Fuel-efficiency and efficient Aid

— An analysis of factors affecting the spread of fuel-efficient cooking stoves in Northern Tanzania

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Abstract

This thesis is the result of nine weeks fieldwork in Babati and Bukoba districts in Northern Tanzania during spring 2012. The purpose of this thesis is to study why development projects on fuel-efficient stoves have had a limited adoption in these two regions and what obstacles and opportunities there are for further spread of fuel-efficient cooking stoves. Semi-structured interviews were the main method used for collecting the empirical data, which was then analysed from a socio-economic perspective with help from the framework of Sustainable Rural Livelihoods.

The Results showed that people’s perceptions of fuel-efficient stoves are positive but that projects face many obstacles connected to socio-economic conditions. Knowledge on how to get stoves and access to financial capital is main obstacles for further spreading. Social networks and organisations are channels for information, but to spread outside these networks will need complementing strategies from organisations promoting fuel-efficient stoves. Important are also finding ways of making the financial aspect of adopting stoves less, like using materials with lower costs, using stove-models with low costs and training people in building stoves so re-investments are unnecessary and dependency of funding from organisations less. Gender is a factor affecting the adoption of fuel-efficient stoves, regarding access to assets and generated benefits. There is therefore an importance of involving gender throughout the different stages of the projects.

Keywords: foreign development aid, fuel-efficient cooking stoves, Tanzania, VI-SCCC, fuel-wood, Sustainable Rural Livelihoods
"I see using technologies such as the fuel-efficient stove as an opportunity prevailing from poverty and shifting from the traditional way of living to a more modern lifestyle."

Farmer with fuel-efficient stove, Babati District, Waang’waray village, 24 February 2012
Acronyms

FTPP- Forests, Trees and People Programme
LAMP- Tanzanian Land Management and Environment Programme
LTT- Livingstone Tanzania Trust
MDG- Millennium development Goals
NGO- Non-governmental organization
NSGRP II - Tanzania’s national development strategy for growth and reduction of poverty II
PRA- Participatory Rural Appraisal
RRA- Rapid Rural Appraisal
SIDA- Swedish International Development Cooperation Agency
SRL- Sustainable Rural Livelihoods
TZS- Tanzanian Shillings
VI SCC- VI Swedish Cooperation Center
VS&LA- Village Savings and Loans Association
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**Asante Sana!**

**Cover:** Portable fuel-efficient stove built by member of VI SCC in Bukoba district.
Photography by author 27 March 2012
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1. Introduction

This thesis touches the issues of rural development and environmental issues on a local scale. As a strategy of increasing livelihoods and reducing dependency of unsustainable use of natural resources, such as fuel-wood, projects on building fuel-efficient stoves have been a part of different national and international aid-programs in Tanzania. The first chapter will give further knowledge of the studied area and its problems, the purpose of the thesis and its research questions. The second and third part will describe the theoretical and analytical framework used in this thesis. The forth and fifth chapter describes the field methods for the thesis and a presentation of the studied area. This is followed by the result and analysis, presented from a socio-economic perspective of the situation. To conclude it all is a discussion on possible obstacles and opportunities for spreading of fuel-efficient stoves.

1.1 Why the need of fuel-efficient stoves?

According to the UN Foundation 3 billion people – half of the world’s population – is dependent of biomass for cooking and heating. In Tanzania 93% of the population is dependent on biomass-based fuels such as firewood and charcoal (NAPA 2007). Dependency on biomass can be seen from two sides, on one hand it is a renewable energy source, which is preferred to use instead of fossil fuels with the aspect of climate change and emissions of carbon dioxide. On the other hand, the methods used today in Tanzania, and many parts of the world, to extract wood fuels are not sustainable which increases the pressures on local resources and lead to land-degradation and deforestation (Barnes et al. 1994). At the same time the demand for energy is increasing due to a growing population and a developing economy. Efforts have been made globally by governments and non-governmental organisations to make the use of biofuels more sustainable, where some of the strategies include forest conservation, planting of trees and promoting fuel-efficient stoves (Malimbwi & Zahabu 2009). Fuel-efficient stoves are stoves that are designed to isolate heat. They can be of different models but have in common to reduce amount of biomass needed compared to when cooking over open fire. In Tanzania the national energy policy puts an emphasis on energy-efficiency and focuses on techniques that take environmental concern. Sustainable use of energy is also highly connected to socio-economic development, on both a commercial and household level,
and seen as a mean to secure livelihoods and decrease poverty (MEM 2003).

There is also a social dimension on the use of biomass that affects both health and gender structures. In rural areas the main use of energy is for cooking and heating made over open fire. This method of cooking has a low efficiency and creates a lot of smoke. The exposure to smoke from traditional cooking stoves is a problem in developing countries and is mainly affecting women, who are most often responsible for cooking (Barnes et al 1994). The use of fuel-efficient stoves is said to contribute by reducing the exposure to harmful smoke and amount of fuel-wood used. It is also promoted as saving time and money for the households due to less consumption of fuel-wood (Khan & Islam 2007).

Even though the need for sustainable technologies regarding national resources seems high, studies show that spreading of these can be slow and they have limited success in many rural areas. What are the factors affecting adoption of certain technologies and how do we make international aid efforts more efficient?

1.2 Why study fuel-efficient stoves in Tanzania?

Natural resources form livelihoods in rural areas. In Tanzania the majority of people is depending on natural resources for their livelihoods. In Babati and Bukoba Rural districts over 70 % is depending on farming as their main income and biomass as their number one energy source (Masologo 2012, Kavishe 2012). To sustain and access resources different variables play their part: social structures and what other assets you have, such as money and knowledge. Issues as erosion, deforestation and land degradation also affect people’s vulnerability and have an impact on access to these resources. The complexity is high and when implementing development projects and natural resource management many aspects need to be considered. To make people plant trees to combat deforestation will not be successful in areas where people for example are starving. When dealing with development projects, it is therefore of relevance to look at the whole socio-economic context in which people interact.

Trainings on building fuel-efficient stoves have been part of strategies in aid-programs in both Babati and Bukoba District, Tanzania, for quite some time. In Babati different organisations and programs have been working with these stoves, some are no longer active and some are failing to reach a further spread (Cronström 2011). In Bukoba Rural district the promotion of fuel-efficient
stoves is a part of VI Swedish cooperation centres and their Agroforestry Programme’s work in the region. According to VI SCC the strategy has not reached the level of implementation the organisation was expecting (Masologo 16 April 2012). This study will therefore explore why certain aid-projects only reach a limited success by looking at the cases in Babati and Bukoba and their activities on training farmers in building fuel-efficient stoves.

1.3 Purpose

The aim of this thesis is to study why projects on fuel-efficient stoves have had a limited spread in Babati and Bukoba districts in northern Tanzania. To do this the framework of Sustainable Rural Livelihoods (SRL) has been used to further understand which socio-economic factors affect the possibility for farmers to adopt fuel-efficient stoves. This with the purpose to understand what obstacles and opportunities there are for further adoption of fuel-efficient stoves in the two districts.

In order to fulfil this purpose the following research questions have been developed:

- What perceptions do farmers and involved organisations have of fuel-efficient stoves and their expected outcomes?
- Which socio-economic factors affect adoption of fuel-efficient stoves and what are the possible obstacles for further spread of these stoves within in Babati and Bukoba districts?

1.4 Scope

The objective of this study is to explore what obstacles are there for further spread of these projects by looking at two case studies in Babati and Bukoba districts, Tanzania. In this thesis an objective position regarding the view of fuel-efficient stoves is taken. Instead of assuming that it is good or bad, the study seeks to understand how people and promoting organisations themselves perceive the intervention and how it might affect people’s livelihoods. The thesis will partly explore how farmers perceive fuel-efficient stoves with regard to health, fuel-wood consumption, time and money saved. It will also seek to understand which socio-economic factors affect the spreading of fuel-efficient stoves. When understanding which the decisive factors are, this information can be used to further understand which aspects are important to be further emphasized when educating communities on fuel-efficient stoves.
2. Background

This section aims to provide the conceptual framework for this thesis. Further knowledge on fuel-efficient stoves and fuel wood consumption will be presented, as well as previous research on the area of fuel-efficient stoves, development projects and gender issues concerning these. National policies regarding issues relevant for this thesis, such as sustainable energy, forestry and rural development will also be presented.

2.1 Fuel-efficient stoves and the need of saving fuel-wood

In 2003 the firewood consumption for cooking by households in rural areas of Tanzania was approximately 25,000,000 m$^3$ and the main activity of energy consumption (Malimbwi & Zahabu 2009). The primary source for fuel wood for cooking is collected from private farmlands and depends on accessibility from unreserved forests. A previous study indicated that if faced with scarcity the alternative would be to collect fuel wood from governmental forest reserves or to use residues from industries and agriculture (Kaale 2005) The study also indicates that firewood is mostly gathered without costs and bought only under scarcity or unavailability (Malimbwi & Zahabu 2009). Different studies point out that household consumption of fuel wood has only a small impact on deforestation from a national perspective, but that it can lead to decrease in wood mass regionally. Regions in Tanzania can be divided into three groups depending on access to wood fuel. Category one is regions with satisfactory biomass fuel supply, category two is regions with moderate biomass supply and the third group is regions that have severe biomass scarcity unavailability (Malimbwi & Zahabu 2009). The regions in this study are Manyara and Kagera. Manyara falls within category two as a region with moderate scarcity and Kagera within group three as a region with severe fuel wood scarcity (Kaale 2005).

Wood fuel is an umbrella term for biofuels derived directly or indirectly from trees and shrub lands. When referring to wood fuel four different classes of products are included; fuel wood, charcoal, black liquor and other (Malimbwi & Zahabu 2009). This thesis will mainly focus on fuel wood, and to some extent charcoal. Fuel wood and firewood is synonymous in the text.
2.2 National policies relating to fuel-wood consumption in Tanzania

The last decade development has risen in Tanzania and the country has one of the fastest economic growth-rate in Africa. Despite this it is still one of the poorest countries and the main recipients of foreign aid in Sub-Saharan Africa (SIDA 2011). Even if GDP goes up the growth happens within sectors that do not affect the general income levels and the country remains poor. A large number of Tanzania’s 44 million inhabitants still have low access to basic services such as healthcare and education. To channel the economic growth to reduce poverty is therefore one of the biggest challenges of the country (African Development Bank 2011). The relationship between poverty and environment is closely entwined, not only are national resources a base to people’s livelihoods and the national economy, but poverty also affects people’s capabilities to take environmental concern. Sustainable energy use is therefore highly related to rural development and poverty reduction. This is something that is emphasized in the seventh Millennium Development Goal (MDG) and highlighted in Tanzania’s national development strategy for growth and reduction of poverty (NSGRP II). Main focus of NSGRP II is to combat poverty and increase welfare through economic growth and democratic governance. The document consists of different cluster strategies and goals to achieve a sustainable growth and development. Dependency on aid is listed as one of the challenges for development in the strategy paper for 2011-2015. This shows a concern for self-sufficiency and suggested solutions are for example efforts for strengthening natural resources and economic activities in the private sector (African Development Bank 2011). Within the goal of reducing income poverty one of the targets is to double the access to wood fuel substitutes for cooking from 10 percentages to 20 percentages by year 2015 and to promote energy-efficient technologies on a household and community level. The use of fuel-efficient stoves is mentioned both in the development strategy and in the national energy policy as one of activities to help achieve the expected outcomes (NSGRP II 2010). The national energy policy is the leading document regarding energy use in Tanzania and puts an emphasis on energy-efficiency and focus on techniques that take environmental concern. Sustainable use of energy is also highly connected to socio-economic development, on both a commercial and household level, and is seen as a mean to secure livelihoods and decrease poverty (MEM 2003).

The consumption of fuel wood is also highly related to the use and management of national forests. Tanzania has a national forest policy from 1998 that focuses on ensuring a sustainable development and use of national forests. The policy recognizes a poor governmental protection of forest reserves as a problem and highlights the extensive dependency of fuel wood. It also points out a correlation between environmental degradation and poverty and emphasizes the need for fuel-efficient
technologies, tree planting, community-based forest management and governance, gender equality and involvement of the private sector in environmental protection (MNRT 1998). There are different kinds of reserves for wood fuels such as forests, shrubs, bushes and grasslands, which can be managed by the government and customary laws, by the village council or as private woodlots. The access and restrictions to fuel wood within these different tenure systems is depending on their management. Traditional forests are reserves governed by customary law. Village forest reserves are under the village government’s management and tenure. Of the country’s 33.5 million hectares of forest and woodlands more than sixty percentage was by the time of the forest policy lacking sustainable management due to public access. To meet this, joint-forest management was promoted and rights given to local authorities to manage unreserved forests and grasslands (MNRT 1998). The motivation and knowledge of planting trees by local communities can be seen as low. One explanation for this can be a strong governmental power over forest resources and limited access to forest resources by indigenous people during the colonial period. Today the land act from 1999 makes up the guidelines for land ownership and divides it into three categories: General land monitored by the commissioners of lands, reserved land which is under a specific body and village land administered by village councils. The uncertainties regarding tenure on public land led to free access to these woodlands and forests. It is allowed to collect fuel wood from all kinds of land, with certain exceptions of fees. The effect of land tenure on fuel wood access can therefore be concluded as small (Malimbwi & Zahabu 2009).

