Barriers and Bridges for Introducing Agroforestry and Community-Based Forestry among Food Insecure Households in Eastern Africa

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Doctoral Thesis
Swedish University of Agricultural Sciences
Skinnskatteberg 2015

Acta Universitatis Agriculturae Sueciae
2015:68

ISSN 1652-6880
ISBN 978-91-576-8335-9

Print: SLU Service/Repro, Uppsala 2015

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Abstract

The aim of introducing agroforestry and community-based forestry is to secure and improve livelihoods, maintain and restore ecosystem services, and contribute to climate change mitigation and adaptation. However, the adoption and scaling up of these systems among food insecure communities have proved to be difficult. To better understand why, I identified barriers and bridges at different adoption stages and levels of governance. These were analysed using policy narratives and the sustainable livelihood approach in the light of sustainable development, sustainability and resilience of landscapes. The first stage was the negotiation process between the Swedish NGO Vi-Skogen and the Swedish International Development Agency (Sida) about funding. Three explanatory approaches were used: organizational, power and context. Vi-Skogen and Sida were caught in policy incompatibility dilemmas that slowed down the NGO policy process, and delayed critical changes that could have improved project outcomes. The second was Vi-Skogen's agroforestry project in Tanzania's Mara Region. A random sample of 21 households was drawn from each of 89 project villages. The proportion of households with surviving agroforestry trees varied from 10-90 % among villages. Field training and visits to farmers with good practices were important for households to start planting trees. Local collaboration, perceived ownership of trees and benefits of trees for crop production were additional factors important for households' decision to continue with agroforestry practices. The third was eleven community-based forest producer and user groups (CBFGs) in eastern and southern Africa. Development of many groups had stagnated and few had managed to develop large scale value-added production. I identified eight barriers and four bridges that influenced the scaling up process of agroforestry and community based forestry among food insecure households. All resulted from interactions among social, political, and economic structures and processes at multiple levels of governance. It is concluded that these interactions influenced the scaling up process and the development of sustainable subsistence systems among food insecure households. Collaborative knowledge production and learning is an approach through which the social capital and organisational capacity of the food insecure households can grow, enabling them to constructively address these multidimensional interactions to work in their favour. The use of this approach, i.e. a landscape approach, holds the opportunity through which subsistence systems can be transformed from causing degradation to promote sustainable development and livelihoods.

Keywords: poverty reduction, food insecurity, landscape approach, multi-level governance, social learning, stakeholder collaboration, technology adoption and scaling up, civil society, policy narrative, negotiation, sustainable livelihood, resilience

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Dedication

Dedicated To:

- The food insecure households

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List of Publications

I Johansson, K.E.V., Elgström, O., Kimanzu, N., Nylund, J.E. & Persson, R. (2010). Trends in development aid, negotiation process and NGO policy change. *Voluntas*, vol. 21, pp. 371-392.

II Johansson, K.E., Axelsson, R. & Kimanzu, N. (2013). Mapping the relationship of inter-village variation in agroforestry tree survival to social and ecological characteristics: The case of the Vi Agroforestry project, Mara region, Tanzania. *Sustainability*, vol. 5, pp. 5171-5194.

III Johansson, K.E., Axelsson, R., Kimanzu, N., Sassi, S.O., Bwana, E. & Otsyina, R. (2013). The pattern and process of adoption and scaling up: Variation in project outcome reveals the importance of multilevel collaboration in agroforestry development. *Sustainability*, vol. 5, pp. 5195-5224.

IV Johansson, K.E., Gondo, P., Nantongo, C., Roos, G. & Kleinschmit, D. (2013). Community based forest groups in Eastern and Southern Africa – a study of prospects for capacity improvement. *International forestry review*, vol. 15 (4), pp. 471-488.

V Axelsson, R., Angelstam, P., Elbakidze, M., Stryamets, N. & Johansson, K.E. (2011). Sustainable development and sustainability: Landscape approach as a practical interpretation of principles and implementation concepts. *Journal of landscape ecology*, vol. 4 (3), pp. 5-30.

The contribution of Karl-Erik Johansson to the papers included in this thesis was as follows:

Type of activity / Article No:	I	II	III	IV	V
Idea and hypotheses	80%	75%	67%	50%	10%
Planning of work	100%	75%	75%	25%	10%
Performance of work	80%	50%	50%	50%	10%
Analysis and summary of result	80%	67%	50%	50%	10%
Writing of the manuscript	80%	75%	67%	67%	10%
Participation in correspondence with the journal	100%	100%	100%	60%	0%

Abbreviations

BR	Biosphere Reserve
CBFM	Community-Based Forest Management / Community Based Forestry
CBFG	Community-Based Forest User and Producer Groups
FHK	Faith home of Kenya
FIH	Food Insecure Households
GDA	Government Donor Agency
HQ	Headquarter
ICRAF	World of Agroforestry Centre
ILRI	International Livestock Research Institute
KNFU	Kenya National Farmers Union
m.a.s.l.	Meter above sea level
MF	Model Forest
NGO	Non-Governmental Organisation
NRM	Natural Resource Management
Ph.D.	Doctor of Philosophy
SD	Sustainable Development
SFM	Sustainable Forest Management
SLA	Sustainable Livelihood Approach
Sida	Swedish International Development Agency
Slu	Swedish University of Agricultural Sciences
ViAF	Vi Agroforestry Programme
ViAFP	Vi Agroforestry Project, Mara Region Tanzania
ViM	Vi Magazine
ViS	Vi Skogen

Preface

With a vision to improve and secure livelihoods for food insecure smallholders and forest dependent communities my interest in and reason for carrying out a PhD was to explore ways to improve the contribution of empirical research to the development of these communities. Hence, the aim has not been to become a disciplinary scientist, but to develop my capacity as a transdisciplinary development practitioner to facilitate rural development processes involving the food insecure with public, civil, private sectors and integrative research to improve their lives.

Through my work in development cooperation I have experienced how collaboration among development efforts, research, civil, private and public sectors can contribute to improved sustainability, effectiveness and local ownership of the development process. I have also experienced how the process can be disrupted by top-down leadership, corruption, diverging and conflicting interests, lack of transparency, and insufficient involvement of the poor. Hence, to build capacity as a facilitator of this complex process is a long learning process in which practical experience is as important as research work and studies. For this reason, I have alternated between practical work, studies, and thesis work over the past 25 years.

On my first assignment as a development worker (1986-1989), I lived in Mertule Mariam, a remote village in Ethiopia, assigned as an associate expert by the Swedish International Development Agency (Sida) to facilitate the establishment of a national training centre for agroforestry, community forestry and soil conservation. I advised the development of five pilot and demonstration areas that had been designed by the World of Agroforestry Centre (ICRAF) at different altitudes from 2000 to 3500 m.a.s.l. apart from ICRAF many other development and research organisations were involved in work. The contribution of these organisations, notably the International Livestock Research Institute (ILRI),

a Swiss research project in soil conservation, an Australian livestock development project, and Sida's regional land management unit in Nairobi, were crucial for the development of the pilot areas. My colleagues in this work were government employees. It was a difficult situation as local farmers had revolted against the local government administration just one month before my arrival. In this situation, my government colleagues did not feel free to move around in the local villages. Still, together we managed to solve the daily problems. The problem solving capacity that I had gained during my education at SLU's School for Forest Management was essential for succeeding in this work.

In my next assignment in development co-operation I was again employed by Sida (1992-1994) this time in Zambia, as an agroforestry and soil conservation advisor, in the Soil Conservation and Agroforestry Extension programme (SCAFE). I facilitated the collaboration between ICRAF's field station and the Provincial government extension and adaptive research team in Eastern Province. The result of this collaboration has been recognized in published work (e.g., Kwesiga et al. 1999).

During a later assignment for Vi-Skogen (1997-2001) in Tanzania, I developed my capacity in collaboration to facilitate the scaling up process of agroforestry integrated with other sustainable practices such as organic farming, and soil and water conservation. With the aim to empower households and to improve local farming and livelihoods, a collaborative learning and governance structure was gradually developed out of necessity to overcome barriers to the process (see Article III). Local government, including technical executive and political departments, were actively involved in collaboration with international NGOs, ICRAF, Sida and multi-laterally funded projects. A total of 420 households across the project area were focal points in the collaborative knowledge production process. The number of households with surviving agroforestry interventions increased from 1500 in 1997 to 20,000 households in 2001.

From an academic perspective the approach that I have used can be characterised as transdisciplinary knowledge production. I have developed considerable experience and knowledge in improving the effectiveness in collaboration through my long-term alternation of practical work, academic studies, and research. In the end of 2001 I completed my licentiate exam, which focused on tree nursery management and tree establishment for subsistence-oriented farmers.

