increasingly problematic (#6, #24).

As one respondent recalled, “People were coming without following any procedures ... they were coming in large numbers to harvest the forest. They were coming and they were just cutting trees randomly” (#6). Another respondent even recalled that “People were just doing whatever they liked ... we had no control over that forest” (#7).

With a large number of invaders conducting activities without following any rules, the forest was becoming degraded (#6, #23, #27). It seems that a large number of trees had been cut and the tree cover reduced. Among other things, this meant that grasses had started growing and that fires had become all the more common.

As one respondent explained, “They were destructing the environment in such a way that it was easy to have those fires in the forest. Because before, it was not easy for grasses to grow because of the trees, they were everywhere. After cutting the trees, it allowed the grasses to grow, and when it is dry, you might find that there are lots of fires in the forest. Fires were following that grass, which was dry” (#6).

In response, the village revised the property regime and under the revised regime, things improved. As a former committee member explained, “There was improvement ... people from the outside knew that this village had a plan. If you want to harvest, you have to follow these procedures – you have to go to the village, and they have to show you were to harvest ... I can say when this system started, people that were coming in as invaders, the frequency of them coming in declined a lot” (#6).

As things improved, it seems that the forest eventually recovered. In the words of one respondent, “Even when the investor came, the forest was really healthy” (#31). When describing what the forest looked like back then, respondents would frequently mention the size of the trees of which it was made up; the trees back then were big (#16, #23, #31, #24). Some trees were so big that even if three people held their hands around the stem of these trees, they would not be able to touch each other’s hands on the other side one respondent explained (#23).

Often times attributed to the big trees, various resources flowed from the forest (#2.1, #3). Resources ranging from vegetables, fruits, mushrooms, honey, clay, wild animals, and traditional medicines to wood and timber could all be found in the forest (#1, #3.1, #8, #16,

#24). However, wood and timber seem to have been the resources in greatest demand amongst the different groups of users (#8, #16, #24).

As the forest was preserved through time, the many resources that flowed from the forest were preserved too. As one respondent explained then, “It was so nice because people were able to meet their needs from that forest the governance was good and there was peace, and people were conserving the environment in a good manner. And the taxes collected were helping the village and villagers” (#1).



Personal photo: the vegetation in and around the buildings in the Mzungu Forest where the trees have been preserved. Frequently used as an example of what the Village Forest once looked like.

8.2 The Mzungu Forest: Tragedy Unfolding

Without an effective property regime in place, resource users are now pursuing individual strategies. Mainly two resources of interest to current resource users can be found in the Mzungu Forest: wood and fodder. As part of Sun Biofuels operations, the Village Forest along with the areas provided by the other ten villages were all cleared (#1, #3, #4, #8, #11, #15, #16, #57). As one respondent explained then, “This whole place ... it was like plain” (#11).

Over the course of Sun Biofuels’ operations, the trees were left to regenerate but many of the resources once found in the Village Forest had been lost (#1, #3, #4, #15). Resources such as mushrooms, honey, and wild animals had all disappeared (#1, #3). The only resource that remained was wood, but the wood is only suitable for charcoal making (#2, #3, #5, #15, #30, #42). Aside from wood, fodder can now be found in the area. With a less dense tree cover, grasses and other forms of undergrowth that can serve as fodder have spread throughout the area.

Based on the foregoing it is perhaps no surprise that one of the main activities that have taken place in the area since Sun Biofuels left is charcoal making. Villagers refer to themselves and others making charcoal in the forest as charcoal makers. However, a distinction is usually made between local charcoal makers – those from the village and other surrounding villages – and non-local charcoal makers coming from elsewhere.

Villagers believe that the non-local charcoal makers using the area originate from all across the country, but that many of them arrive from Dar es Salaam (#4, #11, #32, #37, #30). One respondent attributes their arrival to shattered dreams: people from all across the country go to

Dar es Salaam with the dream of a better life, but once there, the harsh reality of city life sets in. Due to its close proximity to the city, the forest offers a way out (#32).

Respondents find that a large and growing number of local and non-local charcoal makers alike have turned to the forest (#13, #40, #42). As explained by one respondent, “We have lots of people coming, all of them are coming to use this forest” (#4). Respondents would sometimes use the word “industry” to describe how busy the forest has now become. In the words of another respondent, “It is like an industry. There are lots of people now. Everyone can come and try to get what he needs to make charcoal” (#31).