2.3 Previous Research

2.3.1 Fuel-efficient stoves

Efforts on promoting fuel-efficient stoves have been made within both governmental organisations such as Tanzania’s traditional energy development organization (TaTEDO) and several NGOs in different part of Tanzania, for example by SCAPA (soil conservation and agroforestry project). The implementation of these projects has however also reached a limited success, just like in Babati and Bukoba. The biggest obstacles preventing a wider spreading within these previous projects have been identified as lack of skills regarding construction and use of the stoves and also issues regarding funding (Malimbwi & Zahabu 2009).

Previous research has also shown that activities on fuel-efficient stoves are more successful in regions with scarce access to fuel-wood, that people’s perceptions often is positive but that economic or organisational obstacles are preventing a further spread of fuel-efficient stoves (Barnes...
et al. 1994). To get a deeper understanding of this issue and how to tackle it, this thesis aims to understand the socio-economic context in which people interact to fully understand which are the decisive factors for adopting and further spread of fuel-efficient stoves. How can both cooking methods and aid programs become more efficient?

2.3.2 Development projects and gender

Studies have shown that development projects focusing on female empowerment are most successful when involving certain features. Projects that strengthen the whole household’s economy, that affects both men and women’s workload and includes intra-household relations, i.e. roles and responsibilities of men, have shown to be effective (Holmboe-Ottesen et al. 1989). Women’s exclusion from power over household economy might however be one constraint affecting the success of these projects (Payeur 1996). Whether projects focusing on women only, or projects that include both genders, gain women more can be discussed. Projects solely for women have shown to be more effective in reaching women in specific, but also run a bigger risk of isolating women from the rest of community, they also have lower priority and smaller budgets (Holmboe-Ottesen et al. 1989). IFAD highlights the need for including women empowerment in development projects and means that projects have been more effective when including needs and roles of women in project design from the beginning (IFAD 2011).
3. Theoretical Framework

3.1 The Sustainable Rural Livelihoods approach

The analysis takes ground in the framework of Sustainable Rural Livelihoods (SRL). By putting people at the centre of development the concept gives us a broader understanding of people’s livelihoods and the main factors affecting these. The framework is useful when assessing development projects and how they contribute to more sustainable livelihoods for the participants. It also opens the discussion on how to think of poor people’s livelihoods and provides a base for improving development programmes regarding for example poverty reduction (DFID 1999).

A livelihood is defined by the institute for development studies as:

"A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets, while not undermining the natural resource base."

(Scoones 1998)

When trying to understand why farmers choose to adopt fuel-efficient stoves Sustainable Rural Livelihoods theory provides a useful tool to understand how people prioritize and why. It also provides a picture of the surrounding context and how this relates to the strategies people take to improve their livelihoods (see figure 1). Indicators of the different capitals identified by the SRL framework have been selected to fit the purpose of this thesis (see Box1). SRL also helps when identifying key elements, such as which groups have been participating in the trainings on fuel-efficient stoves, and can then provide tools on how to meet these elements. Is it for example only people with a high access to certain capitals, such as economy or knowledge that are participating? The different parts of the framework have been considered during the planning of methodology and during analysis of the result. The framework is to be seen as a guideline with the purpose to get a deeper analysis, to support the method and to make sure that a holistic perspective has been considered and that important factors have not been overseen.
3.2 The asset pentagon

The framework highlights that livelihoods depend on access to five different capitals: social, human, natural, physical and financial capital. The access to these assets is said to determine people’s ability to influence their own livelihood and choose strategies to fulfil their objectives. To further visualize people’s access to different assets and to further understand the inter-relationships between these, we use the "heart" of the livelihoods framework: The Asset Pentagon (see Figure 2). The centre of the pentagon represents zero access to assets and the outer corners represent maximum access. The pentagon thus takes different shapes depending on perceived access to capital assets. One important aspect is the inter-relationships between assets, where change in one can affect another by generating more capital or decreasing the capital (DFID 1999).

Figure 1. The Sustainable Rural Livelihoods Framework (DFID 1999).

Figure 2. The asset pentagon (DFID 1999).
BOX 1. The Indicators of capital assets that have been used in the study have been identified with the help of guidelines from the SRL-framework. The indicators that were used in this study are here presented and explained (Carney 2002, DFID 1999).

| Financial Capital: Financial resources do not necessary have to be economically but also includes flows of consumption and production, such as Income and savings. In this thesis access to rotational funds or credits, livestock and indicators of activities generating income or indicating consumption have been noted as financial capital. |
| Physical capital: The access to infrastructure is also a deciding factor, even though a hospital exists in an area does not mean everyone affords to visit it, certain groups might have limited access. Physical capital has been analysed from access and condition of shelter, equipment and transport. |
| Human capital: Indicators used is level of education, certain skills and knowledge, access and possibilities of labour and access to information about stoves. |
| Social capital: Social resources can help develop knowledge and reduce free-rider problems to common resources such as forests. Membership in organisations groups and networks. The importance of social capital is relevant for how knowledge is received and given, it can lead to higher access to other capitals and influence of forming structures and processes. Indicators used for social capital is membership of groups, how information about fuel-efficient stoves is spread, knowledge about and connections to neighbours and villagers, marks on increased security such as help with activities for elders. |
| Natural capital: To understand which groups are excluded from natural resources, and where potential conflicts over resources lie is valuable information when analysing natural capital. If farmers have access to land and forests and clay soil has been noted. What kind of tenure rights that rule in the area regarding private and public forests and also own productive resources are other indicators used to analyse natural capital. |

3.3 Relationship between assets and the other parts of the SRL framework

A key to fully understand the dynamics of the SRL approach is the relationship between assets an the other parts of the SRL framework (See figure 1). Regarding assets there are especially two relationships worth considering when analysing the importance of capitals in development projects: Substitution and Sequencing. Substitution means that one capital can compensate for another, if for example increased financial capital can compensate for the lack of natural capital in the specific circumstances. Sequencing can tell us if a specific asset or a set of assets are necessary for fulfilling
certain livelihood strategies, if for example financial capital is needed when adopting fuel-efficient stoves (DFID 1999).

The vulnerability context affects assets through seasonality, trends and shocks. Fuel-wood supply is smaller during rainy seasons, and changes depending on demand and natural conflicts or shocks. By trying to identify the risks and priorities in people’s life, an idea of which context they are in is given. Questions on risks, agricultural conditions and changes in fuel-food access during seasons and generations are examples of indicators chosen (DFID 1999).

Transforming structures and processes affect the vulnerability context and strategies taken. Organisations can be seen as structures operating depending on the existing processes. An example is how people’s choices are affected through accessibility or risks regarding for example fuel-wood, processes such as market prices, access of forest reserves and legislations set by structures such as governments and NGOs. Culture, class, age and gender roles and how they are influencing access to assets, power over economy and decision-making are other in this case highly important processes (DFID 1999). Relevant policies, maps and document have been studied and questions regarding forest legislation have been discussed with respondents to pin out which structures and processes exist within the case studies.

Livelihood strategies are actions and choices taken to achieve certain goals or outcomes to improve livelihoods. Access to assets can be identified as the major factor affecting the possibility of making these strategic decisions (DFID 1999). An example of strategies can be to seek specific skills or the adoption of fuel-efficient stoves. To be able to make these choices, capital might be needed, like economic capital to pay for education or knowledge to build a clay-stove. To fully understand obstacles for wider spreading of fuel-efficient stoves there is a need to identify which assets are needed to be able to adopt fuel-efficient stoves. Differentiating groups is an important factor when analysing livelihood strategies (Carney 1998, DFID 1999). Groups within the study can be divided into men, women, living area and people with different economic capital.

When fulfilling a strategy, livelihood outcomes are achieved. By studying which strategies people pursue, and the reasons for choosing these, can give us a deeper understanding of people’s priorities, the means used to achieve their strategies and what hindrances they might face. An example of livelihood outcomes might be increased income, improving food security, reduced vulnerability or a more sustainable use of natural resources (DFID 1999). To identify the respondents’ livelihood outcomes, questions about reasons for choosing to implement fuel-efficient stoves or being members of VI SCC were asked. Reasoning about importance of saving fuel-wood and views of a good and bad life were also a part of the interviews. Something that makes it difficult when analysing existing outcomes is to understand to which level they are already being achieved and possible conflicts between outcomes. An example can be how certain groups’
outcomes affect others, like how decreased vulnerability might affect the natural resource base for others (DFID 1999).

Farmers’ choice to collaborate with VI SCC can be seen as a strategy to achieve a certain livelihood outcome. This strategy might then affect farmers’ access to assets, to their possibility to implement new strategies and their vulnerability to shocks or trends. This study will explore how farmers perceive the fuel-efficient stove and if adopting it might have affected their livelihoods. The fuel-efficient stove can be seen as both an increase in physical capital that might help to increase other capitals or as a livelihood strategy affecting the whole structure. How big impact the stove actually has on people’s livelihoods is hard to say and should not be exaggerated. This model is to understand how fuel-efficient stoves might be a way to increase the adaptive capacity and resilience to shocks.

An interesting aspect is to compare how expected livelihood outcomes might differ between the farmers and the programmes promoting the stoves. This with the purpose to further understand which capitals might or might not affect adoption of fuel-efficient stoves. The SRL approach includes governance in promoting participation, putting people at the centre and including analysis on multiple levels. To what extent the design of projects on fuel-efficient stoves involves governance will also be explored through the SRL framework to a certain degree.

3.4 Weaknesses with SRL

Even the sun has its spots. Two aspects worth considering with the SRL framework will be mentioned here. The first one is the difficulties with defining who are these “poor people” which the framework should be applied on and the views affecting this. The other is the consideration of gender within the framework. It is addressed as a part of “transforming structures and processes”, but there are still dimensions with the risk to be overseen in analysis or implementation. An example could be to not give enough attention to inequalities within homes when looking at a household level, or the constant failing of participatory techniques to get a fair representation of women’s actual perceptions, interest and needs regarding to their livelihoods (Krantz 2001). To bridge these gaps, I have chosen to use complementary gender theories and research relevant to this field (See Background and 3.5).
3.5 Feminist Political Ecology

When including local knowledge into development projects and natural resource management the importance of a deeper analysis of inequalities and power relations is important to avoid the risk of obstacles regarding gender dynamics or exclusion of vulnerable groups (Goebel 2011). The SRL approach addresses the issue of gender as a structure that affects people’s access to assets, their choices regarding livelihood strategies and their possibilities to achieve desired livelihood outcomes (DFID 1999). The use of the feminist political ecology theory will try to highlight how gender might interact within the SRL framework and to explore how it is addressed within the projects on fuel-efficient stoves. The theory came from the empirics, when noting that gender might be a variable affecting livelihoods and project designs to a high degree. With the help of theories on gender in project design and political ecology the thesis will shed a light on to what degree gender is a variable affecting obstacles for spreading of projects on fuel-efficient stoves and how can it be tackled.

Feminist political ecology explores gender as a factor in political and ecological relations and aims to deconstruct traditional views on women’s and men’s capabilities in different tasks and situations (Rocheleau et al. 1996). The theory means that gender is a critical factor that affects the access and control over resources and it also interacts with social class and culture to shape livelihood opportunities and development on both an individual and community level (Rocheleau et al. 1996).

Policies regarding natural resource management can also be put in a gender perspective. Resources such as forests or lands are managed through policies in which women are locked in the position of users rather than managers, which can be mirrored in ownership rights and others (Goebel 2011). In this thesis the primary aspect of gender relations is women’s positions as depending on tasks of men, taking over responsibilities of men because these are not fulfilled. As mentioned before, a woman’s main responsibilities are often centred on the domestic sphere, which put them in positions to view issues regarding economy and environment from the perspective of the home. Women will not necessarily be excluded from economic activities, but their main objective will be domestic responsibilities rather than economic incentives (Rocheleau et al. 1996).
4. Field Methods

To gather the empirical data for this thesis a field study was carried out in Tanzania, in Babati and Bukoba districts, from February 20th to April 20th 2012. Total 13 villages were visited and 64 interviews were conducted. I facilitated the study with logistical support from the VI Agroforestry office in Bukoba and by the MFS scholarship granted by SIDA, Swedish international development and co-operation Agency. Three weeks of fieldwork was conducted in Babati District, which worked as a pilot study to get a general understanding of the socio-economic situation and the work with fuel-efficient stoves in the district. It also gave an opportunity to improve the interview guide and identify the most important aspects of the purpose. The coming seven weeks were spent in Bukoba District where fieldwork was done together within the organisation VI Agroforestry/VI SCCs activity on fuel-efficient stoves. The organization provided general support and information regarding their work with the fuel-efficient stoves in the area, transport and assistance in field.

4.1 Qualitative research methods and Topical RRA

The thesis takes ground in an abductive approach within the qualitative school of methodology. An abductive approach theory alternates empirics and combines parts of both a deductive and inductive approach. This gives an alternative approach for understanding a specific topic (Danermark et al. 2003). This thesis seeks to understand why activities on fuel-efficient stoves reach a limited adoption and the potential hindrances for further spreading by combining empirical observations with existing theories regarding livelihood strategies, and organisational and social structures. To understand why farmers adopt certain technologies it is important to understand the context in which they interact, their socio-economic situation and what their abilities and priorities are regarding their livelihoods. Qualitative research methods seek to gain a wider understanding of a certain case studied (Danermark et al. 2003). This study does not aim to test a certain theory, but rather to find explanations to a certain phenomenon, an abductive approach and qualitative methodology is therefore suitable tools for this specific purpose.