In 2011, I was involved in a capacity study of community-based forest user and producer groups in eastern and southern Africa carried out by the Department of Forest Products at SLU, African Forest Forum, and the

Swedish Forest Agency with funding from Sida through the Forest initiative. This study had a transdisciplinary character with focus on the practical interaction between economy, governance, ecology, and sociology. It improved my knowledge and understanding of community-based forestry and my transdisciplinary capacity considerably. The study resulted in a synthesis report and a published article (Article IV). I had the great opportunity to carry out this work with the practitioners, Peter Gondo, specialised in community based forestry and dissemination and Christine Nantongo, specialised in advocacy and climate change mitigation and adaptation, as well as academic co-authors, Anders Roos specialised in forest economy and Daniela Kleinschmit, specialised in International forest governance and policy.

To find a department and supervision at SLU with both transdisciplinary capacity and an interest in agroforestry systems proved difficult. My journey towards a PhD has thus became a struggle of my own, alternating between practical work, research and studies, publishing my papers with practical and academic co-authors of relevant disciplinary background, and trying to find people within the university that could join me on the last part of the journey. Gradually, I have been lucky to find and develop collaboration with increasingly interdisciplinary and transdisciplinary researchers and co-authors. The last two articles in my thesis were developed with practically oriented co-authors at different levels in the process and an academic co-author who shared my interest and commitment to transdisciplinary knowledge production, Robert Axelsson. Additionally, I am fortunate that I at last have found a supervisor for the completion of my thesis that has a solid transdisciplinary experience, interest and commitment, Per Angelstam.

The lack of a merit system that acknowledges interdisciplinarity and practical usefulness of research does really decrease the incentive to take on the extra work and efforts to become an interdisciplinary scientist or a transdisciplinary facilitator of development processes. In order to be unbiased, I believe that it is too late to start building a transdisciplinary perspective after the PhD has been completed. To decrease the disciplinary and theoretical biases this learning process has to start already at the undergraduate level. The School for Forest Management has a long tradition of integrating theoretical learning of different disciplines (biology, technology and economics) through real projects/assignments with different forestry actors. Students gradually develop transdisciplinary and social capacity to use their theoretical knowledge in building syntheses with stakeholders – to create solutions that are biologically, economically and

technically applicable in reality. I was lucky to get my first degree in this flexible problem oriented learning system. To continue in this way, by integrating theoretical knowledge with practical learning experience has been a very interesting and intellectually rewarding journey.

My father, Lennart Johansson has had a special influenced in my personal and professional development. On a farm in the county of Södermanland he thought me and my siblings, through his own way of living and thinking; to be appreciative and careful of what we have and to live our lives in harmony with others and our natural environment. He believed that everyone, apart from taking good care of his/her health and resources, also should help others and contribute to harmony and what today is known as sustainable development. My late mother in-law Ayalnesh Damtew showed through her life how to overcome and stand hardship like sickness, lack of resources, security and rights; to be appreciative, and build happiness, love and livelihood out of whatever small thing you have. During the Mengistu regime in Ethiopia, despite of bad health, as a single mother, she and her five daughters managed to sustain their lives together and pay school fees without any regular income. They gave me a deeper meaning of adaptive capacity before I even knew the word resilience. To learn to know her and her family have been one of the greatest gifts in my life.

1 Introduction

Rural landscapes in eastern and southern Africa are presently subjected to a range of diverging transitions. Populations are growing, roads, dams and rural towns are developing, the climate is changing, and local and global demand for resources, including food, wood and non-wood forest products are increasing (FAO 2009). A variety of stakeholders from local to global levels express claims on land and resources, thus often exploiting the vulnerable situation of the poor and the environment on which they depend. At the same time large land areas are used only to a fraction of their potential benefits, mainly because the poor households lack knowledge, and are unable to mobilize the required labour, and funds needed to rehabilitate these areas towards more sustainable management systems. The multi-level governance of rural landscapes to satisfy this increasing range of stakeholder demand is thus very challenging (Dietz, Ostrom, & Stern (2003, Berkes 2006, Wilson 2006, Southworth & Nagendra 2010, Lambin & Meyfroidt. 2011). This complex and interdependent situation may lock the food insecure households into a development impasse with negative effects on the local environment and the climate, and thus their long term well-being (FAO 2011, Chavez-Tafur & Zagt 2014).

A number of interventions have been developed to unlock this situation. Some have focused on agriculture (e.g., green revolution, organic farming, farming systems), others on forestry (e.g., sustainable forest management and community-based approaches to forestry), others have proposed multi-level governance approaches (Ostrom 1990, Armitage 2008, Nagendra 2012, Rantala, Hajjar, & Skutsch 2014). Agroforestry is a collective name for all systems combining agricultural crops and/or domestic animals with woody perennials either spatially or in sequence over time on the same land. Agroforestry can be small or large scale; it can be subsistence oriented or commercial, and all combinations in-between. (Nair 1993)

Agroforestry can help the food insecure to balance the trade-off between their urgent need for food and income with the vision of long-term sustainability, to restore and conserve ecosystem services. (Nair, Kumar, & Nair 2009, Nair et al. 2010, Akinnifesi et al. 2008a, 2008b, Jose 2009, Oyebade, Aiyeloja & Ekeke 2010, Schoeneberger 2009, Kalab 2009).

Traditional agroforestry systems have developed over centuries from tropical to temperate conditions in different governance systems and many of these are still in use today (Elbakidze & Angelstam 2006, Admasu & Struik 2002, Tadesse 2002, Almaz Negasha, Admasu, & Visser 2002, Tesfaye et al. 2006, Mahapatra & Shackleton 2011, Stryamets, Elbakidze & Angelstam 2012, Stryamets, Elbakidze & Angelstam 2014, Hartel 2014, Bergmeier, Petermann & Schröder 2010, Paltto et al. 2011). However, the introducing and scaling up of agroforestry practices has often proved difficult, and a number of reasons have been suggested for the lack of tangible results. Sanchez (1994) proposed that the perceived poor return and elevated labour investment of alley cropping is one reason for the poor adoption. Franzel et al. (2004) argues that agroforestry technology is knowledge intensive compared to agricultural interventions like green revolution technologies, making the dissemination and adoption processes difficult. Pollini 2009 argues that agroforestry has been designed with too much focus on the biophysical process and the finding of find 'the perfect technology' with inadequate consideration of the socio-cultural realm. Many projects and scientific studies are designed to consider and analyse few other than biophysical factors. Issues widely recognized to be critical to adoption of agroforestry, such as risk and uncertainty, the impact of labour, and market or tenure policies, were rarely investigated (Mercer et al. 1997, Pattanayak et al. 2003).

National forest development policies that aim to halt deforestation and foster sustainable forest use have shifted over time from top-down approaches to more community-based forest management (CBFM – here also community based forestry), which recognises the knowledge, experience and interests of local people (Arnold 1992, Odera 2004). This shift has occurred because the effectiveness of forest management activities in this context is dependent on local knowledge, needs and institutions (Berkes et al. 1989, Ostrom 1990). Community-based forest groups (CBFGs) are institutionalised and recognised community organisations practicing CBFM. Several studies have demonstrated the need for CBFM arrangements to ensure equitable benefit sharing and sustainable development (Forsyth, Leach & Scoones 1998, German, Karsenty & Mtiani 2010, Shiferaw 2006). CBFGs have become more common in the region,

driven by decentralisation policies, an emerging enabling policy environment for CBFM, local needs and inspiration from successful CBFGs (FAO 2011, Odera 2004).

However, CBFM and CBFGs have not succeeded in improving the quality of life for poor forest dependent people tangibly (Brockington 2008, Tesfaye 2011). Studies have identified several factors hampering CBFG effectiveness, including poor leadership, organisational issues, and poor negotiating power (Shively et al. 2010, Molnar et al. 2007). CBFGs in Africa often also face insecure or ambiguous land tenure rights (Russell & Franzel 2004). Other challenges that have been documented are a lack of management, technical skills, poor capacity in marketing, and corruption (Mustalahti 2006, German, Karsenty & Mtiani 2010). Furthermore, research indicates that poor and marginalized members may not benefit from participating in CBFGs, because they lack capacity, time and resources. This means that they do not have enough spare capacity and resources to involve themselves in activities oriented towards something other than satisfying immediate needs (Tesfaye (2011) in Ethiopia, Vyamana (2009) in Tanzania).

