(Source: author)

Turning green into black in REDD+ forests

Preventing deforestation for charcoal production in the Kasigau Corridor REDD+ Project Area (Kenya)

CEU CENTRAL EUROPEAN UNIVERSITY

A thesis submitted to the Department of Environmental Sciences and Policy of Central European University in part fulfilment of the Degree of Master of Science

Turning green into black in REDD+ forests: Preventing deforestation for charcoal production in the Kasigau Corridor REDD+ Project Area (Kenya)

Ivana KESTEN

July, 2015

Budapest

Notes on copyright and the ownership of intellectual property rights:

(1) Copyright in text of this thesis rests with the Author. Copies (by any process) either in full, or of extracts, may be made only in accordance with instructions given by the Author and lodged in the Central European University Library. Details may be obtained from the Librarian. This page must form part of any such copies made. Further copies (by any process) of copies made in accordance with such instructions may not be made without the permission (in writing) of the Author.

(2) The ownership of any intellectual property rights which may be described in this thesis is vested in the Central European University, subject to any prior agreement to the contrary, and may not be made available for use by third parties without the written permission of the University, which will prescribe the terms and conditions of any such agreement.

(3) For bibliographic and reference purposes this thesis should be referred to as:

Kesten, I. 2015. *Turning green into black in REDD+ forests: Preventing deforestation for charcoal production in the Kasigau Corridor REDD+ Project Area (Kenya).*Master of Science thesis, Central European University, Budapest.

Further information on the conditions under which disclosures and exploitation may take place is available from the Head of the Department of Environmental Sciences and Policy, Central European University.

Author's declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Ivana KESTEN

CENTRAL EUROPEAN UNIVERSITY

ABSTRACT OF THESIS submitted by:

Ivana KESTEN

for the degree of Master of Science and entitled: **Turning green into black in REDD+ forests: Preventing deforestation for charcoal production in the Kasigau Corridor REDD+ Project Area (Kenya)**

Month and Year of submission: July, 2015.

Charcoal is one of the major drivers of deforestation at the Kasigau Corridor REDD+ Project Area and in Kenya, which is rapidly losing its forest cover despite law reforms and bold goals for reforestation. Two ways towards preventing deforestation for charcoal purposes in the Kasigau Corridor REDD+ Project Area, Kenya were assessed: direct and in-kind compensation. Seventy-four semi-structured interviews with current (68), past (5) and future (1) charcoalers were conducted in May 2015 in Sagalla, one of the six administrative locations of the Project Area where charcoaling is prevalent. Findings suggest that, should direct compensation be put in place, it could differentiate between either male and female, permanent and seasonal charcoalers or Charcoal Producers Association members and non-members, as there is a significant profit difference in each of the binary oppositions. The average monthly reported profits is KES 9,626 per person (87USD) and it could be compensated through carbon finance should 89ha be designated as a REDD+ area. Another option is covering for school fees of charcoalers' children to the average monthly amount of KES 4,057 (41USD) to those two thirds that claimed that they would stop charcoaling should such compensation be put in place. Here, only significant difference of the three categories was between female and male charcoalers, and the in-kind compensation model should take that into the account. Other recommendations include providing income-generating alternatives, loans and funds and providing water to the communities to even larger extent.

Keywords: charcoal, compensation, compensation, payments for ecosystem services (PES), Reducing Emissions from Deforestation and Forest Degradation (REDD+).

Acknowledgements

This thesis would not have been possible without my supervisors: Dr. Brandon Anthony of Central European University (CEU) and Dr. Mwangi Githiru of Wildlife Works. They have guided me throughout the entire process and kept me motivated. I have learnt a great deal while working with them. I am thankful to John Harbord and Robin Bellers of CEU Academic Writing Centre who have both supported me at some stage of my thesis writing. My writing skills have improved substantially throughout my work with them.

Nothing would have been possible without Full fellowship and Research Travel Grant received from the Central European University. In-kind support from Wildlife Works has proven to be crucial in making this research happen. I am thankful for both of these contributions.

I would like to thank also my team in Kenya, who have supported the research in various ways. Simon Kasaine from Social Monitoring Department was a wonderful encouragement and a source of useful information. Rehema Mwauo, my dear friend, was there with me each day throughout the research, accompanying me to the field and sharing all the joys and dangers of this endeavour. Carol Wakesho stepped in the last week of the research to replace her. Laurian Lenjo and Joseph Mwakima were of particular help in the initial phases of the research. I am particularly thankful to Rob Dodson, who flew me over the Project Area in his gyrocopter for monitoring for charcoal production from the air. I would like to thank all the Sagalla community representatives who were helpful in organizing interviews with charcoalers.

Entire Wildlife Works team on the ground was supportive and welcoming and I am utterly thankful. Rob and Lore Dodson, Cara Braund, Keith Hellyer and all the rest of the friendly people I have met there have made my one month in Kenya more enjoyable than I could have ever imagined it. All the wildlife drives, visits to the coast and our evening gatherings remain a dear memory.

My family, including the one from home for children without parental support where I grew up, my friends and many others always believed in me made me who I am. I could not be happier to have you in my life. Finally, I would like to thank my husband Christoph Baumann for always being there for me and pushing me to fulfil my dreams. This research by far fits this description, as well as the life I share with him.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

CCB(A)	Climate, Community & Biodiversity (Alliance)
CEU	Central European University
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
CPA	Charcoal Producers Association
CPG	Charcoal Producer Groups
ES	Environmental Services
EU ETS	European Union Emissions Trading System
FPIC	Free, Prior and Informed Consent
GHG	Greenhouse gas
ISEEA	Integrated System of Environmental Economic Accounts
IUCN	International Union for Conservation of Nature
KES	Kenyan shilling
KFS	Kenya Forest Service
NEMA	National Environmental Management Authority
PES	Payments for ecosystem services
PSA	Paying for Environmental Services
REDD	Reducing Emissions from Deforestation and Forest Degradation
REDD+	(a) Reducing emissions from deforestation; (b) Reducing emissions from forest degradation; (c) Conservation of forest carbon stocks; (d) Sustainable management of forests; (e) Enhancement of forest carbon stocks.
tCO_2	Metric ton of carbon dioxide ($1tCO_2 = 0.27tC$)
TEK	Traditional Earth Kiln
TEEB	The Economics of Ecosystems and Biodiversity
UNFCCC	United Nations Framework Convention on Climate Change
WAVES	Wealth Accounting and the Valuation of Ecosystem Services
VERs	Voluntary Emissions Reduction credits
VCS	Verified Carbon Standard

1 Introduction

Forests' major contribution to climate regulation is being put in jeopardy by heavy deforestation worldwide (Chakravarty *et al.* 2012). Eastern and Southern Africa are especially badly affected, with a reported 0.66% rate of forest loss in the period 2000-2010, amongst the highest rates in the world (FAO 2010). In Kenya, where forests covered 10% of its surface in 1963, in 2012 it was only 6.1% (3.445 million ha) with a decreasing trend (WB 2012). Charcoal burning is the second biggest cause of deforestation in Kenya and it provides domestic energy for most of the urban and part of the rural households (MEWNR 2013).

In Kenya the problem of deforestation is made worse by ineffective state regulation, which has not been able to find an acceptable solution for this rapid forest loss (Owen 2013). An attempt to slow it down was made in 1986, when charcoal production was made illegal (MEWNR 2013). As this was not successful, in 2009 Forest Regulations were reformed, which allowed for charcoalers to legally form Charcoal Producer's Associations (CPA). Through this association, they could then acquire permits should they prove adequate reforestation or other types of sustainable charcoal production (Forest Regulations 2009). However, due to various obstacles (Owen 2013), this has created a grey area that may have allowed increased charcoal production (WW BSMD 2015).

One path towards a solution might be REDD+ (**R**educing **E**missions from **D**eforestation and forest **D**egradation **+** conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks). The United Nations Framework Convention on Climate Change (UNFCCC) started this payment for ecosystem services (PES) programme in 2005 because of the contribution of forests to prevention of climate change (Holloway and Giandomenico 2009). PES means that ecosystems' numerous provisioning, regulating, cultural and supporting services become economically perceivable through the creation of a market, in this case, a carbon market (Gómez-Baggethun *et al.* 2010). Instead of, for instance, charcoaling, forest owners are provided with an income should they decide to turn their forest area into a conserved REDD+ project. In this way, the human vs. nature conflict could be turned into a win for both sides. Once established, the project area can be managed either by government bodies or private organizations and/or NGOs. Conserved forests' carbon storage capacity is calculated and a corresponding number of carbon credits are issued to the owner(s) or the manager(s) of the land. Subsequently, these credits are bought by either developed countries or private companies as a means of carbon offsetting, thus creating a market solution to the environmental problem (Gómez-Baggethun et al. 2010).

The Kasigau Corridor REDD+ Project Area is the first REDD+ project established in 2008 by Wildlife Works. As a pioneer, it aided many following projects both in Kenya and in the world with their knowledge and experience (Wildlife Works 2014b). With the expansion of the Project Area to the Phase III ranches, there will be even more exposure to heavily charcoaled areas. Kasigau Corridor is a suitable case study to investigate the potential of REDD+ for minimising deforestation for charcoal purposes in Kenya. The land owners here are, amongst others, local communities, which makes distribution of carbon income somewhat challenging. So far, accumulated funds were invested according to the wishes of communities in, e.g. school bursaries, provision of water, school conditions improvement (Wildlife Works 2014b). These indirect payments however, as Engel *et al.* (2008) also point out, might not be enough to induce long-term changes in land-use preferences. Therefore, research is needed to investigate other ways of compensating charcoalers, for instance, through direct payments or some other type of in-kind compensation.

Indirect payments in terms of community benefits have not incentivized many charcoalers to move away from the activity within the Kasigau Corridor. Direct compensation has proven to be a successful scheme for achieving the aim of conservation (Clements *et al.* 2013, Pagiola 2008; Xu and Cao 2002). It is argued that, should a direct payment conversation scheme be put in place, it should unambiguously target the cause of deforestation (Clements *et al.* 2013) It is also imperative to take into account different categories of payment beneficiaries, in order to maximize the scheme's efficiency (Flury *et al.* 2005). Both direct and further indirect compensation options that have not been applied so far will be explored.

1.1 Research question

This thesis will address the question: "What measures can be put in place to minimise illegal charcoal production at the Kasigau Corridor REDD+ Project Area?" To answer this successfully, two options are investigated. First, the level of direct financial compensation required will be estimated for charcoalers should they quit producing charcoal. To do this, first it is necessary to understand general demographics, as well as charcoal related characteristics of the sample. Different categories of charcoalers might need different direct compensation (Flury *et al.* 2005). After that, profit components of each of these categories will be calculated both per person per month and per bag, so as to indicate direct compensation necessary. These opportunity costs will subsequently be coarsely compared to potential earnings from REDD+ financing.

The second option is to identify incentives beyond direct financial compensation, that have not been implemented so far and that would encourage charcoalers to cease unsustainable charcoal

production. The first part of this process is to understand charcoalers' attitudes towards this activity, including the reasons for engagement. Tackling the reasons might be a way forward to develop a workable compensation scheme. As sustainable charcoaling is the closest alternative activity, this will be analysed in the context of reformed Charcoaling Regulations. Once this is investigated, other alternative livelihoods will be addressed as well. To support this, five cases of ex-charcoalers will be examined, so as to understand what their reasons for quitting the activity were. Below is a summary of the thesis aims and objectives:

Aim 1: To estimate level of direct financial compensation for different categories of charcoalers needed to incentivise them away from this activity in the Kasigau Corridor REDD+ Project Area.

Objective 1.1: To identify demographic and general charcoaling characteristics of charcoalers.

Objective 1.2: To identify profit components of local charcoal production of different categories of charcoalers.

Objective 1.3: To estimate the potential of carbon revenues to finance the compensation model.

Aim 2: To investigate other incentives beyond direct financial compensation that can also catalyse a departure from this activity.

Objective 2.1: To understand attitudes of charcoalers towards charcoaling.

Objective 2.2: To understand attitudes towards sustainable charcoaling options.

Objective 2.3: To identify alternative livelihood options.

This research is important for various reasons. First, it is necessary for local management of the forest and carbon stock by Wildlife Works. Financial data on how much money charcoalers are actually making can inform the feasibility of the direct compensation model. Second, the results of this research will be communicated to the Kenyan government, especially Taita-Taveta County where the Project is based, with which Wildlife Works cooperates on solving the issue. Implementation of current Charcoal Regulations will be one of the important topics of discussion with charcoalers. Charcoalers will also be asked about their recommendation for the government regarding charcoaling issues. Third, there is little empirical research (Merger *et al.* 2012) related to opportunity costs of charcoal production as it pertains to REDD+ both locally and globally. Local-

empirical studies are needed to contribute to global approaches and simulation models, which in turn define global REDD+ policies (Wertz-Kanounnikoff 2008).

1.2 Methods

Fieldwork was conducted at the Kasigau Corridor REDD+ Project Area, Kenya, in Sagalla location (one of six locations of the Project Area) in May 2015. This location was selected because of both its high prevalence of charcoal production and proximity to researcher's base: Maungu town. The sample included both genders, charcoalers of a wide spectrum of ages, level of education, household sizes, CPA and non-CPA members, seasonal and permanent charcoalers. Sixty-eight charcoal producers, five ex-charcoalers and one person planning to become a charcoaler were interviewed. Although initially planned to be random, the sampling design changed due to various obstacles encountered and the results can only be applied to the interviewed sample. Once the data was collected, it was analysed both quantitatively and qualitatively. Quantitative methods were used more for financial and numerical data and calculating direct compensation. A qualitative method was applied for gathering information on solutions beyond direct compensation.

1.3 Thesis outline

Chapter 2 will present how the research contributes to the ongoing discussion in the field of ecological economics, REDD+ to be more specific. After that, Chapter 3 will elaborate how the research was carried out, including both methods of data collection and data analysis. Chapter 4 discusses general demographics and charcoaling characteristics of the sample. Chapter 5 will elaborate on the direct compensations needed and Chapter 6 on in-kind compensation. Charcoalers' recommendations and recommendations from the author are separated each in its own chapter.

2 Literature review

This literature review locates the research problem in the context of existing literature (Figure 1) and outlines how this research contributes to knowledge in the area. First, it sets a broader picture on payments for ecosystem services (PES) for forests, with a discussion on compensation possibilities. It then moves on to REDD+ as one of the PES schemes, including its perceived strengths and weaknesses, and influence on livelihoods. This is followed by a general description of deforestation for charcoal purposes, first in Kenya, then within the Kasigau Corridor. A study area, as well as the organization managing it is introduced, and peculiarities of REDD+ programmes are further elaborated. This research fits mainly within the field of ecological economics, and aims at providing a path towards a long-term solution for illegal deforestation for charcoal purposes at Kasigau. Finally, although opportunity costs are presented as the main tool for determining a potential financial deterrent to deforestation, other non-financial options are also explored.

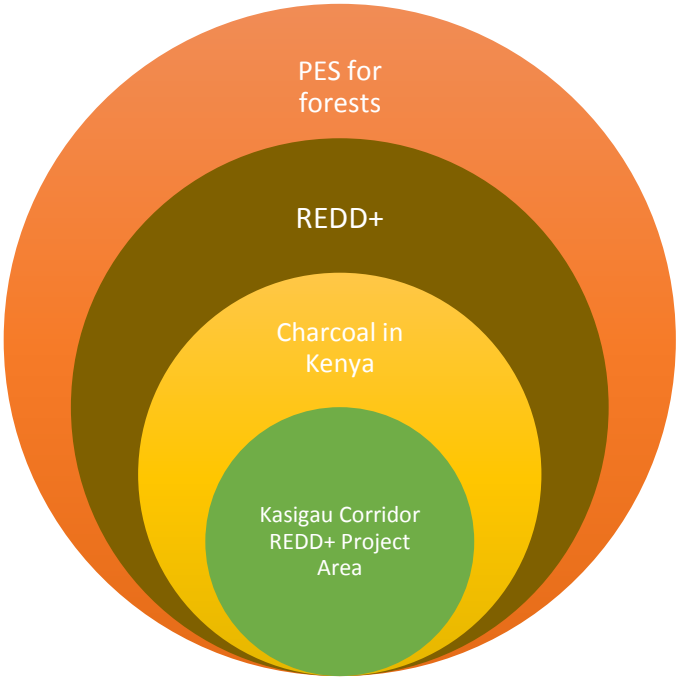


Figure 1 Structure of literature review

2.1 Payments for ecosystem services of forests

PES have been stirring discussions in the environmental arena for a few decades (Gómez-Baggethun *et al.* 2010). This controversial topic occupies the attention of ecological economists, conservationists and human rights activists, amongst others, in an attempt to diminish the economic invisibility of nature. As a recent UNEP report (2014, 1) put it, "PES refers to situations

where a specific, usually local, agreement is made for users of an ecosystem service to pay the providers of that service".

Although the discussion about PES started earlier (Gómez-Baggethun *et al.* 2010), it gained momentum with the first attempt to put value on these services by Costanza *et al.* in 1997. The Millennium Ecosystem Assessment by UNEP in 2003 caused a proliferation of academic responses and pushed the topic to the mainstream policy domain (Gómez-Baggethun *et al.* 2010). Gómez-Baggethun *et al.* (2010) argue further that PES came on the agenda of, to name a few, the United Nations with their Integrated System of Environmental Economic Accounts (ISEEA), and the World Bank with their Wealth Accounting and the Valuation of Ecosystem Services (WAVES). This meant that, for the first time, natural resources were mainstreamed in development planning and national economic accounts. The European Union Emissions Trading System (EU ETS) and other trading platforms followed, providing a market for transactions to take place. Both mandatory and voluntary trading schemes allow mainly private companies to offset their carbon emissions and pay for forests' ecosystem services. One of the newer initiatives is The Economics of Ecosystems and Biodiversity (TEEB) that is developing country studies, as well as various case studies (Hedden-Dunkhorsta *et al.* 2015). They aim to mainstream values of biodiversity and ecosystem services into decision-making at all levels.

All these initiatives illustrate numerous benefits of the PES approach. These include the translation of externalities into clear financial incentives (Engel *et al.* 2008; WWF 2009). A second involves making nature's value more visible. On the example of forests, PES makes the following services economically perceivable:

- provisioning of food, wood, fibre and fuel,
- regulating for erosion control, flood prevention, climate regulation, carbon sequestration and water purification,
- cultural services, such as aesthetic and spiritual, recreation and education, tourism industry and
- supporting services like nutrition cycling, soil formation, species and habitat conservation (UNEP 2014).

The total value of, for instance, tropical forest per hectare was estimated to be around 2,000USD per ha per year in 1994-dollar values (Costanza *et al.* 1997). Having this figure might be helpful for planning and management of forests, while taking into account their "real" value. PES is considered particularly effective for rural development, poverty alleviation and creating long-term commitment for conservation of the ecosystem (UNEP 2014), as an alternative to donations.

However, the main opponents of PES point out drawbacks and moral issues related to monetizing services provided by nature (Costanza *et al.* 1997; Engel *et al.* 2008; Lele *et al.* 2013; Norgaard and Bode 1998; Redford and Adams 2009; Spash 2008; Norgaard 2010).

Costanza *et al.* (1997) pointed out in their seminal paper that there are several methodological and economic related problems, like distorted prices, inaccuracy of willingness-to-pay due to imperfect knowledge, and lack of dynamics in the model. Engel *et al.* (2008) argue that environmental subsidies such as PES are only second best to environmental taxes, as the subsidies suffer from additionality or paying for activities that would have been performed anyway. Leakage, shifting of unwanted activities to other areas could be of particular issue arising from stopping deforestation at a limited area (WWF 2009) such as Kasigau Corridor. Angelsen (2008) argues that leakage is more likely in situations where labour and capital mobility are high, occupation of adjacent lands easy, and returns from REDD-barred activities high. Engel *et al.* (2008) also point out social inefficiencies: payments, particularly indirect ones, might not be enough to induce change in land-use preferences. Leakage and social inefficiency are some of the issues that will be addressed in this thesis. Norgaard (2010) concluded that PES does not deserve the amount of attention and application, as it over-simplifies the nature of environmental problems the planet is facing.

2.2 Compensation within PES schemes

PES schemes function with a form of compensation. Compensation for Environmental Services (ES) means that those who bear direct or opportunity costs from conservation scheme should be compensated (Wunder 2005). He also claims that the choice between PES cash and in-kind payments is highly context-dependent, especially in the case of illegal resource use, like charcoaling in Kenya. Valid concern in compensating illegal users is that PES could eventually endorse crime (Vogel 2002) or create perverse incentives (Pagiola *et al.* 2002), pushing currently legal workers into illegal activities, in order to benefit from the payments. Costa Rica seems to be achieving wanted aims without mentioned problems, though (Wunder 2005). Wunder (2005) argues also that 'providers surplus' or gains from the transaction that exceed their costs and thus make them better off, should be avoided.

For deciding on the right balance of the direct (aim 1 of the thesis) and indirect (aim 2) compensation it is advisable to think *ex ante* and even experiment with selection and the periodicity of payment Wunder (2005). This research will offer a couple of suggestions that could be experimented with. Wunder (2005) also summarised advantages and disadvantages of direct compensation on an example of farmers in Bolivian watershed; cash and beehives (more

environmentally friendly alternative source of income) are compared. On the side of the advantages is that cash is more flexible, it can have impressive poverty–alleviation impact and has smaller administrative cost (Conrad and Ferraro 2001; Ferraro and Simpson 2002; Hanlon 2004). It also corresponds to ES suppliers' short-term interest: if they can receive more benefits from clearing an area of habitat than they could from protecting it, they will clear it (Ferraro and Kiss 2002).

On the side of the disadvantages of direct payments, especially rather short-term ones, is that cash may leave no long-run benefits. Disadvantage of beehives is that creating alternative livelihoods means costs of training and staff of implementing organization, as well as time costs of working on the beehives. Beehives are also inflexible to sell or subdivide (Robertson and Wunder 2005; Wunder 2005).

Another example of indirect compensation would be in some form of complementary inputs such as contingent transfers of infrastructure (school, road) or providing education, some of which were already implemented at Kasigau Corridor. A problem in this approach is that large up-front benefits are dubious incentives for a continuous supply of contracted services over time, as one cannot credibly sanction non-compliance (Wunder 2005).

Direct compensation is a preferred option when suppliers of ES forgo cash income to comply with a PES and when local capacities for saving, investment and entrepreneurship are in somewhat good shape, which is the case with Kasigau charcoalers. Finally, the best solution is to offer various payment modes, even in the same village (Wunder 2005). The direct payment for conservation looks different in different countries. For instance, in Costa Rica it is 35USD per hectare of forest protected annually (Ortiz 2002), in Guyana 1.25USD per hectare per year (Rice 2002), in Kenya's migration corridors on private land through conservation leases 10USD per hectare per year (Gullison *et al.* 2000).

The example of direct payment for biodiversity conservation in Cambodia, Clements *et al.* (2013) argue, shows that it is an effective tool for delivering conservation outcomes, in a way that also delivers development benefits to local people. They further claim that payments significantly improved the success of conservation at an annual cost of 30,000USD given to local people as conditional payments. They also argue that it is important for any direct payment conversation scheme that payments correctly target the cause of deforestation, which in the case of Kasigau Corridor would be happening. It is also imperative to take into account different categories of payment beneficiaries, in order to maximize the scheme's efficiency (Flury *et al.* 2005).

For the direct compensation calculation, opportunity costs will be taken as a measurement of the amount needed. They are defined as "costs of an alternative that must be forgone in order to pursue a certain action or the benefits you could have received by taking an alternative action" (Henderson 2008). Opportunity costs of forest conservation are, therefore, the difference between benefits from charcoal production and benefits from forest conservation.

As the World Bank manual on opportunity costs argues (2011), REDD+ affects, and potentially benefits, a wide range of land users, such as farmers, ranchers, loggers, private businesses, and charcoal producers. Organizations managing REDD+ projects need to decide how to prioritize programs and share the benefits. Identifying the opportunity costs of participating in REDD+ programs helps decision makers to facilitate the process of developing benefit-sharing schemes (WB 2011).

Apart from the direct, on-site opportunity costs, there can also be non-financial costs: social-cultural and indirect costs (WB 2011). Examples of social-cultural costs include psychological, spiritual or emotional impacts of livelihood change, loss of local knowledge, and erosion of social capital. Indirect, off-site costs are often borne by downstream actors of associated product supply chains and influenced by potential price increases in timber, agricultural and ranching products, food, fiber and fuel (WB 2011). This research will focus mainly on the financial opportunity costs, and include social-cultural aspects to a minor degree. This is due to the fact that assessing social-cultural aspects are more difficult to understand through the method chosen in this research: direct in-person interviews with charcoalers themselves. For understanding social-cultural opportunity costs, larger scale community condition should be investigated, including historical analysis of engagement with charcoaling.

2.3 REDD+

Corbera (2012) calls REDD (Reducing Emissions from Deforestation and forest Degradation) the world's largest experiment in PES. REDD+ is an environmental policy that tackles two major crises simultaneously: greenhouse gas (GHG) emissions leading to climate change, and deforestation and forest degradation. To put the emissions from deforestation into perspective, it is important to note that reducing emissions from land use change contributes to total greenhouse gases by 18.2%, whereas the entire transportation sector contributes only 13% (WRI CAIT 2005). REDD+ initiative, as one of the main mechanisms of climate change mitigation in the world, comes with benefits such as conservation and enhancement of carbon stock, biodiversity, economic productivity, water supply, soil protection, protection of indigenous and local community territories, sustenance, etc.

The idea of REDD was launched at the 11th session of the Conference of the Parties (COP-11) to the United Nations Framework Convention on Climate Change (UNFCCC) in Montreal in 2005 (Angelsen *et al.* 2012). In the beginning, REDD focused on reducing emissions from deforestation and forest degradation only. In 2007 at the COP-13 it was expanded in the Bali Action Plan. In 2010, at COP-16, REDD evolved to REDD+, and included now also conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks (Holloway and Giandomenico 2009).

It very soon came to be regarded as potentially one of the most effective and efficient mitigation strategies available today (Stern 2006). According to Stern (2006), the cost of eliminating most deforestation would be only 1–2USD per tCO_2 on average. He argues that this is very inexpensive compared to almost all other mitigation options. These estimates have been, however, criticised and Kindermann *et al.* (2008), for example, argue that the costs would be higher. This research will join this debate and try to assess whether REDD+ revenues could lead to stopping deforestation. Another reason for the popularity of REDD+ is that it aims for reforms and transformational change beyond the forestry sector, which is different and more promising than any previous approach to tackling deforestation (Angelsen *et al.* 2012; Kanninen *et al.* 2010).