The study relies on the qualitative methodology of Topical Rapid Rural Appraisal. Many different techniques of gathering data are used within RRA and the ones used in this study are semi-structured interviews, observations and second hand data sources (McCracken et al 1988). The main
method is semi-structured interviews with staff from organisations promoting fuel-efficient stoves and farmers in areas where fuel-efficient stoves have been promoted.

RRA emphasizes the importance of diversity through the use of several sources when gathering information, an approach called triangulating. Within the different scope of RRA techniques, topical RRA have been applied in this thesis. In a topical RRA-approach a specific question is targeted and explored in detail, and the analysis normally gets deeper and narrower than for example exploratory RRA techniques. The approach seeks to give a descriptive explanation of the area studied and its causes, rather than a direct answer to the problem. The methodological process can be divided into different parts, whereas one is an extended hypothesis that can then be used either as a working or research hypothesis. A working hypothesis is assumed to be a representation of the situation and actions may be taken based on the findings. In a research hypothesis the result is further tested through research, which can later be analysed and which acts as base for recommendations (McCracken et al 1988). The topic for this thesis started with the question on how successful activities on fuel-efficient stove have been in Babati and Bukoba districts in Tanzania. The extended hypothesis was that adoption of stoves has been limited. To explore this further semi-structured interviews and observations were made.

**Triangulation**

To strengthen the validity of this thesis triangulation has been used to make sure that the information gathered reflects the reality rather than the individual perceptions of informants. Different methods have been used during the fieldwork and as previously mentioned, also written sources and observations was given to complement the data gathered from interviews. An example is how a diverse group of both farmers and organisations and people on different positions helped with providing a multi-dimensional view on the issue. The same scope of questions was asked to all informants and several people in the same area were asked to cross check information given and make sure it was coherent.

### 4.2 Semi-structured interviews

Semi-structured interviews with farmers and organisations have been complemented with observations and second-hand data with the aim to validate the data and get a broader and more complex understanding of the issue and its surrounding context. By conducting semi-structured interviews grounded in the SRL-framework, information have been given on how farmers perceive the stove and experience their own capital and which of the capital assets play a decisive role when
adopting fuel-efficient stoves. The interviews were divided into a structured part and a semi-structured part consisting of two or three themes, depending on whether the respondent had a fuel-efficient stove or not. The questionnaires were similar and touched the topics of perceptions of fuel-efficient stoves or other cooking method, fuel-wood access and consumption. See Appendix for interview-guide example. During interviews certain issues might be more sensitive, something I felt regarding for example collecting firewood in prohibited areas. A measure taken for this was to keep these questions general, open and to be clear beforehand that interviews are anonymous and voluntary.

**Farmers**

A total of 55 interviews and 3 complementing group interviews were held. The interviews took part in two regions in Tanzania, Manyara and Kagera. 42 interviews were carried out in Kagera region and 13 interviews in Manyara region. In Bukoba district, Kagera region half of the farmers interviewed had adopted fuel-efficient stoves and half had not. The activities involve both men and women and both genders were interviewed in equal numbers. The original plan was to only interview female farmers in both regions but due to the participation of both men and women in VI SCCs project in Bukoba made it highly relevant to involve both genders, this with the purpose to get a holistic understanding of the different views, factors and structures that might affect the adoption of fuel-efficient stoves. In Babati one organisation and 13 farmers in 8 different villages were visited. The three group interviews were conducted with different women groups and schoolgirls. In Babati Districts, eight of the farmers had adopted the stove and five had not. In Babati activities on fuel-efficient stoves were focusing on women groups and therefore only women were interviewed in this region.

The interviews were made within people’s households to get a better understanding of their situation. In most cases the cooking place and stove was displayed and worked as a conversation starter. The majority of the interviews were held in Kiswahili or in the respondents’ mother tongue, Kihaya in Kagera region. A translator was present at all times during interviews to help in another language than English. The language barrier and information getting lost in translation is of course something affecting the result. The interpreters’ gender, education and position are other factors to have in mind. Of the three field assistants taking part in the study, two were men; something that might have affected the situation to a certain degree, especially when interviewing women.

In both areas key informants were identified with the help from the field assistant and organization.
A selective method was partly used when choosing respondents. Certain criteria needed to be fulfilled, such as an even distribution of gender, kind of stove used, membership or non-membership in organisation (VI SCC) and living area. A diverse group of respondents was wanted with the purpose to get a representative picture of the communities. With this in mind, various people were chosen, somehow randomly, and by snowball selection. When visiting villages we would go to the area and ask people randomly to participate or take help from farmers or village facilitators to recommend other people or villagers to visit. The influence of these people on who was chosen is a fact, friends and family to village facilitators were somehow common and people with a certain knowledge. When asked to interview certain groups, for example non-members of organizations or people without fuel-efficient stoves, the response was “But why? That will not be interesting for you, because they can’t tell you anything about what you want to know”. Even this information was of course valuable and by open communication with my field assistants, some of these gaps could later be filled.

Representatives of NGOs
Semi-structured interviews with staff from organisations promoting fuel-efficient stoves, VI SCC in Bukoba and Livingstone Tanzania Trust in Babati, have been conducted to provide a general overview of the projects on fuel-efficient stoves and to get a deeper understanding of their perceptions, motives and ambitions on these activities. Six interviews were made with people on different positions within the organizations, which helped with both crosschecking data and to get an as good overview of the issue as possible.

When working with organizations the question of bias is worth mentioning. To not let your own opinions and gratitude influence the result is of high importance, but also almost impossible. During the field work this aspect has been kept in mind, and I feel that it sometimes made me be more critical and alert of structures regarding to the organization.

4.3 Secondary data
Second hand sources used includes official reports, survey results and documents from VI SCC, also national policies regarding energy, forest and development strategies. Previous research papers on the topic of fuel-wood consumption and fuel-efficient stoves have also been used to provide an insight of the research field and helped when analysing the collected data. Regarding the reliability of the chosen sources, it’s important to keep in mind that certain information might reflect the
publishers’ interests. This can for example be the case of information from both governments and organisations. Electronic resources have been used to a limited amount, regarding for example background information on organisations.

4.4 Observations

Observations have helped providing valuable information for this thesis. During interviews within households and in villages observations were made with the purpose of triangulation and to provide valuable information regarding certain indicators. An example is the indicators showing physical capital, such as housing and infrastructure. Indicators were identified with the help of the SRL-framework. To observe and participate in societal activities have also given a deeper understanding of Tanzanian life and their social structures.

4.5 Coding

Coding has been important when interpreting and analysing data collected during interviews and observations. Coding helps finding correlations between what has been observed and gives the concept its meaning. When using the SRL model the analytical framework is already defined and guidelines for coding is given through the analytical concepts and indicators (DFID 1999). The work has consisted identifying relevant indicators (see box1) and then classing the found data into these given categories within the SRL framework, a process that have been quite challenging from time to time. To interpret the actual access to certain capitals have for example been a bit difficult, when answers from interviews sometimes were a bit unclear.

4.6 Position of the researcher

My own influence on the reliability of data is something worth mentioning. Aspects such as age, class, ethnicity and gender influence how people relate to each other in social situations and not at least during interviews, this is therefore something that might have been affecting both the interview situation and the answers. How my own expectations, conceptions and knowledge of the field beforehand could influence were something I also tried to keep in mind during the fieldwork.
5. Study areas

In this section the regions and the examined projects on fuel-efficient stoves will be presented. To have in mind is that the study does not aim to compare the two regions but rather use the information given to get a broader holistic understanding of the obstacles for spreading of fuel-efficient stoves from two regions with some differences in their socio-economic situations. The two case studies were taken place in Kagera and Manyara regions in Tanzania, eastern Africa (See figure 3). The regions have both similarities and differences that make them interesting to study from a socio-economic perspective.

Figure 3. Tanzanian map with the regions districts and wards for the study marked. The two regions Kagera and Manyara, the Babati and Bukoba districts and the wards visited. The studied areas are marked on map with dark blue and purple. (Map made in ARCGIS10 by author, 30 May 2012, shape files provided from VI SCC in Bukoba)
5.1 Babati District, Manyara Region

Babati District is found in Manyara region in northeast of Tanzania, south of Arusha (see figure 3). The district is divided in 21 wards and 81 villages. The East African rift is passing through the area and gives it features of valleys, hills, mountains, lakes and rivers. The soils are mostly volcanic with a high content of minerals, which makes it suitable for cultivation. The district has an altitude from 950-2450 meters above sea level (Lindberg 1996). Babati is a developing district consisting of different ethnical groups and religions. Most of the population in the district are depending on farming for their livelihood and the crops grown are food crops such as maize, beans and potatoes with pure cash crops such as pigeon peas, sunflower and bananas. Different agricultural methods are practised in the region and agroforestry is one of these, brought by both migrants from Kilimanjaro and also promoted by NGOs in the region, an example is tree-planting projects during the 1980s. The region has a long tradition of international aid-support and projects on fuel-efficient stoves can be traced back to these tree planting projects and Tanzanian Land Management and environment programme (LAMP) funded by Swedish SIDA in the late 1980s and forward (Kavishe 2012). Historically the region suffered from deforestation but has been able to decrease the negative impacts due to a successful shift to a participatory forest management in the area (Katila et al., 2003). The major problems in the area are soil erosion and land shortage (Lindberg 1996). Seven villages and four wards were a part of this study. The villages visited were Waang'waray, Mamire, Endabeg, Sawe, Mrara, Ghala and Haraa. They were chosen for both their location and inclusion of projects on fuel-efficient stoves. The villages differ in distance to both urban areas and forest reserves; some villages have been highly involved with projects on fuel-efficient stoves now and historically. Villages Wang'waray and Haraa are close to forest reserves while Mrara is somehow close to the urban area of Babati town. One of the common denominators in the area is soil erosion and the presence of NGOs.

5.1.1 Projects on fuel-efficient stoves in Babati

No specific project was assessed in Babati like in Bukoba; instead a more general picture of the spreading of fuel-efficient stoves in the region has been explored. There has been a presence of fuel-efficient stoves for a long time in Babati, which have been promoted in many areas by different actors such as international NGOs and aid-organisations. Previous studies showed that lack of financial resources had been important regarding the possibilities in the region for further adoption of fuel-efficient stoves and other renewable energy technologies (Cronström 2011). This thesis
explores this further and takes the socio-economic situation into consideration when exploring the possible obstacles fuel-efficient stoves face in reaching more people. Even if a more general perspective is given, farmers mentioned mainly two projects when discussing fuel-efficient stoves in Babati. One is an on-going activity through the international NGO Livingstone Tanzania Trust and the other was an already ended activity as a part of the SIDA sponsored LAMP-project. This took place in the village of Mamire, where a group of women started with different projects such as tree planting and fuel-efficient stoves in 2003. LAMP provided women with trainings on how to build stoves and also supported the group through funding’s for travel costs for getting the materials needed. When the funding was phased out in 2006 it left the group with financial problems, which resulted in that the group is no longer active (Kavishe 2012).

Livingstone Tanzania Trust is a British, independent grassroots organization working with poverty alleviation on a local level since 2006 in Babati, Tanzania. The organization is working with five problem areas: education, environment, health, community business and agriculture. Integration of its projects in the local communities is highly relevant and PRA is an important base for this The Projects on fuel-efficient stoves have been active for 2,5 years with the aim to train and construct stoves. The objective of the project is to reduce the amount of fuel wood consumed and then slow down the deforestation of mount Kwaraa in Babati area (Page 27 February 2012). The project focuses on training women in constructing fuel-efficient stoves and then building these for others to generate an income.

5.2 Bukoba Rural District

In Tanzania’s north western corner is where we find Kagera region, surrounded by Uganda, Rwanda and Lake Victoria. Kagera region is divided in eight districts and this study was conducted in the district of Bukoba Rural, in a zone called Bugabo. The zone consists of five wards: Rubafu, Kishanje, Kaagya, Buhendangabo and Nyakato. Four of five wards and 6 villages were visited during this field study (see figure 5). Bugabo zone was one of the first zones where the activity on fuel-efficient stoves were promoted since the entry of the organisation in Kagera region, which makes it an appropriate zone for studying the spreading of fuel-efficient stoves. (Masologo 16 April 2012)
Bukoba rural, Bugabo area, is a hill sided area with an average amount of rainfall. In 2003 the population reached 395 130 (REDET 2007). Most people in the region are depending on agriculture as their main source of income. Banana, coffee and vanilla are grown as cash crops and constitute a base for the economy in the region. The most common agricultural system is agroforestry, often consisting of smaller farms with intercropping, livestock and tree planting. The main issues affecting the agricultural conditions are low soil-fertility and crop-diseases. The fuel wood situation is considered to be scarce and the main sources are private woodlots or forests, bushes and shrubs governed by the village councils. Roman-Catholicism, Islam and lutheran christian are the main religion(REDET 2007).