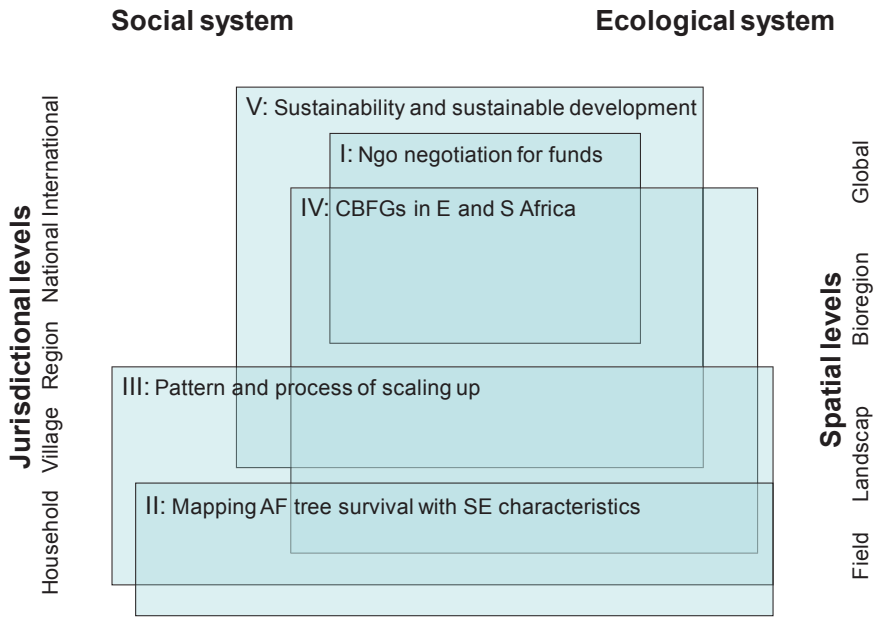

Figure 1. Illustration of how the five articles included in the thesis relate to social and ecological systems, as well as different levels of the jurisdictional and spatial scales, respectively.

The aim of this thesis is to contribute to the understanding of how the adoption and the scaling up process of agroforestry and community based forestry can be improved to involve and benefit a larger proportion of food insecure rural households in eastern Africa. The thesis is based on five articles that highlight different aspects critical to the scaling up process, including different jurisdictional and spatial levels (Figure 1).

Articles II – IV make up the core empirical material for the analysis in this thesis. Barriers and bridges to the scaling up process were identified. Theories were used from articles I and V as part of the analytical framework. Three research questions were used for the analyses:

1. To what extent and how are the identified barriers and bridges influenced by the social and economic structures and processes in which they are embedded?
2. How does the identified barriers and bridges influence the aim and goal of the scaling-up process, i.e. to support sustainable development that lead to improve social, economic and ecological sustainability of the food insecure households' subsistence system and their livelihood?
3. How can the identified barriers be resolved and bridges be used to improve the capability and social capital of the food insecure as assets in the building of their livelihoods sustainably?

2 Theoretical and Analytical Frameworks

2.1 Sustainability and Sustainable Development

Sustainability and sustainable development (SD) are often used interchangeably (e.g., Norton 2005), but do have different connotations. The meaning of sustainability originates from the idea that natural resources should be used without depleting them (e.g., Hartig 1804, Hunter 1996). The definition used today is more complex (Lee 1993, Clark 2002), and ecological sustainability aims at targets described as ecological integrity and resilience (Parrotta, Agnoletti & Johan 2006). Sustainability can be defined as weak or strong sustainability (Neumayer 1999). Weak sustainability implies that the natural resources base can be used to fulfil needs and desires today as long as future generations have the same opportunities. In this view, nature and species have no value of their own and are therefore not necessarily protected unless they are of use to humans. Strong sustainability, however, means that nature has a value of its own. Ecosystems structure and functions should therefore not be significantly modified nor changed from their natural state (Article V). Recently, social and cultural dimension have been added to the sustainability concept (e.g., Axelsson et al. 2013).

SD, on the other hand, is about directing and facilitating the societal process toward sustainability, and seen as a collective process to achieve economic, ecological and socio-cultural goals that include multiple actors and stakeholders at multiple levels of decision-making with different power (WCED 1987, Baker 2006, Wals 2009). In contrast to government, this multi-level process is termed governance. Government power and autonomy is increasingly challenged and affected by international agreements and civil society actors. This can be seen as a shift from government to governance (Pierre 2000, Peters 2000). Collaboration among

societal sectors and administrative levels (Ostrom 1990) is therefore becoming increasingly important. This implies that the level of sustainability, as expressed in policies, is a negotiated target, in contrast to evidence-based targets (Svancara et al. 2005). With a set ambition level, managers, researchers, and other stakeholders may define what policy instruments and tools are needed to reach the agreed policy ambition.

Lee (1993) proposed the terms compass and gyroscope to understand sustainability and SD as a social learning and steering process that include adaptive management - the compass, and governance - the gyroscope (Article V).

2.2 Landscape and Landscape Approach

2.2.1 Landscape as Space and Place

The word landscape occupies a broad niche in human culture. Covering such diverse fields as geography, ecology, arts, and philosophy, landscape has many interpretations and there are several approaches for classification (Angelstam et al. 2013). Landscape is also spatially explicit, and encompasses a wide range of spatial and temporal scales (Liu & Taylor, 2002). Thus, landscape provides a platform to identify and measure themes or information layers that include biophysical, anthropogenic, and intangible dimensions.

Therefore, to use a landscape approach for implementing sustainable development towards sustainability in a defined geographical area, both ecosystems and social systems need to be understood. In landscapes as integrated socio-ecological systems, both sub-systems are of equal important to the development process and its outcomes (Berkes, Colding & Folke 2003). Following Axelsson et al. (2011, 2013) and Article V, I define landscape approach as having five core features, 1) a geographical area, 2) collaboration, 3) commitment to sustainability and understanding of its status and development trajectory, 4) knowledge production and 5) multi-level social learning.

2.2.2 Geographical Area

The area extent can be defined as a spatial unit with particular socio-economic, cultural or biophysical properties, by administrative borders, or natural borders like an ecoregion or a watershed.

In this thesis I define the geographical area of the landscape approach as "a multi-level construction with (1) an area for implementation, adaptation, testing and evaluation, (2) an area to influence, i.e. where the result from

the implementation area can be dissemination and scaled up, (3) a larger area for sharing and networking. These three dimensions of the area do overlap and are thus not strictly delimited" (Article V).

2.2.3 Collaboration

SD is a process of collaborative learning (i.e. social learning, Keen, Brown & Dyball 2005) from local to global community levels (Daniels & Walker 2001; Pretty 2003, Wals 2009). The ultimate aim is to build social capital, capacity and action for addressing sustainability issues (Woolcock 1998). The demand for participatory approaches for tackling sustainability issues is increasingly included in national to international policies (e.g. UN 1992, European Commission 2000, Moseley 2003, Bryden & Hart 2004, Anon. 2008). Ideally, the collaborative process should gradually develop into partnership that makes participation meaningful to all involved partners (Svensson & Nilsson 2008). Assessments of the sustainability status (i.e., ecological, economic and social) of the area can be used as a base for starting the collaborative process (Veltheim & Pajari 2005). This includes stakeholders and actors from different sectors that represent the area, depending on the issue or purpose of the collaborative process (Article V).

Partnership building requires trust and understanding among partners if the process is to lead to collaborative learning. Inequalities in power and capacity need to be dealt with, i.e. by building equity through empowerment and acceptance (Lickers & Story 1997, Holmes, Lickers, & Barkley 2002, Pollock 2004). To develop a true partnership requires patience and time (Borrini-Feyerabend et al. 2004). It might take time for more powerful actors to step back and change to a more participatory approach (Daniels & Walker 1996, 2001, Hemmati 2002). It is advisable to start with easy tasks based on local capability, and as confidence improves, step by step address more complex issues. A neutral facilitator that assists in the process is important to identify the collaborative potential and gaps, assist with communication, and develop a plan for the procedure (Daniels & Walker 2001, Gray 2008, Axelsson 2009).

To conclude, the aim is to create a common platform for collaborative learning among actors that may not normally meet and collaborate but are critical to the sustainable development process (Article V).

2.2.4 Commitment to and Understanding of Sustainability

The landscape approach is a comprehensive and collaborative approach to practise SD and address sustainability. This requires learning about states and trends of ecological, socio-cultural, and economic dimensions of

sustainability (Bell & Morse 2003, Angelstam et al. 2007, Axelsson, Angelstam & Elbakidze 2008). An understanding of the social landscape is crucial, i.e. social structure with its actors and stakeholders from local to national and international levels representing public, civil and business sectors (Elbakidze et al. 2010).

There is also a need for a continuous and ongoing dialogue about the societal ambition level regarding sustainability, in which indicators have to be compared to norms (Andersson 2011). Policies may define norms or performance targets, which need to be satisfactory for a particular indicator variable to be considered as sustainable (Lammerts van Buren & Blom 1997). Defining norms may not only be difficult but also controversial (Vucetich & Nelson 2010).

2.2.5 Knowledge Production

Collaboration as transdisciplinary knowledge production is a way to identify and learn about SD. This means that everyone will bring in their expertise in the collaborative process (Daniels & Walker 2001, Cheng & Fiero 2005). Initially, a framework for knowledge production will be defined through the process. Whereas some partners contribute with disciplinary expertise, others bring in inter- or transdisciplinary perspectives in the process to secure that the produced knowledge and solutions are socially robust. Socially robust knowledge means socially accepted improvements and solutions that lead to SD and sustainability (Nowotny 1999). Hence, knowledge production is both the production of new knowledge and local capacity building. This includes learning about the entire social-ecological system. It involves the needs and interests of its different stakeholders and its interconnectedness with the regional, national and international levels (Carlsson 2008), and different sustainability dimensions. To build capacity among stakeholders to strengthen their involvement is central to the process. This means empowering them to have a say in management and strategic decisions locally, and to influence policy development. The ultimate aim of the social learning process is that the community will learn how to manage its own sustainability (Leeuwis & Pyburn 2002, Keen, Brown & Dyball 2005, Wals 2009) (Article V).