Although local and non-local charcoal makers alike are free to pursue individual strategies concerning the way in which to conduct activities in the area, they appear to conduct activities in somewhat different ways. Among other things, local charcoal makers tend to alternate between charcoal making and farming, while non-local charcoal makers tend to make charcoal for prolonged periods of time (#11, #14 #20, #33).

As local charcoal makers alternate between farming and charcoal making, months can sometimes pass by between each visit to the forest (#20, #30, #4). As explained by one respondent “Villagers have other activities they do, like this season, most of them are busy farming... people coming from town, they only have one job: cutting trees ... I remember I told you; I went three years without going there and when I went back, I met the same man I had met three years ago. So, I asked him: are you still in the forest? He said, “Yes I am still in the forest, where else will I go?” so that means that he can stay for years. His main job is cutting trees, he has no other activities” (#32).

It follows naturally perhaps that local charcoal makers make smaller quantities of charcoal than non-local charcoal makers. As the same respondent later added then, “So these two people, they use the forest in different ways. The ones coming from outside, they expect to get maybe a thousand bags of charcoal while those from this village, or nearby villages, they usually only want a small number of bags, they just want a little money to survive while they are doing their farm activities. Those coming from outside maybe want to finish their houses so they are looking for a thousand bags” (#13).



Personal photo: charcoal being collected and transported out of the forest

Although respondents believe that local and non-local charcoal makers differ in the duration of time spent making charcoal and the amount of charcoal made, respondents believe that local and non-local charcoal makers alike leave certain trees, such as the smallest trees (#12, #31, #33, #38). As one respondent explained, “We cannot cut everything like we are making a

farm. We select trees, the big ones we cut, and then we leave the small ones ... most people do it that way, it does not matter where you come from” (#3).

When asked why he would leave the smallest trees, the same respondent explained that “cutting the big trees makes it easier. When you cut the small ones, you have to cut a lot of small trees. It is like you are clearing the field for planting. If you cut the big trees, you only have to cut a few” (#3). Along similar lines, another respondent stated that “Mainly I have been cutting the big ones. You get more income when you cut the big ones compared to the small ones. Those who are cutting the small ones are just getting small amounts of charcoal” (#12).



Personal photo: Size of trees in an area resembling the Village Forest versus the size of suitable trees in the Mzungu Forest

Although most charcoal makers leave the smallest trees, it seems that even the smallest trees being cut have become progressively smaller over time. As the forest was cleared by Sun Biofuels, and has been heavily used ever since, the average size of the trees in the area has been declining (#10, #12, #31, #37, #35). As one respondent explained then, “Now, the trees which are restoring are the ones that people are cutting” (#37).

Along similar lines, another respondent explained that “...there are no big trees ... we only have these small trees... so we select at least the bigger ones, but the smallest ones, we leave them” (#31). When asked what trees the charcoal makers in the area might leave, one respondent answered, “Maybe they will leave those trees the size of my finger, but those other small trees, they will cut them” (#9).

Aside from the smallest trees, respondents seem to believe that most charcoal makers leave certain other trees as well. Aside from the smallest trees, certain other trees are deemed less suitable for charcoal making. Trees with thorns for instance require additional steps to remove the thorns. Similarly, trees with a higher water content including jatropha trees produce only light charcoal (#29, #32).



Personal photo: current vegetation where some larger trees deemed unsuitable for charcoal making can still be seen standing

Respondents believe that a large and growing number of charcoal makers, and the way in which they conduct their activities, is leading to the ongoing degradation of the forest (#2, #11, #14, #19, #32, #30). The activities of non-local charcoal makers are seen as especially problematic. As explained by one respondent, “If they could have that routine that I have, for example, I cut and then shift to another activity, like now I came to farm. If they could do the same, that could improve the sustainability” (#4). Along similar lines another respondent stated “so the way they we are doing it; we are giving the forest time to regenerate” (#32).

Still, the activities of local and non-local charcoal alike are deemed problematic. Even though both local and non-local charcoal makers appear to leave the smallest trees, respondents believe that the trees being cut by the charcoal makers are too small. As one respondent stated then “someone making charcoal in that forest, he is not making charcoal, he is just clearing the forest because the trees are just small” (#13).