Since it was launched, there was a slow progress in global climate negotiations, which resulted in insecurity for the long term funding of REDD+ (Angelsen *et al.* 2012). This, together with strong interest for domestic business as usual has had an influence on the further pace and form of REDD+ development. Nevertheless, 28 tropical forest countries, as well as hundreds of local REDD+ projects have started (Angelsen *et al.* 2012), including Kasigau Corridor REDD+ Project Area.

According to REDD Monitor (2011), many controversies of REDD+ implementation have been observed so far. One concerns the additionality principle: it should be proven that forests would be destroyed if there were no for REDD+. In this way, already sustainably managed forests are not eligible for funding; those that were previously "misbehaving" are rewarded. Furthermore, it is not clearly defined what a forest is. Although two types of different tree species might provide equal amounts of carbon storage, not all of them protect biodiversity to the same extent. For example, plantation can also be seen as a forest worth protecting under REDD+, although it already has another commercial purpose and has potentially destroyed native forest that was there before. In addition, similar to other conservation projects, there is a fear that people will need to be displaced or forced to leave the REDD+ area, thus becoming REDD+ refugees. Carbon markets are also being criticized for encouraging carbon offsetting instead of emission reduction.

This is not considered the right approach by many environmentalists (REDD Monitor 2011). Other major problem is the relationship between those that manage a REDD+ project and local and indigenous people directly benefitting from the forest. Before establishing a project, Free Prior and Informed Consent (FPIC) is needed. Negotiations between project proposer and communities with rights can go on for months, even years, and there is no guarantee that the final agreement will be reached (WW BSMD 2015). A very important aspect of these negotiations is the maintenance of sustainable livelihoods, defined as "a livelihood which (…) can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation" (Chambers and Conway 1991, 6).

2.4 Charcoal production in Kenya

REDD+ schemes often clash with other land uses that degrade or destroy forests, and in Kenya, charcoal production is one of the strongest causes of deforestation (MEWNR 2013). Charcoal is defined under Kenya's Charcoal Regulations (2009, 2) as "wood fuel product derived from carbonization of wood or other plant materials". Charcoal burning is the second biggest cause of deforestation in Kenya, with 31% of all Kenya's forests being cut for the purposes of charcoaling (Ministry of Forestry and Wildlife 2013). In Kenya, close to 22 million cubic metres of wood is carbonised every year (MEWNR 2013).

Demand for charcoal in Kenya was estimated at 2.3 million tonnes in 2013 (Owen 2013). Overall wood fuel supply is on the other hand 1.6 million tonnes (ENDEV 2015). Such a deficit means that resources are being depleted, and with loss of forest cover, undesirable consequences follow: changes in rainfall patterns, drought, famine, soil erosion, etc. Prices are also consequently at record levels (Mutimba and Barasa 2005; Weaving 2013). Charcoal production is therefore, according to the definition of Chambers and Conway (1991), an unsustainable livelihood, as the next generation may not be able to participate in this activity.

Both legal and illegal charcoal production takes place in Kenya. For many years, it was illegal to produce charcoal in Kenya, but not illegal to use it, while trading was a grey area (WW BSMD 2015). In 2009, the Kenya Forest Service (KFS) set new Charcoal Regulations that generally tried to regulate the production, trade and transportation of charcoal. One can either be an independent producer or a Charcoal Producers' Association (CPA) member, but either way, charcoal producers, traders and transporters need proper licencing. Exempt are those producing charcoal for non-commercial purposes (MEWNR 2009). Those that do not abide by this law can be pronounced guilty of an offence and liable to a fine of not less than KES 50,000 or imprisonment for a term of not less than one year, or to both (MEWNR 2009). If they are charged under 'General Penalty',

there is a fine of not less than KES 10,000. Despite of these reforms, Kenyan government captures no revenues from charcoaling business (Figure 2).

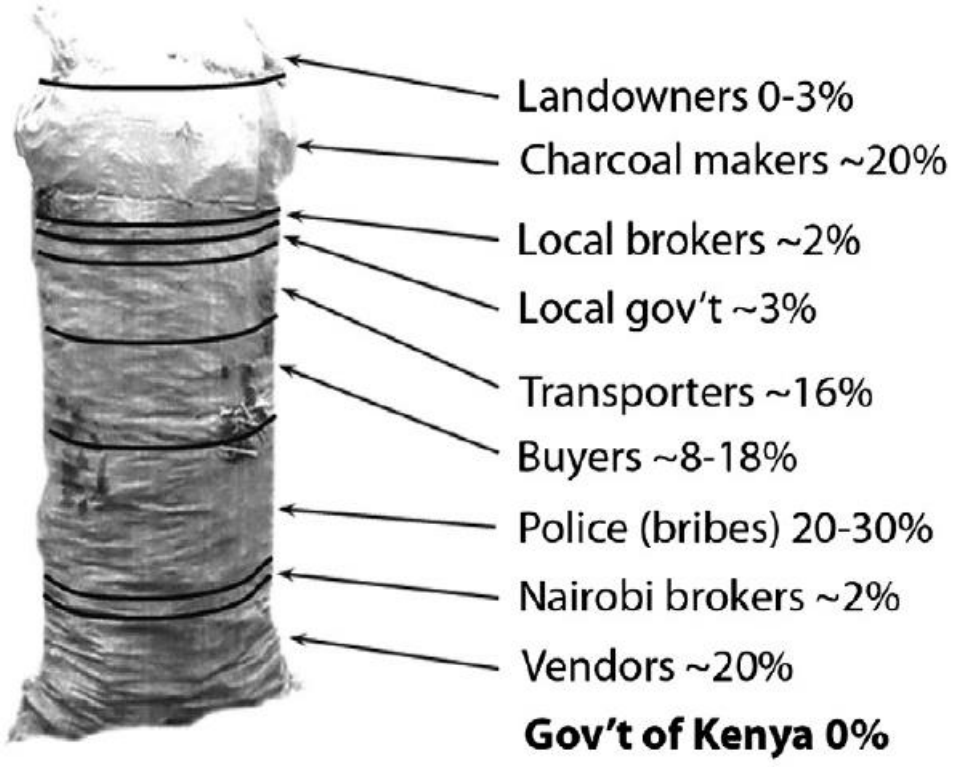


Figure 2 The proportion of revenue captured by different stakeholders along the charcoal commodity chain in Kenya (Source: Mwampamba *et al.* 2013).

Generally, formation of a Charcoal Producer Association (CPA) is more convenient for charcoal producers than an individual licence. Forming a CPA means, that charcoal would be produced in a controlled and sustainable manner. For example, the association has to demonstrate areas of tree re-planting, use of efficient kilns, etc. (MEWNR 2009). However, due to administrative bottlenecks, enforcement difficulties and corruption, this has created a grey area that may have facilitated increased charcoal production (WW BSMD 2015). These Regulations are currently under review from KFS and European Research Council (ERC) to address gaps in the charcoal value chain (Oimeke 2012).

Only 6% of Kenya's surface is covered by forest (GFW 2015) (Figure 3), and Kenya set a goal of reaching 10% cover, as required by the Constitution (MEWNR 2014). The Forest Policy (MEWNR 2014) defines the government's goal as promoting sustainable production of charcoal, but there has not been a concomitant development of an action plan towards this. Kenya Vision 2030 advocates for a cleaner path towards a prosperous economy: it fails to mention, though, how to tackle the ever-growing demand for charcoal (NESC 2007). Kenya REDD Readiness

Preparation Proposal (FCPF 2010) does the same: points out problems without clearly delegating responsibilities. Despite clearly identified and acknowledged problems surrounding charcoal production in the country, there still seems to be a lack of feasible action plans from the government. This research will, therefore, aim at identifying a set of potential recommended actions for government, especially the local government of Taita-Taveta County.

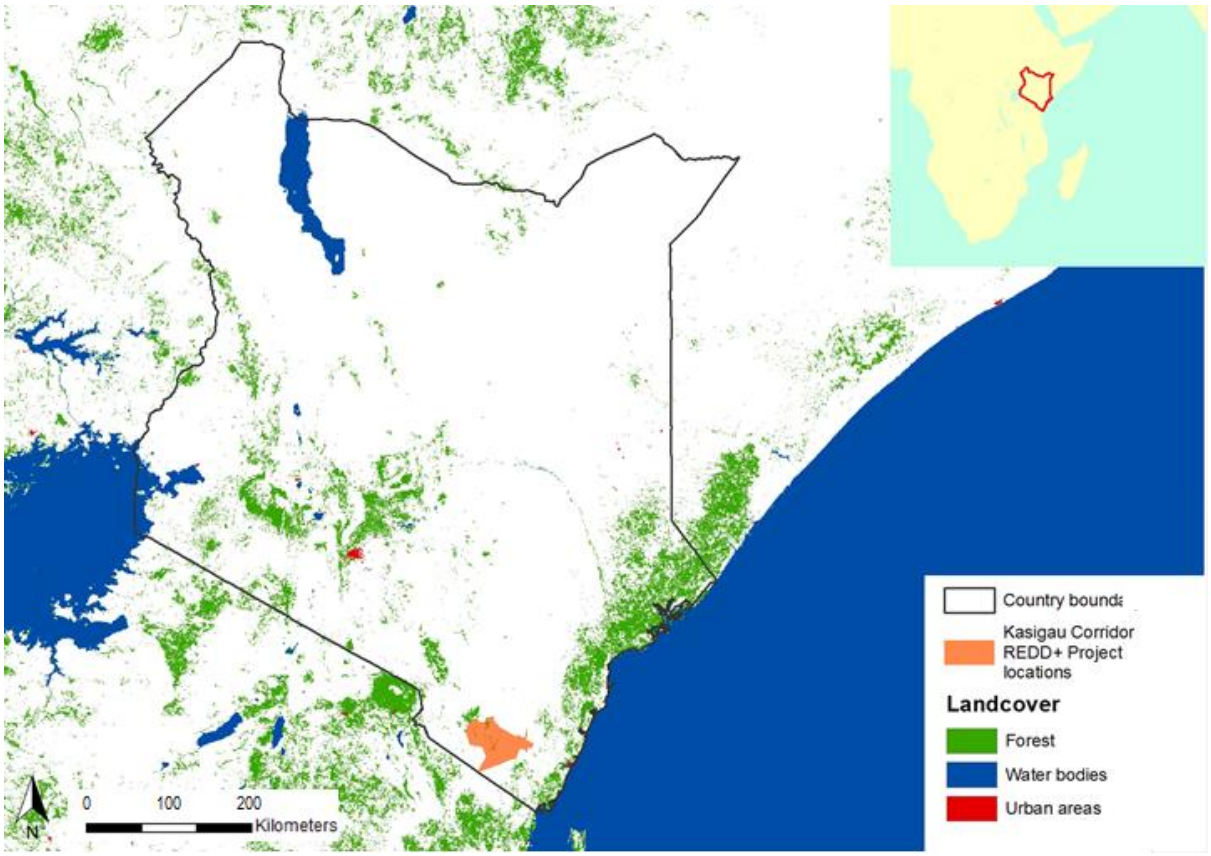


Figure 3 Kenya's forest cover (Data sources: ESA and UCLouvain 2010, ILRI 2015, WW BSMD 2015)

2.5 Wildlife Works and its objectives

Wildlife Works is a for-profit company based in Kenya and the USA that has pioneered the use of REDD+ carbon credits (Voluntary Emissions Reduction credits or VERs) to finance large-scale tropical forest conservation (2014b). It started as a conservation social enterprise and now is amongst the world's leading REDD project development and management companies. It leverages private-sector investment to fund projects. Currently, it has REDD+ projects in Kenya and Democratic Republic of Congo, and is planning expansions to Cameroon, Zambia and Ethiopia, Asia and Central America (Wildlife Works 2014b).

It is not the intention for Wildlife Works to prevent legal, non-commercial charcoal production (WW BSMD 2015), but it is in their interest to reduce unsustainable charcoal at six administrative locations bordering the Project Area. Their intention is to support the community

in the transition towards eco-charcoal production, the only sustainable replacement for the traditional charcoal. It is their motive to investigate compensation options beyond the currently implemented ones. It is of their particular interest to assess feasibility of direct compensation for people engaged in charcoaling, as this has proven to be a successful scheme for achieving the aim of conservation (Clements *et al.* 2013). Should the direct compensation scheme be put in place, it would not be the first one in the forestry sector. Costa Rican PSA (Paying for Environmental Services) scheme and the Sloping Lands Conversion Programme in China, both do it per unit of land reforested or conserved (Pagiola 2008; Xu and Cao 2002).

2.6 Study area

The Kasigau Corridor REDD+ Project Area (Kasigau Corridor) is located in south-eastern Kenya between Tsavo East and Tsavo West National Parks, covering a surface of more than 170,000 hectares (Figure 4). The Phase I REDD project begun in 2008 and was validated in 2009 (WW BSMD 2015). Wildlife Works has been in the area since the late 90's, working on improving biodiversity, as well as community conditions. It is located in Taita-Taveta County and, with Phase II ranches it is situated in six locations (third-level administrative units of Kenya): Kasigau, Marungu, Sagalla, MacKinnon Road, Mwachabo and Mwatate. These are further divided into sub-locations.

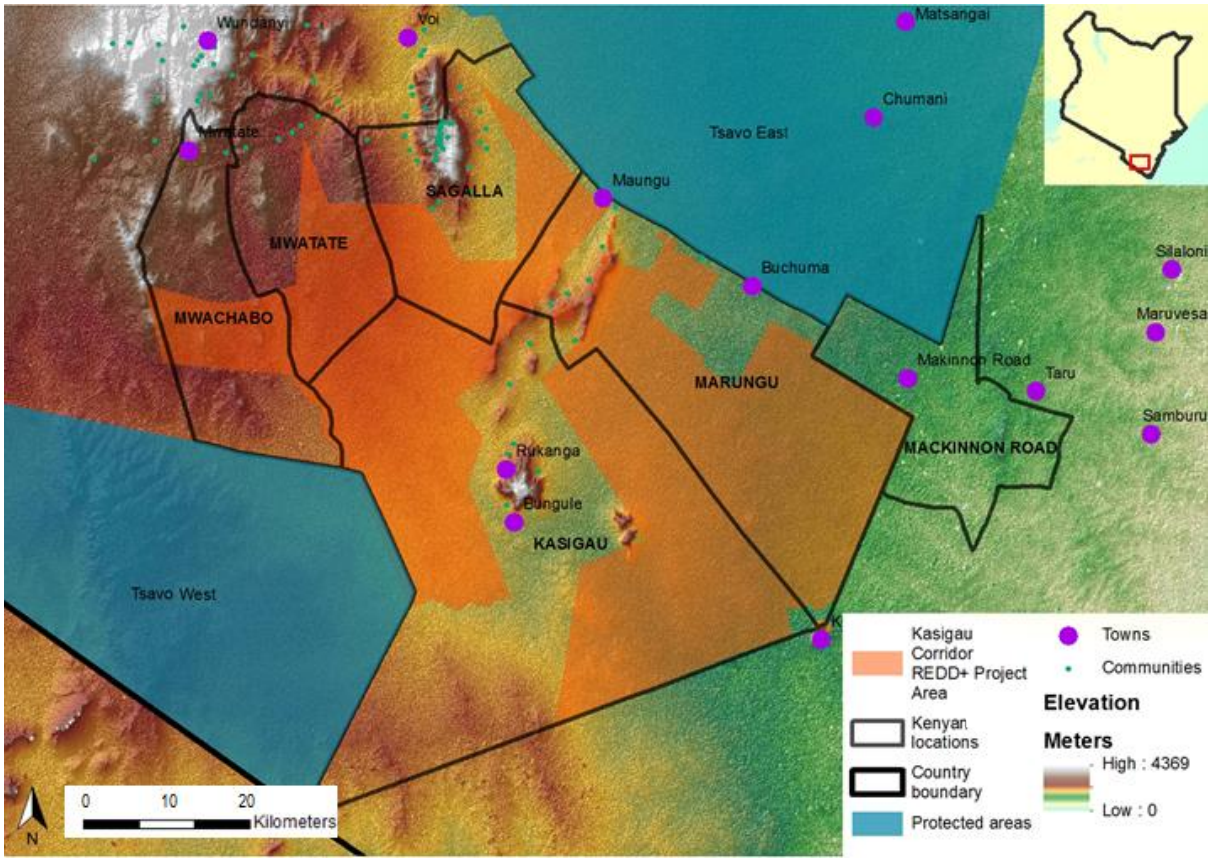


Figure 4 Locations of Kasigau Corridor REDD Project Area. (Data sources: GADM 2011, ILRI 2015, WW BSMD 2015)

Unlike most REDD+ projects, this one aims to conserve tropical dryland forest, the distribution of which can be seen in Figure 5. According to Wildlife Works (2014b), this Project Area consists of 14 ranches, one of which is privately owned (Rukinga, Phase I). are owned by Local Taita, Duruma, Kamba and other indigenous tribes own the remaining Phase II ranches and lease their carbon rights to Wildlife Works. This organization manages the carbon accounting and financing on behalf of the owners and distributes REDD+ funds indirectly through a project trust fund (Wildlife Works 2014b). These are in turn invested according to the wishes of communities in projects including provision of water, agricultural improvement, school and education conditions improvement and medical centre establishment. There are about 80,000 people in total in these locations (as of 2009) (Wildlife Works 2014b).

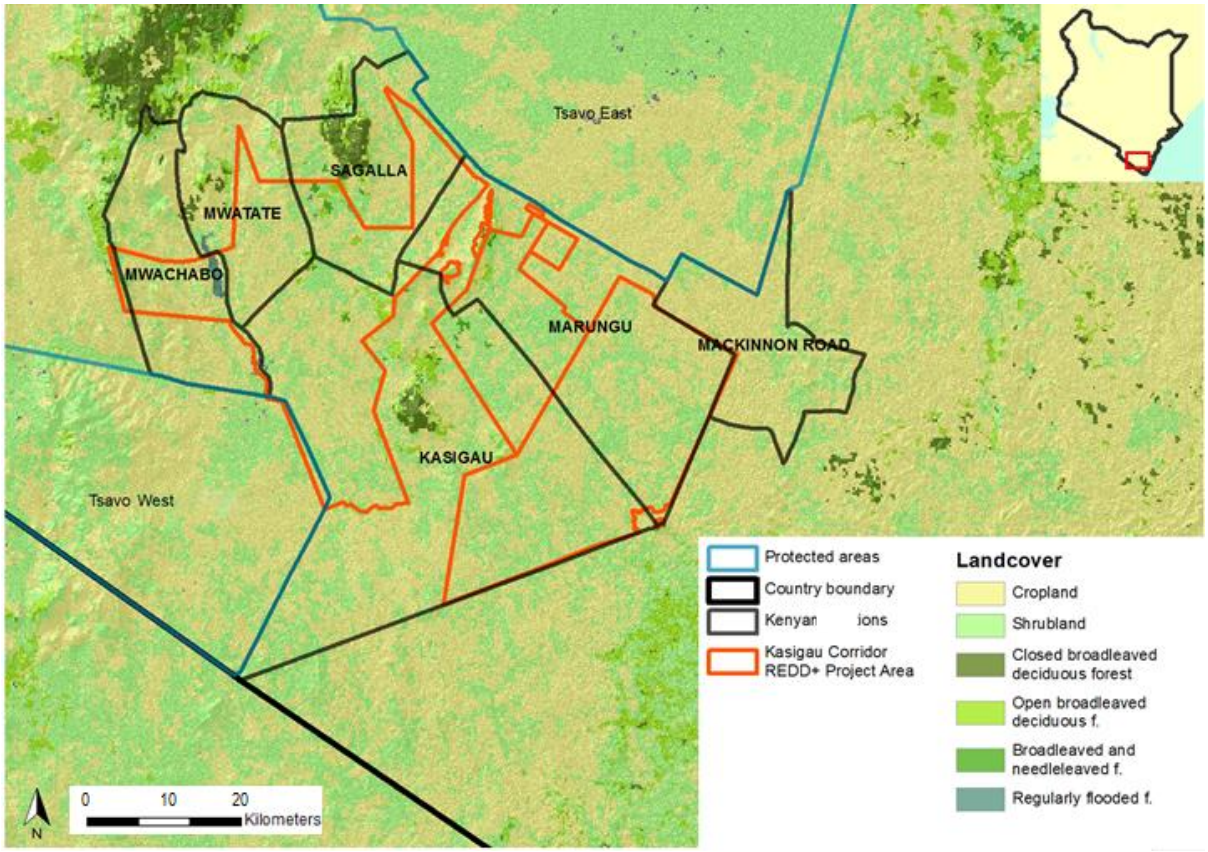


Figure 5 Land cover at Kasigau Corridor REDD+ Project Area (Data sources: GADM 2011, ESA and UCLouvain 2010, ILRI 2015, WW BSMD 2015)

The importance of this area stems from the fact that it was issued the first Verified Carbon Standard (VCS) REDD credits in early 2011 (Peters-Stanley *et al.* 2011). As such, it is a pioneer and a model for many projects that followed. Additionally, it was rewarded under the Climate, Community & Biodiversity (CCB) Standards and has achieved a Gold Level for both its provision of Climate Change Adaptation Benefits and its Exceptional Biodiversity. The area has 50 species of large mammals, 20 species of bats, and over 300 bird species. The International Union for Conservation of Nature (IUCN) Red List threatened species found in the area include Grevy's zebra (*Equus grevyi*), lion (*Panthera leo*), cheetah (*Acinonyx jubatus*), and African elephant (*Loxodonta africana*) (Wildlife Works 2014b).

Illegal charcoal production is one of the primary drivers of deforestation in the Kasigau Corridor, along with slash-and-burn agriculture (Wildlife Works 2014b). Mainly small-scale illegal charcoal operations are executed, which although small in volume, significantly degrade the forest by taking out the best hardwoods for carbon storage, like *Acacia nilotica*, *A. bussei* and *A. mellifera* (Wildlife Works 2014b). Charcoal production supports not just domestic needs in the area. Products are also transported to nearby towns and cities, e.g. Voi, Mombasa, and Nairobi. Veronesi

et al. (2012) state that charcoal leaves the port of Mombasa on ships. It is likely therefore, that Kasigau Corridor charcoal participates in a global market.

Charcoaling is monitored in several ways. First, there are monthly counts of the amount of charcoal bags that can be seen along the 63km long section of Nairobi-Mombasa Highway from Voi town to McKinnon Road town. This monitoring shows an upward trend in observed charcoal bags and active kilns. In addition, rangers report the number of kilns and charcoal bags encountered. One 180km aerial transect was established, where the area is monitored by a gyrocopter flown every two months at an average height of 120m from the ground at 130kph air-speed. Since October 2012 it has reported charcoaling activities on several occasions within the Project ranches (Wildlife Works 2014b).

The community also attempts to engage in the activity legally through forming CPAs. Currently, there are four CPAs in the area close to the REDD+ Project: Sagalla, MacKinnon, Mwatate and Kasigau (WW BSMD 2015). Sagalla CPA is further divided into four Charcoal Producer Groups (CPGs). These are working, as explained previously, not so well. The most promising one is Wildlife Works' sustainable eco-charcoal factory in MacKinnon Road, set up as part of an endeavour to address fuel needs in the areas around the Project. Nine employees' key activity is harvesting the annual re-growth of hardwood shrubs and bushes and ensuring that regrowth is more significant than harvested biomass (Wildlife Works 2014b). After the factory received a licensing agreement with the Kenya Forest Service (KFS) under 2009 Charcoal Regulations and a certificate issued by National Environmental Management Authority (NEMA) in February 2013, upscaling of production began. The project produces 2,300 briquettes per week, which were sold at KES 10[1] per piece in 2013-2014. Upscaling of production is somewhat slown down by the briquettes' price still being higher than the prices of conventional charcoal (WW BSMD 2015). It is planned to expand this establishment to the other locations as well once the financing is secured.

For assessing the number of primary producers of charcoal in the six administrative locations, in 2014 (a), Wildlife Works held meetings with chiefs, sub-chiefs and locational carbon committee (LCC) chairs[2]. The initial list used for this research was created as well as the names of the known charcoalers. A total of 529 people are engaged in the activity according to this study, with the largest proportion in the Kasigau administrative location (156). Sagalla, with 132

[1] 1USD = KES 86.4 in 2013 (XE.COM INC 2015).

[2] Elected representatives of the communities who work in liaison with Wildlife Works officials to oversee the implementation of community project funded under Kasigau corridor REDD project (Wildlife Works 2014a).

charcoalers, was selected for the purposes of this study as a key charcoaling area and due to logistical ease. MacKinnon Road has 121 charcoalers according to this study and Marungu 49. Mwatate and Mwachabo each have reported nine charcoalers.

An option for direct compensation is considered at the Kasigau Corridor and an assessment is needed to estimate profit components of charcoal producers in the area. It is known that an average income of KES 4,496 per month in 2004 and KES 8,400 in 2013 is generated from producers of charcoal in Kenya (MEWNR 2013). The profits remain unknown, as well as income from other activities charcoalers engage in. Subsequently, also in-kind compensation will be investigated in this area.

To conclude, Kasigau Corridor has implemented the indirect payment option (WW BSMD 2015). It appears, though, that charcoalers' costs are not compensated adequately, as pressure on forests continue. Veronesi et al. (2012) argue that this is due to increasing prices of charcoal, which are expected to continue rising. This was locally supported by a recent study on price trends in the area after regulation implementation (Weaving 2013). Wildlife Works is, therefore, considering implementation of direct payments for charcoal producers (WW BSMD 2015); this is quite complex, however. As the World Bank (2011) argues, a policy to compensate illegal operators (those engaging in activities deemed illegal by the local government) could create perverse incentives for other members of the community to cut trees in order to receive payments. It is of high importance, that, should direct payments be established, an adequate amount is paid. This is why identifying direct financial compensation cannot be observed in isolation from non-financial aspects.

3 Methodology

In this section, the reason for choosing the particular approach is explained, followed by a description of methods utilized for both data collection and analysis, with identification of challenges encountered during the research. Finally, limitations and delimitations will be summarized, as well as ethical issues.