2.2.6 Multi-Level Social Learning and Governance

This final core feature is about learning locally and as a result of networking and sharing of experiences. People that meet, do things together, and produced results should have an emphasis on learning based on their failures and successes. Using a landscape approach implies that

you would like to improve sustainability locally and regionally and contribute at national and global levels, i.e. multi-level.

The notion of "multi-level" refers to multi-level governance (Bache & Flinders 2004) which is a description of how our society is changing from the traditional government with one or few decision-makers to a complex system of decision processes at multiple levels (Stoker 1998, Fry 1998, Sundström 2005). This is correlated with "government tasks" being handled by non-public stakeholders to a larger degree. The corresponding adaptation of the society is moving from a government that steers from above, to a government that co-ordinates social systems and is a stakeholder among others (Pierre 2000, Peters 2000). Some see this as a dismantling of society while it can also be seen as a further development of democracy, making the civil sector more engaged in common goods and steering towards a more sustainable future (Fry 1998).

Multi-level social learning is learning based on the four previous core features of the landscape approach (Potschin & Haines-Young 2011). This kind of learning is done together. People learn together to solve or handle sustainability problems or challenges. For a landscape approach initiative, this is needed locally and regionally as well as nationally and internationally. A multi-level social learning process involves, (1) the sharing of experiences and new knowledge with others to enhance the local knowledge production process, (2) to disseminate and communicate the new knowledge and experiences produced locally (Morris, Fitz-Gibbon & Freeman 1987, Cheng et al. 2008, Cox 2009, Pollock 2009) and (3) reflections, connecting to the participants own former experiences (Keen, Brown & Dyball 2005, Dyball, Brown, & Keen 2009). This requires a safe and neutral platform where the participants feel at home and safe (Ramsden 1992, Kolb 1984, Vella 2002). Building of trust and credibility are important parts of a learning process (Peters et al. 1997). To share experiences and new knowledge with others to enhance the knowledge production process, means that the local landscape approach initiative is part of the collaborative learning and knowledge production processes at the local level, network level and with other networks (Dyer & Holland 1991). In a local initiative the knowledge production process results in local or tacit knowledge. To make locally generated knowledge more general applicable, quality assured and explicit (Nonaka & Konno 1998), there is a need to critically assess and reflect locally, within the concept network and with other networks and stakeholders (Terry, Ullrich & Riecken 2006, Brulin & Svensson 2011). The process to make knowledge socially robust and more generally available can be considered an integration of practical

and experiential knowledge with theoretic and scientific knowledge and political ethical knowledge as expressed in policy documents from local to global levels (Aristotle in Gustavsson 2000).

Another important dimension of multi-level social learning is dissemination of new knowledge and experiences to increase public awareness. This includes both communication and education (Hesselink et al. 2004). The aim is both public awareness and to scale up the sustainable practices and behaviours from the local landscape initiative (Binswanger & Aiyer 2003, Mansuri & Rao 2004, Grin, Rotmans & Schot 2010). Sharing include both new technical knowledge and knowledge about new ways to address sustainability, e.g. as a collaborative learning processes (Daniels & Walker 2001) and as learning through ongoing evaluations (Svensson et al. 2009).

2.3 Negotiation Theory

Bargaining is one type of decision making (Bercovitch 1984, Morley & Stephenson 1977) and is characterized by interdependence and the existence of both common and conflicting interests (Jönsson 1990, Zartman & Berman 1982, Pillar 1983). The bargaining process was studied in line with Elgström (1992), i.e. with regard to the relative presence of distributive and integrative bargaining. Distributive denotes confrontational bargaining where the interests of the negotiating parties are almost diametrically opposed, i.e. a win-lose situation. When joint problem solving and co-operative behaviour are predominant, the term integrative is used. Even if conditions for integrative bargaining are present, the process may become distributive if, for instance, the bargaining attitude of one or the other party is distributive and/or if one or both parties uses coercive tactics. In this way, an apparently integrative bargaining situation can be turned into a distributive process. The terms coercive and persuasive are used to characterize the bargaining strategy and tactics used by the negotiating parties (Elgström 1992).

2.4 Policy Narratives

Jones & Mc Beth (2010) observed that the power of narratives to influence belief and action has been highlighted in the literature of a variety of academic disciplines, including psychology (e.g., Gerrig & Egidi, 2003), neuroscience (e.g., Ash et al., 2007) marketing (e.g., Mattila, 2000), and communications (e.g., McComas & Shanahan, 1999).

A general definition of narratives is given by Roe (1994), where 'policy narratives are stories (scenarios and arguments) which underwrite and stabilize the assumptions for policymaking in situations that persist with many unknowns, a high degree of interdependence, and little, if any, agreement e.g.:

- dominant international and domestic models, practices and ideas about development cooperation;
- narratives related to the natural resources and environment, such as; desertification, fuel wood crises and overgrazing (Leach & Mearns 1996);
- predominant perceptions of NGO's role in development.

Jones & Mc Beth (2010) view narratives as particular categories of communication as well as a method for cognitive organisation that help the individual to emphasis certain "elements of reality" while others are levelled. They have defined two levels of narrative analysis, micro and meso, at which narrative cognition and communication can be studied.

Empirical research at the micro level of narratives focuses in general on explaining how the individual public opinion is influenced by policy narratives and its ability to aggregate public opinion, i.e. the persuasiveness of narratives on individuals. At the meso level the study focuses on how coalitions of elites are influence or driven by policy narratives that in turn may drive both policy change and policy outcomes. (Jones & Mc Beth 2010)

2.5 Introduction, Adoption and Scaling up of Agroforestry

Many projects and scientific studies about agroforestry are designed to consider and analyse few other factors than the biophysical once. Issues widely recognized to be critical to adoption of agroforestry, such as risk and uncertainty, the impact of labour, and market or tenure policies, have rarely been investigated (Mercer et al. 1997, Pattanayak et al. 2003). Also, the majority of agroforestry-adoption studies have been based on formal household/farm surveys comparing the characteristics of non-adopters to that of adopters (Pattanayak et al. 2003, Kiptot et al. 2007, Montambault & Alavalapati 2005, Mercer 2004). Mercer (2004) identified village-level studies and spatial analysis of adoption as an important area for future research. Ajayi et al. (2007) has argued that the explanation to the contradicting results of some agroforestry adoption studies lays in the institutional and social context.

Mainly based on adoption studies of improved tree fallow, Kiptot et al. (2007) have argued for the need to consider households in different stages of adoption, e.g., testers/experimenters, re-adopters, pseudo-adopters, and adopters, because their motives differ during these stages.

Horizontal scaling up is the spread across geographical areas and to more people, while vertical scaling up is institutional in nature, involving different types of organizations and stakeholders from local to regional, national and international levels. This includes civil, public, and business sector stakeholders such as grass root farmer groups, extension services, policy makers, private companies, and national and international organizations [IIRR 2000]. In order to achieve sustainable impact and to improve adaptive capacity, horizontal and vertical scaling up have to be linked (IIRR 2000, Farrington & Lobo 1997). Likewise, Long & Long (1992) and Long (2001), stress the importance of interactions between people, technologies, and institutions. Sanginga et al. (2007) emphasize collaboration as a way to improve coordination of the activities among different stakeholders. Similarly, Daniels & Walker (2001) take collaboration to a higher level and argue for the importance of developing collaborative learning processes among stakeholders in complex natural resource management situations.

2.6 The Sustainable Livelihood Approach

The sustainable livelihood approach (SLA) is based on the assertion that development combines resources and capabilities (Chambers & Conway 1992). It emphasises that capabilities are critical for people to improve their situation, influencing the social context and the rules governing how resources are managed (Sen 1997, Bebbington 1999). SLA has developed out of participatory approaches to rural development, applied social science and farming systems/agro-eco systems analysis. The typical attribute of the SLA is that the analysis of livelihoods is put within a holistic framework covering policy and institutional processes at different levels, including micro-level determinants and conditions, and of livelihood Ashley and Carney (1999). The UK's Department of Foreign and International Development (DFID) define livelihood and sustainable livelihood as follows:

> "A livelihood comprises the capabilities, assets (stores, resources, claims and assets) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, and provide sustainable

livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term." (Chambers & Conway 1992, s. 6).