Degradation of the forest is made visible in the declining size and number of trees in the area. In the words of one respondent, “When Sun Biofuels left, we had some big trees left, not that many of them ... but now, all of them have been cut” (#2). When asked if the forest has changed over the past three years that he has been working there, another respondent stated “So it is quite different. During those days, there were lots of trees, but now the trees are declining” (#3).

With fewer and smaller trees, charcoal makers have to cut trees across large areas to make enough charcoal. As explained by one respondent then, “You can cut like an acre and you will only end up with 10 bags of charcoal” (#31). Along similar lines, another respondent explained that “So before, we had big trees, so you could go and use a small area and you would get enough charcoal” (#14).

As hardly any suitable trees can be found in the outskirts of the area, charcoal makers also have to travel deeper into the area to find enough suitable trees (#2, #4, #11). Many of them have even started cutting close to the buildings where the security guards have been staying – an area they would usually avoid to avoid being caught by the guards. As explained by one of the respondents, “People are even cutting and making charcoal near the camp where the investors have been staying ... everything else is finished aside from the area close to the buildings” (#2).

Degradation of the forest has been leading to declining outputs from charcoal-making activities. When asked about how much charcoal he had been able to make over the course of one month when he started going to the forest in 2017 versus now, one of the respondents answered that he could get between fifty and sixty bags – even up to a hundred bags – back then but that he now only ends up with ten to fifteen bags (#30). Along similar lines, another respondent answered “In a month you could get up to 60 bags of charcoal, but now you only get 15 to 18 bags” (#19).

Villagers are now worried that the forest will cease to exist (#9, #14, #37). As one villager stated, “We are thinking, if the situation will continue, it will become a desert” (#37). Yet, villagers still believe that the forest *can* regenerate. (#4, #7, #32, #37, #13). The soil in the forest is believed to be particularly fertile, so the trees always regenerate and they regenerate quickly (#4, #7, #13, #31). In the words of one respondent, “Always when you cut here and you leave it, the trees regenerate” (#7).



Personal photo: desert-looking swaths of the forest

8.3 Concluding Remarks

From the foregoing, it appears that the changes incurred by the non-operational land deal on the property regime pertaining to what used to be the Village Forest – now turned into the Mzungu Forest – have had a major impact on the strategies adopted by resource users and the outcomes obtained. Under the common-property regime pertaining to the Village Forest, most resource users throughout most of the time would adopt coordinated strategies. During the 1980s, a growing number of users pursued individual as opposed to coordinated strategies, but by revising the property regime, the number of users pursuing individual strategies declined. Overall, the common-property regime appears to have been fairly effective then. As the non-operational land deal replaced a fairly effective common-property regime with an open-access regime, all charcoal makers using the area now appear to be pursuing individual strategies, the outcome of which is severe degradation of the forest.

9.0 Discussion

9.1 The Village Forest

9.1.1 Effectiveness

Having covered the findings, some of the findings made will be further explored in the following. As the private investors have in fact devised one rule, a major difference between the property regime that pertained to the Village Forest and that which pertains to the Mzungu Forest is that of effectiveness. It is apparent, that the common property regime that originally pertained to the Village Forest was effective enough to prevent any major suboptimal outcomes up until the 1980s. When the number of outsiders invading the forest grew during the 1980s, however, the regime originally in place was no longer sufficiently effective, resulting in a suboptimal outcome.

To improve the outcome, villagers revised the property regime in place. To quickly summarize the revisions made, these included establishing a designated Committee on environmental conservation, implementing rules that restricted outsiders to designated areas of the forest, and which specified the number of trees outsiders were allowed to cut, and more frequent monitoring, now undertaken by the Committee. These revisions seem to have been geared towards not only more frequent but also enhanced monitoring. By confining outsiders to designated areas and by limiting the number of trees that outsiders were allowed to cut, the Committee could easily follow up on the work of outsiders. They could also follow up on their work in greater detail; they could count the number of tree stems remaining from their activities.

As these measures seem to have been geared towards a higher rate of enforcement and they improved the outcome, it seems that they effectively changed the structure of the game. More

specifically, these measures increased the likelihood of being caught and sanctioned when breaking the rules. In a repeated situation, resource users come to learn – through approximations – the extent to which rules are enforced. This seems to have happened amongst resource users of the Village Forest too. As one respondent explained, people now knew that the village had rules and procedures that people had to follow. When outsiders now contemplated breaking the rules, the benefits of breaking the rules no longer outweighed the cost – at least amongst enough users so that the outcome was improved.