This thesis is both a quantitative and qualitative study focused on "How can illegal charcoal production at the Kasigau Corridor REDD+ Project Area be minimised?" As the solution to this problem can be financial and/or non-financial, particular attention was given to the right balance between these two aspects. For financial aspects, quantitative methods were more relevant and qualitative methods were of greater utilization for the non-financial aspects. In designing the methods, particular care was given to addressing the aim and objectives, and several revisions of objectives were part of this process. The research involved a month-long field study in May 2015 at the selected location in the Project Area.

3.1 Methods of data collection

The main method used in this research was semi-structured interviews. Before they are explained, the sampling rationale is presented. It was intended throughout the process to adhere to principles of validity, reliability and representativeness.

3.1.1 Sampling

Kasigau Corridor REDD+ Project Area lies within six administrative locations and in the pre-field phase of the research, chiefs, sub-chiefs and LCC chairs assisted in creating an initial list of charcoalers they knew from each location (Wildlife Works 2014a). Sagalla administrative location was selected due to time constraints, proximity and accessibility as well as it being one of the key areas of charcoaling. There are 132 charcoalers in an area of 424.8 km^2 (IEBC 2015). It should be noted that nobody lives in the REDD+ Project Area itself. The main areas where charcoaling takes place are Kishamba B group ranch, Teri B group ranch, Mgeno ranch and on charcoalers own farms, according to Wildlife Works (2014a).

In order to maintain a confidence interval of 8 and confidence level of 95%, at least 70 of the 132 charcoalers needed to be sampled (Creative Research Systems 2012). After the list of the names was transferred to an excel sheet, it was randomized without replacement. Each name was assigned a number and with help of Online Random Number Generator (Urbaniak and Plous 2013), a final sample list was created. If somebody from the randomly generated list was encountered who had quit charcoaling, was not available or not willing to participate, s/he would

be replaced by the next person on the original full list of names. All randomly selected charcoalers were then contacted, mostly through village elders, and meetings were scheduled. It was attempted for logistical reasons that in one day, meetings were to be conducted at a single sub-location (Ndara, Kishamba, Teri or Talio). Interview locations are presented in Figure 6. It took daily approximately four hours for travelling to the interview locations and back, be it on foot, with local *matatu* (minibus) or *boda-boda* (motorcycle taxi).

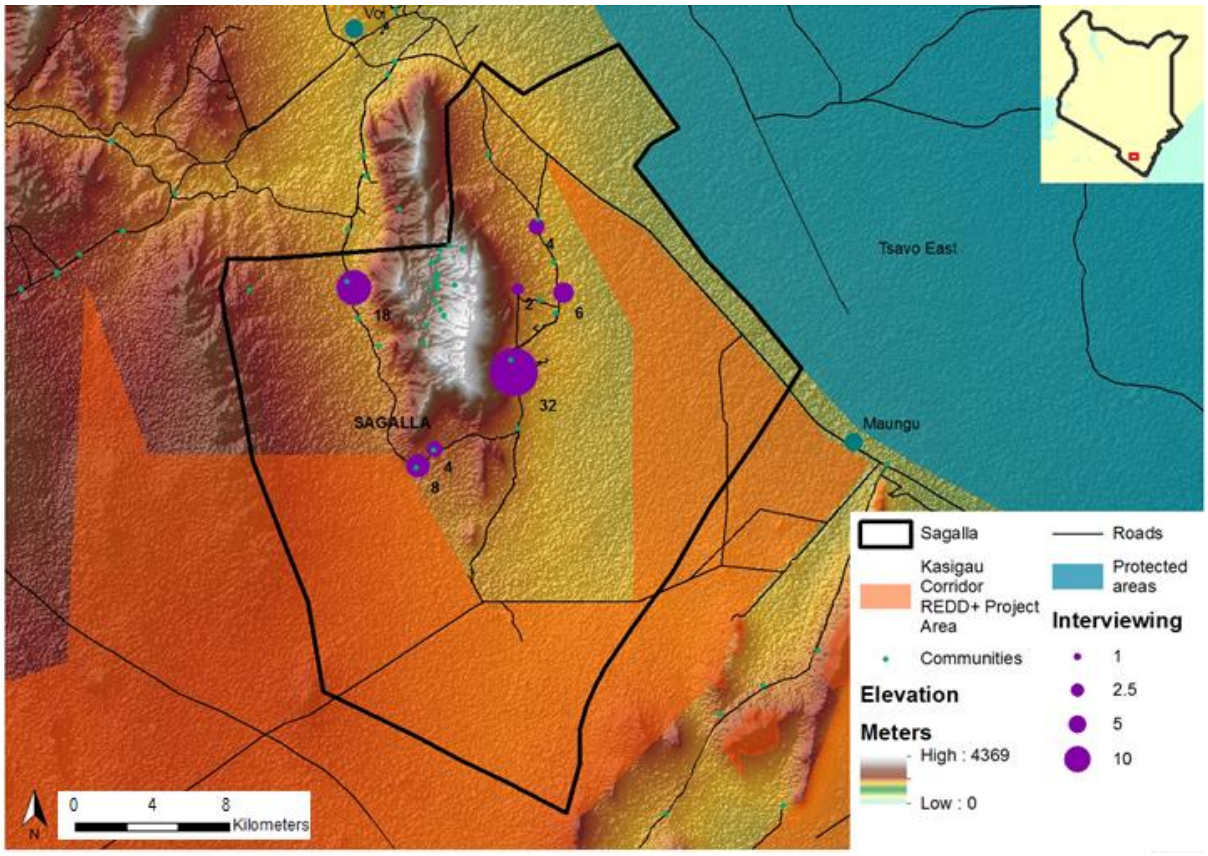


Figure 6 Interviewing locations with depicted number of interviewees (Data sources: GADM 2011, ILRI 2015, WW BSMD 2015).

Once in the field, it turned out that there were more than 200 charcoalers and the actual number of charcoal producers is unknown. This means that the intensity of charcoaling in the area might be higher than previously anticipated. The initial list became smaller: 109 or even less (Figure 7). Sixty-nine were unknown to the village elders or other contacts we were able to get in touch with. This happened because the same people that generated the list of 132 before this research was carried out were not available at the time of research. Thirty-two were interviewed from the initial list and the rest (36) were replaced by charcoalers from an additional list, generated by non-random invitation by village elders. Thus, despite the effort, the final sample of 74 present, future and past charcoalers cannot be considered representative, and results are not possible to generalise with confidence to other Sagalla charcoalers or to the initial list of charcoalers.

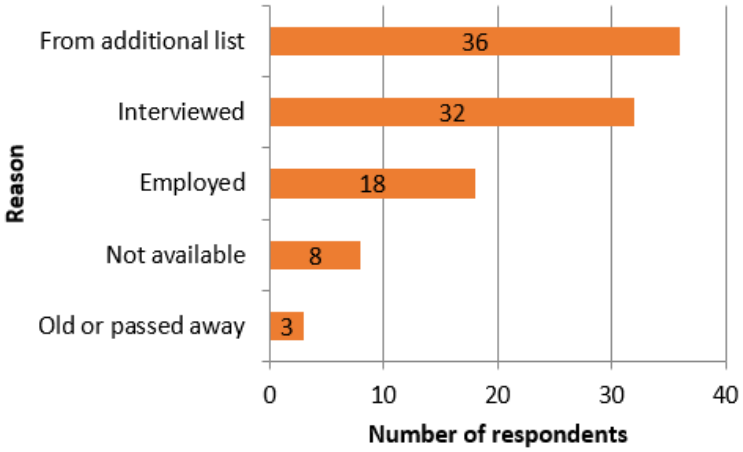


Figure 7 Distribution of initial list of 132 charcoalers in the Sagalla location.

Five interviewees were former independent charcoalers, or ex-charcoalers. The rationale of including this sample in the research was due to potential support with identifying the threshold for behavioural change and identifying reasons for stopping charcoal production. It was planned to purposely select individuals by asking active charcoalers and local leaders. However, these individuals approached the research team on their own. One other individual with the intent of becoming a charcoaler was also interviewed.

3.1.2 Semi-structured interviews

With support of a Swahili translator, an average of five (min=1, max=11) face-to-face in-depth interviews were conducted per day in May 2015 (Figure 8). They took place throughout the work weeks, including one Saturday. In the last week, the translator was changed and the effect on data validity was minimised through prior detailed briefing and explanation of the results accumulated until that point. Both quantitative and qualitative data was obtained from these interviews. The semi-structured nature of the interviews allowed for following up on issues important to the respondent. At the end of each interview, a token of appreciation was given: a pen from the author as a souvenir from Croatia and a black t-shirt from Wildlife Works. Interview protocols were adjusted throughout the interviewing period on the basis of experiences (Appendix 1). The main aspects covered in the interviews are presented in the Table 1, along with the associated research objective(s).

Figure 8 Interviewing charcoalers: a) in their homes, b) at the meeting point Kajire village (these charcoalers are CPA members engaged in charcoaling legally and they have agreed to have their pictures taken) (Source: author).

Table 1 Sections of interview protocols and how they relate to research objectives.

Interview section	Relation to objectives
1. Interviewing independent charcoalers	*Objectives 1.1-2.3*
1.1. Demographic information	Objective 1.1
1.2. General information on charcoaling	Objective 1.1
1.3. Volume of production	Objective 1.2
1.4. Cost aspects of charcoaling	Objective 1.2, Objective 1.3
1.5. Earning aspects of charcoaling	Objective 1.2, Objective 1.3
1.6. Sustainability aspects	Objective 2.2
1.7. Compensation and alternative livelihoods	Objective 2.2, Objective 2.3
1.8. Closing questions	Objective 2.1
2. Interviewing ex-charcoalers	*Objective 2.3*

Careful phrasing of questions is particularly important when conducting an interview. Fowler (2002) discusses various reasons for reduced validity of responses, for instance: respondents not understanding the question, not knowing the answer, or non-willingness to share. In order to minimize this, negative phrases and double-barrelled questions were avoided. Biased questions, where respondents feel that they can answer only in a certain way, were also avoided, as well as questions that could imply one or several correct answers. Phrasing and question ordering was done in a way that interviewees felt comfortable with their responses. Occasionally, skip patterns were used to increase validity (Lapan and Quartaroli 2009).

3.2 Methods of data analysis

As a first step of analysis, the three sample groups' (current, past and future charcoalers) results were analysed separately, both quantitatively and qualitatively. The 'current' group, as well as the 'past' and 'future' groups were observed for identifying rationales for ceasing charcoal

production and, consequently, elimination of illegal deforestation from the Kasigau Corridor REDD+ Project Area.

3.2.1 Quantitative analysis

Once the data was gathered, financial and numerical components were processed in an excel-based database. Descriptive statistics was used for analysis of the results, and presented in charts. Independent and dependent t-tests were performed in order to compare these categories within themselves.

Opportunity costs related to charcoal production were calculated subsequently. In the context of Kasigau Corridor, there are two perspectives from which one can address opportunity costs, applying the definition of the opportunity cost as the foregone benefit. The first would be from the perspective of someone who was an independent charcoal producer (1) and can no longer produce it, expressed in dollars. The second would be from the perspective of an area that was to be cut down for charcoal production but can no longer be, expressed in dollars per hectare (2). The World Bank (2011) argues for the third approach using CO_2e; this however includes complex carbon accounting and estimates on time-averaged carbon stocks. As these are beyond the scope of this paper, the first and second options will be used. Hence, two calculations will be made (Table 2).

Table 2 Calculating opportunity costs according to different formulas (yearly)

Perspective	(A) Formula for the benefit of charcoaling	(B) Formula for the benefit of not charcoaling	Final formula	Unit
(1) Independent charcoaler	Revenues - costs = profit	Indirect benefits from carbon finance	(A) - (B)	USD
(2) Land area to be cut	Profit per ha from charcoal produced from 1ha	CO_2e per one hectare * CO_2e price = profit per ha when there is no charcoaling	(A) - (B)	USD/ha

For the independent charcoaler's opportunity costs, the amount of units was first needed, which together with unit prices gave revenues. Costs were aggregated from various individual components, like equipment, transportation, labour costs etc. Finally, profits were calculated as a difference between the revenues and costs. These calculated profits were then also compared to the reported profits, amount stated during the interviews by the charcoalers themselves as their profit. This, together with an estimation of how many charcoalers there are gave an indication of what the monetary incentive needs to be – for this landscape, at this time – to offset the lost incomes. For the individual charcoaler, there is no direct financial benefit if s/he cannot deforest, and indirect benefits per person are difficult to calculate. Hence, this will be ignored.

For the opportunity costs from the land area perspective, first the calculation of profits from charcoal produced from one hectare was obtained. Interviewees were asked about the amount of trees needed for one kiln. Subsequently, the monthly amount of trees cut was calculated through multiplying number of kilns per month and the amount of trees needed per kiln. This was extrapolated to a hectare from a carbon biomass plot sample data for Sagalla (WW BSMD 2015). This plot sample contains information on how many trees greater than 15cm DBH (diameter at breast height) within fifteen 0.1ha plots there are. This is, therefore, considered a rough estimate on the amount of hectares of forest destroyed due to charcoaling, with the assumption that forest stand density is consistent across the sampled area. For the profits without deforestation, the amount of CO_2e in that amount of hectares and price of CO_2e at the voluntary markets were calculated. All this information was obtained from interviews, with the exception of CO_2e in one hectare and its price, which was generated from already existing Wildlife Works' databases (WW DBSM 2015).

3.2.2 Qualitative analysis

As this thesis also covers a qualitative research component, a content analysis was performed (Strauss and Corbin 1990). The coding process yielded keywords and key concepts important for respondents. These were classified according to the similarity and relatedness to the same category of ideas, and main findings were presented.

3.2.3 Limitations and delimitations

The main limitations of this study include: language barrier, cultural differences, disease and violence risks, time constraints, lack of control, and certain ethical issues.

Language barrier and cultural differences were addressed by having a local interpreter present at almost all interviews. The translator was very helpful in providing an introductory briefing concerning the culture of the local tribes: Taita, Duruma, Kamba and other less-prevalent tribes (Wildlife Works 2014b). Prior to the study visit, the author took Swahili classes which proved useful in numerous situations.

Danger for the author was related to general threats in tropical and wilderness areas. All necessary vaccination and medicines were taken (e.g. yellow fever). Additionally, vaccination against typhus and hepatitis A were given. Malarone medicine was consumed throughout the field research as a preventive measure. In addition, dressing appropriately was important not only for decreasing the probability of mosquito or tick bites, but also to adhere to local cultural norms. As Kasigau Corridor is a wilderness area, walking out at night or walking alone in the bush is strongly discouraged. On several occasions, violent or highly uncomfortable situations were encountered

due to high alcoholism rates in the area and the illegal nature of the business. Always going to interviews in pairs and being transported to communities only by a reliable motorcycle driver mitigated the danger.

Due to the relatively short time available for field study, only a limited number of respondents were able to participate in the research. Sampling was adjusted to this and time was used as efficiently as possible at the project area. In the field, there was a need for being spontaneous. The author was unable to control times and places of meeting interviewees and sometimes there was a need to act spontaneously and take advantage of this constraint.

There are several ethical issues with this research. The activity is often illegal and could jeopardize or be harming for the participants. Maintaining confidentiality was of highest priority throughout the research. Names of respondents were not written down and were known by only a small number of people involved with the research. Verbal consent at the beginning of the interview was requested from the respondents. The illegal nature of the activity might have resulted in respondents answering in a way that suits the researchers. If this is the case, the extent of deforestation for charcoal purposes, or other problems discussed, might be greater than reported here. One of the research team members was selected hence due to her experience with both charcoaling (she has done it previously herself and knows the activity very well) and with interviewing charcoalers for different purposes. A second issue is due to the author having received in-kind support. Wildlife Works provided the author with a walk-in tent at the project area, an assistant and Swahili supporter and a driver. However, the author has maintained an objective outlook and openly communicated opinions without facing restrictions. At no moment was there an indication of the sponsor interfering with the results. The thesis supervisory committee was consulted as needed to ensure ethical considerations. The research gained ethics approval through Central European University.

In order to increase the validity of data, it was important to manage the expectations of the interviewees. When asking about the compensation options and job alternatives, they might think that a benefit could be gained. Thus, at the beginning of the interview it was explained that this is not the case.

The main body of thesis is divided in four chapters and follows social sciences model with combining results and discussion. First general demographic and information on charcoaling will be presented. After that, direct compensation estimates and calculations will be given. Finally possibilities beyond compensation will be explored. Another chapter will cover recommendations from charcoalers, also part of the results.

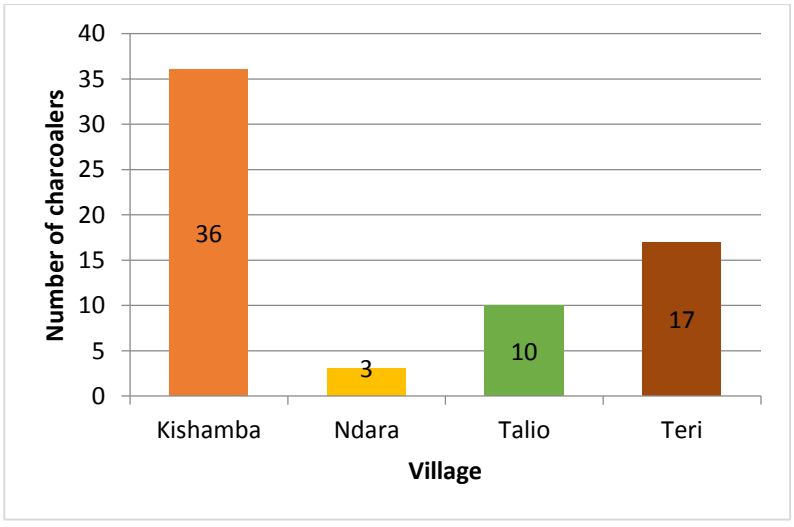
4 General information on charcoaling: who, when, where, why

In this chapter, first demographic information about charcoalers is presented. After that, general information regarding charcoaling activity is also discussed. These two chapters provide an initial indication of certain steps needed to minimize charcoaling in the area, especially as it pertains to in-kind compensation or informing context around direct payments: to whom and why.

4.1 Demographic information

Gender and sub-location are the only two sets of information known about both the sample and the population at this stage, so they will be discussed first. Most of the charcoalers interviewed were male (84%). Compared to the population, the sample could be over-representing female charcoalers (11 out of 18 known charcoal producing women were interviewed). However, it was mentioned by 12 male charcoalers that their wife is helping in one or all the processes. On the initial list of the charcoalers provided by the Wildlife Works, wives were not mentioned, as they are not seen as the main charcoaler or spokesperson of the family. Therefore, the number of women involved in the activity could be larger than assumed.

The largest number of interviewed individuals comes from Kishamba sub-location in both sample and population (Figure 9). Ndara sub-location is underrepresented due to logistical problems towards the end of the interviewing period. However, due to the proximity to Kishamba and their similar conditions, it can be assumed that they are comparable. Most of the sample is of Taita tribe (97%) and two interviewed were part of Watha tribe.



(a)

(b)

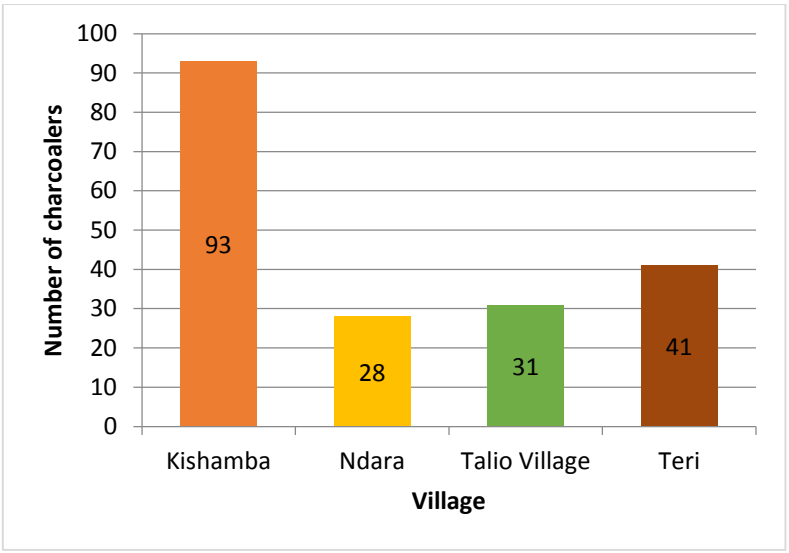


Figure 9 Sub-locations of the sample (n=68) (a) and overall population (n=193) (b)

Charcoal producers' age is between 24 and 74, most being between 31 and 40 (Figure 10). Average age (n=68) in the sample is 42 (s=11). Most of the charcoalers have been in business for 11 to 20 years (Figure 11). Interviewees were asked how old they are and for how long they have been involved in this activity (average 14 years (s=10)). These two numbers combined gave a "critical age" for starting with charcoaling. This would be between 21 and 30 (Figure 12), or at 28 years old on average (s=10). It should be noted that almost a third of the charcoalers worked on their first kiln while they were minors, with the lowest reported age being six. It is therefore surprising that only one charcoaler (female) mentioned that her children are helping out in one or more processes of charcoaling. The critical age of starting with charcoaling might be a useful number for the indirect compensation scheme to prevent starting the charcoaling at all, as the scheme should target the most sensitive groups in order to reach the maximum effectiveness.

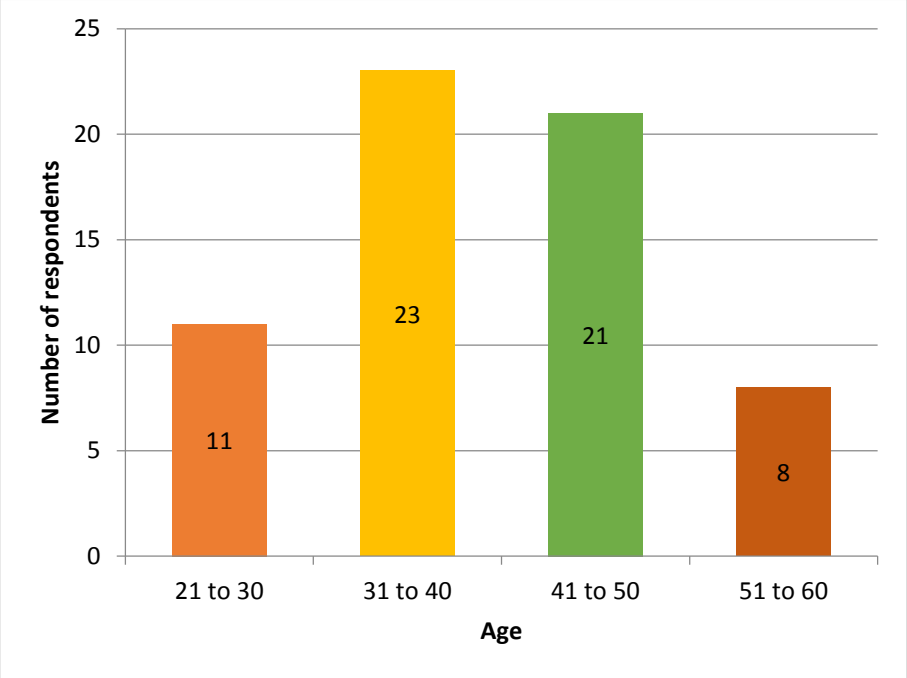


Figure 10 Age distribution of the sample (n=68)

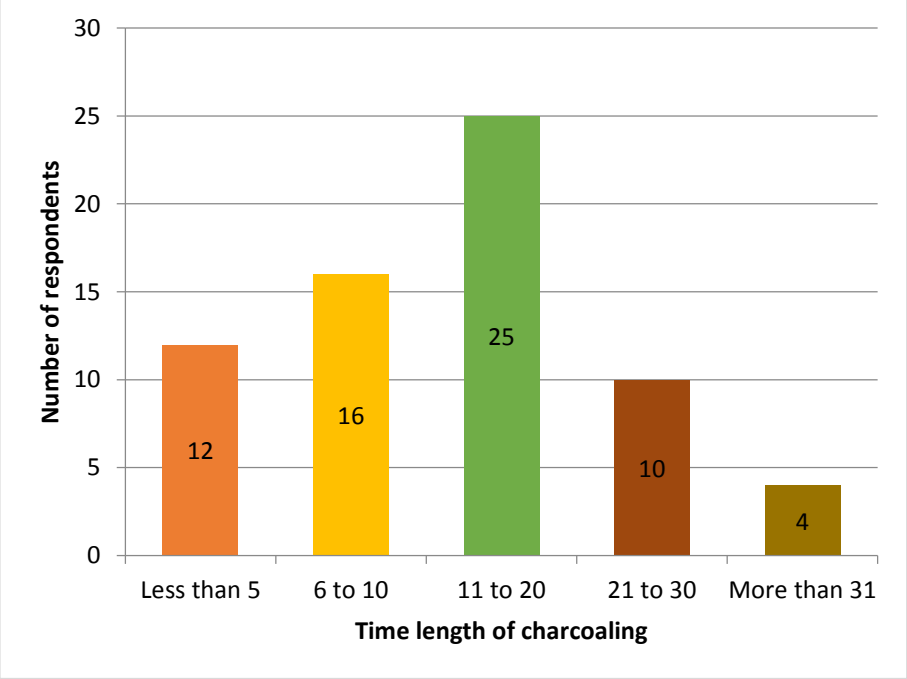


Figure 11 Responses to the question "For how long have you been charcoaling?" (n=68)

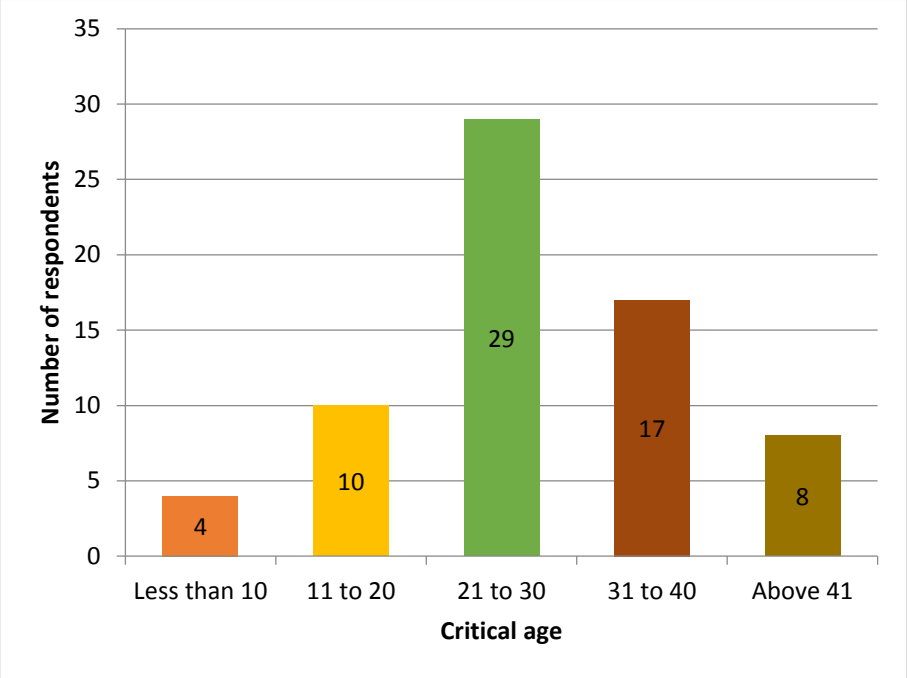


Figure 12 Critical age for starting with charcoaling (n=68)

Charcoalers live in households of up to 12 people with an average of six household members (s=2) (Figure 13). Most (51 out of 68) are married with one partner; one person has two. The average number of children per household is four (s=2). The size of the household is possibly related to how much would a charcoaler produce per month, and hence, it is indirectly related to needed compensation.