The SLA framework suggests that rural livelihood should be understood in terms of:

a) People's access to assets (Carney, 1998). Assets are considered to be stocks of different types of capital that can be used directly or indirectly for generating livelihoods. They can give rise to output, that may become depleted as a consequence, or may be accumulated as a surplus for investment in future productive activities. Based on the sustainable livelihood framework, five assets have been identified:
   - *Natural capital:* Consists of water, land, and biological resources like trees, pasture, and biodiversity. The productivity of these resources may be degraded or improved by human management.
   - *Financial capital:* Consists of stocks of money or other savings in liquid form. Hence it does not include financial assets only, but also easily disposable assets such as livestock, which in other senses may be regarded as natural capital. It includes income levels, variability over time, access to credit, and debt levels, and distribution of financial savings within society.
   - *Physical capital:* Is what economic production creates. It includes infrastructure such as roads, works, electricity, irrigation, housing, and reticulated equipment.
   - *Human capital:* is constituted by the quantity and quality of available labour. Hence at household level, it is determined by household size, but also by skills, education, and the health of household members.
   - *Social capital:* Any assets such as rights or claims that are derived from membership of a group. This includes the ability to call on friends or relatives for help in times of need, support from trade or professional associations (e.g framers' associations), and political claims on chiefs or politicians to provide assistance. Platje (2008) have argued for the need to change focus from 'the economic effects of institutions' to 'the importance of institutional capital' for sustainable development. He proposes the following definition of institutions; "institutional governance" and governance structures that reduce uncertainty, stimulate adaptive efficiency (i.e. the ability of a system to adapt

to changing conditions) and stimulates the functioning of the allocation system and sustainable production and consumption patterns" (Platje 2004a, 2004b, s.15). In this thesis we regard institutions and what Platje define as institutional capital to be part of the social capital.

b) The ways in which people combine and convert these capital into assets for building of their livelihoods (Bebbington, 1999);

c) The ways in which they are able to enlarge their asset base through interactions with other actors governed by the logic of the state, market, and civil society (Bebbington, 1999); and

d) The ways in which people are able to position and enhance their capabilities to lead their lives, making their living more meaningful, and influencing the dominant rules and relationships that govern the ways in which resources are distributed, controlled, and transformed in society. Special consideration is put on the importance of social capital as an asset through which people are able to broaden their access to resources and other actors (Bebbington 1999).

One specific condition in the work with poverty alleviation at the policy level (e.g. in the development of Poverty Reduction Strategy Paper (Norton & Foster 2001), is the importance to collaborate with many partners. It is also important that donor agencies should not control the process. In this collaborative process with multiple partner organisations Ashley and Carney (1999) suggests that the focus should not be put on using the SLA as an operational 'tool', but should be put on the core SLA principles, i.e. "poverty-focused development activity should be:

- *People-centred:* sustainable poverty elimination will be achieved only if external support focuses on what matters to people, understands the differences between groups of people and works with them in a way that is congruent with their current livelihood strategies, social environment and ability to adapt.
- *Responsive and Participatory:* poor people themselves must be key actors in identifying and addressing their livelihood priorities. Outsiders need a processes that enable them to listen and respond to the poor.
- *Multi-level:* poverty elimination is an complex challenge that will only be defeat by working at multiple levels to ensure that micro-level activity informs the development of policy and an effective enabling environment, and that macro-level structures and processes support the poor to build on their strengths.

- *Conducted in partnership:* with both the private and the public sector.
- *Sustainable:* there are four key dimensions to sustainability; economic, institutional, social and environmental. All are important and must be balanced.
- *Dynamic:* external support should consider the dynamic nature of livelihood strategies, respond flexibly to changes in people's situation, and develop longer-term commitments"

Without specific interventions, decentralisation processes [the process of redistributing or dispersing functions, powers, people or things away from a central location or authority (Merriam-Webster Dictionary 2013)] are more likely to benefit the local elites rather than empowering the poor. Based on the findings of empirical studies from decentralization processes in 60 countries, Manor (2000) suggest three factors that are critical for generating outcome that lead to sustainable livelihoods for poor people; bodies elected at lower levels need to have

- adequate funds and
- adequate powers,
- functional mechanisms are needed to ensure accountability of elected representatives to citizens and that of lower level bureaucrats to elected representatives.

With these factors in place the decentralisation process may improve government responsiveness, transparency and accountability to people at the local level. This may lead to enhance political participation and incentives for people to organize themselves into stronger forms of organisation (improved social capital). Good evidence proves that under such conditions impact of health, education and environmental efforts improve partly due to the possibility for such efforts to adapt interventions to local conditions (Manor 2000).

2.7 Resilience and Socio-Ecological Interactions

Walker et al. (2004, s. 2) define resilience as; "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks". Adaptive capacity and transformability are important elements of a system's capacity to absorb disturbances and reorganise after changes. Adaptive capacity refers to the human capacity to take care of a system's resilience. Transformability refers to the existing capacity of recreating a system that is no longer sustainable (Walker et al. 2004). Adaptive capacity can also be explained as the capacity of a system to absorb changes before

they materialise. Transformability can be explained as a system's capacity to recover from disturbances (Adger 2000). Resilience is increasingly used for the understanding of the dynamics in socio-ecological systems (Folke 2006).

Socio-ecological or ecosystem resilience is characterised by the capacity of a socio-ecological system to buffer and resist chock while retaining its functions and structures. Socio-ecological resilience is a reciprocal process between disturbances, reorganisation, sustainability, and development. The focus is on a system's capacity to adapt, transform, learn and innovate in a context that is characterised by feedback and dynamic interaction between different scales (Folke 2006). Carpenter et al.(2001) have defined weak and strong resilience with an intermediate level:

- *Weak resilience*: changes should be avoided and controlled
- *Intermediate resilience*: the system has a capacity to self regulate after change
- *Strong resilience*: changes can be accepted and used to increase the capacity of the system to learn and adapt.

Brondizio, Ostrom & Young (2012) discuss the challenges facing environmental governance due to the increasing connectivity of resource-use systems and the increasing functional interdependency of ecological and social systems. They argue that there is no appropriate fixed spatial or temporal level for governing ecosystems and their services effectively, sustainably, and equitably. The need to recognize the multilevel nature of such problems and the importance of institutions for the facilitation of cross level environmental governance, is highlighted as a vital type of social capital for the long-term protection of ecosystems including the health of different populations (Brondizio, Ostrom & Young. 2012).

Brondizio, Ostrom & Young (2012) have argued that the growing interdependency among resource use systems, driven by the twin forces of global environmental change and economic globalisation, increase the urgency to understand and address interactions that;

1. increase global market chains that compete for land and water resources
2. extend the overlap of government jurisdictions; local and regional forms of use, and ownership rights that have been formed through export policies, development programs, parks, and production reserves (Young 2006)
3. grow interregional migration and connectivity among social groups in different regions (Moran & Ostrom 2005)

4. form regional trade blocks, international/trans-boundary conservation areas, and multilateral infrastructure (Giboson et al. 2000), and
5. increase variation in global climate patterns that affects the frequency and distribution of drought, rainfall, and temperature change (Brondizio & Moran 2008)

Brondizio, Ostrom & Young (2012) highlight the need for building social capital, which requires the academic and policy community to recognise forms of mediation, translation, knowledge coproduction, and negotiation that are capable of managing complex interlinked systems.
They also stress the need of developing monitoring systems that are capable of providing continuous and timely feedback regarding changes (e.g. shifts from one domain of attraction to another, and on making use of adaptive processes that can help maintain resilience in the face of change. This is particularly the case in SE-systems that are characterised by high level of functional interdependence and highly dynamic. Such systems often feature tipping points. Crossing a specific threshold may trigger nonlinear and rapid changes, so it is important to anticipate these disproportionate changes and to respond quickly whenever possible.

Cash et al. (2006) have highlight the urgency of building social capital, which requires the policy and academic community to acknowledge forms of mediation, translation, knowledge coproduction, and negotiation that are capable of managing complex interlinked systems.

Brondizio, Ostrom & Young (2012) also stress the need to develop monitoring systems that can provide continuous and timely feedback of changes, and to help making use of adaptive processes. This is particularly important in highly dynamic SE-systems characterised by high level of functional interdependence. These systems are often characterised by tipping points. To cross a specific threshold may trigger rapid nonlinear changes. Hence it is important to be able to foresee such changes in order to be able to respond promptly.