9.1.2 Sustainable Resource Use

As the common property regime in place was fairly effective, most resource users abided by the rules in place and adopted coordinated strategies. Although important, an effective property regime is not enough on its own to ensure sustainable resource use and the preservation of resources. The rules must also be well-designed. As the Village Forest, and the many resources therein, were preserved through time, this seems to indicate that the rules in place were in fact well-designed.

It seems that various factors can help account for the success of the rules in place. Among other things, the rules accounted for the different use patterns on the part of different groups of users. For instance, while outsiders only were permitted to harvest x amount of forest produce; villagers were allowed to harvest as much forest produce as they liked. According to one villager, this was because the forest was considered big in relation to villagers' use of the forest.

Underlying this statement, there seems to be an assessment of the intensity of villagers' use of the forest relative to the productive capacity of the forest. It seems that the rate at which

villagers would harvest forest resources, relative to the capacity of the forest to regenerate these, had been deemed modest. Had this not been the case, the forest would presumably be considered small in relation to villager's use. Consequently, villagers' use of the forest did not pose a threat to the forest, even if villagers were allowed to harvest as much forest produce as they liked.

The rules were also adapted to the forest as a resource system. For instance, rules that required resource users to leave the smallest trees and the trees in and around the water sources. These rules were based on traditional knowledge passed down through generations. As much traditional knowledge is tacit, it is perhaps no surprise that the "purpose" of these rules was never articulated as such. However, the function of these rules, when put into western, scientific terms, was still to ensure sustainable forestry practices.

9.2 The Mzungu Forest

9.2.1 (Lack of) Effectiveness: Changing Incentives?

Unlike the common property regime that pertained to the Village Forest, the private property regime pertaining to the Mzungu Forest is highly ineffective, making it an open-access regime in practice. Certainly, the data collected cannot explain the lack of an effective property regime, but because the forest was left to regenerate while Sun Biofuel's operations were still ongoing, the lack of an effective property regime appears to be directly related to the land deal turning non-operational. I therefore find it worthwhile to explore the way in which incentives *might* have changed.

While Sun Biofuel's operations were still ongoing, protecting both the plantation and the expensive equipment located in the area could have produced strong incentives to protect the

area, or at least the area where the plantation and the equipment were located. However, at the time, the forest had been cut down and those from surrounding villages were employed by the company. Consequently, the benefits of protecting the area might have been substantial while the costs might have been less so.

After the project came to an end, there was no longer any equipment to protect and a large number of people have been attempting to use the area. It seems then, that the benefits of protecting the area might have been less substantial at the same time as the costs might have been more substantial. After all, a large number of guards would have had to be hired to cope with all the people attempting to use the area and the principal-agent problem would have had to be overcome.

If Sun Biofuels had had any use for the forest after the company's operations came to an end, deterioration of the forest could of course have produced strong incentives to protect the area. For instance, if the company planned on harvesting timber every so often, protecting the forest would have been important. However, it seems that Sun Biofuels only has had one use for the area after operations ended: to sub-lease it to other investors. The forest then, might just have happened to sit on top of a piece of land that could be sub-leased to other investors.

After the new investors arrived, these investors have been keeping animals in the area, which could produce incentives to protect the area in order to protect the animals. However, the costs of protecting the area might still be greater than the benefits obtained thereof. Had frequent theft of animals been an issue for instance the economic losses incurred might have been substantial enough to make up for hiring more security guards and spend more time and energy overcoming the principal-agent problem.

Still, the operations of the later investors have been confined to a very small part of the entire area. Most of the time it seems that the animals are confined to some enclosures close to the buildings. It is therefore hard to see why the investors would be incentivized to protect the entire area against intruders. Moreover, the later investors only use the remaining parts of the area to graze the animals. Consequently, overexploitation in these parts of the area could be beneficial. After all, overexploitation is leading to a less dense tree cover, which in turn is allowing grasses to grow. If significant overexploitation takes place, the forest might even be converted into grassland, which would be beneficial to anyone wishing to keep animals in the area.