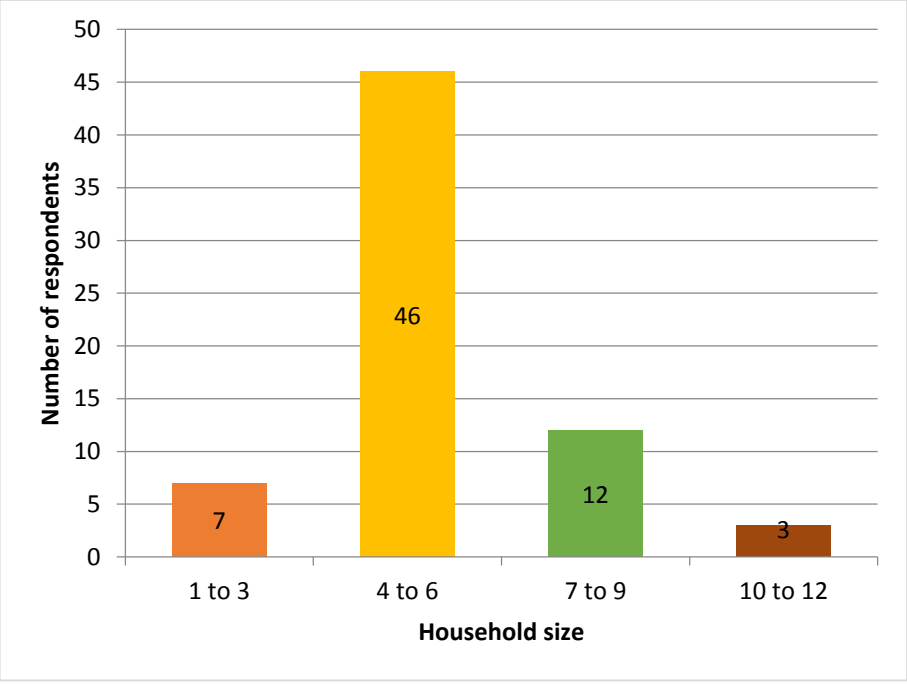


Figure 13 Household size of the sample (n=68)

Most of the charcoalers have eight or less years of education (Figure 14). School drop-outs are fairly common: 43% of all the charcoalers dropped from primary school and one third dropped from secondary school. The percentage of charcoalers that finished secondary school (18%) is higher, though, than the Kenyan average of 8.5% (Global Education Fund 2015). Increasing level of education and percentage of school completion might be a way ahead in terms of moving away from illegal activities. Government and NGOs should work on improving education system and facilitating school completion and subsequent job finding.

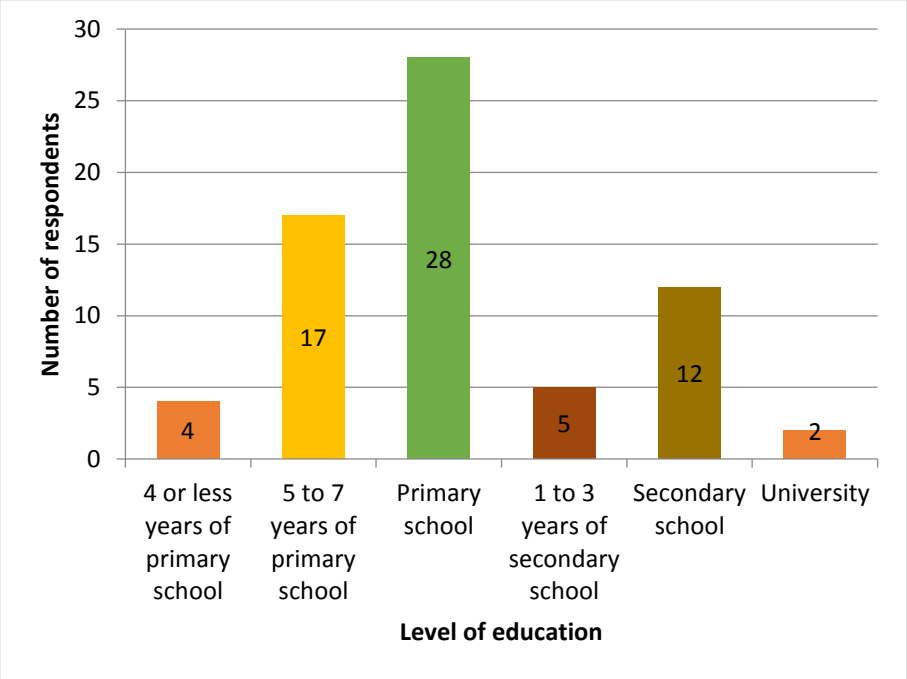


Figure 14 Level of education of the sample (n=68)

4.2 General information regarding charcoaling activity

Most of the charcoalers interviewed engage in charcoal burning throughout the year (65%). Those that produce it seasonally, do it mostly in the dry season, usually when they cannot tend their farms. The main dry season in Sagalla is from June until October with a shorter and less severe dry season in January and February, which is seven months (Weatherbase 2015).

Wildlife Works (2014a) reports that charcoaling activity takes place mainly on Kishamba B group ranch, Teri B group ranch, Mgeno ranch and on charcoalers own farms. This is somewhat confirmed with this research (Figure 15). Bwaka forest and other forests on slopes or hills are an addition to this list.

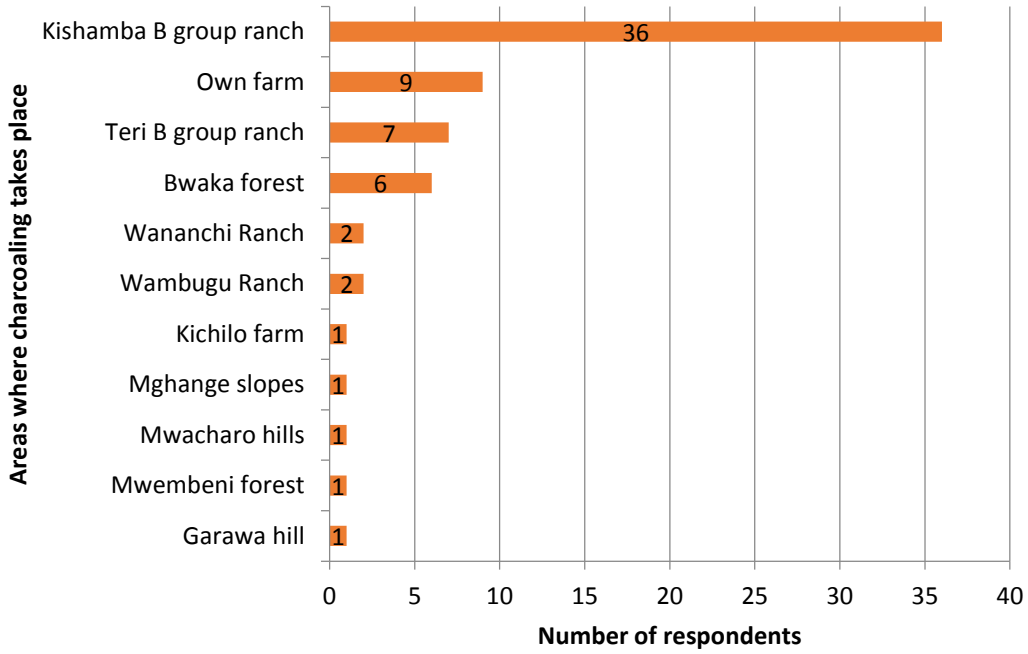


Figure 15 Areas and ranches at which charcoaling takes place (n=68)

Most of the charcoaling knowledge is passed on through the family (62%), be it parents, siblings or cousins. The rest is passed on by friends (37%). As such, it might be argued that charcoaling is a tradition in the area. This is not an ideal situation, as such an informal education leaves significant knowledge gaps, for instance regarding reforestation and eco-charcoal options, as this research also has confirmed.

When coming up with a compensation scheme, reasons for charcoaling should be taken into account (Figure 16). The reason reported most often is taking care of one's family, including school fees, food and clothes. A reason mentioned by more than half of the women is loss of partner, be it through death of the husband or divorce. Supporting charcoalers with taking care of family, especially the single parents could potentially decrease pressure on forests. One of the interviewed individuals is not engaged in charcoaling yet, but plans to. His motivation is expanding his beehive business with savings from charcoaling. This might signal that funding options or loans could be advertised to the community to provide an alternative to going into charcoaling.

There is also a smaller number of charcoalers whose main reason for engaging in the activity is clearing their farms for agricultural purposes. It is difficult to come up with compensation scheme with these people, due to lack of jurisdiction over their area and the charcoal production being only secondary goal of deforestation, as Mwampamba *et al.* (2013) have already noted.

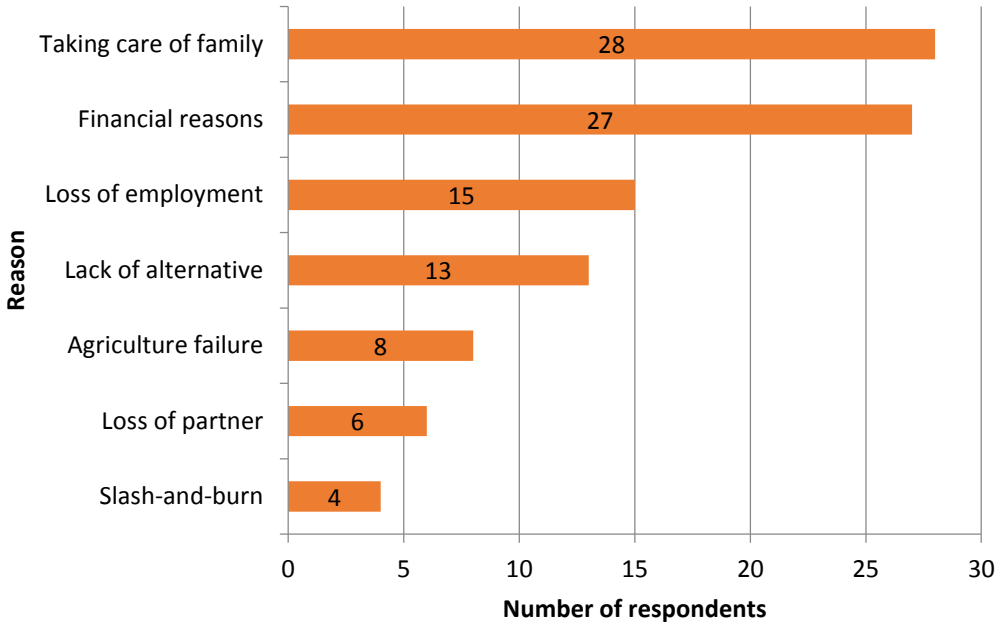


Figure 16 Reasons for charcoaling (n=68)

Most of the charcoalers do not like their job (90%). Figure 17 and Figure 18 present reasons for both negative and positive attitudes. Mentioned health hazards are: pain (chest, back, hip and related painkillers, cuts and wounds, tuberculosis, quicker aging, eye injury, coughing and asthma. Charcoalers mentioned fear of the following types of wild animals: snake, elephant, buffalo, scorpion, centipede. For conservation action purposes, it is what charcoalers like about charcoaling that someone wanting to do something about it should focus on providing. As charcoalers' attitudes are mostly negative, it was challenging to get data on what is it that they like about it. Income source and school fees seem to be the most important elements.

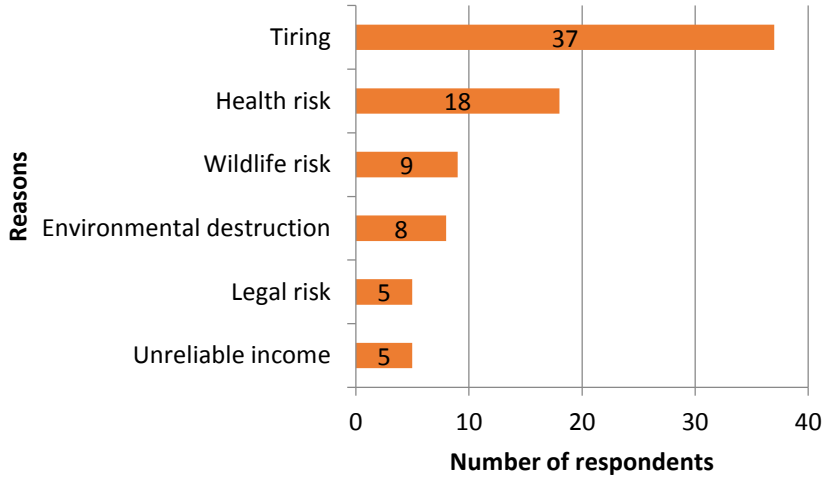


Figure 17 Reasons behind negative attitudes of charcoalers towards charcoaling (n=62)

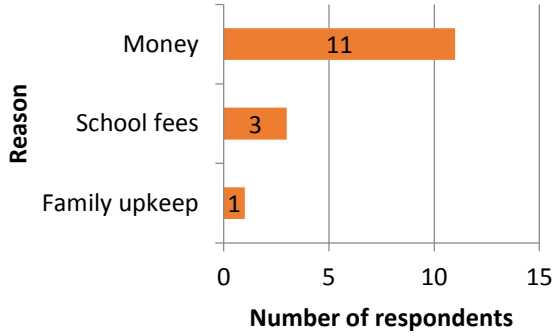


Figure 18 Reasons behind positive attitudes of charcoalers towards charcoaling (n=15)

Of the twelve tree species identified, the three most commonly used ones for charcoaling are *Acacia tortilis*, *A. bussei* and *A. nilotica* (Figure 19). Weaving (2013) reports that the best species for charcoaling in the Project Area are *A. nilotica*, *A. bussei* and *A. mellifera*. *A. tortilis*, although widely used at the moment is Sagalla location, is rarely amongst the most preferred species. This might be an indicator that there are fewer preferred trees available.

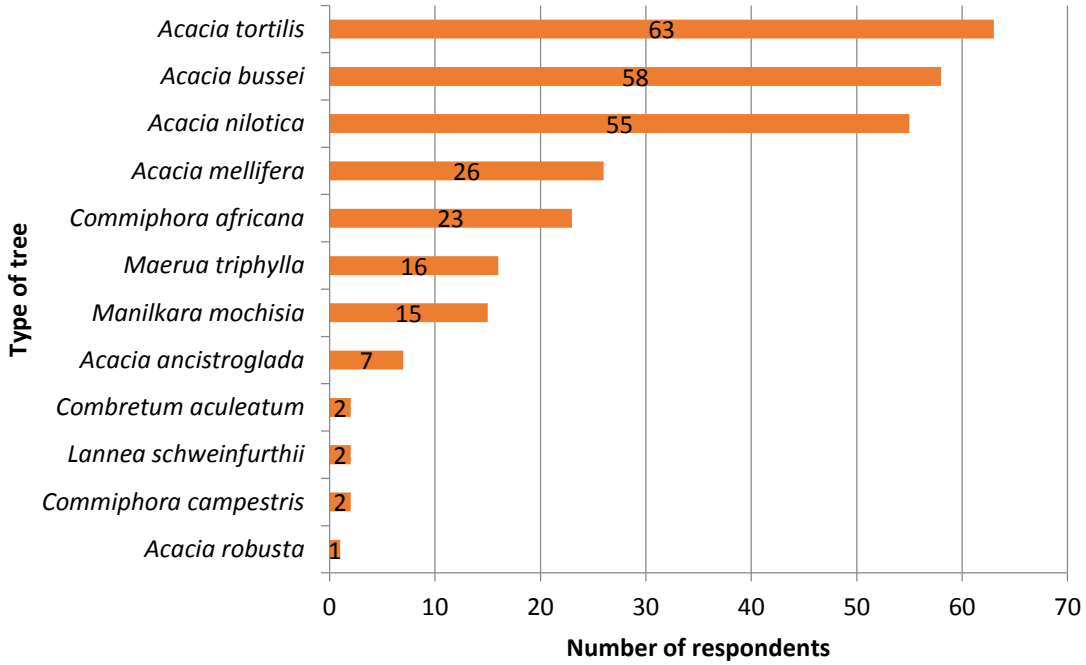


Figure 19 Tree species used for charcoaling (n=68)

Perhaps a more sustainable option towards charcoal production could be a kiln of improved efficiency. Kalenda *et al.* (2013) define various methods of kilning used in Kenya. Traditional Earth Kiln (TEK), Improved Earth Kiln (Cassamance), Drum kilns (Kefri or Maxwel design), Mekko

kiln (Biochar), Portable metal kiln, Ring Kilns, Brick kilns (Half orange kilns, Duom or Rectangular shaped kilns) and Retort. The half orange kiln and retort have the highest production efficiency.

Charcoalers reported that they almost exclusively use TEK (Figure 20). This type of kiln starts with placing logs in a desired shape. After that, it is first covered by grass, and finally with soil. Its efficiency is 10 to 15%, compared to, for instance, Retort technology that can reach 80% efficiency (Kalenda *et al.* 2013). Improved traditional kilns with lumps for better ventilation was only reported twice. Improved raised kiln with two logs below and the rest on the top was reported once. Sakamanzi kiln, which keeps trees standing, originated from South Africa and was also reported once. Most charcoalers reported that they did not know of other types of kiln that would have higher efficiency. Considering that learning about the activity is informal (passed on through family and friends), it is of no surprise that charcoalers do not know much about other types of kilns, or possibility for higher efficiency of production. A formal education for charcoalers could inform them about these and other issues and widen their knowledge about the field in general. Charcoalers could benefit from formal education for the purposes of producing legal eco-charcoal, as well as learning about processes regarding reforestation.

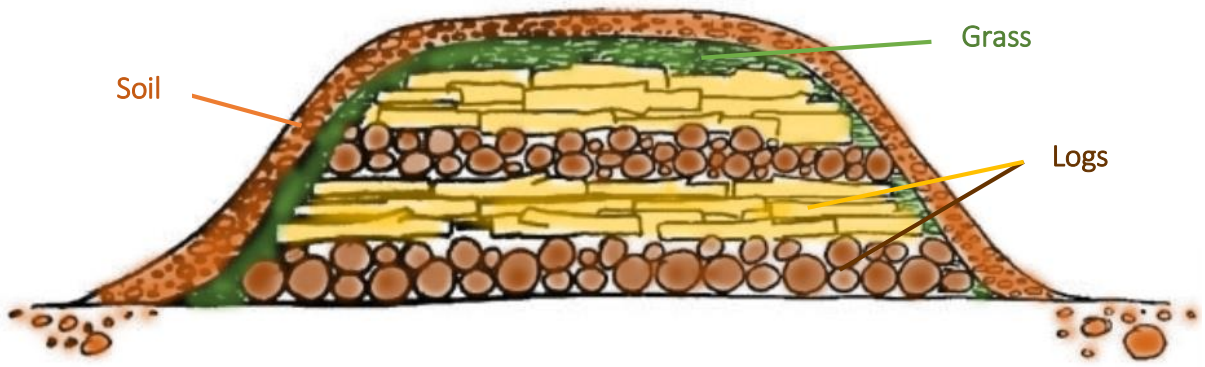


Figure 20 Traditional earth kiln method (Source: Kalenda *et al.* 2013 (with amendments)).

4.3 Legality of charcoal production

Attitudes and behaviours regarding Charcoal Regulations in general and CPAs in specific will be explained next. Were Charcoal Regulations successfully implemented, charcoal production would progress towards sustainability and forests would be renewed. That is not the case though, even when a person is a CPA member, as hardly any reforestation or sustainable production is taking place now.

Almost half (46%) of charcoalers reported that they have never heard of Charcoal Regulations, although when asked if somebody ever got into trouble, they had ready responses. Several charcoalers have been imprisoned for not longer than six months. In prison they were taught about conservation, and that charcoaling is bad. The importance of trees for protection against soil erosion, fresh air, bringing rain etc. was also a topic. It would probably be more efficient if this type of education was taking place outside of prison, before the crime is committed. For release from the prison, charcoalers paid or would pay an average KES 17,864 (s=KES 6,600) per incident and as a bribe KES 1,960 (s=KES 1,200) per incident. Other types of troubles encountered by charcoalers are listed in Figure 21.

Figure 21 Type of trouble encountered by charcoalers (n=37)

Wildlife Works is mentioned the most often as the source of information regarding Charcoal Regulations. KFS or agriculture officers, community meetings, conference and newsletter are also a source of information. Most of the charcoalers who have heard of them believe they are good, one person believes they are not good, and six claim that they do not know much about it. One person was invited to a Charcoal Regulations meeting but did not attend: "*Of what benefit would those lessons be to me, when I will continue anyways? I wouldn't sleep hungry just to follow some regulations.*"

Charcoalers that have heard of the Regulations, associate different things with it (Figure 22). The most common association is that the Regulations teach about the importance of trees and promote replanting trees. Trees are seen as important, as they maintain good air quality, protect against soil erosion, and provide timber. Promoting eco-charcoal or briquette production and pruning was mentioned a couple of times. This is an alternative charcoalers would like to get involved with. One of the respondents fear that marketing will be a challenge; people are used to

normal charcoal. It is also mentioned that implementation of Charcoal Regulations might be problematic. Preventing climate change is also associated with Charcoal Regulations, as government fears desertification and that the rainfall patterns will change even more drastically.

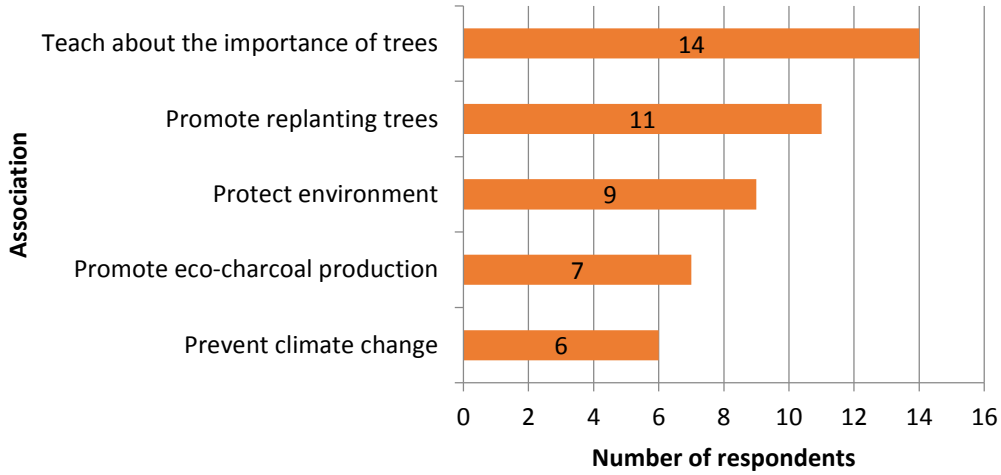


Figure 22 Associations regarding Charcoal Regulations (n=47)

Most of the interviewees are not a member of a CPA (57%), or they are dropouts (8%). As a member, one has to pay a CPA membership and CPA fee for selling the charcoal at the central selling point along the highway (Figure 23). Fourteen charcoalers (20%) mostly from Teri and Talio report that they have never heard of CPA, compared to 46% who have never heard of Charcoal Regulations. Mostly, the attitude towards CPA or similar organizations is negative (69%). Some of the members have joined only after receiving threats from the relevant authorities. There are couple of disadvantages (Figure 24) and advantages (Figure 25) of CPAs or the general idea of bringing charcoalers together in a group. One of the large problems is the fact that some CPA members, despite of carrying out the activity legally in their own eyes and paying CPA membership and a fee, got into trouble or jail. One case reports that one member ended up in jail, and the fellow members presented the CPA certificate in prison in order for their colleague to be released, but the officers that issued it called it fake. False promises refer to situations in which CPA promised a charcoal price increase or individual nametag that would differentiate members from non-members, but that has not happened. On the side of the advantages, the most prominent one is protection against harassment and conflict with environmental stakeholders.

Figure 23 Sagalla CPA selling point along the Nairobi-Mombasa highway (Source: author).