3 Materials and Methods

3.1 Study Areas at Three Scales

(Text transferred from Article I-IV)

3.1.1 Sweden - Africa

The foundation "Insamlingsstiftelsen Vi Planterar Träd" (commonly known as Vi Skogen, (hereafter called ViS) is an international NGO with its headquarter (HQ) in Stockholm, Sweden (see Figure 2). ViS coordinates the Vi Agroforestry Program and was registered as an international NGO in four East African countries: Kenya, Uganda, Tanzania and Rwanda. ViS is mainly financed by Sida, the Swedish cooperative movement, and over 30,000 private annual donors in Sweden. The decision to plant a forest in Kenya was made in December 1982 (Viklund 1992) by the Vi Magazine. The first article about ViS was published in the Vi Magazine in 1983. Readers were asked to give away trees for any celebration or commemoration to be planted against the spread of the desert in Kenya. The response was overwhelming. Nearly 2-million SEK was contributed during 1983 (Lundgren, Boëthius & Nyberg 1995). To use all the collected money became one of the most difficult problems. A local NGO, Faith Home of Kenya (FHK), was

Figure 2, the location of Sida headquarter, Vi Skogen headquarter and its projects in Africa in 2001

engaged to raise seedlings to be planted in the semi-arid areas of West Pokot. However, due to weak planning, poor accountability, and lack of focus FHK faced difficulties in coping with the pace of the ViS demands (Viklund 1992). In 1985, a coordinator located in Sweden was employed. The cooperation with FHK was terminated and at the beginning of 1986, a partnership with Kenya National Farmers Union (KNFU) was initiated. ViS was registered as an independent NGO in Sweden in 1986 (Viklund 1992, Johansson & Nylund 2008); later, ViS was registered as a local NGO in Kenya, initially using the name Vi Tree-Planting project, which was later renamed to Vi Agroforestry Project. The cooperation between ViS and KNFU, which in practice ended in 1988, was officially terminated in 1990 (Viklund 1992, Lundgren, Boëthius & Nyberg 1995, Johansson & Nylund 2008). ViS had and still has close and regular communication with its individual donors through ViS articles in the Vi Magazine (Johansson & Nylund 2008). Journeys to the ViS project(s) were arranged annually for Vi Magazine-readers; this activity started in November 1986. In December 1992, an article published in the ViM presented ViS's vision of a 20-km green belt of agroforestry around Lake Victoria (Johansson & Nylund 2008). ViS was registered in Uganda 1992 and in Tanzania 1994. At the end of 1996, Sida approved ViS's organizational set-up with its own local NGOs (Sida/SEKA 1996). ViS continued to reform its policy and organization during the following years (Haldin, Koppers & Auren 2000, Johansson & Nylund 2008, Vi Skogen 1998a, 1998b, 1999), gradually developing into its present organization with its distinctive character and a policy in line with today's predominant aid ideology, recognized for its efficiency and good results (Johansson & Nylund 2008).

Sida is the Swedish development agency working on behalf of the Swedish parliament and government, with the mission to reduce poverty in the world. In cooperation with others, Sida contributes to the implementation of the Sweden's Policy for Global Development that will enable poor people to improve their lives. Sida works in a total of 33 countries in Africa, Asia, Europe, and Latin America (Sida 2015).

3.1.2 Vi Agroforestry Project Mara, Tanzania.

The Vi Agroforestry project in the Mara region, Tanzania (Vi-AFP), was a local NGO registered with the Ministry of Home Affairs in Tanzania. The project appraisal was carried out early in 1994. Field activities were initiated with the employment of the first project extension agents (PEA) in the beginning of 1994 (Anon 2001). The target group of the Vi-AFP was the subsistence oriented farmers with unsecure food supply, estimated to

80% of the total population in the lake zone of the Mara Region (Anon 1998). The development objective was to make a substantial contribution towards improved livelihoods of this target group. The project objectives were to increase food and nutritional security, fuel wood availability, and sources of income. The implementation approach used by the project was labelled as; age and gender sensitive participatory agroforestry extension.
The number of project extension agents employed in the project increased from 16 in 1995 to 113 in 2000. At the end of 2000 the project had 155 permanent employees in total (Article I-II, Haldin, Koppers & Auren 2000, Barklund 2004, Anon 1998, Anon 2001).

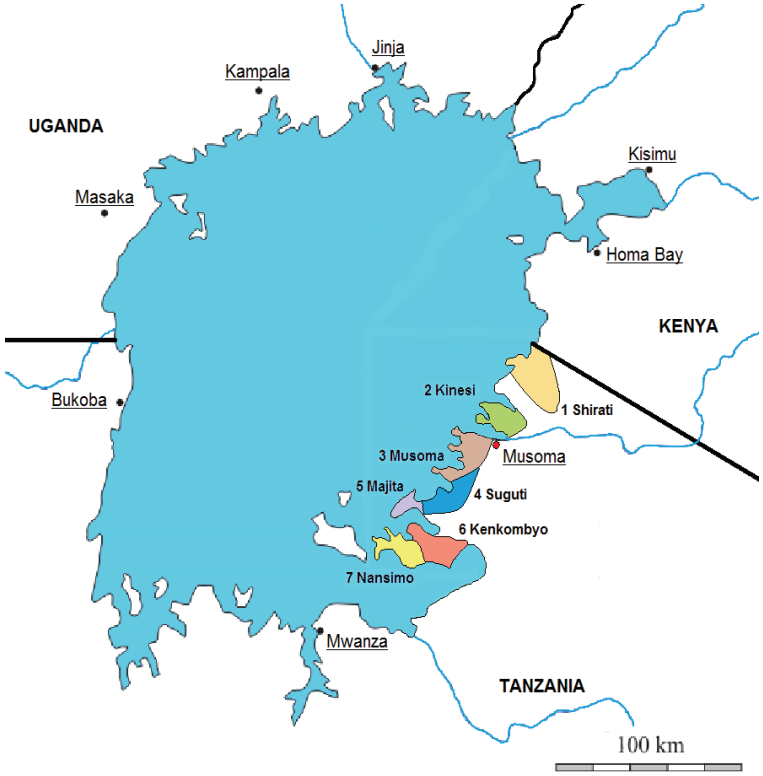

Figure 3. Location of the Mara region Vi Agroforestry Program project area and its seven project zones (coloured areas) on the eastern shore of Lake Victoria.

Each project extension agent was responsible for a village or part of a village as their specific area of concentration. The project area included 104 villages along the Victoria Lake in Mara divided into 7 subprojects (Zones,

see Figure 3) with about 15 to 16 project extension agents in each. Each zone was led by a zonal manager responsible for its running operations. The total number of households in the project area in 2001, was approximately 34,500, On average 305 households per area of concentration/project extension agent (Article I-II, Haldin, Koppers & Auren 2000, Barklund 2004, Anon 1998, Anon 2001).

In an effort to focus on the most useful agroforestry interventions for the small scale farmers, a consolidated package gradually developed in collaboration with farmers, district staff, and ICRAF-Shinyanga (International Centre for Research on Agroforestry, today World of Agroforestry Centre, field station in Shinyanga). The aim was to plant all trees in a way that improved and protected the soil and conserved the water resource. As their common aim was to improve productivity and sustainability of the local farming system; project and government extension services, and ICRAF-Shinyanga joined efforts. The collaboration focused on the integration of sustainable practices in the local subsistence systems of Mara, including agroforestry, improved crop varieties, organic farming, and soil and water conservation. An important part of the collaboration was farmers co-designed learning experiments. In the year 2000, 54 tree species and four improved crop varieties were promoted by the project (Article II and III, Haldin, Koppers & Auren 2000, Barklund 2004, Anon 1998, Anon 2001).

The Mara Region is divided into five districts: Tarime, Bunda, Musoma Rural, Musoma Urban, and Serengeti. The part of the Lake Victoria basin in Tanzania covers 84,920 km², which equals 46% of the total lake catchment area, and includes the Mwanza, Mara, Kagera and Shinyanga regions. The Mara Region is situated along the east side of Lake Victoria. On average 667 people used one km² of cultivated land for their livelihood in the region (estimate for year 2000; Anon 1998). Most of the lake zone inhabitants are subsistence farmers, cultivating crops, keeping livestock, or fishing. Land pressure and deforestation are increasing rapidly. People in the lake zone are faced with several problems including low and unpredictable agricultural production due to erratic precipitation and soil erosion, increasing poverty coupled with malnutrition, high incidences of disease, and rapid environmental degradation (Article II-II, Anon 1998, Swallow 2009, Odada 2004).

The lake zone is a strip of land about 10 to 15 km wide along the lake including parts of Tarime, Musoma and Bunda Districts at altitudes from 1100 to 1200 m.a.s.l. The annual precipitation is normally less than 900 mm divided in two main seasons, about mid-September to early December

and March to June. Duration of the rainy season is highly variable causing difficulties in predicting the timing of farm operations. This situation for agricultural practices is further aggravated by a commonly occurring mid-season (early December to March) dry spell. Soils in the lake zone are mainly sandy and thus prone to drought, easily exhausted, and susceptible to erosion. In areas that are seasonally waterlogged, the soils consist of heavy clay. Eleven ethnic groups are represented in the lake zone with the Jita, Luo, and Kuria being the largest. Jita and Luo are semi-agropastoralist and Kuria are agro-pastoralists (Anon 1998, Swallow 2009, Odada 2004).

3.1.3 Community Forests in Eastern Africa

Eleven CBFG were selected in five countries, three in Kenya and two in Ethiopia, Tanzania, Uganda and Zambia (See Figure 4). The age of the selected cases from their foundation to the time of the study varied from 1 to 15 years. The area coverage of the cases ranged from those organised in the local communities to CBFGs organised at the national level.