9.2.2 Unsustainable Resource Use

Without an effective property regime in place, local and non-local charcoal makers are pursuing individual strategies. Still, it is notable that they conduct activities in different ways. Local charcoal makers tend to stay in the forest for shorter periods of time, and they tend to make smaller quantities of charcoal. However, local charcoal makers still appear to be pursuing individual strategies. Decisions concerning how long to stay in the forest and how much charcoal to make seemed to come down to practical, and presumably economic, considerations – not rules or agreements between local charcoal makers.

I was encouraged to pursue this in some greater detail, based on the expectation that local charcoal makers still retained some norms amongst themselves it seemed. Efforts were most certainly made to probe further to attempt to reveal such norms, but no such norms were revealed. It seems that this can come down to a lack of property rights. As local charcoal makers, including villagers, no longer hold any property rights to the forest, it is apparent that they would not be guaranteed any of the resulting benefits of crafting, and abiding by, rules

that would prevent them from making charcoal. Without the right to exclude others, resource users cannot be guaranteed the benefits of devising withdrawal rights. Consequently, doing so would most certainly incur costs but with far less certain returns.

Although the strategies of local charcoal makers appear to be less unsustainable so to say, the combined effect of local and non-local charcoal makers' activities amounts to unsustainable resource pressure. Currently, it appears that charcoal makers are engaged in a race to the bottom; everyone is attempting to secure the last few benefits from the forest before it is too late. The outcome of which is rapid degradation. Consequently, the predictions of Hardin might hold in the case of Mzungu Forest, which would imply that the forest eventually ceases to exist.

Importantly, open access regimes need not lead to the unsustainable use of common-pool resources. When demand for resource units is low, there might not be any need for a property regime but when demand for resource units is high, open access can lead to unsustainable use. Based on the work of Hardin and others, this can be explained on the basis of externalities. As common-pool resources are used by more than one person, no one internalizes the full cost of the degradation incurred by their activities. This is of course why privatization has been a common policy prescription. By privatizing resources and assigning exclusive rights to the private owner, the private owner will internalize such externalities. After all, the costs of overexploitation will be borne *only* by the owner.

9.3 Land Access Revisited

It must be acknowledged that an analysis of property rights and regimes and therefore the findings of this thesis do not capture access in a comprehensive manner. For instance, the

findings only reflect access on a group level on the basis of rights and they only reflect “snapshots” of access. Thus, the findings most likely hide significant differences within groups and they do not reflect access as a process. A more holistic and comprehensive approach to access could therefore yield interesting, additional findings.

Still, it seems that the changes to the property regime have impacted the ability of villagers to benefit from the area in significant ways. For instance, under the common property regime once in place, villagers were able to derive a range of forest resources from the forest not just for a brief moment but for decades. Moreover, because villagers owned the forest, they could devise withdrawal rights and thereby obtain tax revenue from outsiders using the forest. By contrast, under the open-access regime currently in place, only wood suitable for charcoal making can be found, but because of unsustainable resource use the output of charcoal making activities has declined significantly.

10.0 Concluding Remarks

Although the impacts of the biofuel policies of the 2000s have been the subject of attention for nearly two decades, some of their many “side effects” are just now being uncovered – including the side effects of non-operational land deals. Given the high opportunity cost of land in countries and regions where these land deals are concentrated, their impact on land access in particular appears to be an issue of critical concern.

While it has been acknowledged that these land deals can alter property rights and thereby property regimes, the particular way in which they do so has not been studied before. By looking into the impact of one such land deal on property regimes as well as resource use and outcome, this thesis seeks to shed light on this so-far understudied topic.

Based on the findings, it appears that the non-operational land deal looked into has had a significant impact on the property regime as well as resource use and outcome. The non-operational land deal replaced a comprehensive common property regime with an open-access regime. What used to be a diverse village forest has therefore been replaced by an increasingly degraded forest.

Importantly, even though property and property regimes can capture access, property and property regimes and therefore the findings only capture access in a narrow and static manner. The findings only reflect access on a group level on the basis of rights and they only reflect “snapshots” of access. Thus, the findings most likely hide significant differences within groups and they do not reflect access as a process. A more holistic and comprehensive approach to access could therefore yield interesting, additional findings.