5.3 Main project: VI SCC/Agroforestry in Bukoba, Kagera
The greater part of this study was conducted in Bukoba Rural district focusing on the activity of VI Agroforestry on fuel-efficient stoves. VI Agroforestry, also referred to as VI SCC in this thesis, is a Swedish non-governmental organization working in eastern Africa around the Victoria basin with
agroforestry and rural development projects. The main focus of the organisation is to alleviate poverty among small-scale farmers by implementing sustainable agroforestry techniques (Karlsson & Fransson 2010). Agroforestry is a farming system where perennial trees, shrubs and annual crops are grown on the same land and is often highlighted as a more sustainable alternative to traditional agriculture (Kiptot & Franzel 2011). The objective is to empower communities and increase their socio-economic situation in a sustainable way, for example through natural resource management and the planting of trees, fuel-wood and food sufficiency and by starting enterprises. To fulfil this VI SCC has structured its work through putting emphasis on five main components: sustainable land management, farmer enterprise development, groups and networks, lobbying and advocacy and environment and climate change. The organization has been working in Tanzania since 1994 in three areas, where the most recent area is Kagera region in which they entered in 2005 and at the moment is active in three of eight districts (Nilsson 2008). The organisation gets it funding from Swedish SIDA.

5.3.1 VI SCC’s project on fuel-efficient stoves

Within the latest program RESAPP a part was focusing on climate change and Sustainable energy with the main aim of forest conservation and environmental protection. When VI SCC synthesized the communities on these issues, such as planting trees, the organization realized the importance of also addressing the issue of sustainable energy use. Over 70% of households in Bugabo get their energy from wood mass and there is a need for practices of reducing the use of fuel wood. Since VI SCC entered Kagera region activities on fuel-efficient stoves have been a part of the strategy, to reduce the use of fuel wood and to make it more sustainable (Mtui 12 March 2012).

Different models of fuel-efficient stoves have been practised. The project started with training groups of farmers on how to build fixed stoves from bricks and sand. The farmers gathered materials themselves and the trainings were held in one of the farmers’ homes, where VI SCC Staff built and explained how they did it. The spreading of this fixed model was limited mostly due to economic constraints and material costs. To face this obstacle the activity was reformed and a new kind of stove made from clay was promoted. Trainings on these portable clay-stoves have been held since November 2011 in Bukoba rural district. VI SCC works from a demand-driven approach and no economic contribution is made to the farmers, this with the aim to decrease dependency on the organisation. Instead, the organisation synthesizes communities on different techniques that farmers can demand to get more information about if they see the need for them. Farmers form groups and
request trainings from VI SCC, who then can help to train the groups in the technique demanded (Mtui 12 March 2012). This way the demand comes from the farmers and this can be seen as a more bottom-up approach. The aim of trainings on fuel-efficient stoves is to that farmers will have the knowledge needed to face the challenges themselves and be able to build the stoves for own use and for others. Some farmers continue trainings to become what they call “experts”. Experts can then train others and hold own trainings on how to make stoves. One incentive, not yet practiced to a high degree in Bugabo zone, is to make fuel-efficient stoves into an enterprise and build stoves and sell them to others. During VI’s trainings on fuel-efficient stoves in Bukoba rural, both men and women can participate. The importance of training both men and women is mentioned by VI SCC staff as a way to bridge potential hindrances due to gender aspects.

5.4 Stoves within the study

There are several different models of fuel-efficient stoves and this study focuses on two different designs of fuel-efficient stoves and on the traditional three-stone stove. The steel-stove for charcoal is mostly used in urban areas but will be shortly mentioned due to the fact that some farmers also use this model as a complementing stove.

5.4.1 Fixed fuel-efficient Rocket Stove

The fixed stove, often called rocket-stove, is made of bricks, sand, grass etc. Bricks for stability and design of the interior structure make the ground structure. The bricks are later covered with a mixture of sand, clay, grass and other materials to making it more stable and smooth. In some designs cement has also been used. The use of cement is more expensive and doesn’t hold heat as well as sand or clay. The sand or clay can be varied and the need for a specific kind of sand or clay is not as important as for a portable clay-stove (see figure 6.)

Figure 6. Fixed fuel-efficient rocket stove, made by Waang’waray women’s group Livingstone Tanzania Trust in Babati district, Waang’waray village. Picture taken 29 February 2012
The stove can be varied in design but most often has two or three holes for cooking, one hole for putting firewood and a chimney that leads the smoke outside. By having two holes for cooking the stove is multifunctional and the small leading pipe isolates heat that increases the efficiency. When built, the pot-size is being measured to get the correct size of the cooking holes. The efficiency regarding fuel-wood consumption, that it is multifunctional and that it is easier to keep the kitchen clean is mentioned as positive effects of the stove.

5.4.2 Portable fuel-efficient clay stove

The portable clay-stove comes by many names and designs but is in this thesis referred to as portable clay-stove. Different mixtures can make the stove but the main component is clay formed in a bucket-alike shape (see figure7).

The stove has one hole for putting fuel-wood or charcoal in one direction and one hole at the top for the pot. In Bukoba the stove is made by clay-soil, grass, cow-dung, sawdust and ash. The mixture can be defined to prevent cracks. The stove is mobile and can therefore be used both inside and outside. It can also be used with both fuel wood and charcoal. The use of less fuel wood is leading to less smoke produced. A negative aspect of the stove is that it can easily break.

Fig 7. Portable clay-stove made by members of VI SCC in Bukoba district, Bugabo zone, Kishanje ward. Picture taken 18 March 2012
5.4.3 Traditional three-stone stove

The traditional three-stone stove is made of an open fire and three big stones formed as a triangle. The pot is put on the stones, which can be adjusted according to the pot size, and fuel wood is placed between the stones in three different directions (see figure 8). The stove comes with no costs, it is easy to handle and the risk for breaking it is none.

Fix 8. Traditional three-stone stove in Babati district. Picture taken 20 February 2012.

It is considered as fast, versatile and easy to adjust by supplying different amounts of fuel-wood. It can be used for cooking different kinds of food such as normal food and for fish smoking. Except for cooking, the stove can be used for heating and lighting the house and the smoke functions as an insect repellent and to strengthen the hay and timber in traditional houses (Interviews Bukoba: Ibosa & Babati). Negative aspects with the stove are that it is not very energy-efficient and therefore needs a lot of fuel wood and produces a lot of smoke. Its efficiency is said to be around 15%, meaning only 15% of the energy produced is actually used (Barnes et al. 1994). There is also a risk for fires and it can be a hazard for children with the open fire (Kuhnhenn 2003).
6. Socio-economic situation in Babati and Bukoba

In this section the results will be presented and analysed from the perspective of the SRL-framework and the asset pentagon. By taking ground in the access to capitals, the socio-economic situation will be presented and discussed within the two cases of Babati and Bukoba rural districts. For further understanding of the issue the empirical findings are connected with the theoretical framework presented in section two. How access to the different capitals relate to the other components of the SRL framework and how this might affect the spreading of fuel-efficient stoves will be analysed within each capital.

“A good life for us in the village is when we are able to take care of our family, take our kids to school, when we have many cows, pigs and livestock and people that can help you take care of these, and you can hire labour power and be able to pay them. It is having an own woodlot with trees for getting firewood, having money to buy the things you need. In the village- this is the good life. The bad life is when you don’t have much to eat, when you have to work hard gathering fuel wood from the governments forest and they chase you out, this is not good. When you don't have enough money to buy important things or can’t give your children a good education, this is the bad life.”

Farmer without fuel-efficient stove, Bukoba District, Bushagara village 4 April 2012

6.1 Natural capital

The poorest part of the population are the ones most dependent on natural and public resources and are the ones most vulnerable to potential decrease and destruction of them. By analysing natural capital we can understand which groups are excluded from which resources. Natural resources provide a base for economic activity in the areas that are relying on natural resources and also enable access to other capitals. How natural capital affects the spreading of fuel-efficient stoves in Babati and Bukoba will here be further explored.

6.1.1 Access to and quality of land

The most people in rural villages are dependent on cultivation of land in one way or the other. In Bukoba the majority of people are farmers, but even households who are not entirely depending on farming as a source on income have a piece of land as their kitchen garden, or “shamba” in Swahili,
to get their basic supply of food crops, fuel wood and other necessities for their family. Access to land is therefore required. All of the respondents in this study had an own kitchen garden, but the size of their land varied from less than an acre to around 10 acres. The main agricultural method in Bukoba is what might be referred to as agroforestry, where a variety of crops are mixed, livestock is used and in some cases trees are planted. Regarding agriculture and the quality of land the main problem raised by the farmers in Bukoba was low soil fertility and crop diseases, something also stated within previous research of the area (Karlsson & Fransson 2010). Wilt-diseases affecting coffee and banana production was emphasized as a big problem by many farmers, something also mentioned by the VI SCC-staff who is working with helping farmers develop solutions to face these diseases. Regarding low soil-fertility the issue of having enough manure was a concern. Few farmers own enough livestock to produce the amount of manure needed for agricultural use and efforts of using other sources such as plants for manure is practiced by some. In Babati the soils are fertile and the problems is rather the access to water and land degradation. Many of the people interviewed in both districts expressed concern about low harvests that make it harder for them to rely and generate an income from their land.

6.1.2 Access to forests and firewood

“During raining time it is very difficult and we are struggling to gather enough fuel-wood. During dry-season it is easier but still hard because the forests are not there anymore. Due to climate change we don't have enough fuel-wood. In my youth there was easier access to firewood, we could just go and gather sticks easy. This is not the case anymore. We have changed the climate and destroyed our forests; you can see that the forests are no longer here. If there could be any mean of reducing the use of fuel-wood - we need to start use that thing”

Bukoba District, Bushagara village farmer without stove, 4 April 2012

In both Babati and Bukoba fuel wood is a scarcity. As previously mentioned, Kagera is one of the regions which is classified as a zone with serious fuel wood scarcity and Babati to a region with medium scarcity (Malimbwi & Zahabu 2009). In both districts this seems to still be the case, and demand for fuel wood is high compared to the availability. The access to fuel wood varies between seasons and scarcity is most severe during rain seasons when less dry wood is available and the access to scrublands is difficult due to the water. In many of the visited villages the primary source is traditional forests, bushes and shrub lands managed by the village government. In many of these traditional forests it is illegal to cut trees or branches, but it is allowed to collect deadwood. Due to the scarcity many people still enter these forests without respecting the legislation.

In Babati agroforestry was often used in the own kitchen garden but complemented with mono
cropping, for example maize, in their farming lots. Some farmers in both Babati and Bukoba planted trees within their farm or had separate woodlots where they planted trees. Some of the farmers mentioned gathering fuel wood within their farm and said to use branches from coffee plants after pruning as fuel wood. In most cases the kitchen garden itself didn’t seem to supply the household with enough fuel wood and needed to be complemented by gathering from public forests or buying. Demand for firewood is high in both regions and a decrease in availability and longer distances to retrieve it were something commonly mentioned during interviews. The reason for this can be a decrease of natural forests in the regions, something both mentioned during this study and also in previous research of the area Bukoba Rural, Bugabo zone (Malimbwi & Zahabu 2009, Karlsson & Fransson 2010).

Both this study and previous research shows that fuel-wood scarcity has shown to be a deciding factor for farmers wanting to reduce the use of fuel wood and adopting fuel-efficient stoves. All of the farmers that adopted a fuel-efficient stove mentioned saving fuel wood as the main reason. Of the 20 farmers in Bukoba without fuel-efficient stoves 15 of these also mentioned saving fuel wood as something important. When asked about the importance of saving fuel wood most people put emphasis on the economic benefits and the need for saving time and money as the main reasons. Some farmers mentioned the need for saving fuel wood to be able to store for times of scarcity or due to their limited capacity of gathering themselves. By reducing their consumption of fuel wood the farmers experienced that they saved time spent on gathering and that they are less vulnerable during scarce times. During interviews many people brought up the fact that bushes and shrubs in their close surroundings have become more scarce and that they need to go further to be able to find the same amount as before. In Bukoba Rural, over 88% of the farmers interviewed experienced a general scarcity of fuel wood and 73% said they themselves were affected directly by it. The majority of farmers experience availability as extra severe during rain seasons. The consequence is more time spent on gathering firewood due to longer distances and decreased availability. Out of the 42 farmers interviewed in Bukoba 43% also buy firewood to complement the amount gathered during times of scarcity. 17% of the farmers are mainly depending on buying firewood. 40% of farmers say that they don’t buy firewood but half are depending on other fuels such as charcoal or kerosene to fulfil their fuel-supply for cooking. 83% of the informants in Bukoba depend on traditional forests managed by the village councils for their fuel wood supply.
As figure 9 shows, the majority of farmers with their own woodlot had a fuel-efficient stove. A Pearson chi-squared test of these results shows that we get a significant difference between farmers with and without woodlots that have a fuel-efficient stove ($\chi^2=4.11$, df=1, p<0.05). Out of the 15 farmers with their own woodlot, 10 of them were still depending partly on traditional forests and shrubs for their fuel-wood supply. Access to land is an issue also affecting people’s livelihoods and can be considered as both natural and physical capital, and will in this thesis be considered as a natural capital with regard to access to private woodlots. In both regions this was an issue, but something more often mentioned in Babati, where many people started plating trees on their land to be able to claim higher compensation when government bought up their lands.