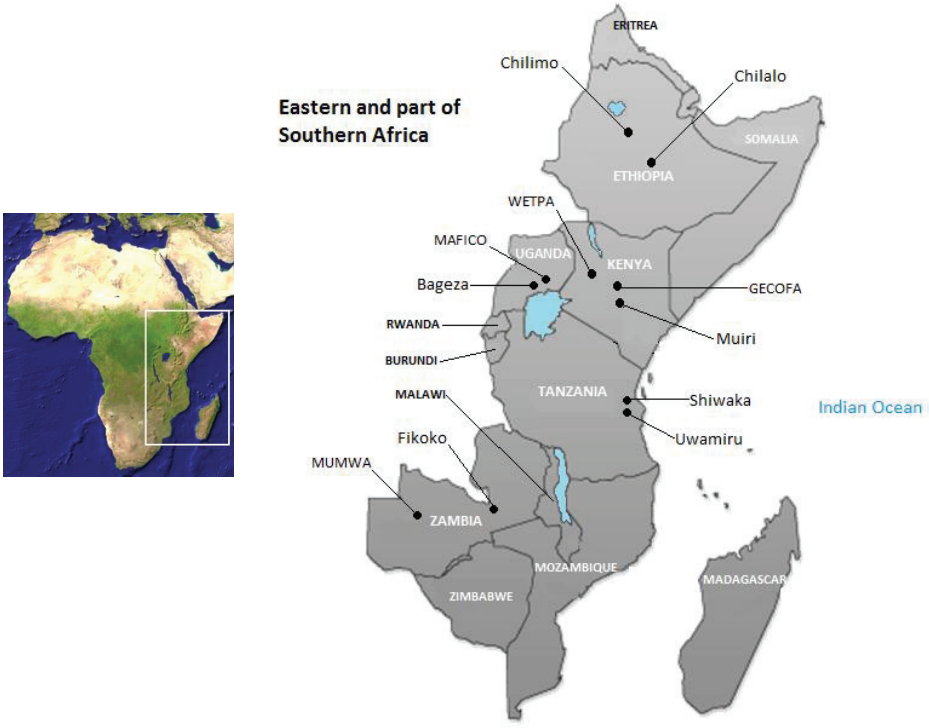

Figure 4. Map of Eastern Africa and parts of southern Africa presenting 11 cases

The number of organisational levels also varied from an independent CBFG with only one organisational level, to organisations with two levels and organisations with three levels. Organisations with two levels included an apex with a secondary level of local community-based groups. CBFGs with three organisational levels included an intermediate level between the apex and the local groups. Membership in the CBFGs ranged from 34 to 7000. The ways in which the CBFG were initiated varied from a local community initiative, to an initiative co-developed by the local community and an external actor (agency or development organisations). The forest areas managed by the CBFGs ranged in size from 50 to more than 5000 ha. Land tenure and rights to access and use of the forest were diversesly ranged from individual private property rights to (Bageza), ownership devolved from government to the CBFG in partnership with a parastatal enterprise (Chilalo and Chilimo), customary use rights transferred to the CBFG (Zambia), government-owned and held citizens' trust (MAFICO), user rights against payment (Kenya) and government ownership devolved to CBFG but with the final agreement pending (Chiwaka and Uwamiru). Some CBFGs focused on several activities while other had a more narrow focus. For example, the Fikoko co-operative specialised in honey production, while others were engaged in both timber-based activities and several others based on non-timber forest products such as beekeeping, fruit and herb gathering and ecotourism. However, the selected groups shared a purpose, to improve the livelihood of members and the resilience of the natural resource base on which they depend (Article IV).

3.2 Methods

In this thesis, sustainability is understood as the goal for development, often described in official policy. Sustainable development on the other hand is about how stakeholders collaboratively learn to steer towards the goal of sustainability (Baker 2006, see also section 2.1 above) in a landscape. Landscape is a term that includes both the social and ecological dimensions of a place (see Article V and section 2.2 above). Using a landscape approach for development and transdisciplinary research means (1) to work in a landscape as a social and ecological system, (2) to establish collaboration among stakeholders at multiple levels of governance, (3) a commitment to and understanding of the landscape's sustainability status and development trajectory, (4) to produce new knowledge needed for the process, and (5) that the process result in learning at local, regional, national, and international levels of governance (Article V).

My thesis is about the introduction and scaling up process of two approaches to improve landscape resilience, namely agroforestry (Article I – III), and community-based forestry (Article IV). Both agroforestry and community-based forestry aims to increase social, economic, and ecological sustainability. This includes adaptation, integration, and adoption of new organisational and technical interventions into existing subsistence systems, and finally the scaling up of interventions to reach a majority of the target groups, gradually moving towards a resilient landscape.

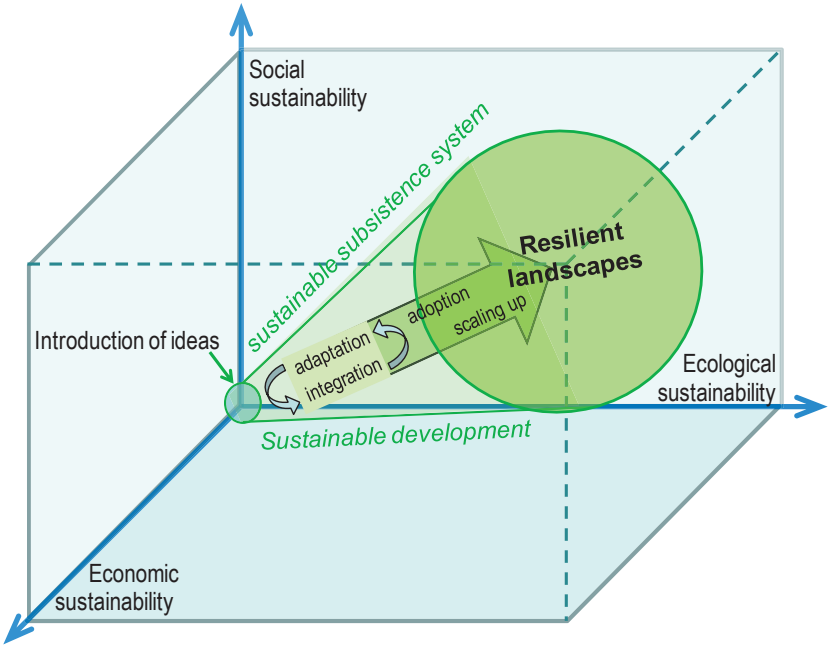

Figure 5. Three-dimensional model to illustrate (1) a sustainable development process regarding introduction of new ideas, adaptation and integration, leading to adoption and scaling up of agroforestry and community based forestry with (2) the aim to improve social, economic, and ecological sustainability of the local subsistence systems towards (3) a resilient landscapes.

The introduced interventions and the process of adaptation, integration, adoption, and scaling-up can be considered as a sustainable development process that gradually improves economic, social, and ecological sustainability of the local subsistence systems, thus progressively navigating towards a more resilient landscape (Figure 5).

a) *Ecological sustainability* is assumed to improve with an increasing proportion of the population integrating sustainable land management practices in their subsistence system. The process is coordinated in time, space and pattern aptly at different levels in the landscape to increase connectivity and rainwater infiltration for enhanced biodiversity, soil and water conservation - moving towards an ecosystem increasingly capable to maintain itself against disturbance and stress (Adger 2000)**.** This implies to gradually turn the degrading interaction between subsistence activities and the natural capital found among many food insecure communities, to sustainable development (Scherr 2000, Elasha et al. 2005)

b) *Social sustainability* is assumed to improve with an increasing number of the food insecure households being empowered through a collaborative learning process (Keen, Brown & Dyball 2005, Wals 2009, Daniels & Walker 2001, Cheng & Fiero 2005). The process expand and improve their social capital and organisational capability to influence the rules and relationships that govern their lives and the ways in which resources are controlled and transformed in their society (Sen 1997 Bebbington 1999). As the process progressively builds a capacity to withstand external stress from social, economic, political (Adger 2000) and ecological change social sustainability improve.

c) *Economic sustainability* is assumed to improve with the improved technical, entrepreneurial, and organisational capability among an increasing number of the food insecure households. They gradually improve productivity, income stability, and economic sustainability of their subsistence system (Chambers & Conway 1992, Bebbington 1999, Elasha et al 2005), moving towards a capacity to confront economic changes and risks (WRI 2008).

Barriers and bridges to the scaling up process were identified in Article I-IV from introduction to scaling up with focus on those critical for the food insecure households. Their specific (in the Result and Discussion section) and general (in the General Discussion section) influence on the scaling up process was analysed on the scaling up process per se, and the prospect to improve economic, social and ecological sustainability of the local subsistence systems and navigation towards a resilient landscape.

3.3 Methods Used in the Articles

(Text transferred from Articles I-IV)

3.3.1 Analysing Negotiation Processes, Article I

Inspired by Allison (1971), Elmore (1978) and Elgström (1992), three analytical concepts, the power, organizational, and contextual approaches, were used as explanatory categories when analysing the empirical material of the negotiation process between ViS and Sida. Each approach places the focus on a particular set of variables. Thus, three separate explanatory perspectives are presented. These could be viewed as mutually exclusive theories; however, the three approaches are considered as supplementing perspectives, each highlighting some particular aspects of the bargaining process. (1) The power approach argues that the power of the actors involved in the negotiation is the main determinant of bargaining behaviour and results. The distribution of material power resources is one essential dimension of power, and the presence of influential norms is another. (2) The organizational approach claims that it is crucial to study factors pertaining to characteristics of the organization of both negotiating parties, such as organizational culture and capacity. (3) The contextual approach argues that knowledge about the context of the negotiation episode is vital for the understanding of bargaining process and result (Article I).