11.0 References

- Agency, I. E. (2008). *From 1st to 2nd generation biofuel technologies: An Overview of Current Industry and RD&D Activities*.
- Beyene, A., Matondi, P. B., & Havnevik, K. (2011). *Biofuels, land grabbing and food security in Africa*. Bloomsbury Publishing.
- Bombina, K. (2022). *Management practices and perceptions of employee engagement in a local fast-food restaurant*. Theseus. <https://urn.fi/URN:NBN:fi:amk-2022053013227>
- Borras, S. et al. (2022). The value of so-called ‘failed’ large-scale land acquisitions. *Land Use Policy*, 119, Article 106199. <https://doi.org/10.1016/j.landusepol.2022.106199>
- Brittaine, R., & Litaladio, N. (2010). *Jatropha: A Smallholder Bioenergy Crop : the Potential for Pro-poor Development*. Food & Agriculture Organization of the UN (FAO).
- Broegaard, R. B., Vongvisouk, T., & Mertz, O. (2022). The impact of unimplemented Large-Scale land development deals. *Frontiers in Sustainable Food Systems*, 6. <https://doi.org/10.3389/fsufs.2022.789809>
- Bryman, A. (2012). *Social Research Methods* (4th ed.) Oxford University Press.
- Burley, H. & Bebb, A. (2010). *Africa: up for grabs the scale and impact of landgrabbing for agrofules*. Friends of the Earth Europe. Retrieved from https://www.foeeurope.org/sites/default/files/publications/foee_africa_up_for_grabs_0910.pdf
- Clark, T., Foster, L., Sloan, L. Bryman, A. (2021). *Bryman’s Social Research Methods* (6th ed.) Oxford University press.
- Crang, M. & Cook, I. (2007). *Doing Ethnographies*. Sage Publications.
- Dahiya, A. (2014). *Bioenergy: Biomass to Biofuels*. Academic Press.
- Dawes, R. M. (1980). Social dilemmas. *Annual Review of Psychology*, 31(1), 169–193. <https://doi.org/10.1146/annurev.ps.31.020180.001125>

Forsyth, T., & Johnson, C. (2014). Elinor Ostrom's Legacy: Governing the Commons and the Rational Choice controversy. *Development and Change*, 45(5), 1093–1110.

<https://doi.org/10.1111/dech.12110>

Gaya, H. J. & Smith, E. E. (2016) Developing a Qualitative Single Case Study in the Strategic Management Realm: An Appropriate Research Design? *International Journal of Business Management and Economic Research*, 7, 529-538. <http://www.ijbmer.com>

German, L. & Keeler A. G. (2010). “Hybrid institutions”: Applications of common property theory beyond discrete tenure regimes. *International Journal of the Commons*, 4(1), 571–596.

<http://dx.doi.org/10.18352/bmgn-lchr.108>

Hall, R. & Paradza, G. (2012). *Pressures on land in sub-Saharan Africa: Social differentiation and societal responses*. Overseas Development Institute. Retrieved from http://landwise-production.s3.amazonaws.com/2022/03/Hall_Pressures_on_land_in_sub_saharan_africa_social_differentiation_and_social_responses_2012-1.pdf

Heller, J. (1996). *Physic Nut, Jatropha Curcas L.* Bioersivity International.

ICAP. (n.d.). *Tanzania_Regions_31-01*. ICAP Global Health.

https://icap.columbia.edu/where-we-work/tanzania/tanzania_regions_31-01/

Khan Academy. (n.d.). *The Gold Rush*. Retrieved December 1, 2023, from

<https://www.khanacademy.org/humanities/us-history/the-gilded-age/american-west/a/the-gold-rush>

Kheshgi, H. S., Prince, R. C., & Marland, G. (2000). The potential of biomass fuels in the context of global climate change: Focus on transportation fuels. *Annual Review of Energy and the Environment*, 25(1), 199–244. <https://doi.org/10.1146/annurev.energy.25.1.199>