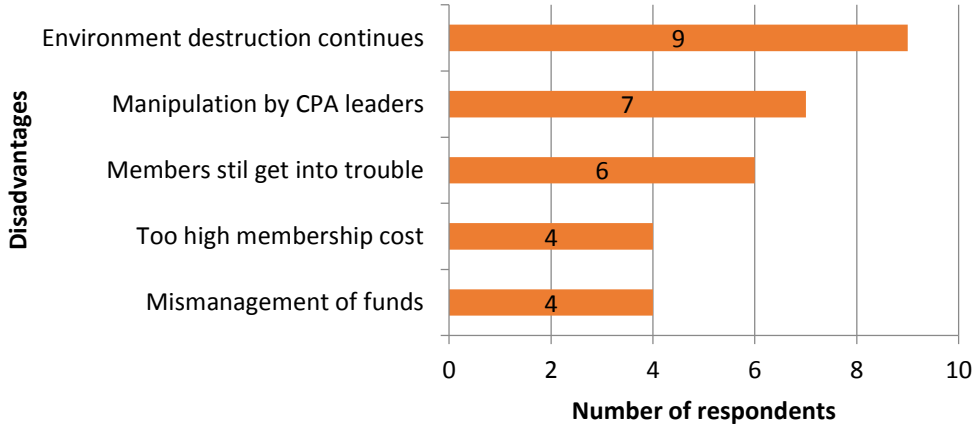


Figure 24 Disadvantages of CPA (n=30)

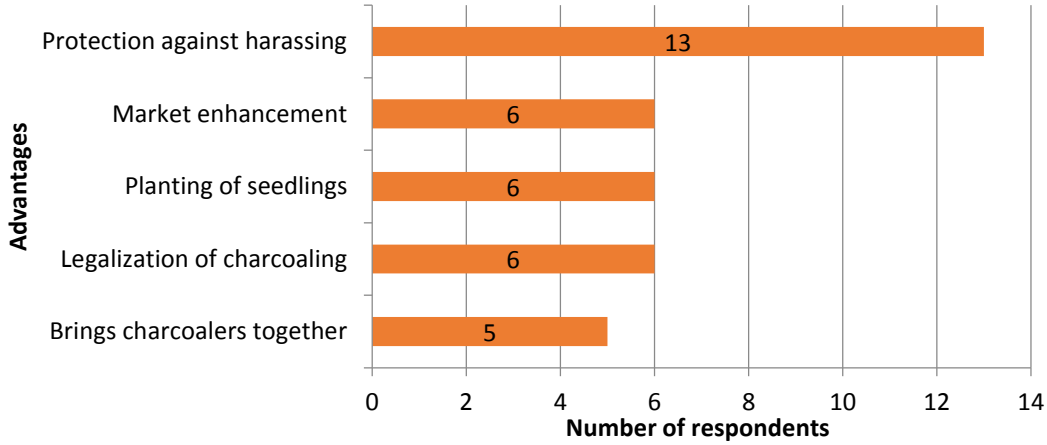


Figure 25 Advantages of CPA (n=36)

CPAs are, although perceived legal by charcoalers that are members, not being sustainable. They have a permit to carry out the activity in the area on the basis of claiming that they are replanting trees and being sustainable. Approximately 2/3 (65%) of interviewed charcoalers remove together at least 393 trees of big or average size (DBH around 15cm) in the dry season and this is the amount that should be replaced. This is not the case, though. Most of the interviewees (70%) claimed that although they have replanted a tree, they refer to trees replanted on their own farms. Figure 26 presents the types of trees that were replanted or actions taken to support reforestation. Only nine charcoal producers reported replanting in the bush to replace trees that they have cut down for charcoaling, and only a small number of trees. Some have reported that they were taught that if one cuts a tree, they should replant at least two trees, but they note that *"nobody else does it"* and that is not motivating them. They also report that trees dry out when/if replanted in the bush, which signals need for formal education, and possibly dedicated employment for ensuring reforestation.

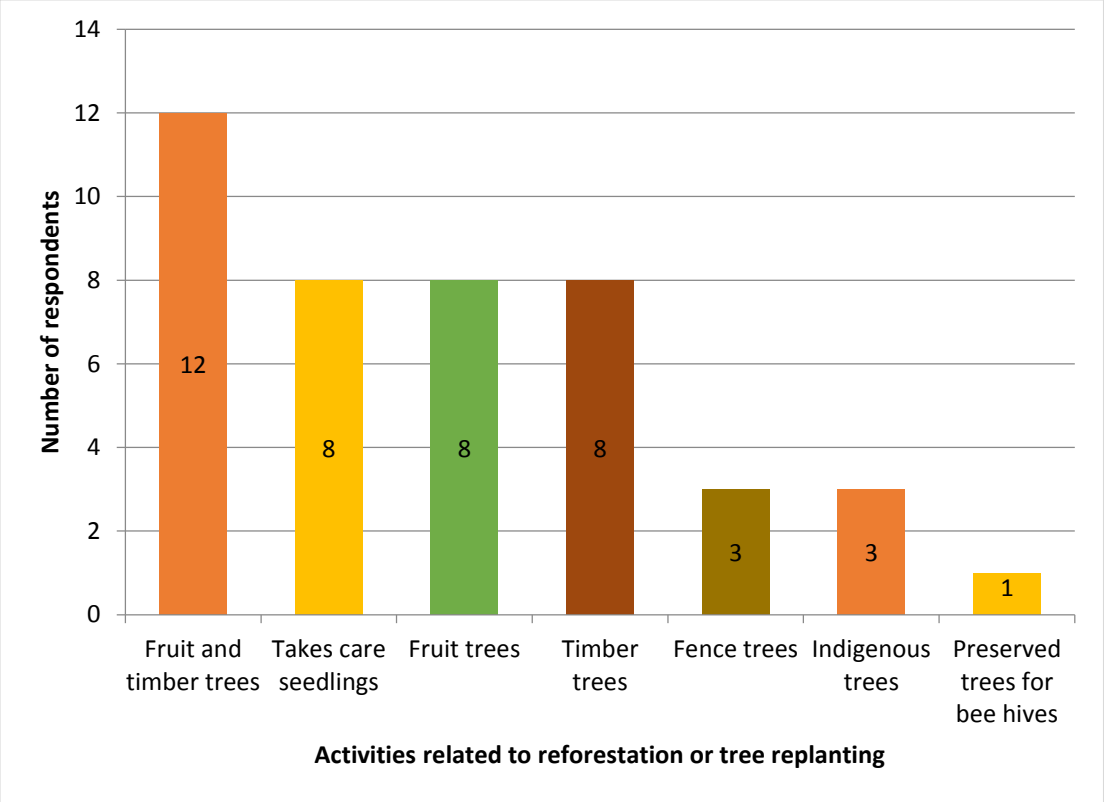


Figure 26 Activities related to reforestation or tree replanting (n=43)

Most of the charcoalers report that they believe that their children will not have trees from which they will be able to produce charcoal. For Kishamba B group ranch it is specifically reported that there might be trees for only three more years. After that, they plan to relocate due to depletion

of resources (leakage), start searching more intensively for another job, or just stay at their farm and "hope for the best".

4.4 Initial findings

Already this chapter has provided certain insights into what might be needed to minimise charcoaling in the area, and thus fulfilled the Objective 1.1: " To identify demographic and general charcoaling characteristics of charcoalers". First useful information is critical age, or age of starting with charcoaling. As the most sensitive group seem to be between 21 and 30, indirect compensation could target specifically individuals of this age. Also, it seems that there are many school dropouts in the sample and that the most of the individuals do not have a secondary school education. It is of importance to keep increasing level of education and percentage of school completion, as a way of moving away from illegal activities.

When coming up with a compensation scheme, reasons for charcoaling should be taken into account. The reason reported most often is taking care of one's family, including school fees, food and clothes. Covering school fees, for example, could be a form of in-kind compensation, and the amount needed will be investigated in chapter 6. Women seem to be pushed into charcoaling upon loss of a partner. Specific programmes could therefore be put in place to support single mothers, being careful, though, about not incentivizing couples to split up in order to benefit financially.

Currently, knowledge about charcoaling is being passed on by family and friends or in jail once a person is imprisoned. A formal education seems like something what charcoalers could benefit from. In these "schools" they could get informed about legal eco-charcoal and learn about reforestation processes. They could also learn about different types of technology available for both higher efficiency of charcoal production and consumption.

Objective 2.1 was addressed here: "To understand attitudes of charcoalers towards charcoaling". They mostly do not like charcoaling at all, due to various health reasons and danger related to carrying out the activity. This could mean the compensation scheme could perhaps provide less than what they are earning or asking for.

Chapter 4.3 fulfilled the Objective 2.2: "To understand attitudes towards sustainable charcoaling options". In terms of switching to sustainable charcoaling as a way of minimizing deforestation, it seems that there are many obstacles with the system as it is now. CPA does not cover all the areas where charcoaling is taking place, so a way forward would be to support organizing one wherever there is charcoal production taking place. The chief support will be needed in terms of proving sustainability: charcoalers could replant either as much as they cut or

produce eco-charcoal or briquettes in a sustainable way (Charcoal Regulations 2009). Other type of support will be needed as well: differentiation of members from non-members, improving the image of CPAs, ensuring the transparency of fund management, differentiating legal sustainably (CPA) produced charcoal from other types of charcoal through labelling and proper marketing. Consumption of illegal charcoal could be banned to encourage consumers to choose sustainably produced products.

5 Estimation of direct compensation for different categories of charcoalers

The previous chapter has reported on demographic information about charcoalers and general information regarding charcoaling activity. Certain subsets of charcoalers were selected to calculate category specific profit components: male-female, permanent-seasonal, CPA-non-CPA charcoalers. These three binary oppositions (gender, seasonality of charcoal production and legality) were randomly chosen as they would not result in too much complexity should the compensation scheme be put in place.

Estimation of direct compensation is based on profits, calculated from the charcoaler's estimation of costs and revenues. These calculated profits are then compared to reported profits, both of which the source are interviewees themselves. The possible difference might be due to simple confusion over numerical questions. Opportunity costs from the REDD+ Project Area perspective are subsequently roughly estimated as well, to see whether REDD+ revenues could generate needed direct compensation.

5.1 Profit components of the identified categories

Charcoalers struggled to estimate their average yearly production rates. Sometimes there are interruptions, like community meetings or burials, which mean that they cannot go out to the bush and produce. Sometimes they decide to rest for a couple of days before continuing, as charcoaling is a tiring process for them. Therefore, it is important to bear in mind that the following data are rough estimates for monthly values.

5.1.1 Volume of production

All the bags were standardized to 50kg, as most of the charcoalers are using this size (66%). Other reported size is 90kg and one charcoaler reported use of 70kg bag. It should be noted, though, that a 50 or 90kg bag does not necessarily represent 50 or 90kg of charcoal. A 50kg bag, for instance, holds about 33-36kg of actual charcoal for most tropical hardwoods (FAO 1983). Bags used for charcoaling are second-hand, having previously been used for fertilizers, wheat, flour or maize, according to interviewed charcoalers. This means also that the volume they can contain varies significantly, depending on how stretched out it is from previous uses. This is mostly the case with 90kg bags (32% of the charcoalers use this size of the bag), which means that a 90kg bags will be priced according to the approximated volume of an individual bag and is a lot less standardized than a 50kg bag. Charcoalers make on average two kilns per month. An average size of the kiln is 19 bags (s=14) of 50kg. This means that the monthly production is 2,584 50kg bags from all the 68 charcoalers interviewed.

5.1.2 Charcoaling process

Before going into financial cost, the time cost of the charcoaling process needs to be described. The steps of charcoal production are presented in the Figure 27, and the duration in days is presented in Figure 28. It should be noted that the step of kilning is a passive one, so charcoalers either rest or prepare the second kiln. Ostensibly, once charcoalers light the kiln, they can just leave and return to do the packaging. Most of the charcoalers walk every day on average 3 hours to the bush and back, while some use a bicycle. This time is included here in each of the steps, except from kilning. There is no significant difference between duration of the process for any of the subsets. Nineteen days (s=2) is an average duration of completing one kiln.

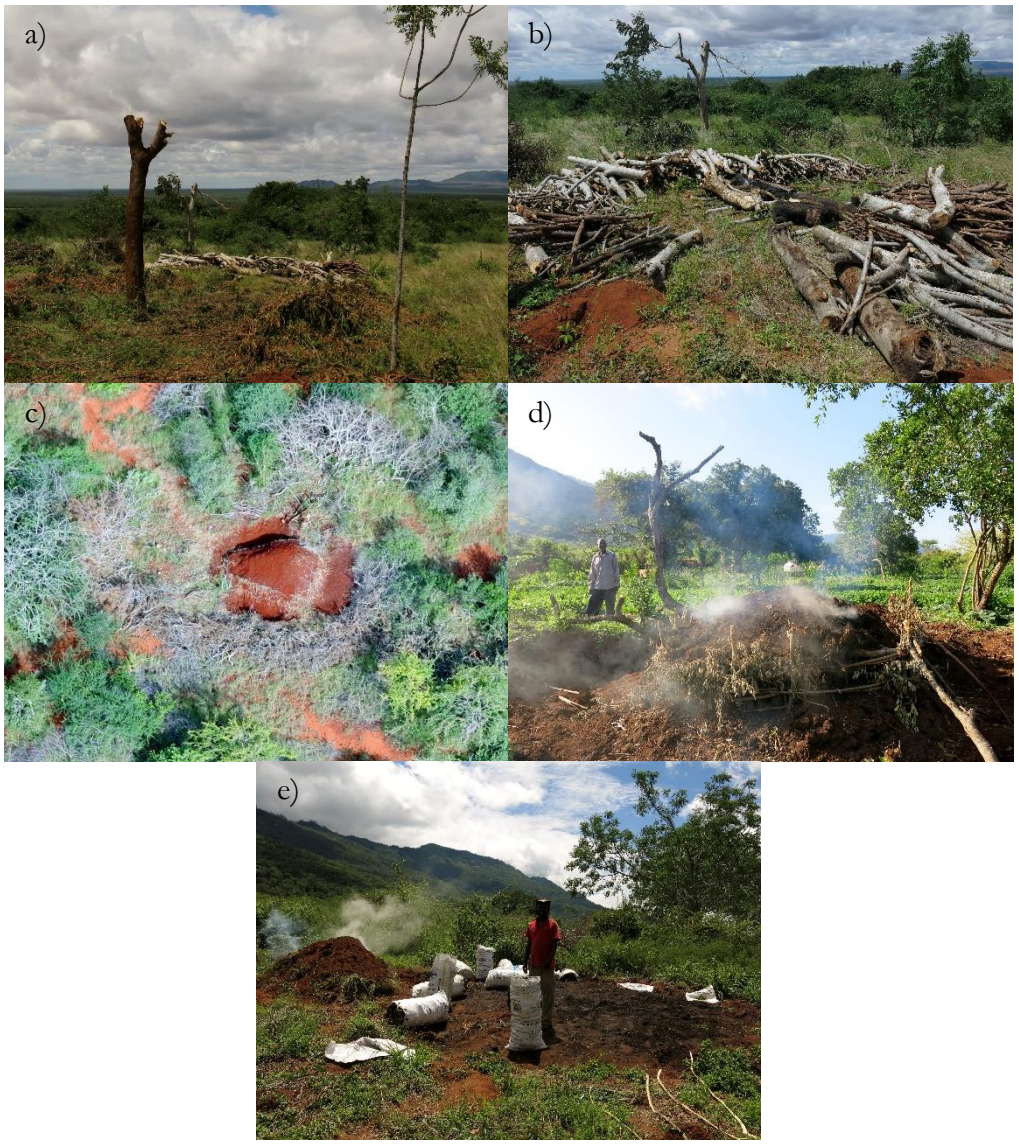


Figure 27 Steps of charcoaling process: a) cutting; b) collecting; c) kiln preparation; d) kilning; e) packaging (Source: author).

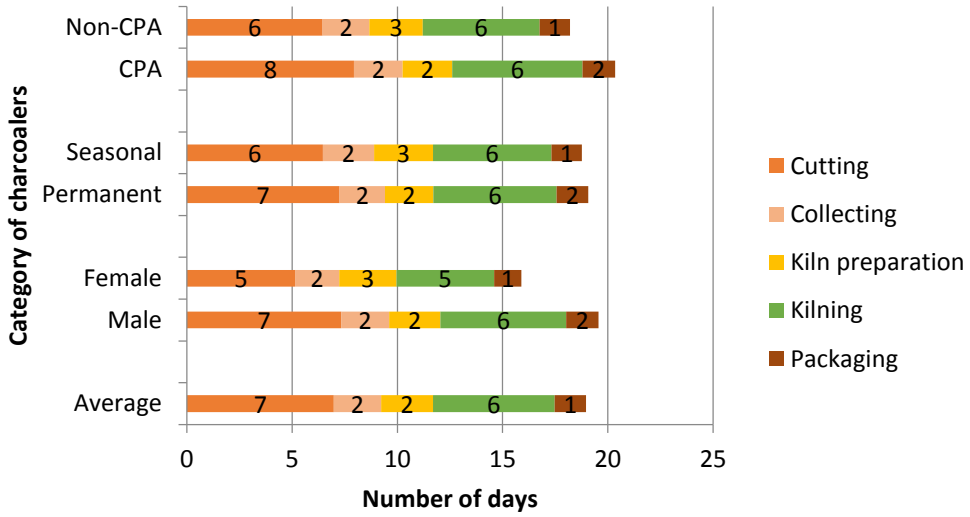


Figure 28 Steps of charcoaling process and their duration (n(non-CPA)=44, n(CPA)=24, n(seasonal)=24, n(permanent)=44, n(female)=11 , n(male)=57)

It should be noted that in this, as well as all the following graphs with same y-axis, only comparisons within subsets should be made. That means that one can compare only CPA-members and non-CPA members, permanent and seasonal, male and female charcoalers. It is not possible to compare, for instance, CPA-members and female charcoalers.

5.1.3 Cumulative costs of charcoaling

The costs of charcoaling are different if charcoal is sold at the production site (in the bush) or at the market (along the highway or in Voi). When selling at the market, the charcoaler has a higher cost, as s/he needs to buy an empty bag, transport the charcoal and pay a CPA fee, if s/he is a CPA member. Differences in costs per month can be seen in the Figure 29, and differences in the costs per 50kg bag equivalent in Figure 30. For all three subsets, it was discovered that there is a significant difference in costs per month. Female charcoalers have significantly lower costs than male charcoalers ($t=2.63$, $p=0.013$, $n=68$), seasonal charcoalers have significantly lower costs than permanent charcoalers ($t=3.35$, $p=0.0013$, $n=68$), and non-CPA charcoalers have significantly lower costs than CPA charcoalers ($t=4.81$, $p<0.0001$, $n=68$). Costs per month per CPA member are so much higher than the non-CPA ones because they produce more charcoal (Figure 29) and therefore have more expenses. Already "per bag" values offer a more evened out figures, and profits are likely to show values that are closer to each other as well. Average cost is KES 2,023 (s=KES 252) per month (USD21[3]) or KES 63 per bag.

[3] 1USD = KES 97.74 on the last day of the research, May 31st 2015 (XE.COM INC 2015).

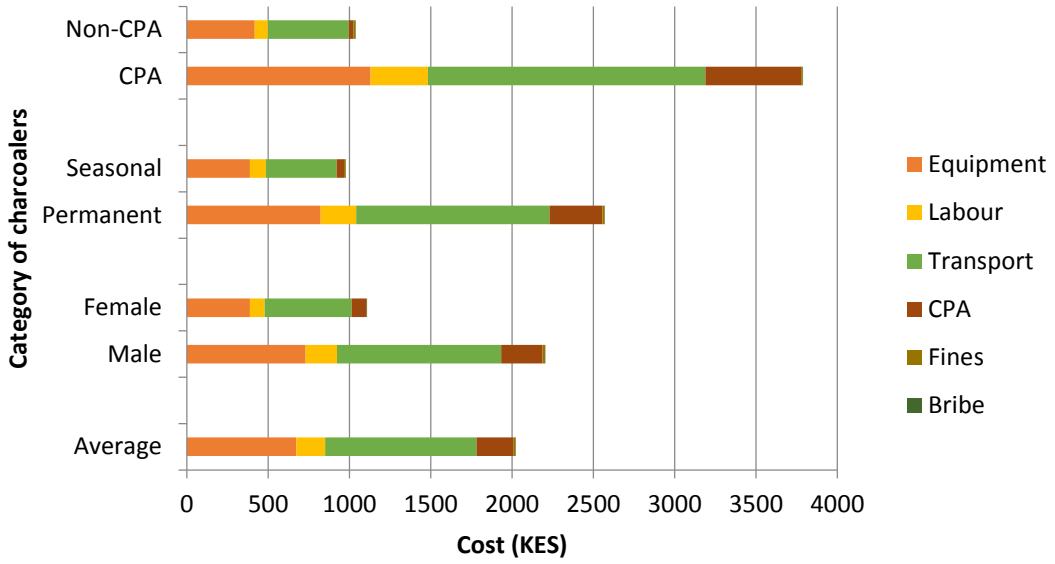


Figure 29 The cost of charcoaling per month per person (n(non-CPA)=44, n(CPA)=24, n(seasonal)=24, n(permanent)=44, n(female)=11 , n(male)=57)

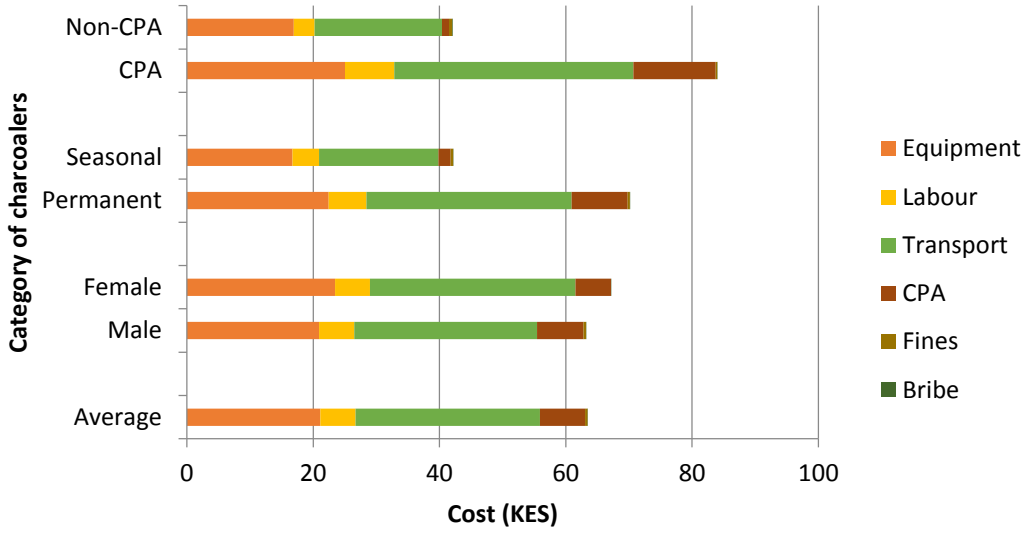


Figure 30 The cost of charcoaling per 50kg bag equivalent (n(non-CPA)=44, n(CPA)=24, n(seasonal)=24, n(permanent)=44, n(female)=11 , n(male)=57)

Equipment includes the cost of an empty bag and tools (axe, machete, hoe, spade, matches). Some of the equipment can be seen in the Figure 31. It also includes camping costs, which is plastic for creating a roof-like protection in the bush. Cost of uptake (food, water and similar) was ignored.

Figure 31 Some of the equipment used for charcoaling. a) axe, b) hoe and c) machete (Source: author); d) empty bags and plastic for protection while camping in the bush (Source: WW BSMD 2015).

Labour costs include costs of occasional involvement of a second person in the production process. Charcoalers either pay this second person per day, they hire them (Figure 29 and Figure 30 above), or they have some other type of arrangement, like exchange of labour. Sixteen charcoalers reported that they hire someone for one or more processes. For hiring costs, based on interviewees indications, it was estimated that one person for one day per kiln is hired. Figure 32 indicates other types of arrangement with the second person involved in the charcoaling process. There is no money exchanged in this case. Sometimes family members are involved.

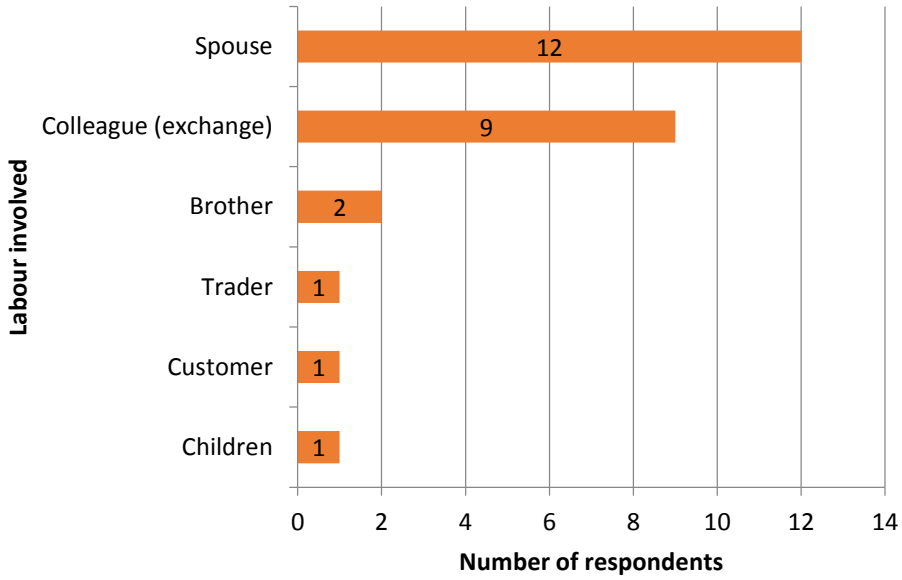


Figure 32 Labour involved in charcoaling process (n=26)

Transportation costs cover hiring or owning a cart with donkeys, motorcycle or bicycle used for transportation of the charcoal to the market, if needed. Self-made wheelbarrows are also sometimes used, but it has no cost, as charcoalers themselves make them in the bush during one day, and it can last up to one year. The highest transportation costs to the final consumer of producers are reported in Teri. They only have motorcycles and bicycles as means of transportation, but mostly they sell their bags at the production site to a middle man. In Voi they can get better prices than in the bush, so some prefer going there with their bags than selling the bags to a middle man. One young man reported, for instance, that he spends ten days each month selling his bags to Voi. He goes on his bicycle every day and can transport only one bag per trip (he makes ten 90kg bags per month).

CPA costs are both costs per bag and membership paid out once. It should not be surprising that non-CPA members also report CPA costs. Some were previously part of the CPA and have paid a one-term non-refundable payment for the membership.

Encounters with law enforcing stakeholder, like KFS officers and Wildlife Works rangers, are quite frequent. If they are caught producing charcoal, most often their charcoal is burnt or taken away and their tools taken away. If they end up in prison, for release from prison, charcoalers paid or would pay on average KES 17,864 per incident. Bribing happens with both Wildlife Works rangers and KFS officers. They have paid on average as a bribe KES 1,960 per incident.

Each of the components had a different way of calculation. Cost of empty bag, hiring transportation and CPA fee were obtained first per bag, and then multiplied by the mean number of produced bags per month for each category separately to come to the monthly costs. For the cost of the tools, matches, owning means of transportation and camping costs, charcoalers were asked for price, and lifetime of the product. First, a monthly cost was calculated, and from there values per bag were calculated. Bribing, bailing out of jail and paying CPA membership costs are one-time events. An assumption was made that for the charcoalers that have reported it, they pay it out throughout their career (an average length of sample's career is 14 years). First a monthly cost was calculated, and from there cost per bag.