6.1.3 Access to clay-soil

When referring to fuel-efficient stoves the access to clay-soil is a natural asset that gives advantages to those regions in where it’s more easily accessible. Access to clay-soils differed between the regions and villages in this study. Some villages have the kind of soil needed to build the portable fuel-efficient stoves close while some villages don’t have it within a close distance. Here is where Babati and Bukoba differ in the structure of the two projects focusing on fuel-efficient stoves. In Babati the access to clay soil in the different villages was not identified. It was however something mentioned to be a potential obstacle due to the cost of transports gathering the soil in certain areas. In Babati during the LAMP-project, which has now ended, one of the big obstacles identified by one farmer participating in it was the access to clay-soil. The project focused on portable clay-stoves, and transport to the place where soil was present became a hindrance for further spreading.
of the project. The soil needed to be gathered at specific places and money for transport was funded from the project to make it possible. When the funding was phased out, the project also stopped due to the lack of finance for gathering the soil. The issue of gathering clay-soil has also been brought up by the project that is now active in Babati through the NGO Livingstone Tanzania Trust. To face this problem, the organization are instead focusing on the fixed model which does not need a specific clay, but can be built by a mixture of sands that are available in different regions. The material for this fixed-fuel-efficient stove promoted by LTT was said to be cheap and easy accessible, no exact amount was however given. In Bukoba the material cost for the fixed model had previously been the biggest obstacle for this model to spread, which makes the price of material an interesting question in Babati as well.

“The challenge is the access to the clay soil because it is out of the area. Many people don’t want to go far to get the clay. For the fixed stove many don’t have access to the bricks, which are also a bit expensive. The ones who are willing to go far to get the soil or pay a little for the bricks are the ones that already have the knowledge.”
Farmer with fuel-efficient stove, Bukoba Rural District, Ibosa village, 15 March 2012

In Bukoba the model of interest by VI SCC was the portable model made of clay. The soil for these was found in the villages of Buzi, Rushaka and Bushagara, which are surrounded by wetlands where the clay soil can be gathered. In the village Kishanje the clay soil is available within a medium walking distance. In Mushozi and Ibosa the soil is not available and need to be transported from nearby villages. In these villages the need of transport or financial input for getting materials were emphasized by most farmers, but not said to be a big problem. Only members of VI SCC with fuel-efficient stove were asked about access to clay-soil and other materials. The cost for the materials varied between 3000 to 20.000TZS. Of the farmers interviewed in Bukoba district, many mention that they used a means of transport to get the clay soil, such as car or bicycle. Some women mentioned they walked, but that it’s time and labour consuming.

6.1.4 Connection between Natural capital and adoption of fuel-efficient stoves
In both Babati and Bukoba districts, the main part of the population is farmers who are dependent on natural resources for their livelihoods. The access and use of natural capital is therefore highly relevant to consider when understanding what factors affect the ability to make strategic decisions for livelihoods such as adopting fuel-efficient stoves. There are different variables affecting the access to natural capital. Climate, trends and seasonality have direct impacts on natural capital and are also closely related to the vulnerability context. Trends in consumption of fuel are a factor
affecting the demand of firewood in the rural areas of this study. Seasons are the other variable
which access to natural capital depends upon. The production and harvest of crops is dependent on
season and amount of rainfall. During rains the access to areas for collecting firewood is limited and
the amount of dry firewood is less available. Another factor is quality of land that affects both the
input of labour needed and the actual output of yields. The productivity of agriculture results in
income and affects the financial capital, how the farmers are able to generate income. With high
financial capital like savings in livestock farmers might increase the productivity of their natural
resources through access to manure. The access to natural capital, such as fuel-wood and clay-soil,
also depend on structures and processes, such as legislation, forest policies and land ownership.

Access to natural capital might affect people’s choice to adopt fuel-efficient stoves in different
ways. One of the key factors seems to be fuel wood scarcity and the access to fuels. When put under
scarcity the farmer is more vulnerable and has less access to natural capital. As a strategy to
increase her/his capital and decreasing vulnerability, adopting fuel-efficient stoves can be seen as a
step on the way. The other part is of course access to the material for building the stove. Access to
clay-soil is a natural capital that might play a part in the spreading of fuel-efficient stoves. The
villages that are without clay-soil might face obstacles regarding transport, because more time and
labour is then needed to be able to get the stove. Another possible obstacle identified in Bukoba
might be the up-coming compensation for clay-soil. Today farmers don’t pay the owner of the clay-
soil ball pit anything to collect the material from the land. If the demand increases, especially if
enterprises are developed, the need for compensating the landowner will become an issue. A staff of
VI SCC said that this is something that might happen but the costs will be affordable and will not be
a problem.

If access to materials such as clay-soils and bricks are easier, the individual farmer faces fewer
obstacles when taking the decision of getting these stoves. If access to the materials is difficult or
takes a lot of time and labour, other capitals might be needed to be able to get the fuel-efficient
stove, such as physical capital in terms of transport or financial capital in terms of money. The cost
of material plays a decisive role regarding capability and desire for people to get a fuel-efficient
stove. If the price for needed material is too high, only people with higher financial capital will be
able to adopt the stoves and the spread will be limited.

One of the direct benefits of fuel-efficient stoves on natural capital is that less bundles of firewood
are used per household. If demand of fuel wood were less the amount in both private and public
forests would decrease. According to the interviews, the main perception of farmers was that fewer
bundles were used per household after adopting a fuel-efficient stove. This indicated that by adopting fuel-efficient stoves certain benefits on natural capital could be generated. By reducing the amount of firewood consumed, money can be saved for households. This shows another interaction between natural and financial capital, by increasing or making the access to natural capital more stable the farmer can avoid an effect on their financial capital. The ones with higher financial capital are also the ones that own woodlots. If fuel-wood scarcity were a deciding factor for adopting stoves, people with own trees might not own fuel-efficient stoves. However, the result showed that many people with stoves also owned trees. The strategic decision of planting trees, or collaborating with organisations promoting tree-planting such as LAMP in Babati and VI SCC in Bukoba, can be seen as a livelihood strategy resulting in increasing of capitals. Owning woodlots seemed to come with many benefits, both regarding income, fuel wood supply, time and labour. Farmers with private woodlots mentioned putting less time into gathering fuel wood, they had a secure supply during both dry and wet seasons and could also use the trees to sell or trade for other benefits. This shows that this also helps enlarging the other assets and decrease vulnerability.

The connection between natural and human capital is also a fact, the possible labour force needed to get benefits in term of natural capital. Less possible labour to put into for example gather clay-soil or fuel wood means less access to natural capital. People with limited capacity of labour, for example old or sick people, are then more dependent on others in term of gathering. Here is also a connection to the aspect of social capital, the help from others, or financial capital, the possibility to afford to buy fuel wood instead of gathering.

6.2 Financial capital

Financial capital is important of many reasons. It can affect social structures and processes and is highly interlinked with the other capitals. For farmers it can have a big impact though enabling investments and give access to other capitals, an example can be access to credits or payments for school fees that increase human capital. Financial capital is affecting the spreading of fuel-efficient stoves in different aspects.

6.2.1 Wealth and poverty

The main cash crops for small-scale farmers in Bukoba are coffee and banana, but other crops are also cultivated and sold for further income. In Babati the main crops are coffee, pigeon peas and maize. From the interviews it showed that many farmers in both regions saw a need to complement
their income from the crops, something also noted in previous studies (Karlsson & Fransson 2010). Many of the farmers have developed small enterprises to find more ways to create an income and in a way decrease their dependency on crops as their only source of income. These complementing activities could include having small shops, sewing, making products like coffee, smoking fish, selling chai, bananas and other types of food or selling local alcohol brews. In both regions very few of the respondents were employed, the ones that had were working for the village council, as a mechanic and as teachers. Number of persons that had employment was equal between those who had a fuel-efficient stove and those that didn’t.

6.2.2 Micro finance and VS & LA

A main component of VI SCC’s work in Bukoba is the Village savings and Loans Association systems, VS & LA. VI SCC trains and facilitates its members in forming groups and adapting financial services. VS & LA is a system where the members of the group join to save and loan money in the form of shares from each other. The group meets every second week where its members can contribute by buying shares to the common savings of the group. The value of shares depends on the members’ possibility to contribute, and certain requirements need to be followed to be able to be a member. The group, consisting of maximum 30 members, can then take turns in borrowing money from the group’s savings. If borrowing money, a certain interest is set and the amount should be paid back within a period of time agreed upon by the group (Mtui 10 April 2012). Many members of VI SCC, both with and without fuel-efficient stoves, mentioned the importance and positive effects the ability of taking loans through VS &LA have had on their livelihoods. The loans had been used differently, for example to start small businesses, building houses or to pay school fees. The VS & LA-groups were also mentioned by VI SCC-staff as a binding agent for spreading information on the organisations’ different innovations. When being synthesized on a new intervention, farmers themselves can form groups to then demand trainings on this, as in the case of fuel-efficient stoves.

Of the 21 members of VI SCC that adopted a fuel-efficient stove in Bukoba everyone except two were part of a VS & LA-group. Of the people interviewed without stoves all the 13 members of VI SCC were parts of VS & LA. That most members with fuel-efficient stoves also were part of VS & LA comes natural because these groups act as a binding agent for the work of VI SCC and the information of fuel-efficient stoves. The trainings on how to build the stoves are mainly spread through these groups.
6.2.3 Consumption and production

Of the farmers having own woodlots only very few were complementing their supply with buying fuel wood in comparison to those who where only depending on public forests. Of the households primary depending on buying fuel-wood the reason for buying instead of gathering was said to be a lack of time. In these households the primary source of income was not farming but other fields and depending on employments. In the households that were primarily buying fuel the men had employments. In Bukoba, more than half of households that mainly bought fuel wood had adopted a fuel-efficient stove. In Babati women had the main responsibility to gather fuel-wood. Of the households in Babati most were gathering from traditional forests and just a few mentioned that they were buying fuel-wood.

6.2.4 The pricing of fuel-efficient stoves

What a reasonable price of a fuel-efficient stoves would be was something discussed during the fieldwork. In Bukoba when discussing pricing of the portable clay stove, prices between 2000-8000TZS were mentioned as good when considering material price, transports and construction of the stove. The answers differed between villages, depending on access to different services. In one village, with quite good access to clay soil, one of the VI groups participating in trainings on fuel-efficient portable stoves had discussed the pricing and meant that the demand for buying portable clay stoves would be high with a price around 3000TZS. The example was based on one person selling stoves for around 3-5000TZS who found that many people were unwilling to pay 5000TZS for a stove due to the risk of breaking it and then “wasting” this money. The group instead discussed to gather material together, share the transport costs for the clay and sell stoves for 3000TZS with a smaller profit, but then to sell more of them.

“Many people want the stove but are not able to get it due to for example financial reasons. You need a certain level of capital to access the fuel-efficient stove. You need to be educated and have the financial capital to be able to see the benefits and be able to access the material. My neighbours need to be either supported or linked to access these capitals, like for example in the case of clay-soils.”

Farmer with fuel-efficient stove, Bukoba region, Ibosa village 28 March 2012

The portable clay-stoves were also built within the project in Babati, but the demand was said to be higher for the fixed stove. Many people were careful investing in portable stoves due to the risk of them breaking. The project design in Babati was a bit different than VI SCCs project in Bukoba. In Babati, households wanting a fixed fuel-efficient stove pay 2000 TZS for having it built. They also provided the material themselves, which come with some cost. At the moment four women build
the stove. To be able to pay each woman 1000TZS for the work, the organization today pitch in 2000TZS per stove built. It has shown that this model is not working because the women building don’t see the incentives working for this amount of money, when they can do other work and be paid more. Some changes will be made within the project to meet this, like reducing the number of persons building the stove at a time and increasing the price per stove. This way the salaries can be raised. Self-sufficiency of the project is not an aim within this business model. The project requires donors and don’t have the aim to be self-sufficient.

6.2.5 Household income and domestic responsibilities

“The planning of household-income is important but very rare here. In the rural area farming is the main business. If you go out to the field here you will find 70% of women in the farm and only 30% of men. Even if women do all the work and are bringing productivity to agriculture, when its time it is the men that will take the crops to the market and then have the power over the economy. Women are then excluded from the market and have no power of the household’s income. I believe that it is in very few households where men and women sit down to discuss their economic situation together.”

Female-headed farmer with stove, Bukoba district, Bushagara village, 14 March 2012

The majority of households in this study were male-headed households. The man is the one responsible for household income and investments. In difference to many other regions, in Bukoba the men are also responsible for gathering fuel wood. All male-headed households interviewed in Bukoba mentioned the responsibility of gathering fuel wood as in theory a man’s job, but that in reality the task was distributed on the other members of the household as well. Of the male-headed households that had a fuel-efficient stove only 2 of 21 mentioned the responsibility as something for the whole household, in the households without fuel-efficient stove this number was the double. This can be seen as a vague sign that the incentive to get a stove seems to be higher if it decreases the labour for the man. Many of the farmers, especially in Bukoba, mentioned the need for educating both men and women on the advantages of the stove. By sharing domestic responsibilities, such as gathering fuel wood, could both lead to increased equality or the opposite. If the men abandoned their responsibility of gathering fuel wood the women still need to be able to cook and they will take on the gathering themselves.

6.2.6 Connection between financial capital and adoption of fuel-efficient stoves

Previous studies of small-scale farmers in Bukoba have shown that financial assets are by farmers themselves seen as a key asset (Karlsson & Fransson 2010). Money and the possibility for
investments it provides is something that enables basic survival and gives possibilities for increasing livelihood standards. Through money you could make different investments to increase your livelihood. In the villages visited during this study this also seemed to be the general view, and difficulties accessing financial assets was something many faced. Something emphasized in Bukoba by most VI SCC-members was the access to credits through VS & LA-groups and its positive impact. VS & LA seems to have been a key component for farmers when developing their livelihoods and accessing fuel-efficient stoves. By being a member of VS & LA the farmer not only gets advantages in form of increased financial capital, but it also contributes to enlargement of other capitals, such as social networks and knowledge, both directly and indirectly. Another aspect of these groups is the possible effect on people’s vulnerability. Many farmers perceived an increased security through their membership in VS & LA, something they expressed as an extra place to turn for financial and social assistance in times of crisis. Previous research has shown that main reasons for saving have been to starting own businesses and paying school fees, something also showed in this study (Karlsson & Fransson 2010). Having own trees has also shown to be an advantage when it comes to vulnerability to fuel wood scarcity.