- Komarek, A. M., De Pinto, A., & Smith, V. H. (2020). A review of types of risks in agriculture: What we know and what we need to know. *Agricultural Systems*, 178, Article 102738. <https://doi.org/10.1016/j.agsy.2019.102738>
- León, L. F. A. (2016). Property regimes and the commodification of geographic information: An examination of Google Street View. *Big Data & Society*, 3(2), Article 205395171663788. <https://doi.org/10.1177/2053951716637885>
- Londo, M., & Deurwaarder, E. (2007). Developments in EU biofuels policy related to sustainability issues: overview and outlook. *Biofuels, Bioproducts and Biorefining*, 1(4), 292–302. <https://doi.org/10.1002/bbb.40>
- Lune, H. & Berg, B. L. (2017). *Qualitative research methods for the social sciences* (9th ed.) Pearson.
- Manik, Y., Leahy, J., & Halog, A. (2013). Social life cycle assessment of palm oil biodiesel: a case study in Jambi Province of Indonesia. *The International Journal of Life Cycle Assessment*, 18(7), 1386–1392. <https://doi.org/10.1007/s11367-013-0581-5>
- Meadows, D. (2008). *Thinking in systems*. Chelsea Green Publishing.
- Merriam, S. B., Tisdell E. J. (2015). *Qualitative research: A guide to design and implementation* (4th ed.) Jossey-Bass.
- Miller, C. et al. (2021). *Forest, trees and poverty alleviation in Africa: an expanded policy brief*. Global Forest Expert Panels (GFEP) Programme & International Union of Forest Research Organizations (IUFRO). Retrieved from https://www.greenpolicyplatform.org/sites/default/files/downloads/resource/Forests_trees_and_poverty_alleviation_in_Africa.pdf

Moreda, T. (2023). The social dynamics of access to land, livelihoods and the rural youth in an era of rapid rural change: Evidence from Ethiopia. *Land Use Policy*, 128, Article 106616.

<https://doi.org/10.1016/j.landusepol.2023.106616>

Morris, M. J., Binswanger, H. P., & Byerlee, D. (2009). Awakening Africa's sleeping giant. In *The World Bank eBooks*. <https://doi.org/10.1596/978-0-8213-7941-7>

Nolte, K. (2020). Doomed to fail? Why some land-based investment projects fail. *Applied Geography*, 122, 102268. <https://doi.org/10.1016/j.apgeog.2020.102268>

Nolte, K. & Sipangule, K. (2017). Land use competition in SubSaharan Africa's rural areas. *PEGNet Policy Brief, No. 10/2017*, Kiel Institute for the World Economy (IfW), Poverty Reduction, Equity and Growth Network (PEGNet), Kiel. <http://hdl.handle.net/10419/168329>

Norwich University. (n.d.). Historical Impact of the California Gold Rush. Norwich

University: Online Programs & Certificates. Retrieved December 1, 2023, from

<https://online.norwich.edu/historical-impact-california-gold-rush#:~:text=The%20Gold%20Rush%20also%20had,chemicals%20from%20the%20mining%20process>

Oksanen, S. et al. (2019). *Advanced Biofuels what holds them back?*. IRENA. Retrived from [https://www.irena.org/-](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Nov/IRENA_Advanced-biofuels_2019.pdf)

[/media/Files/IRENA/Agency/Publication/2019/Nov/IRENA_Advanced-biofuels_2019.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Nov/IRENA_Advanced-biofuels_2019.pdf)

Openshaw, K. (2000). A review of *Jatropha curcas*: an oil plant of unfulfilled promise.

Biomass and Bioenergy, 19(1), 1–15. [https://doi.org/10.1016/s0961-9534\(00\)00019-2](https://doi.org/10.1016/s0961-9534(00)00019-2)

Ostrom, E., Gardner, R. & Walker, J. (1994). *Rules, Games, and Common-Pool Resources*.

University of Michigan Press.

Pacini, H., Silveira, S., & Da Silva Filho, A. C. (2013). The European Biofuels Policy: from where and where to? *European Energy Journal*, 3(1), 17–36.

<https://doi.org/10.4337/eeej.2013.01.02>

Pyman, D. H. (2021). *The risk-return trade-off to diversified agriculture in Malawi : a quadratic programming approach*. Theseus. <http://hdl.handle.net/10019.1/109912>

Quintana, A., & Campbell, L. M. (2019). Critical Commons Scholarship: A typology. *The International Journal of the Commons*, 13(2), 1112–1127. <https://doi.org/10.5334/ijc.925>

Ribot, J., & Peluso, N. L. (2003). A theory of access*. *Rural Sociology*, 68(2), 153–181.

<https://doi.org/10.1111/j.1549-0831.2003.tb00133.x> Timilsina, G. R. (2014). Biofuels in the

long-run global energy supply mix for transportation. *Philosophical Transactions of the Royal Society A*, 372(2006), Article 20120323. <https://doi.org/10.1098/rsta.2012.0323>

Schlager, E. & Ostrom E. (1992). Property-Rights Regimes and Natural Resources: A Conceptual Analysis. *University of Wisconsin Press*, 68(3), 249-262.