Producers were also asked about variability of the cost as well. Tools and transportation were reported as the most common variables that change. Tool prices change for various reasons (Figure 33). One of the charcoalers mentioned that this might be the case because of the demand from the increasing number of charcoalers. The other variable cost is transport. If distance is larger, a supplement usually needs to be paid out.

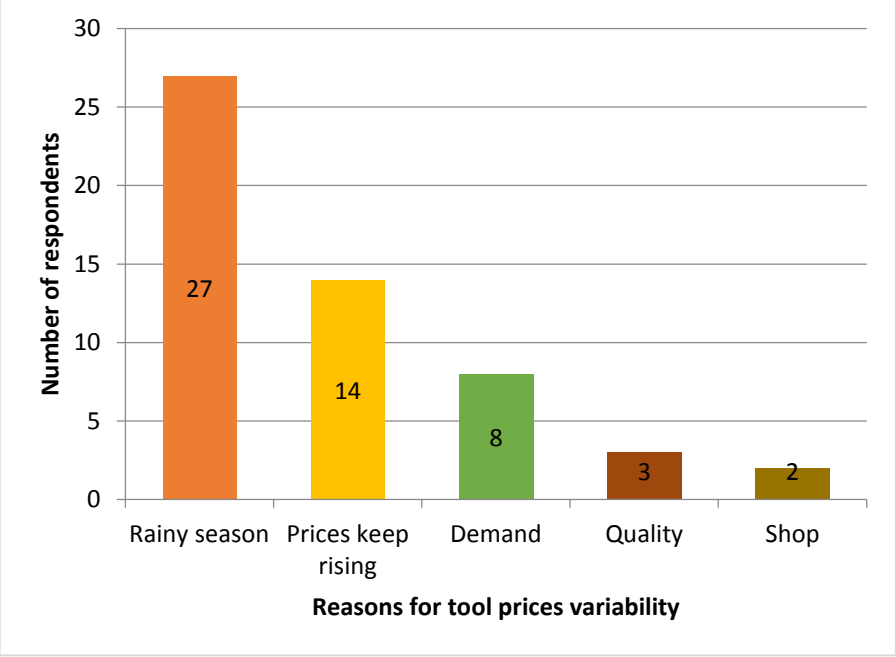


Figure 33 Reasons for tool prices variability (n=54)

Charcoal consumption was excluded from the cumulative costs estimation, as they are an unembedded cost. Ex-charcoalers have all said that once they stopped producing charcoal, they have also stopped consuming it. According to producers, charcoal is a better energy source than firewood, as it does not produce an eye-irritating smoke. People are pleased to cook with it and it is the fuel of more prosperous households. Forty charcoalers report that they use charcoal, half of

whom do so on a regular basis. The regular users consume 1.04 bags per month which costs on average KES 305 for a 50kg bag. Combining charcoal with firewood prolongs the time during which the specific amount of charcoal can last in one household. Irregular charcoal consumers are using leftovers of poor quality. They consume on average 0.63 50 kg bags per month, which would give them the occasional cost of KES 186.

5.1.4 Revenues from charcoaling

Two types of charcoal bag prices are reported in different areas of Sagalla. Kishamba and Ndara sub-location sell mostly 50kg bags, and Talio and Teri mostly 90kg bags. The first price is the one in the bush or at the production site. This one seems more convenient for charcoalers, as it takes less time, and is the preferred option, specifically when there are urgent living costs. One 50kg bag is sold for the average of KES 256 and a 90kg bag for an average of KES 745. The reason behind 90kg bag being sold at three times the price of a 50kg bag is that a 90kg is used in the area with a lot higher transportation costs. Secondly, when charcoal is sold at the market like on the highway or in Voi Town, the market price is KES 393 for a 50kg bag and KES 920 for a 90kg bag on average. Figure 34 shows buyers of charcoal: traders, motorcycle and bicycle drivers buy mostly at the production site, whereas lorry drivers and households buy on the market.

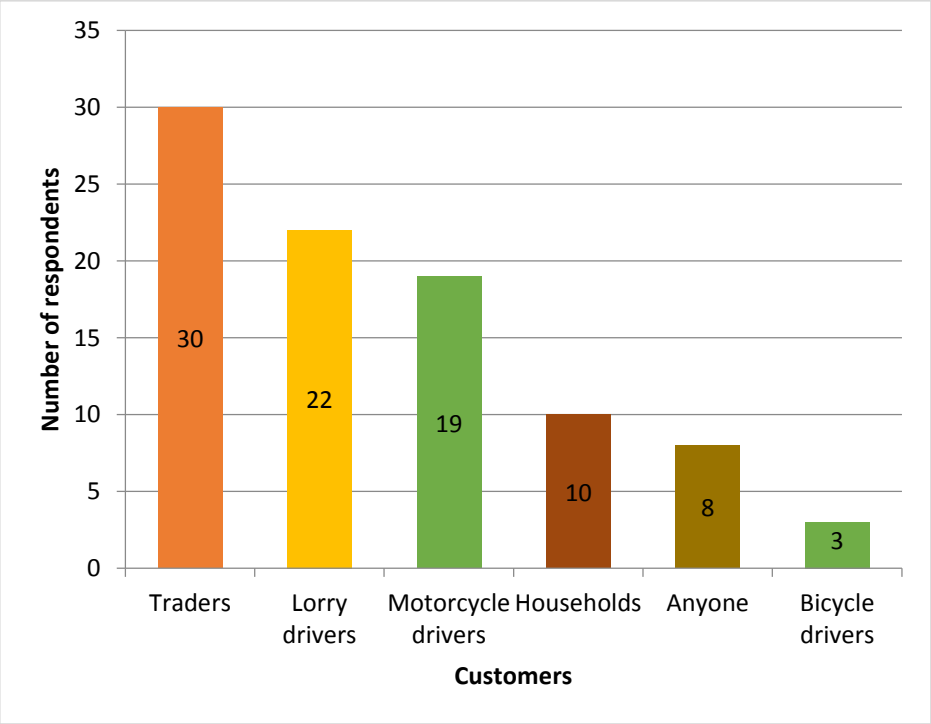


Figure 34 Charcoalers' different types of customers (n=68)

Prices for the reported number of bags sold per month give an estimation of monthly revenues. Figure 35 presents revenues from charcoaling per month and Figure 36 per 50kg bag equivalent. It should be noted that charcoalers reported smaller number of bags sold than bags produced per month. The difference might be result of charcoalers using some of the produced bags themselves or using it as bartering (and hence not selling them).

Additionally, 23% of charcoalers report that they are selling at both production site and market prices depending on the circumstances. They are unsure about how much would they sell at each of the prices. In the figures, only the case of 100% bags sold at each of the prices is reported, in order to understand possible range of revenues. The average of the two revenues for both prices is KES 10,601 (s=6,708) or KES 332 for 59kg bag equivalent. Compared to the Kenyan average income in 2013, KES 8,400 (MEWNR 2013), one can conclude that revenues in the Kasigau Corridor could be higher than the average. There is a significant difference in average revenue value for the seasonality and CPA subset. Permanent charcoalers have significantly higher revenues than seasonal charcoalers ($t= 3.97$, $p<0.0001$, $n=68$), and CPA charcoalers have significantly higher revenues than non-CPA ones ($t= 5.71$, $p<0.0001$, $n=68$). There is no significant difference in average revenues between male and female charcoalers.

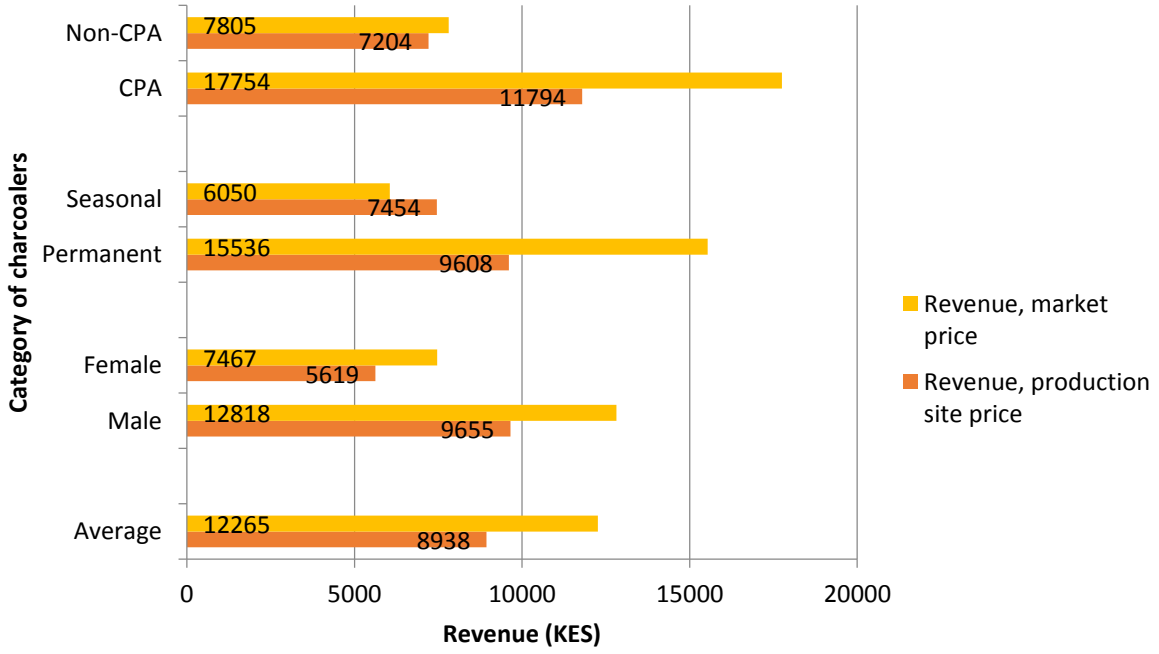


Figure 35 Revenue from charcoaling per month per person (n(non-CPA)=44, n(CPA)=24, n(seasonal)=24, n(permanent)=44, n(female)=11 , n(male)=57)

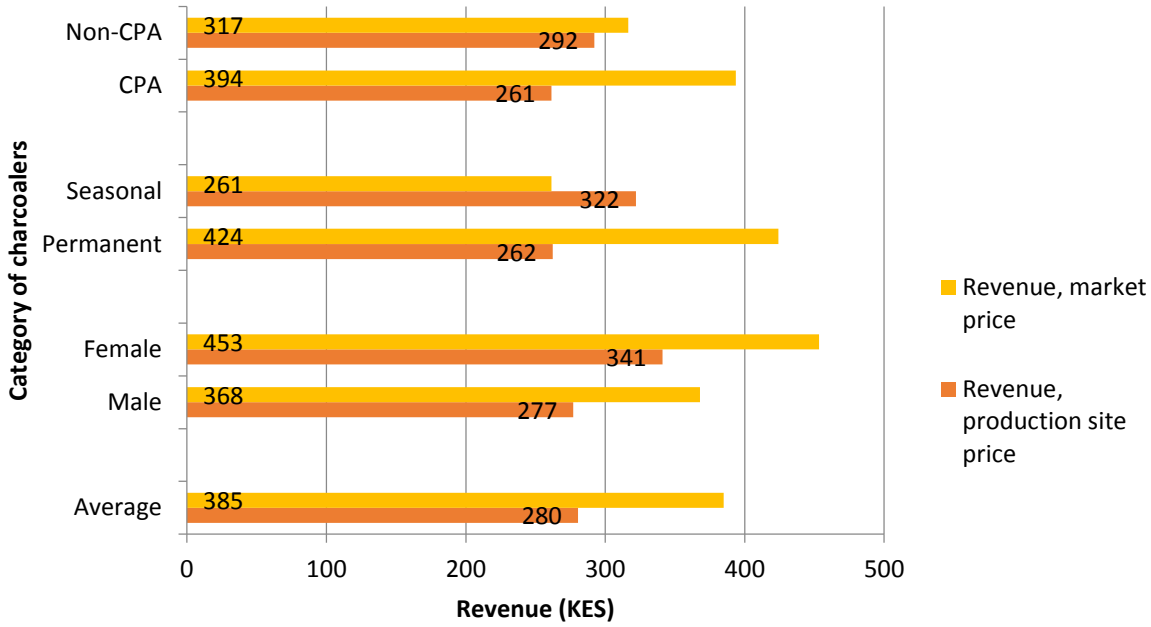


Figure 36 Revenue from charcoaling per 50kg bag equivalent (n(non-CPA)=44, n(CPA)=24, n(seasonal)=24, n(permanent)=44, n(female)=11 , n(male)=57)

Prices of charcoal can go up in the rainy season, when a number of charcoalers go back to their farms. This means that there is less charcoal available on the market, and the simple supply-demand principle pushes the price up. When the prices go up, some decide to go to the highway, where they can get higher prices for the charcoal, albeit with attendant transport costs. Prices also vary with customers and the quality of charcoal, but only a few charcoalers mentioned this. Charcoalers report that the prices have been quite constant, despite their desire to increase it. This is of particular interest to CPA members, who complain that they cannot raise the price of charcoal due to the illegal charcoal producers selling at lower prices.

5.1.5 Profit from charcoaling

Figure 37 and Figure 38 represent profit from charcoaling per month and per 50kg bag equivalent, and this fulfils the Objective 1.2 of the thesis: "To identify profit components of local charcoal production of different categories of charcoalers". They were calculated as a difference between cost and two revenues: one created at the production site price and the other at the market price. In general, it is more profitable for charcoalers to sell to the final consumer than it is to sell to a middle man. Calculated values are compared here to reported values about monthly profit.

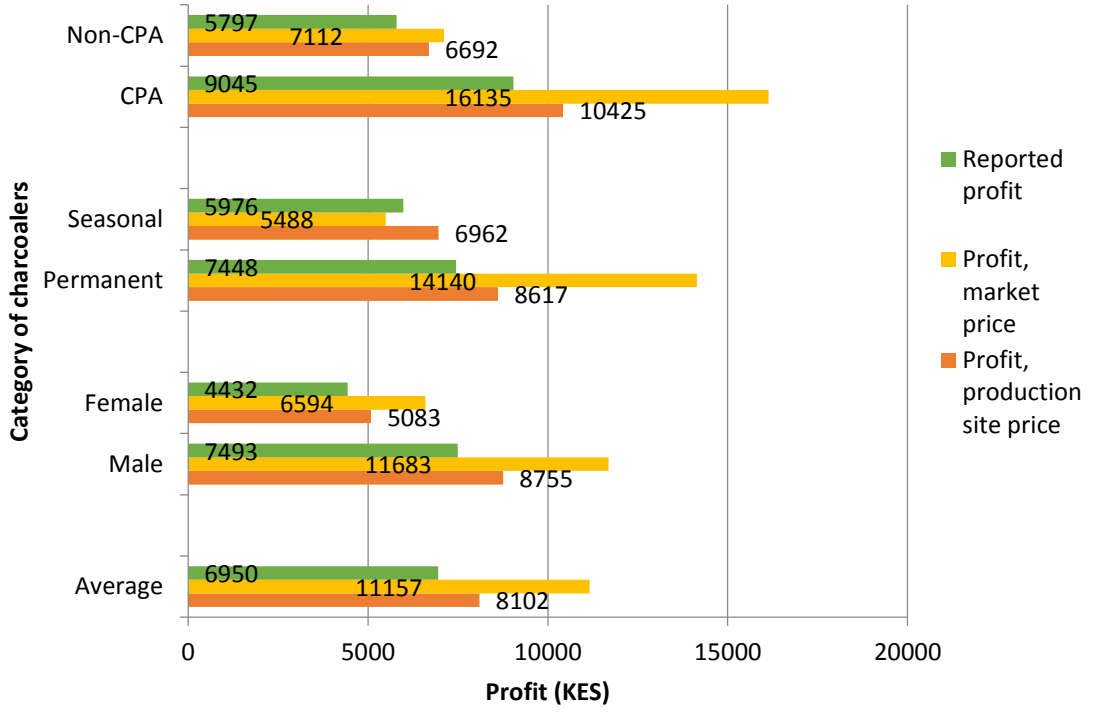


Figure 37 Profit from charcoaling per month per person (n(non-CPA)=44, n(CPA)=24, n(seasonal)=24, n(permanent)=44, n(female)=11 , n(male)=57)

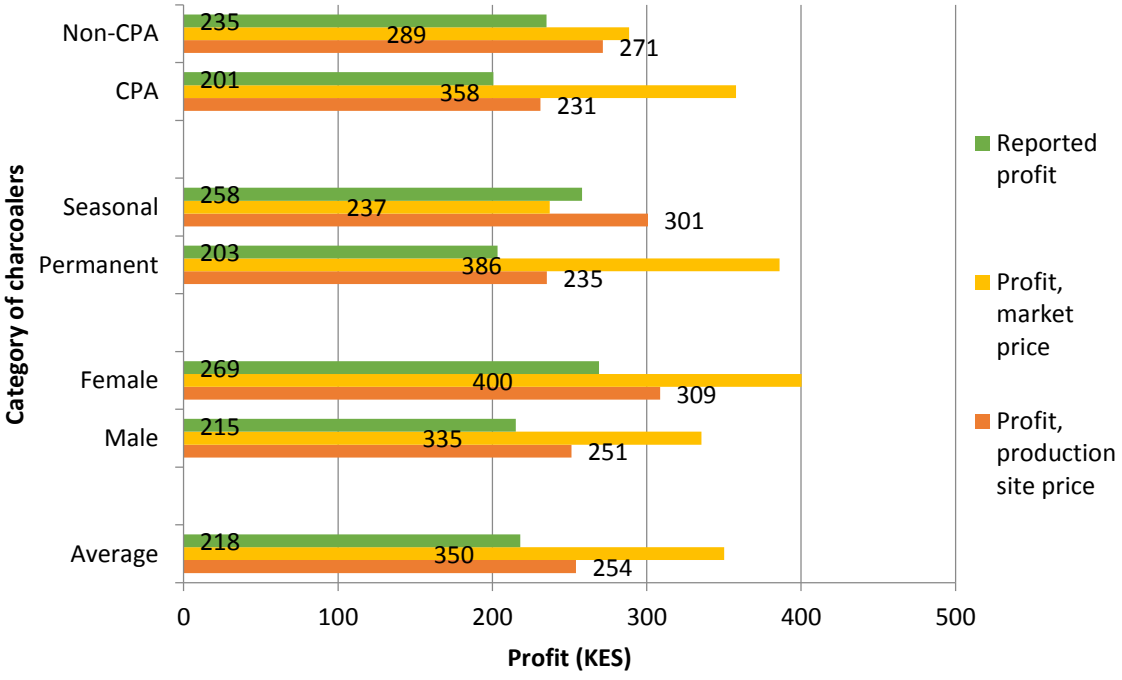


Figure 38 Profit from charcoaling per 50kg bag equivalent (n(non-CPA)=44, n(CPA)=24, n(seasonal)=24, n(permanent)=44, n(female)=11 , n(male)=57)

Average of the two calculated profits (from the revenue stream at the production site price or at the market price) per month is KES 9,626 (s=6,232), and average reported profit is KES 6,950 (s=4,233). There is a significant difference between these two profits (t=4.03, p<0.0001, n=68).

Charcoalers mostly do not keep track of how much they produce and sell and it might be difficult for them to give exact numbers on all of the numerical questions. Another reason for this confusion is that charcoalers might have reported their profits from charcoaling once they have deducted their living costs as well, such as food while they are staying in the bush. This possibility of difference in defining "profit" was observed in the third week of interviewing, and the charcoalers were subsequently warned to make the estimate without the food and other living costs.

For the purpose of creating a compensation scheme, it might be argued that the second value is more interesting, as it presents charcoalers' perception on what they are earning, and it might be a sufficient amount to encourage them to quit charcoaling. However, it does not seem to represent the real value in this particular case. Any compensation scheme should therefore, to be on the secure side, follow the real values.

There is a significant difference in average profits value for the gender, seasonality and CPA subsets. Male charcoalers have significantly higher profits than female charcoalers ($t= 3.90$, $p=0.0004$, $n=68$), permanent charcoalers have significantly higher profits than seasonal charcoalers ($t= 2.29$, $p= 0.026$, $n=68$), and CPA charcoalers have significantly higher profits than non-CPA ones ($t= 4.07$, $p=0.0002$, $n=68$). This means that all of these categorizations are suitable for developing a compensation scheme. Which exactly should be implemented can only be decided once a pilot study has been carried out, and this is one of the suggestions for the further study.

Values per 50kg bag equivalent are: KES 302 for the calculated profit and KES 218 for the reported profit. A summary of "per bag" profit components is presented in Figure 39. Here one can see that the amount of producers' revenues captured by the government (law) is quite small compared to the rest. Mwampamba *et al.* (2013) also claimed that "private taxes" or bribes along the charcoal commodity chain are significantly larger than the government revenues from the activity. From the results of this study, it could be concluded that most of the bribing happens later along the commodity chain, and not within the production stage.

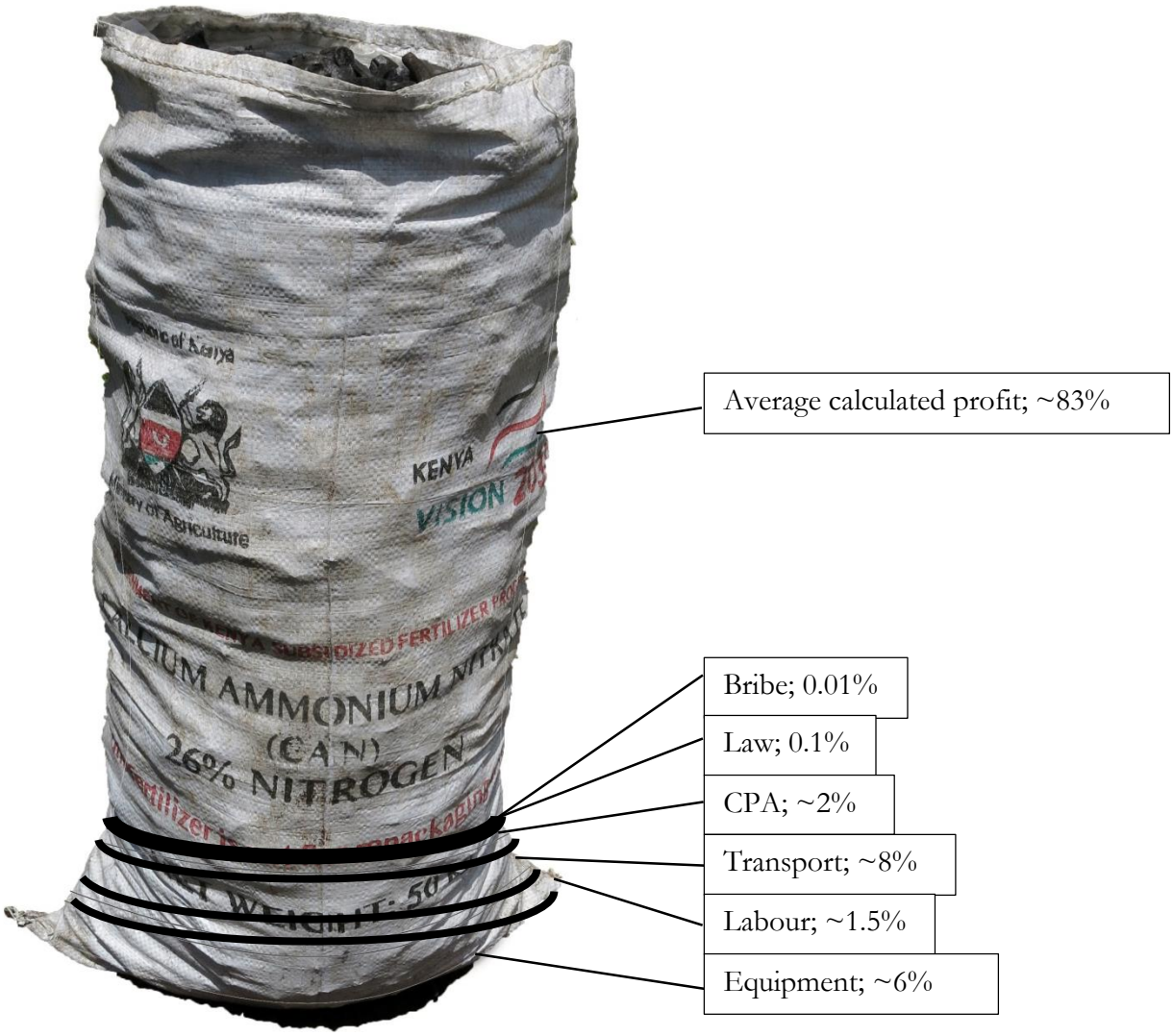


Figure 39 The proportion of producers' revenues in Sagalla sample per 50kg bag (KES) (Source: author)

Following assumptions were made in profit components estimation process:

- All of the 50kg bags equivalents are the same.
- When not reported by the charcoalers themselves, lifetime of charcoaler's own carts and donkeys were estimated at 15 years and bicycles at 10 years. This was done on the basis of lifetime reported by other charcoalers.
- The allocation problem was not discussed. All of the tools and own transportation vehicles can be used for other purposes as well, and only some of its cost should ideally be associated with charcoaling. Here it was assumed that the entire cost is due to charcoaling.
- Cost of being bailed out of jail and bribe, as well as CPA membership cost, was equally distributed over 14 years. This is an average career length of the interviewed charcoalers. Probably careers last longer than was reported here. Here was a more conservative approach to use.

- Charcoal consumption costs were ignored for the purpose of calculating profit.
- Costs were calculated based on the reported bags produced and revenues were calculated on the basis of reported bags sold. This was a more conservative approach, resulting in higher costs.

5.2 Direct compensation scheme

If Wildlife Works were to compensate charcoalers directly, then charcoalers should be paid out the calculated amount stated under profit section, not the reported ones, to be on the safe side (Figure 37 and Figure 38). On average it would be KES 9,626 per month per person or 99USD. To compare this amount to another direct compensation scheme, Clements *et al.* (2013) were paying out 2,500USD monthly for conservation purposes in Cambodia. If the compensation per 50kg bag equivalent would to be put in place, than an average amount should be KES 302 or 3USD. Each category could be given a different amount in order to compensate them, as Flury *et al.* (2005) have advised, either per month or per bag. The most appropriate version will not be discussed here, as it is beyond the aim 1 and the statistical analysis that all three categories could be used. Wunder (2005) suggested experimenting with selection and the periodicity of payment, and this is what can be advised to Wildlife Works, or any other REDD+ organization facing the problem of charcoaling. At this point it also difficult to say for how long should the compensation scheme be in place, or how effective it would be.