The pricing of stoves is of key importance for further spread. If making the price too low, incitements for building stoves will not be enough and by making the price too high will set limits for certain groups to be able to adopt it. A specific price is not possible to set and should depend on material costs, working efforts and place.

The distribution of responsibilities between genders might affect the household’s decisions regarding what to save and invest into, like investing in a fuel-efficient stove. In the villages visited in Bukoba men are normally the ones responsible for the household’s income. Decisions regarding family investments, like getting/buying material or a new stove would therefore fall on the man. A technology that saves amount of fuel wood and leads to less time or money spent on this would affect men’s responsibilities directly and would therefore be in their interest. In Babati where the responsibility of gathering fuel-wood is mainly on the woman, the need of informing men on the benefits, like saving time and money, is extra important.
6.3 Physical Capital

A fuel-efficient stove can be seen as a physical capital. The stove affects directly and indirectly enlargement of other capitals, such as more time and less labour and natural resources used. To increase one’s physical capital in order to increase the rest is therefore a strategic choice to increase one’s livelihood. How physical assets relate to the adoption and benefits of fuel-efficient stoves studied in Babati and Bukoba will now be further analysed. The access to physical capital depends on activities and needs of people in certain settings and is varying to a certain degree between the different villages visited.

6.3.1 Access and Condition of Shelter

As previously mentioned, access and condition of housing can be an indicator of both financial and physical capital. In this thesis physical capital is goods needed to support livelihoods whereas financial capital are things used to achieve livelihood outcomes. From this perspective, shelter will be counted as a part of farmers’ physical capital.

In Bukoba the condition of houses varied between farmers visited, some were living in traditional houses made of clay and wood and some had newer houses made of bricks and cement. Houses made of bricks are favoured and more expensive due to the use of bricks and cement, and many having these houses still had separate kitchens of clay and wood-kind. Of those who had the fixed fuel-efficient stove most people mentioned they had used the bricks that was left from building their house to make the stove. A criterion for having a fixed fuel-efficient stove is to have a permanent kitchen structure. This was something mentioned by both farmers and organisations in both regions as an obstacle for spreading of this fixed model. In Bukoba, many people who had the portable clay-stove mentioned that they had wanted a fixed fuel-efficient stove for a long time but didn’t have the possibility to get the fixed model due to the cost of the material or because they were lacking the structure in their home to have it. The portable clay-stove was instead mentioned as a good alternative due to its lower cost and that it could be used anywhere. In Babati the need for kitchen structure and especially roofs was mentioned as a decisive factor for the spreading of the fixed stoves in the region, especially during rainy seasons. One farmer visited had a kitchen of bricks recently built but was waiting with investing in the roof due to the cost of tin. Brick-houses lacking roofs was something commonly observed during the study in Babati. The need for a roof is key to protect the clay-stoves and for the ability to cook during rains.
6.3.2 Access to transport and infrastructure

In both regions the access to transport was limited. Some of the people visited mentioned that they owned or had access to bikes or other kinds of transportation. Access to cars or motorbikes was not very common. Something noted by both observations and also brought up during interviews was women’s limited access to transportation. Even if transports such as bikes were used, it was men that mainly used them.

Access to markets is a physical capital of importance regarding the spreading and adoption of fuel-efficient stoves. In each village within Bukoba and Bugabo zone there is a village centre that act as a marketplace and meeting point. During the study, one person was seen selling fuel-efficient stoves in one of the centres and during interviews in the area people mentioned that they had seen the stoves there. Access to market is of importance in wanting to start an enterprise, both regarding target group and marketing. Here a difference in access might be between people that are living in more urban areas or closer to village centres and between people that have access to transport. In the more urban areas the access to market is higher and less depending on social networks, but to sell these stoves on an outside market needs access to transport like a car to make it possible for villagers. When the need in a village is filled up the access to markets can become an issue. Social networks and knowledge is then capital that might help in accessing new markets.

6.3.3 Connection between physical capital and adoption of fuel-efficient stoves

Infrastructure and transport is necessary in access to other capital; it can help in reaching different markets, natural resources such as ball-pits with clay or for visiting places for social networking. If there is a need to move far distances and carry things, transports can also save time and labour-capacity. When gathering material such as clay-soil, especially in villages where access is somehow far, transport is key to access. If some groups lack access to transports their access to the clay-soil will also be less. Women would then be depending on men to gather material. Both regarding time or the need for paying for others to gather for them, which then takes more financial input.

The need for having a roof to protect the stove during rainy seasons was mentioned as a possible obstacle for the spreading of the fixed stove during these seasons. This relates the physical capital to both finance capital and norms in society, people invest in things considered “good” or a sign of status but lack the financial capital to invest fully at once.
6.4 Human capital

Indicators of human capital considered in this thesis are level of education, health, ability to labour and access to information about fuel-efficient stoves. Health and lack of education are often pointed out as key factors for poverty, and improving these are primary livelihood objectives (DFID 1999, Carney 1998). Human capital enables the use of the other types of assets and is therefore highly important in pursuing livelihood strategies and in achieving desired livelihood outcomes.

6.4.1 Access to and level of education

“A better life is to have education, if I could be more educated I could have a better life. A good life is equal to knowledge and education. “

Farmer without fuel-efficient stove, Bukoba district, Buzi village, 16 April 2012

In the villages visited in Bukoba access to education is poor, especially for girls (REDET 2007). Of the farmers in Bukoba 30 of 42 farmers (70%) had gone to school until standard 7, which is equivalent to a primary education. Farmers with fuel-efficient stove had higher education than farmers without fuel-efficient stoves.

One of the main incentives for projects on fuel-efficient stoves from the promoting organizations is environmental protection. But only a third of the respondents in Bukoba mentioned environmental protection as a reason to reduce the amount of firewood used and emphasized the need of planting trees. By the ones mentioning environmental protection the majority had adopted the fuel-efficient stove and almost half had a higher education than standard seven. Of the 14 farmers mentioning environmental protection, 9 were men and 5 were women.

6.4.2 Health and ability to labour

When talking about potential health effects from smoke while cooking with both traditional and fuel-efficient stoves, few of the farmers in both districts brought it up before asked. In most cases this didn’t seemed prioritized regarding what people focused on when referring to fuel-efficient stoves, especially in Bukoba. In Babati, more people mentioned a potential health effects from smoke and when asked, health reasons were mentioned as an important benefit of having a fuel-efficient stove. This was also something promoted by one of the women groups building the stoves.

When bringing up the question of potential health effects from traditional tree-stone stove most people in both Bukoba and Babati mentioned pain to their eyes, headache, flu, chest pains and
coughing. This was however explained as something natural and of those cooking with only traditional stove, health effects generally didn’t seem as the main reason for changing stoves. Of the people that had adopted fuel-efficient stoves, one of the benefits of both fixed and portable models, was that it gave less smoke than the traditional tree-stone stove. This was something perceived as positive and many said to be more comfortable cooking with fuel-efficient stoves. The actual health impact is difficult to prove, but by judging of respondents’ own perceptions the stoves seem to have a positive effect on human capital. People that suffer from health problems that are affecting their capability to cook or gather fuel-wood might have a higher incentive for getting fuel-efficient stoves if the benefits of the stoves are known.

Number of members in the households visited in this study varied between 3 up to 10 per household. The domestic tasks were often divided between members and those with less ability to work, due to for example old age or health was depending on the labour of others.

### 6.4.3 Trainings in building fuel-efficient stoves

Since VI SCC started focusing on trainings for portable fuel-efficient clay-stoves the demand has risen. Of the VI-members in Bukoba that had a fuel-efficient stove, 17 of 22 had attended trainings from the organisation (Rwemoulom 17 April 2012). The 5 members with a stove that hadn’t attended trainings themselves were all women. Numbers of trainings within the 5 wards in this study are seven since November 2011. A total of 66 members have participated, of these were 39 men and 27 women (Mtui 17 April 2012).

The projects in Babati mainly focused on empowering women into making these activities into enterprises for them to generate an income. Women involved in these projects were handpicked by the organisation and then chose other members to participate. When choosing others to participate certain traits were wanted and most of the members lived close to each other. The need for certain human and social capital to be included is therefore required. Indirect support is important when wanting to overcome difficulties related to the exclusion of certain groups from accessing human capital, such as training etc. In the case of Babati, structures relating to project design is focusing on a certain group, women, to focus the support to where it’s most needed.

In Babati the need for a certain level of education to build the stoves was brought up during interviews and the part of trainings and building stoves for other has not been as successful as the organization hoped for. Part of the groups building stoves and conducting trainings for others mention the need for education as vital for understanding the process of building the fixed rocket.
stove. Due to some technical and mathematical necessities many people attending trainings didn’t fully understand or were able to build a stove themselves after trainings. They understood how the stove worked and they saw the benefits but wouldn’t be able to make it by themselves, according to the groups holding trainings. This could be an aspect were the choice of stove-model promoted by the NGOs matter. In Bukoba trainings were held primary on portable clay-stoves, most people didn’t find the trainings very difficult and mentioned that within 2 trainings one could easily make it themselves. For the ones attending trainings on fixed stoves in Bukoba also mentioned that they found it quite difficult, but would maybe be able to repair their own fixed stove if it broke. However, one thing done in Babati was that some farmers mentioned they had seen the stove and then built it themselves by copying stoves they observed in other people’s houses. In Bukoba district, this was not something observed, but this could also be a question of selection of informants.

6.4.4 Connection between human capital and adoption of fuel-efficient stoves

The ability to work might have an impact on adoption of fuel-efficient stoves regarding the possibility to gather fuel-wood and building stoves. Members in family and their ability to work affect the labour available in households. For those with less capability to gather fuel-wood this was mentioned as a reason for wanting to adopt fuel-efficient stoves and reduce amount of fuel-wood used. In participating in trainings or women groups building stoves for others, the need for strength was emphasized. Ability to mix clay-soil, gathering material and move between places takes a certain physical capacity, which might be difficult for people of old age or with certain handicaps. Lower human capital could therefore act both as a motivation to get the stove but also as an obstacle, due to the fact that a certain human capital might also be needed to get the stove, for example knowledge and/or ability to build it. Certain tasks concerning getting the stove might also be gendered, mixing soil was for example considered as a man’s job, which might be something affecting the division of labour.

There was a difference between Bukoba and Babati regarding the perceived effect on health from stoves. In Bukoba, many replied that the smoke bothered them, but they didn’t know if it made them sick and they didn’t emphasize it as a main priority. According to previous research the general health status in Bukoba rural district is low and malaria, HIV/AIDS and child mortality is common (REDET 2007). An explanation can be that other health issues are more prioritized. In Babati more people emphasized health. An explanation for this might be that it has been something emphasized by the projects working in Babati as a potential benefit. Diseases from smoke exposure are also an issue often mentioned by international aid-programs and NGOs as a risk with a
traditional way of cooking (Khan & Islam 2007). The actual health impact is difficult to prove, but by judging of respondents’ own perceptions the stoves seem to have a positive effect on health as a human capital.

Farmers with fuel-efficient stoves had generally higher education than those without fuel-efficient stoves. Can this be connected to understanding and prioritizing environmental protection, having a broader social network or higher income? Women tended to have lower education than the men, which says something about the difference in access to education due to gender. Social structures such as norms and culture is to a degree still preventing girls from the same opportunities as boys, even though reforms of educational policies have been part of different projects in the region. Importance of access to education might affect spreading of stoves with the aspect of income and employment, weighing of households investments and time, and it might also affect understanding of technicalities/knowledge and aspects of women empowerment.

To make the project on fuel-efficient stoves spread, organisations in both Babati and Bukoba see starting enterprises as a potential strategy, but the regions take different paths. LTT in Babati builds the project on this, to make the project generate an income to the women building stoves for others. This strategy might strengthen women in income-brining activities and entrepreneurship and also lead to further female-empowerment. As mentioned, previous studies on development projects show that when focusing on women, activities reach further success if including responsibilities of men and benefitting the whole household (Goebel 2011, Holmboe-Ottesen et al. 1989). In connection to this—might there be risks of limited spread of fuel-efficient stoves due to the fact that it’s mainly gaining women’s labour and men still have the power of the household income and investments? If women are the ones with the knowledge and information of the benefits of the stove, will men see the point of investing? In Bukoba, VI SCC said that supporting farmers into starting enterprises on how to make fuel-efficient stoves is the next step after synthesizing the community. Studies show that women face more constraints in starting enterprises and that men most often are ones prioritizing it (Rocheleau, et al. 1996). This is something that can be strengthened within the VI SCC projects, like putting extra emphasis on making sure women are participating in enterprise-trainings and in trainings/collecting material. To empower women and their entrepreneurship is still something highly important and not to be neglected if also involving men. To be aware of the gender structures is important for these projects to consider in all parts of project planning.
6.5 Social capital

The social structures on which society is based are similar in the villages in Bukoba and Babati with some smaller differences. The social order in society is based on structures and networks. Through social capital access to other capitals can be gained and also power to affect policies and structures is enabled.