<https://doi.org/10.2307/3146375>

Sterman, J. D. (2002). All models are wrong: reflections on becoming a systems scientist. *System Dynamics Review*, 18(4), 501–531. <https://doi.org/10.1002/sdr.261>

Sorda, G., Banse, M., & Kemfert, C. (2010). An overview of biofuel policies across the world. *Energy Policy*, 38(11), 6977–6988. <https://doi.org/10.1016/j.enpol.2010.06.066>

Suzuki, K., & Ishiwata, R. (2022). Impact of a carbon tax on energy transition in a deregulated Market: A Game-Based Experimental Approach. *Sustainability*, 14(19), Article 12785.

<https://doi.org/10.3390/su141912785>

Timko, J. A., Waeber, P. O. & Kozak, R. A. (2010). The socio-economic contribution of non-timber forest products to rural livelihoods in Sub-Saharan Africa: knowledge gaps and new directions. *The International Forestry Review*, 12(3), 284-294.

<https://www.jstor.org/stable/24310584>.

Von Maltitz, G., Gasparatos, A., & Fabricius, C. (2014). The rise, fall and potential resilience benefits of *Jatropha* in Southern Africa. *Sustainability*, 6(6), 3615–3643.

<https://doi.org/10.3390/su6063615>

Wagner, D. (2018, March 11). How California’s Gold Rush Forged the Path for Today’s Tech Innovators. Kqed. Retrieved December 1, 2023, from

<https://www.kqed.org/news/11655090/how-californias-gold-rush-forged-the-path-for-todays-tech-innovators>

Wagner, J. & Talaki, M. (2007). Customs, Commons, Property, and Ecology: Case Studies From Oceania. *Society for Applied Anthropology*, 66(1), 1-10.

<http://www.jstor.org/stable/44127023>

Wieczorek, A. M. & Wright, M. G. (2012) History of Agricultural Biotechnology: How Crop Development has Evolved. *Nature Education Knowledge* 3(10) Retrived from

<https://www.nature.com/scitable/knowledge/library/history-of-agricultural-biotechnology-how-crop-development-25885295/>

Wineman, A., Jayne, T.S., & Stevens, C. (2021). *The Relationship Between Medium-Scale Farms and Deforestation in Sub-Saharan Africa*. USAID. Retrieved from [https://www.land-](https://www.land-links.org/wp-content/uploads/2022/01/INRM-Activity-7.3-Medium-scale-farms-and-deforestation-FINAL-2021-11-3508.pdf)

[links.org/wp-content/uploads/2022/01/INRM-Activity-7.3-Medium-scale-farms-and-deforestation-FINAL-2021-11-3508.pdf](https://www.land-links.org/wp-content/uploads/2022/01/INRM-Activity-7.3-Medium-scale-farms-and-deforestation-FINAL-2021-11-3508.pdf)

World Atlas. (2021, May 15). *East African Countries*.

<https://www.worldatlas.com/geography/east-african-countries.html>

World Bank Africa Region. (2017, February 24). *Forests in Sub-Saharan Africa: Challenges & Opportunities*. Profor. Retrieved December 5, 2023, from

<https://www.profor.info/knowledge/forests-sub-saharan-africa-challenges-opportunities>

Yalew, A. W. (2015). The perplex of deforestation in sub-Saharan Africa. *Journal of Tropical Forestry and Environment*, 5(1). <https://doi.org/10.31357/jtfe.v5i1.2494>

Zamda, M. (2010). *Perceptions and realities of biofuels investment in rural livelihood: the case of Kisarawe district, Tanzania* [MA thesis]. Linköping University.

Appendices

Appendix 1 – Interview guide

Interview guide

Demographics

How old are you?

How long have you lived in the village?

What do you do for a living?

Before Sun Biofuels

*Specify: “now focus on the forest given up by village to sun biofuels, *before* sun biofuels came”

What was the forest used for before?

Who used the forest before?

Who managed the forest before Sun Biofuels came?

How was the forest managed?

Implications for use/forest/sustainability

After Sun Biofuels

*Specify: now moving to time *after* Sun Biofuels left

What is the area used for?

Who are using the area now?

Who manage the area now?

How is the area managed?

Implications for use/forest/sustainability



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