To estimate the feasibility of paying out this amount, a rough estimate of potential carbon benefit from the same amount of hectares was calculated according to the formulas in Table 2. Profit per hectare when there is no charcoaling was approximated from the general data on Kasigau Corridor REDD+ Project Area size and emissions avoided. The Project Area covers 169,741 ha and avoids emissions of 1.3 million metric tonnes per year on average (WW BSMD 2015). Prices of carbon credits vary between clients, projects and market, but normally range from 4-10USD per tCO_2e. The average historical price at voluntary carbon markets is 5.9USD per tCO2e (Peters-Stanley and Gonzalez 2014) and was used in this analysis. This price was used to estimate potential income from trees if they were not to be cut down for charcoal purposes. The final profit in Sagalla from carbon financing calculated per hectare per year is KES 4,482 and per month KES 373.

Hectares of forests deforested for charcoaling were calculated through conversion rate from trees to charcoal from the charcoalers' perspective, or for "average-sized" trees they can find. Charcoalers produce a mean of 19 50kg bags per kiln, which is 646 kilograms of charcoal, assuming the actual weight of 50kg bag being 34kg (FAO 1983). This amount of charcoal is then divided by

a conservative conversion rate of 15% (TEK efficiency according to Kalenda *et al.* (2013)), and it gives 4,307kg of dry biomass. This is on the other hand 8,613kg of wet weight assuming 50% is water (USDA FS 1999). Then it is conservatively assumed that there is 250kg of wet weight per average tree of about 15cm DBH (Wildlife Works 2014b). This would mean that 34 trees of about 15cm DBH are cut down for an average kiln. Assuming 37 trees per 0.1ha plot in Sagalla (WW DBSM 2015), these 34 trees would cover 0.09ha. If 68 charcoalers make two kilns per month on average, and each kiln takes 0.09ha, then they cut roughly 13ha every month. Current sum of all the monthly profits from charcoaling that the same amount of trees generates is KES 430,875. Compared to the potential income a hectare in Sagalla can generate from carbon financing, 89 hectares would be needed to compensate charcoalers with the reported monthly profit. This is so because carbon finance can generate yearly KES 4,855 from the same amount of hectares. With this, the Objective 1.3 of the thesis is fulfilled: "To estimate the potential of carbon revenues to finance the compensation model." With objectives 1.1, .2 and 1.3, the first aim is accomplished: "To estimate level of direct financial compensation for different categories of charcoalers needed to incentivise them away from this activity in the Kasigau Corridor REDD+ Project Area."

6 Possibilities beyond direct compensation

After discussing direct compensation as an incentive to stop with deforestation, possibilities beyond it were examined. Two main options have been identified here: alternative jobs and catering for school fees, which builds on findings already presented in the chapter 4. Both of these are explained in separate sections. The first explains alternative livelihood options from the perspective of charcoalers. It contains information on both other jobs that charcoalers are already involved in and possibilities that they see for themselves. In addition, charcoalers were asked: would you be willing to quit charcoaling should your children's school fees be catered for? As 69% of them answered positively to the question, the amount of in-kind compensation depends in this case on school fee costs. They were asked about requested amount for the alternative job income, with and without school fees catered for, so school fees can be calculated through the difference of the two.

6.1 Alternative livelihood options

Identifying alternative livelihood options through a survey is possible through asking about the other revenue-generating activities charcoalers are currently involved in, as they might expand on these in the future. In addition, they were asked about what other activities they would prefer which they are not currently engaged in. Willingness to participate in training was also asked about.

While charcoal production was the main source of income for most of the charcoalers interviewed (88%), they also reported several other income-generating activities (Table 3). The greatest number reported farming, either for consumption or also for sale. The data provided by charcoalers is insufficient for discussing the average monthly income of charcoalers from these activities. In addition, charcoalers indicate that they engage in charcoaling when these other income-generating activities are not available, i.e. when they have time. This poses a significant threat to any direct compensation scheme, as availability of time might be an important factor in continuing charcoaling despite the income generated.

Table 3 Other sources of income with corresponding income (n=39)

Activities	Number of responses	Stated income (KES)
Farming	22	
Digging	11	456 per day
Livestock keeping	6	2,000 per month or 150 per day
Construction	5	350 per day
Casual work	4	394 per day
Carpentry	3	
Poultry farming	2	700 per chicken
Selling peas	2	
Selling milk	2	
Bee hives	1	600 per litre
Shop ownership	1	3,000 per month
Leasing shop	1	2,000 per month
Pastor	1	3,000 per month
Food-for-work	1	2,000 per month
Selling fruit trees	1	100 per sapling
Fruit selling	1	
Selling water	1	
Leather tanning	1	
Hotel	1	
Brick-making	1	

Charcoalers stated their preferences for alternative livelihood options and those mentioned more than once are listed in Figure 40. Poultry farming and livestock keeping are the most popular alternatives. With poultry farming, charcoalers were able to estimate funds needed to start (average is KES 33,333). Some mentioned that they were already involved in the activity, but have sold off everything to pay for child's school fees. Driving is the third option. Lorry is the most desired vehicle, but some would like to drive a taxi, minibus, or motorcycle. However, most still need a driving licence. Those who have it, have not managed to find employment yet. Other livelihood options are *Aloe vera* farming, bakery, barber shop, China construction roads, farming dik-diks (although this is illegal), electrician, farming, gardening, greenhouse, house help, mechanic, plumber, real estate (build house for renting to somebody else), and selling timber. In this list, one cannot see the eco-charcoal production, as charcoalers were asked about this earlier in the interview, and they have perhaps not felt a need to repeat that.

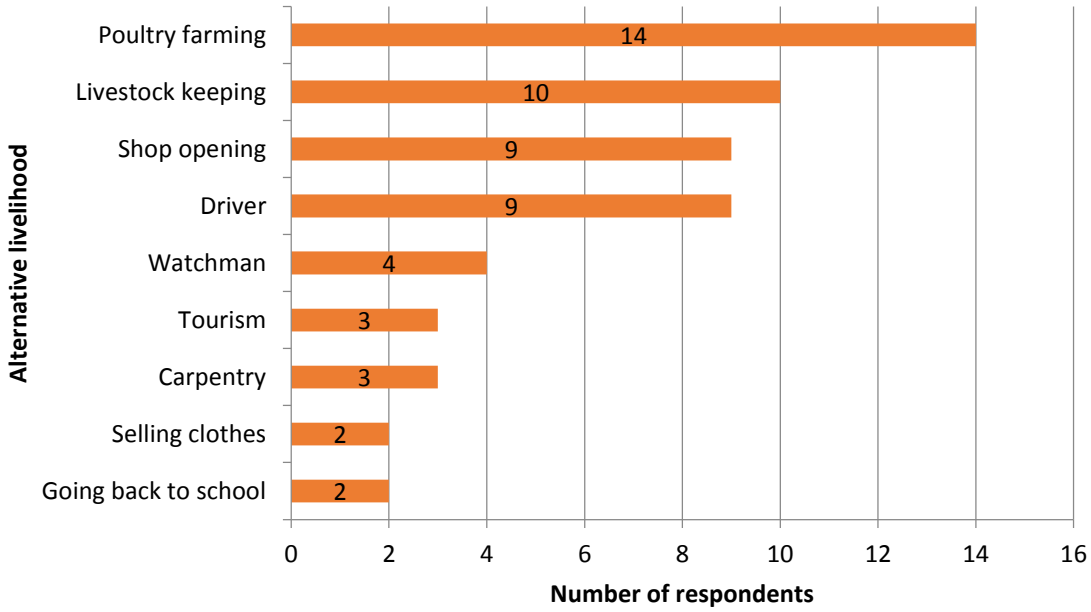


Figure 40 Preferred alternative livelihood option (n=47)

Willingness to participate in a training which would be free of charge was elicited and most of the charcoalers would be willing to join (92%). Reasoning for those who answered "no" was mainly due to their old age. Some answered "yes" with a disclaimer, i.e. it would depend on the duration of the training and potential to earn money in that period as well.

Of the five ex-charcoalers who were interviewed, three are mainly engaged in farming now. One indicated that he went into charcoal production only to pay for his son's school fees, so when his son completed education, he also stopped charcoaling. He argues that if one focuses on charcoaling, agriculture fails, and the other way around, so he has decided to focus on agriculture. Another stopped when forest conservation regulations came to the area. For charcoalers from Talio it is difficult to get employment or cut trees for charcoal in their area. Those that are involved with it now had to move to do it elsewhere, so they stay in the bush, which indicates the leakage problem. He argues that many others also stopped or moved to another area when conservation came, as they do not have an easily accessible community ranch, like Kishamba for instance. The third interviewed ex-charcoaler lost his job, so he had to come back home. As his child was in secondary school, he had to cut trees. Now his children also support him financially. Two other charcoalers obtained alternative jobs: one is currently involved in entertainment contract jobs (guitar playing), which earns him enough income along with livestock keeping; the other was employed by Chinese Railway Construction Company.

One of the charcoalers claims that laws should be stricter: charcoalers should be taken to court and sentenced stronger. For those who say that they do not have an alternative, he suggests that there is always an alternative. Projects have started, like quarry, breaking ballast; one can earn more in this business than from charcoaling. People are not engaging in new projects more because they are "*arrogant or afraid of change*": "*Alternatives are difficult to start, but it is worth it*", according to this individual.

6.2 Minimum salary of an alternative job

More than the two thirds of the respondents claimed that they would be willing to quit with charcoaling should school fees be catered for (69%). A further 24% claimed that they would do it on a smaller scale. The amount of school fees was calculated from their preferences for the minimum salary of an alternative job with (average KES 14,879, s=8,822) and without school fees catered for (average KES 10,822, s=4,233), should they have children in primary or secondary school (Table 4). Average minimum monthly salary of an alternative job is a lot higher than the current average monthly profit from charcoaling (KES 9,626).

This appears somewhat surprising, as the predominantly negative attitude towards charcoaling might suggest that they would be willing to switch to another job for less than what they are earning with charcoaling. From what the charcoalers explained themselves, the reasons for this is that they assume that they would have to relocate to another area and live separately from their families in order to have another job. Hence, their living costs would increase, as they would have to pay for separate accommodation and buy all of their food, instead of cultivating some at their own farm.

For those that have reported that they would quit charcoaling, indirect compensation could be the amount of school fees reported, KES 4,057 on average. Male charcoalers have significantly lower costs of school fees than female charcoalers ($t=2.21$, $p=0.032$, $n=65$). There is no significant difference between seasonal and permanent charcoalers and non-CPA and CPA charcoalers in terms of money needed for covering school fees. Therefore, the most suitable categorization for the compensation for the school fees would be according to the gender of workers. For instance, female charcoalers could be paid out KES 6,300 and seasonal charcoalers KES 3,469 per person per month.

Table 4 Minimum salary (KES) of an alternative job with and without school fees catered for (n=65)

Category	Minimum monthly salary of an alternative job	Minimum monthly salary of an alternative job with school fees catered for	School fee costs
Average	14,879	10,822	4,057
Male	14,769	11,300	3,469
Female	15,450	9,150	6,300
Permanent	15,525	11,019	4,506
Seasonal	13,705	10,528	3,177
CPA	14,152	9,857	4,050
Non-CPA	15,308	11,258	4,295

6.3 Indirect compensation scheme

With completing this chapter, Objective 2.3 is fulfilled: "To identify alternative livelihood options". Alternative livelihoods are identified as both the activities charcoalers are already involved in and as activities they would like to get involved in, and they are expecting from it KES 14,879. Charcoalers should be supported with finding a job for which they are qualified. The entrepreneurial spirit is also present amongst some of the charcoalers and most popular options would be poultry farming, honey harvesting and selling or shop owning, but charcoalers lack funds and mentoring for these projects to be successful. Hence, they should be supported with loans and systematic support from a dedicated investor.

Together with chapter 4, this chapter has informed about possibility of paying charcoalers monthly school fees as a compensation, which would result in roughly two-thirds charcoalers quitting the activity. This is according to what they claimed in the interviews. The amount paid out like this, KES 4,057 on average, is roughly two-thirds as much it would be paid out through compensating producers for their lost profits, KES 9,626 per month per person on average.

Some of the issues warned against both direct and indirect compensation within the REDD+ context in the literature review were observed during the interviewing: leakage, perverse incentives and additionality principle. Leakage remains an issue even should all the charcoalers seize with the activity, as Angelsen (2008) also argued, as demand for charcoal would possibly not decrease. Decrease in one area could increase charcoaling and therefore deforestation in other areas, as some of the interviewees indicated. Currently, there is also no direct energy alternative for buyers. Therefore, eco-charcoal projects should be encouraged fully, to offer an alternative. It is highly recommended that the future studies on charcoaling in the Kasigau Corridor address this issue and assess its potential.

Potential for perverse incentives, of which Pagiola *et al.* (2002) warned, was proved an issue already during this study. As a reward for participating in the interview, charcoalers got a new balck t-shirt and a pen. Towards the end of the study, once the rumours about these gifts had spread throughout the community, ever more people approached the research team wanting to be interviewed as well, sometimes lying, just in order to get the reward (these were identified early on in the interview and the interviews were stopped). It is difficult to imagine what could happen should the money be involved through a compensation scheme.

Another issues of importance when coming with a compensation scheme for charcoalers within the REDD+ Project Area, is the additionality principle, or rewarding those that were previously "misbehaving" REDD Monitor (2011). Should the compensation for charcoalers be put in place, this is exactly what would be happening: rewarding the ones that were misbehaving. Instead, more focus could be put on rewarding and supporting wanted livelihood options in the Area.

7 Recommendations from charcoalers

Charcoalers brought up their recommendations for government, Wildlife Works and CPA. For the government, the most popular recommendation was one of providing an alternative, which rarely contained more details (Figure 41), although food-for-work initiatives were particularly popular. It was mentioned three times under recommendations and several more times under alternatives. Food-for-work is, according to charcoalers, brought to the community by World Vision NGO. They have been rewarding community members with food and KES 2000 per month should they participate in actions like preventing soil erosion, recovering roads etc. Four of the recommendations had an actual job in mind: constructing a factory, stone cutting, promotion of wildlife and watchman. Additional concern was shown towards providing alternatives for sensitive groups: elderly and younger charcoalers and those in remote areas.

Bringing water, either through a water pan or borehole to the community was usually brought up as a way towards alternative jobs: farming and livestock keeping. One of the charcoalers in Teri Marapu mentioned that he initiated making of water pan, which is used for runoff water harvesting followed by digging up of a ground. He made a proposal to government and sourced funds. After three years the water pan is ready for the rainy season to get water. This is a pilot study; if government sees it as beneficial, it can be brought to other communities. Reforestation is suggested as an alternative job as well; mostly earnings from carrying out this activity are expected. Providing loans was another popular recommendation brought up by five charcoalers, also having in mind an alternative livelihood. One of the concerns raised by seven individuals was the low selling price of charcoal. It is suggested to the government to help them raise the price so that they can earn more from it, and subsequently cut less trees, as they claim.

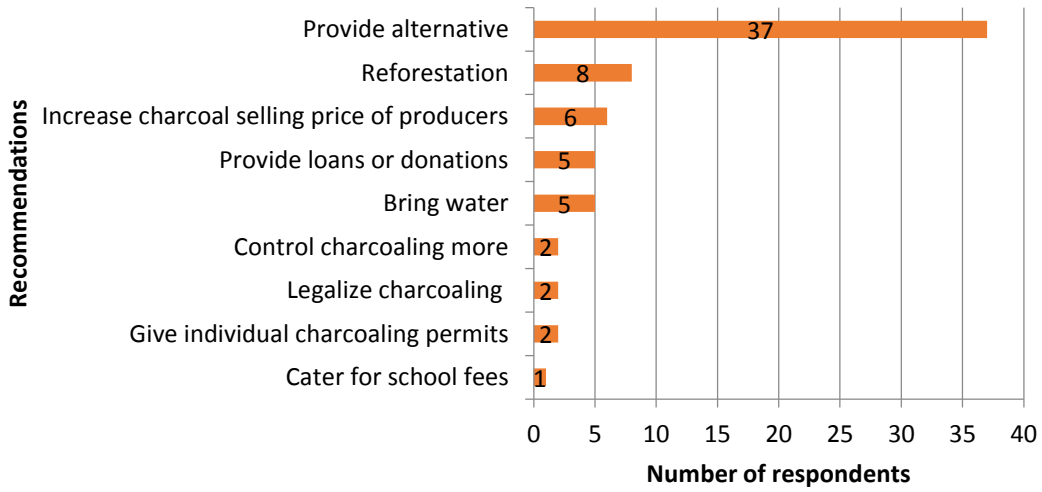


Figure 41 Recommendations for government (n=68)

For Wildlife Works, providing an alternative is again the most popular recommendation from charcoalers (Figure 42). As one charcoaler put it: "*They are not doing charcoaling out of their will, but because there is nothing else for them.*" Another message is: "*understand that charcoaling is not deliberate environment destruction, there are just no alternatives.*" Instead, they are asking for a dialogue and training in more sustainable ways of carrying out charcoaling or another activity. Stopping the harassment by Wildlife Works rangers was the second most frequently cited issue. "*Treat charcoalers with more respect*" and "*in a humane way*" is the way they put it. Other suggestions raised by a single charcoaler are: compensate charcoalers, organize donors, provide loans, support in forming of CPA, provide individual benefits from carbon trading, differentiate between charcoalers cutting the trees on smaller and larger scale, or leave them alone. The last suggestion was accompanied with accusations of pushing them and their children into "*being thieves*". For those that support Wildlife Works, request for continuing their work was made. In particular, empowering them, restoring the environment and seedling collection, as well as raising awareness amongst younger charcoalers is seen as beneficial.

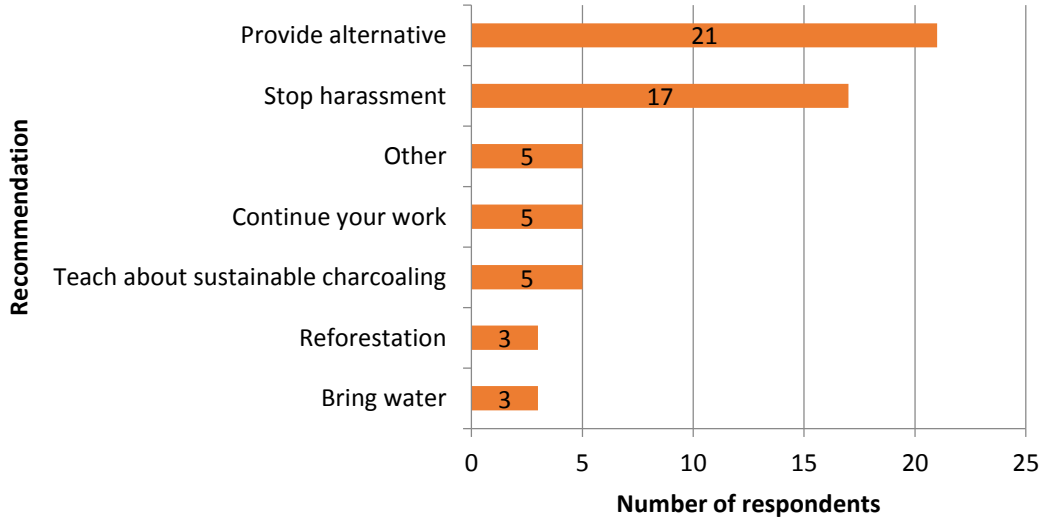


Figure 42 Recommendations for Wildlife Works (n=59)

Only 15 individuals had recommendations for the CPA. Almost half were asking for reforestation. Other mentioned issues included: improving selling point at the highway, working together, increasing prices of charcoal and lowering the membership fee. Improving of the selling point means that protection of charcoal from rain can be achieved, as well as better visibility. This can then attract customers and set grounds for building up other businesses. Additionally, government should develop clearer guidelines according to one individual or dissolve CPA completely.

8 Policy recommendations

Apart from the already mentioned recommendations from the charcoalers themselves, the author would also like to make several recommendations. To the Kenyan government, the following recommendations are listed according to the priority:

- *Directly related to charcoal production*

1. **Introduce individual member card for CPA members.** One of the biggest obstacles for CPA success is that it is not possible for KFS to distinguish between CPA and non-CPA members in the bush. Hence, CPA members continue getting into trouble with officers. Having a unique member card that charcoalers should always carry with themselves would solve unwanted misunderstandings. Government should have a double-checking system to ensure that cards are not forged. For instance, apart from the member needing to present her/his member card, the officer should also have a list issued by the CPA leader or his contact.
2. **Clearly mark designated areas for sustainable charcoal production.** Another way towards easier distinguishing between CPA and non-CPA members in the bush is having clearly marked areas of sustainable charcoal production. KFS officers would know easier that in this area charcoaling could be taking place. Non-cooperation between CPA members and non-members was reported during interviewing. CPA members could therefore, probably self-regulate this area, as those who are paying for CPA fees and investing their time into reforestation will not tolerate those that are not paying this.
3. **Support forming and maintaining a CPA.** Large number of charcoalers still report that they have not heard of both Charcoal Regulations and CPAs. KFS officers need to start a systematic action to support charcoalers to form Association and engage in the activity sustainably. They should support them in finding the most sustainable charcoal production option for the local circumstances, provide seedlings if necessary and teach them how to replant trees. (Also a recommendation to Wildlife Works).
4. **Standardize charcoal packaging**. Currently, there is a confusion regarding volume and weight of bags, which makes it difficult to assess how much trees are charcoalers cutting, or how much charcoal is being sold. Government introduced official packaging for sustainably or CPA produced charcoal should be introduced to the market in order to facilitate consumers' identification of legal charcoal.
5. **Formalize education for charcoalers**. If somebody wants to be a charcoal producer, they should have to go through official training and receive certificate for it. Only

charcoalers who have successfully completed their training should be allowed to carry out the activity. This will increase number of charcoalers doing the job sustainably and reforesting, as well as using technology of higher efficiency.

6. **Employ and educate charcoalers as reforesters**. Reforestation is needed, but it needs to be done professionally (Pagiola 2008; Xu and Cao 2002). Very small number of charcoalers that reported reforestation in the bush, also reported that the seedlings dried out. Kenyan government needs to start having professional reforesters if it is to reach its goal of 10% forest cover as required by the Constitution (MEWNR 2014). Government should provide facilities, funds and teaching staff, as well as diploma obtained after the completion of the course. (Also a recommendation to Wildlife Works).
7. **Legalize charcoaling, but tax it heavily**. Charcoaling is a million dollar industry and government could be earning from that a lot more (Mwampamba *et al.* 2013). High taxes will include then the "price of a tree". Generated profits should be invested into reforestation and eco-charcoal production. KFS rangers could in such a way become tax collectors and there could be less incentive for bribing than there is now.
8. **Subsidize eco-charcoal production**. Eco-charcoal production is legal, according to the Charcoal Regulations (2009). Prices of eco-charcoal are higher than the ones of regular charcoal, though, as the normal charcoal prices do not capture all the costs to the environment. To make the eco-product more attractive, it needs government's support. It is assumed that once charcoal production is legal, but heavily taxed, revenue streams could go into support of the ecological friendlier option. Consumption of illegal charcoal could be banned to encourage consumers to choose sustainably produced products.

- *Indirectly related to minimizing charcoal production*

9. **Continue with Food-for-Work initiative**. World Vision NGO has been rewarding community members with food and KES 2,000 per month should they participate in actions like preventing soil erosion, recovering roads etc. Some of the charcoalers have mentioned that as long as this action was taking place, they were not going to cut the trees. Government should support this and any similar activities. (Also a recommendation to Wildlife Works).
10. **Support single parents. Most of the women have reported that they have started** charcoaling once they have lost their partner. Government should put in place special programme to support single parents. (Also a recommendation to Wildlife Works).

11. **Facilitate education completion and its connection to the labour market.** There are plenty of drop-outs in the sample, which means that parents need a lot more support with paying for education. The amount of school fees needed reported in this sample is around KES 4,057 on average per month and this could be a compensation amount for charcoalers. Gender categorization would be appropriate, as there was a significant difference in the amount requested from women and from men for this purpose. (Also a recommendation to Wildlife Works).
12. **Facilitate connection of education to the labour market** Once the education is completed, there seem to be some troubles with finding jobs. The link between schools and jobs should therefore be improved. Organizing specific training in the area for certain job which is needed in the Project Area could be appropriate, as charcoalers are willing to participate in training for any job that give them an employment should it be for free.
13. **Support alternative livelihood options**. Farming and livestock keeping are amongst the most frequently mentioned alternative jobs, especially with seasonal charcoalers. Driving, construction, carpentry, brick-making and leather tanning seem to be another options in the area. Charcoalers need support in finding the employment, especially the ones of "critical age" for starting charcoaling, between 21 and 30. Government should support charcoalers in finding appropriate jobs. (Also a recommendation to Wildlife Works).
14. **Support entrepreneurial activities**. Some of the charcoalers show an entrepreneurial spirit and there should be a systematic support for these endeavours. The most desired activities are poultry farming, honey harvesting and selling or shop owning. Government, or any other interested stakeholder could provide not just loans or one-off "compensation", but also mentorship and support, especially in the first couple of selected pilot projects. (Also a recommendation to Wildlife Works).
15. **Provide secure water access for farming and livestock keeping**. Large number of charcoalers also engage in agriculture. Due to the lack of water, their farms are dry for most of the year and that is when some of them go to the bush. Stable water source for farms will keep charcoalers busy and they would go to the bush to a lesser degree. Government should fund these projects. (Also a recommendation to Wildlife Works).
16. **Privatize ranches.** Ranches owned by a community make it difficult to monitor the charcoaling area. Tragedy of the commons (Hardin 1968) suggests that resources will be depleted in the case where there is no regulation. Privatizing ranches might be one way around it. In Talio Village for instance, there is no community ranch, so most of the charcoalers moved to other areas or just stopped engaging with the activity.