6.5.1 Social networks and membership organisations

“I joined VI because I found that they provide education on things. First I didn’t know so much about them but then they told me that I would get free education and this interested me. I joined VS & LA group because I cannot have money just laying in the house. In the VS & LA groups we can profit and get a bigger amount. Also the interaction, we share networks and meet friends. It is also giving me an increased security when I have a problem.”

Farmer without fuel-efficient stove in Bukoba District, Bushagara village, 4 April 2012

In Bukoba, civil society is active and many village groups and networks are present in the area (REDET 2007). Each village has its own village groups for men and women. 15 of 42 (36%) of the total number of respondents in Bukoba were also members of other organisations and networks except VI SCC, including World Vision and Mayawa (for organic vanilla production). Only 1 of 22 informants with a fuel-efficient stove was not a member of VI SCC or any other organisation. None of the non-members of VI, with our without a stove, were collaborating of any other organization except the village groups. VI SCC has only been active in the area since 2005 and started synthesizing its members on fuel-efficient stoves the same year. No information on projects on fuel-efficient stoves in the region has been found or mentioned before, all respondents mentioned they got information on the stoves from or through VI. The presence of both governmental and non-governmental organisations has a longer tradition in Babati, with projects on fuel-efficient stoves reaching back to the start of the LAMP project and Forest Tree and People project in the late 1980’s.

Most of the respondents were either married or widows/widowers, and all of them had children. Polygamy was not something that was mentioned and seemed to exist only to a limited degree in the families visited in Bukoba and Babati. Regarding domestic responsibilities relating to fuel-efficient stoves, in most households children had responsibilities of gathering fuel-wood and helping with cooking. Especially elders with a limited labour capacity were highly dependent on their children and grandchildren for these tasks.
6.5.2 Access to information

"The spreading of these stoves is a question of accessibility rather than knowledge, if the access were easier, people would get them. People in the village are considering their fuel-wood consumption because of the scarcity of fuel-wood. If there was a new method accessible, people would use it".

Farmer without fuel-efficient stove, Bukoba district, Bushagara village, 4 April 2012

In both Babati and Bukoba a majority of the informants with fuel-efficient stoves heard about the stove through their social network of family, friends and organisations. Most informants mentioned information and knowledge of fuel-efficient stove as an obstacle for their spreading. Most people emphasized the need for spreading of knowledge on the benefits of stoves and sustainable fuel-wood consumption. Ignorance was also brought up as hindering people in adopting the stoves. Farmers that were participating in trainings and had a fuel-efficient stove mentioned that they were admired for their stove and some were even asked to build for others. This further indicates spreading through social networks. Many of the farmers without fuel-efficient stoves wanted a stove, had the information of the stove and its benefits but lacked the information on how to get it (see figure 10). Lack of network and informative channels for information therefore seems to be a hindrance regarding the spreading of stoves.

Fig 10. Staple diagram over knowledge of fuel-efficient stoves, their benefits and how to get them by farmers that don’t have a fuel-efficient stove in Bukoba region. Of 20 farmers without a fuel-efficient stove, 19 of these have any kind of knowledge about the stove. Out of these 20, 18 know about the stoves benefits but only 10 know how and where to get a fuel-efficient stove. In Bukoba people got the main information through VI SCC and their groups, especially the VS & LA groups. In Babati the informative channels for spreading information of fuel-efficient stoves used by the women-group working with LTT were mainly village meetings. A new strategy from
this group was to use young schoolgirls, girl guides, to spread information and knowledge within their schools. This was however not yet launched when this study took place. During a visit to a school in one village in Babati where fuel-efficient stoves had not been promoted, the only pupil with knowledge about the stoves was from the village Mamire, which has a history of these projects from when LAMP was active. This also indicates that it might be difficult for information to spread between villages, even though the distances are not that far. Here is a connection to physical capital, and the access to transportation and infrastructure that can help increasing access to knowledge.

**6.5.3 Connection between Social capital and adoption of fuel-efficient stoves**

In connection to adoption of fuel-efficient stoves, social capital seemed to have certain effects. Social groups and networks can have positive effect in the way that they are strengthening relationships between individuals but also help people organize themselves collectively (DFID 1999). With tight social relationships a form of social security can be gained. An example is how joint efforts were made when gathering material for building stoves, this way the labour, time and costs were shared. Formal institutions such as marriage form relationships on a household level. Marriage and children act in many rural areas as a social security and gender relationships within the households might affect the level of access to different capitals.

A social network also increases one’s social capital, which can enable access to information. A great source of people’s information and knowledge seemed to come through social interaction. Human capital enables the use of social capital. Higher access to social capital can also increase human capital, for example through networks an increased capacity of labour can be achieved (DFID 1999). In Babati the social networks connected to the use and knowledge of fuel-efficient stoves seemed to be village-groups, schools and projects through NGOs. In Bukoba, membership of VI SCC seemed to be a key factor for getting a fuel-efficient stove. By being a member of VI you gain access to the trainings and the knowledge needed regarding fuel-efficient stoves, this social capital gives access to the human capital needed to want and get the stove. People lacking this social capital, non-members of VI SCC, can also have this access through relationships with members, which then grant them access to the information on stoves. In both regions, these informative channels on how to get a fuel-efficient stove play a decisive role in how it is spreading.

The fuel-efficient stove doesn’t affect access to social capital itself, but rather through increasing other capitals a positive effect on the social assets can be gained. To have the stove can be seen as a physical capital and the knowledge on how to build them as human capital, which might lead to increased social capital through feedback between capitals. The effect on the social capital can
therefore be seen as mainly through interaction and increase of other capitals. The fuel-efficient stove can also be seen as a social marker, enhancing social capital in form of “status quo” within social networks.

Regarding access and spreading of information a connection to physical capital including transportation and infrastructure can be made. In both Babati and Bukoba the villages seemed somehow isolated from each other. This indicates that it might be difficult for information to spread between villages, even though the distances aren’t that far.
7. Concluding Discussion

In this last chapter a concluding discussion of my findings will be presented. Potential obstacles and opportunities for spreading of fuel-efficient stoves within the projects in Babati and Bukoba will be discussed with a ground in the SRL-framework. Thoughts regarding project designs and remarks for further consideration of these are also highlighted. The main findings are conclusively summarized in the end.

7.1 The perceptions of fuel-efficient stoves

There is a general positive perception of fuel-efficient stoves by both organisations and farmers in both regions. In Babati the fixed stove is seen as the best option by organisations, but in Bukoba the portable clay-soil the one preferred. Fuel-efficient stoves are seen by its’ promoting organizations as a mean for promoting environmental protection through reducing amount of fuel wood used by households. By people adopting fuel-efficient stoves main reasons are to save fuel-wood, time and money. Environmental concern is not the main priority by farmers. There is a possibility that the differences in priorities and communication regarding these between organisations and farmers contribute to a slower adoption of fuel-efficient stoves. When the outcome is clear and are matching with the farmer’s objective, the adoption might be higher. The results also shows that stoves provide benefits that seem to give advantages to people’s everyday life in terms of saved fuel wood, money and time (see table in Appendix). In both Babati and Bukoba farmers that had adopted a fuel-efficient stove said it had a positive effect on their life and economy both directly and indirectly, but they could not specify as how much they had actually saved. Inability to calculate the direct benefits might be an aspect slowing the spreading of the stoves down.

7.2 The SRL-framework applied

7.2.1 The Vulnerability context

There seems to be a gap in the expected outcomes of fuel-efficient stoves between promoting organisations and farmers. This might mirror a difference in view of the stoves and the perception of problems and priorities relating to people’s livelihoods. The farmers seemed to seek knowledge
to be able to increase their well being in a long-term perspective, to reduce their vulnerability and to secure their food supply. What I found is that many of the outcomes seem to be entwined. The organisations put emphasis on sustainability of the natural resource base and environmental impacts, something not mentioned to the same degree by the farmers themselves. The priorities of farmers might be different than what the organisations anticipate, and stoves might have less priority. This might affect the spreading of stoves through the way that people prioritize. However, many farmers with fuel-efficient stoves did seem to adopt a stove as a preventive action, as a way to adapt to changing availability of fuel wood. This shows an awareness of environmental issues and is also connected to the vulnerability context of the farmer.

**7.2.2 The access to assets**

Access to different assets plays different roles in possibilities for farmers adopting fuel-efficient stoves. Financial capital has a big impact on the spreading of fuel-efficient stoves. If lacking material for building a stove, or lacking time and money to put the labour-capacity to gather the materials. With higher financial capital you can to pay someone to build a stove or gather material. The VS & LA-groups in Bukoba are an important factor for the spreading of stoves, both that it’s a forum of social networks and that it gives an increased social and financial security. A certain amount of money is needed to be able to invest in the fixed stove in both regions. The portable clay stove is cheaper, but breaks easier and not as cost-effective which might decrease the demand for it.

Access to physical capital, such as transport and bricks, gives advantages when wanting to adopt a fuel-efficient stove. Hindrances for spreading involve no access to transports for gathering material and accessing markets. For the fixed model a fixed kitchen structure is needed, which only enables households with this structure to have it. The need for having a roof to protect the stove during rainy seasons was mentioned as a possible obstacle for the spreading of the fixed stove during these seasons.

Natural capital gives access to materials, such as clay-soil and fuel-wood. With less access to natural capital, materials might be more difficult reaching. Fuel-wood scarcity has shown to be a deciding factor for farmers wanting to reduce the use of fuel wood and adopting fuel-efficient stoves. The access to clay soils for making the portable clay-stove might be an up-coming obstacle in Bukoba district due to the distance and transport costs. The need for knowledge and support on how to make cost-effective analyse and budgets for enterprise management will probably be a deciding factor on how people choose to handle this.
Social capital can lead to increasing other capitals, through for example social networks. Most people emphasized the need for spreading of knowledge on the benefits of stoves and sustainable fuel-wood consumption. Lack of network and informative channels therefore seems to be a hindrance regarding the spreading of stoves. To consider and enabling access to psychical capital, like infrastructure and transportation, into the project planning of these projects might help for further spreading of fuel-efficient stoves.

Human capital such as knowledge of benefits and importance of environmental conservation are deciding factors when choosing to adopt a fuel-efficient stove. Obstacles can be lack of knowledge, labour capacity and strength to get materials or building the stove.

### 7.2.3 Structures and Processes

**The aspect of gender**

Gender is a factor affecting the spreading of fuel-efficient stoves in different aspects. The men having power over household income and decision-making also need to be synthesized of the benefits for wanting to invest in the technology. This is one example of interaction between access to capitals and gender, as a part of “processes” in the SRL framework.

When starting enterprises, transports can become an extra expense and might be something for the projects to consider regarding women’s possibilities starting to sell and build fuel-efficient stoves. The gender distribution of certain tasks and roles is therefore relevant and shows us an example on how processes and structures, in this case gender as a variable, affects the access to capitals. It might also influence the livelihood strategies people choose. If the process of building a stove and gather the material is something where women have limited access to and is outside her gender role, women might instead start an enterprise with something she have easier access to, such as selling bananas. This is problematic on a structural level because it locks people into certain gendered patterns (Rocheleau et al. 1996).

VI SCC’s strategy of training both men and women in how to build fuel-efficient stoves was said to be a way of tackling the issue of gender. A way to do this was to educate men on advantages of the stove as well as women. As previously stated and discussed, gender affects access to assets and livelihood strategies, but if this is considered throughout the stages of the project, to train both men
and women might be an effective strategy. It is however not without risks and might need revising. During interviews, staff from the organization perceived that gender distribution on trainings was quite equal and that more women than men were participating. What was interesting is that this is not corresponding with the statistical data distributed, which stated that a majority participating in trainings were men. This might however be due to local differences between villages, but can also mirror the societal structures within the organisation.

This can be further discussed on how the project includes the responsibilities of men and intra-household relationships that might affect the possibilities for adoption of fuel-efficient stoves. Something not answered by the interviews from Babati are if men acknowledge the benefits of the fuel-efficient stove as gaining the household and if they are willing to invest in this. By interviewing both men and women in Babati could therefore have been an advantage.

**Local Voices**

In Bukoba a demand-driven approach was used when involving people into the project, meaning that the communities got support from VI SCC within the areas agreed upon by the community as important. Livingstone Tanzania Trust used a similar bottom-up approach in Babati. However, in Babati the issue on local involvement in the project design and communication between organisation and the ones participating was from the results a bit unclear. Answers regarding this didn’t match or wasn’t answered. To make sure that the local voices are heard and securing the motivation and participation in the project, this could be reviewed.

**7.2.4 The issue of self-sufficiency within development projects**

Many organizations and governments dealing with international aid projects are aiming at making projects and communities self-sufficient, a perspective which has been developed during many years of dependency. Even in Tanzania’s development strategy, dependency on aid is mentioned as an obstacle and something to avoid in development projects. Reaching self-sufficiency can be tackled in different ways. In Babati projects on fuel-efficient stoves, both historically and in the present, were depending on funding. Regarding further spreading of stoves, the issue of self-sufficiency can be seen as both an obstacle and opportunity. Within the projects in Babati, if funding isn’t mobilised, no stove will be built- but when the project faces out- the spreading of stoves will then stop. Can holding trainings on Portable clay stoves to communities be an alternative for Babati, as a solution to the problem of finding a cost-effective model that makes the project go round?
To see that the projects on fuel-efficient stoves keep spreading, ways to make the project self-sufficient is needed. The pricing of stoves is key, especially in Babati. Also important is synthesizing communities on knowledge on and benefits of stoves, both men and women. If people see the benefits, investments will be more desirable. A plan regarding trainings and compensations is necessary if the stove will keep spreading after the members of VI SCC in Bukoba are synthesized. By increasing knowledge in communities on the stove and how to build portable clay-stoves is of key importance for the spreading of the stove. This model is less cost-effective if buying due to the risk of it breaking and if people know how to build and repair them, the use of it might increase.