To Wildlife Works and other NGOs, following recommendations are made, also according to the priority:

17. **Transform conflict into solution focused dialogue**. Conflict between rangers and charcoalers has not resulted in much significant decrease of charcoaling activity. Instead, rangers could be more of educators, explaining more sustainable ways of cutting trees, for instance, like not cutting the entire trunk of the tree.
18. **Assess leakage potential.** No successful compensation scheme can be put in place at REDD+ project area without addressing the leakage issue. Charcoalers from Teri and Talio areas have reported leakage on several occasions: they left the area to pursue this activity at more distant ranches once the REDD+ project area was established (they have sometimes just went back to farming as well). This would be a suitable area for conducting a field study on leakage potential of Kasigau Corridor according to Angelson's (2008) indicators, e.g. how mobile are labour and capital, how easy is it to occupy adjacent lands, and how high are returns from REDD-barred activities etc.
19. **Investigate further potential for direct compensation**. The direct compensation should be on average KES 9,626 (99USD) per month per charcoaler or KES 302 (3USD) per 50kg bag equivalent. Direct compensation should target specifically different categories, and further research is suggested regarding which categorization would work the best in the context of Kasigau Corridor REDD+ Project Area. For the purposes of this research, three categories were selected: gender, seasonality and CPA membership. Further research could tackle other categorization models. Should a direct compensation scheme be put in place, it is strongly advised to first assess perverse incentives.

9 Conclusion

The thesis successfully answer the research question "What measures can be put in place to minimise illegal charcoal production at the Kasigau Corridor REDD+ Project Area?" The first aim is "to estimate level of direct financial compensation for different categories of charcoalers needed to incentivise them away from this activity in the Kasigau Corridor REDD+ Project Area". Addressing the objective 1.1, "to identify demographic and general charcoaling characteristics of charcoalers", revealed amongst others, gender, seasonality of charcoal production and CPA membership, which were in turn used as the possible categories for assessing differences in compensation for different categories of charcoalers. On average it would be KES 9,626 per month per person or 99USD. As all three subsets have statistical difference between categories, they are all a suitable categorization for the compensation scheme. Objective 1.3, "to estimate the potential of carbon revenues to finance the compensation model" is fulfilled by approximating that 89 hectares of protected REDD+ areas would be needed to compensate 68 charcoalers with the reported monthly profit.

Second aim, "to investigate other incentives beyond direct financial compensation that can also catalyse a departure from this activity" revealed further options for indirect compensation. Objective 2.1 was "to understand attitudes of charcoalers towards charcoaling". One of the major reason for charcoaling is catering for family, and school fees seem to be the most pressing matter for the most. More than two thirds of the respondents claimed that they would quit with charcoaling once their children's school fees are catered for. For those that have reported that they would quit charcoaling, indirect compensation could be the amount of school fees reported, KES 4,057 on average. There is a significant difference only between female and male charcoalers in terms of money needed for covering school fees. Therefore, the most suitable categorization for the compensation for the school fees would be according to the gender of workers.

Attitudes towards sustainable charcoaling options (Objective 2.2) are mostly positive. For instance, briquette production, seem well perceived amongst charcoalers. Government and Wildlife Works (or other NGOs) will need to work closely together in order to bring sustainable charcoal production to Kasigau Corridor REDD+ Project Area. Current model of CPA is not functioning according to them, though. Reforestation is needed and charcoalers would be ready to stop charcoaling in order to pursue reforesting activities as an alternative livelihood.

Alternative livelihood options were also successfully identified (Objective 2.3). Poultry farming and livestock keeping are mentioned by the largest number of interviewees as examples

of alternative livelihood they would like to get involved in. As almost half of the interviewed charcoalers started charcoaling in the age of 21 to 30, certain actions could be made to target this particular age group with alternatives.

This research is important for various reasons. Firstly, local management of the forest and carbon stock by Wildlife Works is informed on possible direct and indirect compensation options for charcoalers. This was previously not assessed. Secondly, the results of this research are an important evidence of the flaws of current Charcoal Regulations. They inform the local Taita-Taveta County and Kenyan government of issues related to CPA system and provide certain steps that can be taken towards improving the policy. Charcoalers recommendation provide a useful source of information for understanding their needs. Thirdly, these results can be a significant case study for any REDD+ project in Kenya that has to deal with charcoaling in its proximity. It can inform the management of these areas on the direct and indirect compensation models that could be put in place. Finally, this research provides data previously not found regarding charcoaling: profit components. So far, only revenues of charcoal producers were assessed, KES 8,400 in 2013 (MEWNR 2013). This area shows higher revenues than known previously, but also explains costs and profits, about which little is available in the literature.

Further studies are suggested for assessing following issues:

- The most efficient mix of indirect and direct compensation options, the one that minimizes perverse incentives. Previous research suggested that the best solution is to offer various payment modes, even in the same village.
- The most suitable categorization of direct or indirect compensation. For this research only gender, seasonality and CPA membership and the differences between them were assessed. Other categories, like age, village, household size etc. could be evaluated as well.
- Leakage potential of the Kasigau Corridor REDD+ Project Area¨. Even if all the charcoalers in the area quit charcoaling, it does not mean that there is less charcoaling in Kenya.

10 References

Angelsen, A. 2008. *Moving ahead with REDD: Issues, options and implications*. Bogor: Center for International Forestry Research (CIFOR).

Angelsen, A., Brockhaus, M., Sunderlin, W.D. and Verchot, L.V. 2012. *Analysing REDD+: Challenges and choices*. Bogor: CIFOR.

Chakravarty, S., Ghosh, S.K., Suresh, C.P., Dey, A. N. and Shukla, G. 2012. Deforestation: Causes, Effects and Control Strategies. In *Global Perspectives on Sustainable Forest Management*, ed. Okia, C.A., 3-28. Rijeka: Intech.

Chambers, R. and Conway, G. 1991. *Sustainable rural livelihoods: Practical concepts for the 21st century*. Institute of Development Studies. Discussion Paper 296. Brighton: Institute of Development Studies.

Clements, T., Raineya, H., Ana, D., Roursa, V., Tana, S., Thonga, S. Sutherlandb, W.J., and Milner-Gulland, E.J. 2013. An evaluation of the effectiveness of a direct payment for biodiversity conservation: The Bird Nest Protection Program in the Northern Plains of Cambodia. *Biological Conservation* 157: 50–59.

Conrad, J.C. and Ferraro, P.J. 2001. *Habitat conservation: The dynamics of direct and indirect payments*. Environmental Policy Working Paper Ser. 2001-2005. Atlanta: Andrew Young School of Policy Studies.

Corbera, E. 2012. Problematizing REDD+ as an experiment in payments for ecosystem services. *Current Opinion in Environmental Sustainability* 4: 612–619.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., and van den Belt, M. 1997. The value of ecosystem services: putting the issues in perspective. *Ecological Economics* 25: 67–72.

Creative Research Systems. 2012. Sample Size Calculator [Computer software]. Accessed: April 25, 2015. URL: http://www.surveysystem.com/sscalce.htm.

Energising development (ENDEV). 2015. Kenya energy situation. Accessed June 30, 2015. URL: http://endev.info/content/Kenya.

Engel, S., Pagiola, S., and Wunder, S. 2008. Designing payments for environmental services in theory and practice: An overview of the issues. *Ecological Economics* 65: 663–674.

The European Space Agency and Université catholique de Louvain (ESA and UCLouvain). 2010. GlobCover 2009 land cover map. Accessed May 5, 2015. URL: http://due.esrin.esa.int/page_globcover.php.

Ferraro, P.J. and Kiss, A. 2002. Direct Payments to Conserve Biodiversity. *Science* 298: 1718-1719.

Ferraro, P.J. and Simpson, R.D. 2002. The Cost-Effectiveness of Conservation Payments. *Land Economics* 78: 339-353.

Flury, C., Gotsch, N., and Rieder, P. 2005. Site-specific and regionally optimal direct payments for mountain agriculture. *Land Use Policy* 22: 207–214.

Food and Agriculture Organization (FAO). 1983. *Wood fuel surveys*. FAO: Rome.

Food and Agriculture Organization (FAO). 2010. *Global Forest Resources Assessment. 2010*. Main Report. FAO Forestry Paper 163. Rome: FAO.

Forest Carbon Partnership Facility (FCPF). 2010. *REDD Readiness Preparation Proposal Kenya*. Nairobi: Kenya Forest Service.

Fowler, F.J. 2002. *Survey research methods*. Newbury Park, London: Sage.

GADM database, version 2.0. (GADM). 2011. Digital elevation model. Accessed May 05, 2015. URL: http://www.gadm.org/country.

Global Education Fund 2015. Kenya. Accessed: June 16, 2015. URL: http://www.globaleducationfund.org/kenya/.

Global Forest Watch (GFW). 2015. Kenya. Accessed June 30, 2015. URL: http://www.globalforestwatch.org/country/KEN.

Gómez-Baggethun, E., de Groot, R., Lomas, P.L, and Montes, C. 2010. The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes. *Ecological Economics* 69: 1209–1218.

Gullison, R.E., Rice, R.E., and Blundell, A.G. 2000. 'Marketing' species conservation: Financial incentives can be found to conserve a species threatened by trade. *Nature* 404: 923–924.

Hanlon, J. 2004. It is possible to just give money to the poor. *Development and Change* 35(2): 375-383.

Hardin, G. 1968. The Tragedy of the Commons. *Science* 162(3859): 1243–1248.

Hedden-Dunkhorsta, B., Braatb, L., and Wittmer, H. 2015. TEEB emerging at the country level: Challenges and opportunities. *Ecosystem Services* 14: 37–44.

Henderson, D.R. 2008. *Concise Encyclopaedia of Economics*. 2nd ed. Indianapolis: Library of Economics and Liberty.

Holloway, V. and Giandomenico, E. 2009. *The History of REDD Policy*. Adelaide: Carbon Planet.

Independent Electoral and Boundaries Commission (IEBC). 2015. Administrative locations and sub-locations. Accessed: June 12, 2015. URL: http://www.infotrackea.co.ke/services/leadership/countyinfo.php?cinf=counties.

International Livestock Research Institute (ILRI). 2015. GIS services – Kenya. Accessed May 05, 2015. URL: http://192.156.137.110/gis/search.asp?id=280.

Kalenda, M., Ngatia, J., Ng'oriareng, P.C., Oscar S. and Oduor N. 2013. Available Charcoal Production Technologies in Kenya (Draft Copy). For Sustainable charcoal production in the Drylands of Kenya. Nairobi: UNDP and KFS.

Kanninen, M., Brockhaus, M., Murdiyarso, D., and Nabuurs, G.J. 2010. Harnessing Forests for Climate Change: Mitigation through REDD+. In *Forests and Society – Responding to global drivers of change*, eds. Gerardo Mery, Pia Katila, Glenn Galloway, Rene I. Alfaro, Markku Kanninen, Maxim Lobovikov and Jari Varjo. Vantaa: International Union of Forest Research Organizations.

Kindermann, G., Obersteiner, M., Sohngen, B., Sathaye, J., Andrasko, K., Rametsteiner, E., Schlamadinger, B., Wunder, S., and Beach, R. 2008. Global cost estimates of reducing carbon emissions through avoided deforestation. *Proceedings of the National Academy of Sciences* 105(30): 10302–10307.

Lapan, S.D. and Quartaroli, M.T. 2009. *Research essentials: an introduction to design and practices*. San Francisco: John Wiley & Sons, Inc.

Lele, S., Springate-Baginski, O., Lakerveld, R., Deb, D. and Dash, P. 2013. Ecosystem Services: Origins, Contributions, Pitfalls, and Alternatives. *Conservation and Society* 11(4): 343-358.

Merger, E., Held, C., Tennigkeit, T. and Blomley, T. 2012. A bottom-up approach to estimating cost elements of REDD+ pilot projects in Tanzania. *Carbon Balance and Management* 7(9): 1-14.

Millennium Ecosystem Assessment (MA). 2003. *Ecosystems and Human Well-being. A Framework for Assessment*. Washington: Island Press.

Ministry of Environment, Water and Natural Resources (MEWNR). 2009. *Forests (Charcoal) Regulations*. Nairobi: Kenya Forest Service, Republic of Kenya.

Ministry of Environment, Water and Natural Resources (MEWNR). 2013. *Analysis of the charcoal value chain in Kenya*. Nairobi: Camco Advisory Services.

Ministry of Environment, Water and Natural Resources (MEWNR). 2014. *National Forest Policy 2014*. Nairobi: Kenya Forest Service, Republic of Kenya.

Ministry of Forestry and Wildlife. 2013. *Analysis of drivers and underlying causes of forest cover change in the various forest types of Kenya*. Nairobi: Ruri Consultants.

Mutimba, S. and Barasa, M. 2005. *National Charcoal Survey: Exploring the potential for a sustainable charcoal industry in Kenya*. Nairobi: Energy for Sustainable Development Africa (ESDA).

Mwampamba, T.H., Ghilardi, A., Sander, D. and Chaix, K.J. 2013. Dispelling common misconceptions to improve attitudes and policy outlook on charcoal in developing countries. *Energy for Sustainable Development* 17: 75–85.

The National Economic and Social Council of Kenya (NESC). 2007. *Kenya Vision 2030, Popular Version*. Nairobi: NESC.

Norgaard, R.B and Bode, C. 1998. Next, the value of God, and other reactions. *Ecological Economics* 25: 37–39.

Norgaard, R.B. 2010. Ecosystem services: From eye-opening metaphor to complexity blinder. *Ecological Economics* 69: 1219–1227.

Oimeke, R.P. 2012. *Charcoal production and commercialization in Kenya*. Nairobi: Energy Regulatory Commission.

Ortiz, E. 2002. Direct Payments as an Alternative Conservation Investment, a symposium at the 16th Annual Meetings of the Society for Conservation Biology, Canterbury, England, July 15, 2002.

Owen, M. 2013. *Miti Mingi Maisha Bora: Support to Forest Sector Reform in Kenya. The Legally Compliant Charcoal Industry and its Barriers to Growth in Kenya*. Vantaa: NIRAS.

Pagiola, S., J. Bishop, and N. Landell-Mills. 2002. *Selling forest environmental services. Market-based mechanisms for conservation and development*. London and Sterling: Earthscan.

Pagiola, S. 2008. Payments for environmental services in Costa Rica. *Ecological Economics* 65(4): 712-24.

Peters-Stanley, M., Hamilton, K., Marcello, T. and Sjardin M. 2011. *Back to the future: State of the voluntary carbon markets 2011: A report by Ecosystem Marketplace and Bloomberg New Energy Finance*. New York: Bloomberg New Energy Finance.

Peters-Stanley, M. and Gonzalez, G. 2014. *Sharing the Stage: State of the Voluntary Carbon Markets 2014*. Washington: Forest Trends' Ecosystem Marketplace.

REDD Monitor. 2011. *REDD: An introduction*. Accessed December 18. URL: http://www.redd-monitor.org/redd-an-introduction.

Redford, K.H., and Adams, W.M. 2009. Payment for Ecosystem Services and the Challenge of Saving Nature. *Conservation Biology* 23(4): 785-787.

Rice, R. 2002. Direct Payments as an Alternative Conservation Investment, a symposium at the 16th Annual Meetings of the Society for Conservation Biology, Canterbury, England, 15 July 2002.

Robertson, N., and Wunder, S. 2005. *Fresh tracks in the forest: Assessing incipient payments for environmental services initiatives in Bolivia (draft)*. Bogor: CIFOR.

Spash, C.L. 2008. How Much is that Ecosystem in the Window? The One with the Bio-diverse Trail. *Environmental Values* 17: 259–284.

Stern, N. 2006. *The Economics of Climate Change: The Stern Review*. Cambridge: Cambridge University Press.

Strauss, A. and Corbin, J.M. 1990. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Thousand Oaks, London, New Delhi: SAGE Publications.

Urbaniak, G. C., and Plous, S. 2013. Research Randomizer (Version 4.0) [Computer software]. Accessed: April 25, 2015. URL: http://www.randomizer.org/form.htm.

United Nations Environment Programme (UNEP). 2014. *The Value of Forests. Payments for Ecosystem Services in a Green Economy*. Geneva Timber and Forest Study Paper 3. Geneva: United Nations.

United States Department of Agriculture Forest Service (USDA FS). 1999. Educational in nature. Volume 1, Forests. Number 2, Water & Forests. Euchre Creek, Georgia: Georgia-Pacific Corporation.

Veronesi, M., Schlöndorn, T., Zabel, A. and Engel, S. 2012. *Designing REDD+ schemes to address permanence concerns: Empirical evidence from Kenya.* Working Paper No. 15. Verona: University of Verona, Department of Economics.

Vogel, J. 2002. *Markets or metaphors? A sustainable livelihoods approach to the management of environmental services: two cases from Ecuador*. London & Quito: IIED & Ecodecisión.

Weatherbase. 2015. Historical Weather for Voi, Kenya. Accessed: June 17, 2015. URL: http://www.weatherbase.com/weather/weather-summary.php3?s=39736&cityname=Voi%2C+Coast%2C+Kenya&units=.

Weaving, A. 2013. Livelihoods under REDD+: An exploration of changes in charcoal production and trade in Kasigau Corridor REDD+, Kenya. Master's thesis, Department of Geography and the Environment, London School of Economics and Political Science, London.

Wertz-Kanounnikoff, S. 2008. *Estimating the costs of reducing forest emissions: A review of methods*. Bogor: CIFOR.

Wildlife Works. 2008. *The Kasigau Corridor REDD Project. Phase I – Rukinga Sanctuary. Project Design Document (PDD) for Validation Using the Climate, Community and Biodiversity (CCB) Project Design Standards* (2nd Ed.). Maungu: Wildlife Works.

Wildlife Works. 2014a. Initial Scouting to Investigate the Main Players in Charcoaling Activities in the Kasigau Corridor REDD Project Area. Unpublished data.

Wildlife Works. 2014b. *The Kasigau Corridor REDD Project. Phase II – The Community Ranches. 4th Monitoring Report (M4) and Implementation Report. VCS Version 3, CCB Standards*. (2nd Ed.). Maungu: Wildlife Works.

Wildlife Works, Biodiversity and Social Monitoring Department (WW BSMD). 2015. Unpublished data.

World Bank (WB). 2011. *Estimating the opportunity costs of REDD+. A training manual.* Ver. 1.3. Washington: World Bank.

World Bank (WB). 2012. Kenya. Accessed July 2, 2015. URL: http://data.worldbank.org/country/kenya.

World Resources Institute, Climate Analysis Indicator Tool (WRI CAIT). 2005. *Navigating the Numbers: Greenhouse Gas Data and International Climate Policy*. Intergovernmental Panel on Climate Change. 1996 (data for 2000).

World Wildlife Fund (WWF). 2009. *Guide to Conservation Finance: Sustainable Financing for the Planet.* Washington: World Wildlife Fund.

Wunder, S. 2005. *Payments for environmental services: Some nuts and bolts*. CIFOR Occasional Paper No. 42. Jakarta: CIFOR.

XE.COM INC. 2015. Currency Converter. 2015. Accessed July 6, 2015. URL: http://www.xe.com/currencyconverter.

Xu, J. and Cao, Y. 2002. The Sustainability of Converting the Land for Forestry and Pasture. *International Economic Review* 3-4: 56-60.

11 Glossary of technical terms

Carrot-and-stick approach: a policy of offering a combination of rewards and punishment to induce behaviour.

Charcoal: wood fuel product derived from carbonization of wood or other plant materials.

Direct compensation: money directly paid to someone in exchange for something.

Indirect (in-kind) compensation: a benefit given to someone that has financial value, but is not a direct monetary payment.

Kasigau Corridor REDD+ Project Area: 500,000 acres of dryland forest in south-eastern Kenya, securing the wildlife migration corridor between Tsavo East and Tsavo West National Parks.

Kenya's administrative units: there are four administrative levels: counties, sub-counties, locations and sub-location. Administrative units of Kenya are quite confusing, as there have been many changes in the last decades. Chief is a head of the location, sub-chief of sub-location and village elder of the individual villages.

Locational carbon committee (LCC) chairs: elected representatives of the communities who work in liaison with Wildlife Works officials to oversee the implementation of community project funded under Kasigau corridor REDD project.

Opportunity cost: value of the best alternative forgone, in a situation in which a choice needs to be made between several mutually exclusive alternatives given limited resources.

Payments for Ecosystem Services: incentives offered to farmers or landowners in exchange for managing their land to provide some sort of ecological service.

Phases of REDD+ projects: Phase 1: Developing a REDD+ strategy supported by grants. Phase 2: Implementing a REDD+ strategy, supported by (a) grants or other financial support for capability building, and enabling policies and measures and (b) payments for emission reductions measured by proxies. Phase 3: Continued implementation of REDD+ strategy in the context of low-carbon development, payments for verified emission reductions and removals.

Providers surplus: gains from the transaction that exceed their costs and thus make them better off.

REDD+: mechanism that has been under negotiation by the United Nations Framework Convention on Climate Change (UNFCCC) since 2005, with the objective of mitigating climate

change through reducing net emissions of greenhouse gases through enhanced forest management in developing countries.

REDD+ opportunity costs: net earnings from conserving or enhancing forests - net earnings from converting forests to other, typically more valuable, land uses.

Sustainable livelihood: livelihood which comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living and which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation.

Verified Carbon Standard: world's leading voluntary greenhouse gas program, assumes management of the Climate, Community & Biodiversity Standards (CCBS).

Voluntary Emissions Reductions: a type of carbon offset exchanged in the voluntary or over-the-counter market for carbon credits.

Wildlife Works: for-profit company dedicated to market based solutions to the conservation of biodiversity. It is based in San-Francisco and runs REDD+ projects around the world.

Appendix 1. Interview protocol

Introduction and objective

I am a student from Eastern Europe and I am doing research through Central European University while interning at Wildlife Works. With permission from the Chief, we are conducting a study to help us understand lives of charcoalers at Kasigau/Sagalla and charcoaling issues. We are conducting this survey for three main reasons:

• First, to understand problems affecting you and solutions for them, as well as to obtain general information on the sales, costs and earnings.

• Second, to assess how production can conform to the charcoal regulations and be less harmful to the environment.

• Thirdly, to understand alternatives that might be open for you as livelihood options apart from the charcoal trade.

We will be conducting interviews at Kasigau/Sagalla and you were randomly selected for this study. We will aggregate your answers with those of other charcoalers in a statistical form: no names or individual responses will be reported. Please use this opportunity to get your voice heard and give your suggestions or ideas about the topic.

Procedure and consent

During this study, you will be asked to answer some questions during approximately **one hour** in length. However, please feel free to expand on any topic or talk about related ideas even beyond this time. Also, if there are any questions you feel you cannot answer or that you do not feel comfortable answering, feel free to indicate this and we will move on to the next question. Your participation will not affect your business or place you under any risk. It is very important for us that you answer these questions as honestly as possible, because this is the only way we can learn about this topic. All the information will be kept confidential. Only the researchers will have access to this information. Upon completion of this project, all data will be stored in a secure location. Do you consent to be part of this study?

1. Demographic information

1.1. Date:
1.2. Village name:
1.3. Waypoint:
1.4. Respondent's number:
1.5. Age:
1.6. Gender:
1.7. Tribe:
1.8. Household members:
1.9. Level of education:

2. General information on charcoaling

2.1. When did you start with charcoaling? For how long have you been a charcoaler?
2.2. Who taught you how to charcoal?
2.3. How did you start with charcoaling?
2.4. Why do you engage in charcoaling? For instance:
- Financial reasons (Which ones?)
- Taking care of family
- Lack of alternatives
- Failed agriculture

- Other

2.5. How much time per year are you involved with charcoaling?
- Entire year
- Dry season
- Other

3. Volume of production

3.1. How many kilns do you make per month?
3.2. How many bags do you produce from one kiln?
3.3. How many kilograms are in a bag that you use?
3.4. How many kilns do you make per year?
3.5. What is the number of trees needed for one kiln?

4. Cost aspects of charcoaling

4.1. Where do you get trees for charcoaling?
4.2. How often do you travel there and how much time does it take?
4.3. Do you stay there overnight camping? If yes, what do you need while camping, how much does it cost and what is its lifetime?
4.4. What is production cost per bag of charcoal? For instance:
- Bag
- Transport and its lifetime (e.g. wheel barrel, bicycle, cart, donkey)

4.5. Are you a CPA member? If yes, how much do you pay for:
- CPA fee per bag
- CPA membership

4.6. What is the price of the tools and its lifetime?
- Axe
- Machete
- Hoe
- Spade
- Matches

4.7. What influences the production cost? (e.g. season, type of tree, origin). How?
4.8. What are the steps of charcoal production?
4.9. How long does it take to produce a kiln of charcoal? How much time per step do you need? What influences the duration?
4.10. Are there any labour costs? Do you work with somebody? If there is, do they support you full-time or part-time? In which processes?
4.11. Did you ever get into trouble with authorities? If yes, did you have to pay and how much? If not, how much would you have to pay if you ever get into trouble?

5. Earning aspects of charcoaling

5.1. What is the selling price of bag of charcoal? If there is more than one price, how much do you sell at each of the mentioned prices?
5.2. What influences the selling price? (season, quality, type of tree, origin, regulation, customer). How?
5.3. How many bags of charcoal do you sell per month?
5.4. What is your monthly earning from charcoaling?
5.5. Do you consume charcoal that you produce? If yes, how much? For what purposes?
5.6. Who are your customers?

6. Sustainability aspects

6.1. Which type of trees do you use for charcoaling?
6.2. Do you think that your children (or children of your village) will also do this job? Why or why not? For how many more years will there be trees for charcoaling? What will you do after that?
6.3. Have you ever replanted trees that you have cut down? Why or why not?
6.4. What type of kiln do you use? Have you considered getting a kiln of higher efficiency? If yes, which?
6.5. Have you heard of Charcoal Regulations? Have you read or been sensitised to them?
6.6. What do you think of the Regulations?
6.7. Have you heard of CPA? What do you think of CPAs?
6.8. If you are a member, how did you become one? If no, would you like to be a member of a CPA? Why?

7. Compensation and alternative livelihoods

7.1. Is charcoaling your main job or source of income?
7.2. Is charcoaling your only job or source of income? If no, what is your other job or source of income? How much do you earn?
7.3. What would you do if you were not a charcoaler? Do you see any alternative sources of livelihood for yourself? If yes, which?
7.4. Would you be willing to participate in training for another job if that was offered free of charge?
7.5. What is the minimum salary of job to which you would switch?
7.6. Would you quit charcoaling if your children's school fees were taken care of?
7.7. What is the minimum salary of job to which you would switch to if your children's school fees were taken care of?

8. Closing questions

8.1. How do you feel about charcoaling? What do you like about charcoaling? What don't you like about charcoaling? Did you ever have any health problems?
8.2. Do you have any other issue you would like to bring to the attention of government, NGOs, Wildlife Works or CPAs?
8.3. Do you have questions for us and what are they?

Thank you for your cooperation, time invested in talking to us and answering all the questions. This will contribute greatly to success of this study. We will distribute the results of this research to Wildlife Works so that they can act on them and attend to the issues we have discussed.