In Bukoba the projects are less dependent of the organisation. The demand-driven approach help individuals take control over what is demanded from the NGOs, “the structures”, instead of vice versa. By increasing many capitals, both financial, knowledge and social networks contributes to an independency towards the organisations and structures ruling. However, financial resources might still need to be mobilised if keeping the spreading of fuel-efficient stoves going, even when VI SCC phase out of Bukoba region. If people don’t benefit from training others in building stoves or receive a profit from selling them, it will most likely stop spreading. By illuminating the obstacle of costs in the project design can also help including people with different kind of economic and physical capital, which will possibly lead to less obstacles for adoption and therefore to a further spread.
7.3 To sum up the conclusions

- People’s perceptions of fuel-efficient stoves are positive and there is a demand for a technology that saves amount of fuel-wood used by households. The spreading of stoves is rather affected by other factors within the framework of sustainable rural livelihoods, such as access to assets and structures. People adopting a fuel-efficient stove perceive that it have had positive effect on their livelihood in terms of increasing of assets, like saving labour and money.

- Knowledge on benefits and how to get fuel-efficient stoves are some of the main obstacles for further spreading. Social networks and organisations are channels for information, but to spread outside these networks will need complementing strategies from organisations promoting fuel-efficient stoves

- The prices of buying a stove and getting the material have a decisive role in the spreading of fuel-efficient stoves. Important is therefore finding ways of making the financial aspect of adopting stoves less, like using materials with lower costs, using stove-models with low costs and training people in building stoves so re-investments are unnecessary.

- Projects on fuel-efficient stoves need to find ways to tackle the issues of self-sufficiency in project design, otherwise there is a risk for projects to end when funding are phased out. Trainings and making enterprises is one way practised by projects today.

- Gender is a factor affecting the adoption of fuel-efficient stoves in different ways, such as in the access to assets. There is therefore an importance of involving gender throughout the project and its processes.
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**Interviews with Key persons within organizations**

Page, Julian (27 February 2012) Director of operations Livingstone Tanzania Trust, Babati

Kavishe, Calyst (20 February 2012). Forester and forestry adviser, Babati.

Masologo, Damas (16 April 2012) Project Manager, SCC-Vi Eastern Africa, Bukoba

Mtui, Clement (12 March 2012, 10 April 2012, 17 April 2012) VI SCC field officer Bugabo, Bukoba

Rwemoulom, Angeliqa (17 April 2012) VI SCC Field-officer and financial service officer in Kishanje ward, Bukoba
10. Appendix

10.1 Summarized table of obstacles for spreading

Table 1. Summary of potential obstacles for spreading of fuel-efficient stoves and deciding factors for adoption relating to each capital asset within the SRL framework.

<table>
<thead>
<tr>
<th>SRL Assets</th>
<th>Financial</th>
<th>Physical</th>
<th>Human</th>
<th>Social</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstacles for spreading</td>
<td>Time and labour, lack of money to get material</td>
<td>Lack of structure, lack of transport</td>
<td>Lack of knowledge, ignorance, education, power relations</td>
<td>Lack of network and informative channels</td>
<td>Lack of access to clay-soil, good access to fuel-wood</td>
</tr>
<tr>
<td>Deciding factor</td>
<td>Financial capital to pay, bricks left from house</td>
<td>Access transport, access bricks</td>
<td>Education and knowledge, seeing the benefits and importance of conservation</td>
<td>Female empowerment, member of social networks</td>
<td>Fuel-wood scarcity</td>
</tr>
</tbody>
</table>

10.2 Lists of Informants Interviewed

Table 2. List of farmers interviewed in Babati District. Group-interviews are not listed.

<table>
<thead>
<tr>
<th>Farmer</th>
<th>Sex</th>
<th>Village</th>
<th>Kind of stove</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>Waang'waray</td>
<td>Fixed + portable</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>Mamire</td>
<td>Fixed</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>Mamire</td>
<td>Fixed</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>Mrara</td>
<td>Fixed</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>Mrara</td>
<td>Fixed + portable</td>
</tr>
<tr>
<td>6</td>
<td>Female</td>
<td>Mrara</td>
<td>Fixed</td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>Mrara</td>
<td>Fixed</td>
</tr>
<tr>
<td>8</td>
<td>Female</td>
<td>Ghala</td>
<td>Fixed</td>
</tr>
<tr>
<td>9</td>
<td>Female</td>
<td>Mamire</td>
<td>Traditional</td>
</tr>
<tr>
<td>10</td>
<td>Female</td>
<td>Endabeg</td>
<td>Traditional</td>
</tr>
<tr>
<td>11</td>
<td>Female</td>
<td>Haraa</td>
<td>Traditional</td>
</tr>
<tr>
<td>12</td>
<td>Female</td>
<td>Sawe</td>
<td>Traditional</td>
</tr>
<tr>
<td>13</td>
<td>Female</td>
<td>Sawe</td>
<td>Traditional</td>
</tr>
</tbody>
</table>
Table 3. List of farmers interviewed in Bukoba district. Fixed and portable represent the models fuel-efficient stoves. F is a shortage for female, M for male. F.head means is a female-headed household.

<table>
<thead>
<tr>
<th>Nr</th>
<th>Sex</th>
<th>Village</th>
<th>Kind of stove</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F. Head</td>
<td>Bushagara</td>
<td>fixed + port</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>Bushagara</td>
<td>portable</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>Bushagara</td>
<td>fixed</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>Bushagara</td>
<td>portable</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>Bushagara</td>
<td>portable</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>Bushagara</td>
<td>portable</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>Bushagara</td>
<td>portable</td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>Rushaka</td>
<td>portable</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>Buzi</td>
<td>fixed</td>
</tr>
<tr>
<td>10</td>
<td>M</td>
<td>Buzi</td>
<td>fixed</td>
</tr>
<tr>
<td>11</td>
<td>F</td>
<td>Buzi</td>
<td>fixed</td>
</tr>
<tr>
<td>12</td>
<td>F</td>
<td>Buzi</td>
<td>fixed</td>
</tr>
<tr>
<td>13</td>
<td>F</td>
<td>Mushozi</td>
<td>fixed</td>
</tr>
<tr>
<td>14</td>
<td>F</td>
<td>Mushozi</td>
<td>fixed</td>
</tr>
<tr>
<td>15</td>
<td>F</td>
<td>Kishanje</td>
<td>portable</td>
</tr>
<tr>
<td>16</td>
<td>F</td>
<td>Kishanje</td>
<td>portable</td>
</tr>
<tr>
<td>17</td>
<td>M</td>
<td>Kishanje</td>
<td>portable</td>
</tr>
<tr>
<td>18</td>
<td>F</td>
<td>Ibosa</td>
<td>fixed</td>
</tr>
<tr>
<td>19</td>
<td>F</td>
<td>Ibosa</td>
<td>fixed</td>
</tr>
<tr>
<td>20</td>
<td>M</td>
<td>Ibosa</td>
<td>fixed</td>
</tr>
<tr>
<td>21</td>
<td>M</td>
<td>Ibosa</td>
<td>portable</td>
</tr>
<tr>
<td>22</td>
<td>M</td>
<td>Ibosa</td>
<td>portable</td>
</tr>
<tr>
<td>23</td>
<td>M</td>
<td>Bushagara</td>
<td>Traditional</td>
</tr>
<tr>
<td>24</td>
<td>M</td>
<td>Bushagara</td>
<td>Traditional</td>
</tr>
<tr>
<td>25</td>
<td>F</td>
<td>Bushagara</td>
<td>Traditional</td>
</tr>
<tr>
<td>26</td>
<td>M</td>
<td>Bushagara</td>
<td>Traditional</td>
</tr>
<tr>
<td>27</td>
<td>M</td>
<td>Bushagara</td>
<td>Traditional</td>
</tr>
<tr>
<td>28</td>
<td>M</td>
<td>Bushagara</td>
<td>Traditional</td>
</tr>
<tr>
<td>29</td>
<td>F. Head</td>
<td>Rushaka</td>
<td>Traditional</td>
</tr>
<tr>
<td>30</td>
<td>F</td>
<td>Rushaka</td>
<td>Traditional</td>
</tr>
<tr>
<td>31</td>
<td>F</td>
<td>Rushaka</td>
<td>Traditional</td>
</tr>
<tr>
<td>32</td>
<td>F. Head</td>
<td>Rushaka</td>
<td>Traditional</td>
</tr>
<tr>
<td>33</td>
<td>F</td>
<td>Ibosa</td>
<td>Traditional</td>
</tr>
<tr>
<td>34</td>
<td>M</td>
<td>Rushaka</td>
<td>Traditional</td>
</tr>
<tr>
<td>35</td>
<td>M</td>
<td>Buzi</td>
<td>Traditional</td>
</tr>
<tr>
<td>36</td>
<td>M</td>
<td>Buzi</td>
<td>Traditional</td>
</tr>
<tr>
<td>37</td>
<td>F</td>
<td>Buzi</td>
<td>Traditional</td>
</tr>
<tr>
<td>38</td>
<td>F</td>
<td>Kishanje</td>
<td>Traditional</td>
</tr>
<tr>
<td>39</td>
<td>F</td>
<td>Kishanje</td>
<td>Traditional</td>
</tr>
<tr>
<td>40</td>
<td>F</td>
<td>Ibosa</td>
<td>Traditional</td>
</tr>
<tr>
<td>41</td>
<td>F</td>
<td>Ibosa</td>
<td>Traditional</td>
</tr>
<tr>
<td>42</td>
<td>F</td>
<td>Ibosa</td>
<td>Traditional</td>
</tr>
</tbody>
</table>
10.3 Example of Interview-guide Babati: farmer with fuel-efficient-stove

structured part

➢ name,
➢ age
➢ source of income(how do the household make their living),
➢ level of education,
➢ civil status/married,
➢ number of children,
➢ acres of land/ farming method,
➢ kind of stoves/ kind of fuel,
➢ participated in trainings on fuel efficient stoves/or bought stove,
➢ part of network/association

semi-structured part

The stove

1. How long have you had the fuel-efficient stove? What kind of stove did you use before?
2. If different kind of stoves, what stove do you use when and why?
3. How did you get the fuel-efficient stove? Did you buy the stove, built it your self, payed someone to build it.
4. What was the cost of the fuel-efficient stove? Total. Do you think this is was a good price? Would you say that the total cost was expensive or cheap? If higher price, would you buy?
5. Did you have access to the material/components of the stove? Did you buy any material and what was the cost?
6. What are the main reasons for you to get a fuel-efficient stove?
7. Do you feel that using the stove has had any effects on your everyday life? If yes, how and in what way? If no, why do you think that is?
8. How did you receive the information about the f-e stove? What kind of information did you get?
9. What were your thoughts about the stove before starting to use it?
10. How do you perceive the clay-stove compared to the tree-stone stove? What is positive and negative with the f-e stove and the traditional stove?
11. What kinds of stove do the people in your surrounding have? Why do you think this is?
12. Would you say that the stove is something perceived as "good"? Is it a sign of status in your community?
13. How do you experience the traditional and the fuel-efficient stoves regarding your health?
   *Did you feel any effects of the tree-stone stoves on your health? If yes, what? Do you feel the same effects of the clay-stove?*
14. *Do you experience a change in taste?*

**Fuel-wood**
15. What kind of fuel-wood do you use? From where do you get your fuel-wood?
16. How much time do you spend on gathering fuel-wood per week? (With f-e stove & trad.)
17. Do you buy fuel-wood or charcoal? Amount of income on fuel-wood per week/month, how much with traditional stove? How much with fuel-efficient stove? Do you experience this as a big expense?
18. Main expense of household?
19. If saved time, do you experience an increased income due to saved time? would you say that the stove has payed back its own price?
20. If saved time, what would the effect be on your everyday life if you didn’t have the fuel-efficient stove anymore? *What is the saved time used for? Household activities, income bringing activities*

**Context**
21. Access to firewood?
22. Access to water?
23. Access to schools, hospitals and dispensaries?
24. Access to rotational funds?
25. Agricultural conditions in area?
10.4 Pictures

**Picture 1.** Farmer Making portable fuel-efficient stoves out of clay in Rushaka Village center, Bukoba district. April 2012

**Picture 2.** (from left) Demonstration of process on how to construct a fixed fuel-efficient stove, Waang’waray village, Babati. Illustrating how to get the measurements correct by using a plastic pipe. 29 February 12

**Picture 3.** Making fire with fixed fuel-efficient stove in Waang’waray, Babati district. 29 Feb 2012
Big bundle of firewood and child in Kishanje village, Bukoba district. Informants in Bukoba replied that they used between 2 to 6 bundles per week of this size when cooking with traditional stove and around 1-3 bundles per week with a fuel-efficient stove. April 2012