3.3.2 Analysing Scaling up, Article II and III

To analyse the scaling up process of agroforestry in the Mara Region, a number of different methods were used. To establish a robust base 21 households were selected, randomly drawn from a list including all households in each of the 89 villages included in the study. This resulted in a total sample of 1869 households. Surviving agroforestry trees were counted in each household/farm divided into age and type of tree (soil improver, long-term trees, and fruit trees). Five response variables were constructed from this data (see Table 1). Each of the selected households were interviewed using a structured questionnaire. Effect variables describing village, division/zonal and district means, and characteristics were calculated from the household data and collected from maps, project documents, government records, and structured interviews with project staff representing different subsystems (see Table 2).

Table 1. *Dependent variables used in the analyses of the scaling up process of Agroforestry in Mara Region, Tanzania*

Abbr.	Description of variable
Sr1-30	No of sample households with 1 to 30 agroforestry trees/soil-improvers (3 m soil-improvement hedge = 1 tree) surviving on their farm
Sr≥40	No of sample households with 40 or more agroforestry trees/soil-improvers (3 m soil-improvement hedge = 1 tree) surviving on their farm
Sp≥5	No of households with 5 or more surviving agroforestry-tree species of the species promoted by the project
SrX	Average number of agroforestry-trees / soil-improvers surviving per sample household in a village, i.e. the total number of surviving trees divided by all 21 sample household
SrS	The accumulated total number of seasons from which the 21 sample household was found to have surviving agroforestry trees

Table 2. *Independent variables and factors affecting agroforestry adoption differentiated into five social and ecological subsystems*

Subsystems of adoption		Factor	Variables
i	Local governance	Local governance related to agroforestry development	Local collaboration, administrative district and project zone
ii	Local belief	Perceptions related to trees and agroforestry	Perceived labour require-ment of tree establishment, tree ownership and the benefits of agroforestry trees
iii	Physical environment	Characteristics of soil and water	Main soil type, water sources and distance to the lake
iv	Subsistence system	Subsistence activities and practices affecting agroforestry integration	Main economic activity, tilling method and main crop
v	Project	Project interventions	Level, duration and type of project activities and characteristics of the project extension agent

A correlation analysis (Shork & Remington 2000) was first made to map the relationship among the variables included in the study using Pearson's

correlation criteria. After correlation, the influence of the 26 independent variables on adoption were analysed, using multiple linear regression and the stepwise procedure with the probability criteria of F to enter set at 0.150 and F to remove set at 0.150. The main reason to use multiple regression analysis is to learn more about the relationship between several independent variables and a response variable (dependent variable) (Hair et al 1998, Mardia, Kent & Bibby 1982). From the models produced by the stepwise procedure the model with the largest number of variables and the highest R2 was selected for each response (Shork & Remington 2000, Draper & Smith 1966, Olsson 2011, Atkinson 1981).

Single ANOVA analysis was conducted to test if the differences among administrative districts and divisions/project zones were significantly separated in terms of the dependent variables used in Article II. Secondly, district and zonal means were calculated for the dependent and independent variables. Tukey‘s test was used for pair-wise comparisons to determine if these means were significantly separated between the different levels of districts and project zones. Thirdly, fitted line-plots were used with the district or project zone as a categorical variable to determine if the influence of the independent variables (presented in Table 1 and in Article II) on project outcome (the five dependent variables) were neutral, positive or negative among the different levels of districts and zones.

Finally, a qualitative method was used for the analysis of data collected using participatory observations, and official and internal project documents ranging from meeting protocols, project accounts, notes, and documented discussions among project staff and project partners. Our analysis included the following iterative steps; (1) reading of the data material; (2) structuring of the dataset and writing; (3) discussions about what was written, which included the descriptive models of the chronology of change and considering differences among districts and zones; (4) discussions and reflections on the text and the models; (5) to confirm and validate the qualitative analyses comparing with quantitative results; (6) trying to falsify our findings using the same dataset; (7) relate the results with similar scholarly work. Then, we went back through the steps several more times to assure that all our findings were well grounded in the data (Glasser & Strauss 2008).

Collaboration was assessed in terms of regular or occasional interaction, and whether the interest to collaborate was one-way or two-way, giving four levels: (i) occasional interaction with one-way interest to collaborate; (ii) occasional interaction with two-way interest to collaborate; (iii) regular

interaction with one-way efforts to collaborate; (iv) regular interaction with two-way efforts to collaborate (Article III).

My co-authors in Article III, included one transdisciplinary scientist not previously involved with the project, and representatives from different levels of governance and societal sectors connected to the project and it's scaling up process, e.g., the program (international NGO), project (local NGO), local government institutions (Regional and District Agricultural Office) and adaptive research (international research NGO). This multiple method approach enables us to better consider the socio-cultural realm and the governance context within which the adoption of agroforestry takes place stressed in a number of agroforestry adoption studies (e.g., Franzel et al. 2004, Pollini 2009, Pattanayak et al. 2003, Ajayi et al. 2007, Kiptot et al. 2007, Mercer 2004). Similar multiple-method approaches have proved useful in other research fields, e.g., health sector (English et al. 2011, O'Cathain et al. 2010), recreation (Bowen 2004) and in inter-sector studies of health and horticulture research (Tenngart Ivarsson & Grahn 2012) (Article III).

3.3.3 Analysing the Capacity of CBFG, Article IV

A qualitative approach based on informative cases was chosen to reflect views, considerations, and relationships (Miles & Huberman 1994, Silverman 2005, Yin 2009) in Article IV. Although the focus was on the CBFG members' perceptions and main concerns, the views of important outsiders and stakeholders were among the data analysed. To distinguish between the insiders' and the outsiders', views have long been utilised in qualitative methods, i.e. emic and etic perspectives (Vidich & Lyman 1994), while Brodsky (2001) and Wolf (1996) have stressed the importance of perspective in research. Based on this approach, the present situation and future development of CBFGs has been examined and analysed from different perspectives; insiders, represented by ordinary and executive members, male and female; and outsiders, being partners, stakeholders and the research team. Representatives of these perspectives were brought together in a verification workshop to synthesise the findings of the whole field survey.

A maximum variation cases approach was used to guide the selection of cases. According to Flyvbjerg (2011), to obtain information about the significance of various circumstances for case process and outcome, three to four cases that are very different in one dimension, such as the size, form, location or budget of an organisation, can be selected. In Article IV variation in the following dimensions were used: location, age of the

organisation, membership, access to the forest, area coverage, organisational levels (i.e., whether the CBFG studied was part of a larger structure), origin of the CBFG, and forest size. Eleven CBFGs were selected in Ethiopia, Kenya, Tanzania, Uganda and Zambia (Figure 4) to represent diversity in terms of the abovementioned dimensions/factors (Article IV).

4 Results and Discussion

4.1 Barriers: Threats and Weaknesses

4.1.1 Dilemmas of NGOs and Government Donor Agencies

In Article I it is described how non-governmental organizations (NGOs) and government donor agencies (GDAs) are "..caught in dilemmas:

- for NGOs: between responsiveness to its target group(s), the expectations of individual donors and the demands of its GDA.
- for GDAs: between its policies to respect NGOs' integrity, its wish to keep NGOs accountable for received funds and its operation within the bounds of its general policies." (Johansson et al 2010, p. 273)

These dilemmas are mirrored in the negotiation for funds between the NGO and its GDA. Environmental NGOs are often initiated through a contemporary narrative such as biodiversity, desertification, or climate change. Support is built among its members around the narrative. Escalas (2004 & 2007) and Ricketts (2007) have found that narratives are more persuasive than analytical reasoning, as they are more likely to transport the reader into the narrative and become involved (Green & Brock 2000).

ViS was initiated out of the desertification narrative in the beginning of the 1980s. The mission was to plant trees as a barrier against a moving dessert frontier. Individuals, companies, and organisations (i.e. private donors) could buy trees as gifts, rewards, promotion, or as a living memory for a deceased friend, member, or relative. Instead of a normal gift, flowers or money, a chance was provided by ViS to give a gift that also proved a contribution to a noble cause. The ViS organization gradually grew around this mission, including central project nurseries. Smallholder and

pastoralists were paid to plant trees on their communal land and/or private landholdings.

As the importance of local ownership, participation, and empowerment in development cooperation increased, ViS's implementation strategy became increasingly at odds with Sida's policies. Similarly, the concept of desertification changed. It was first understood as an expansion of deserts along a visible physical frontier. Although controversial, this understanding has gradually developed into an invisible frontier estimated through the loss of lives and agricultural productivity, seriously affecting millions of people that depend on degraded and marginal lands for their subsistence (UNCCD 2014). Still, the strong support built among members and private donors to the ViS's mission, remained for many years. ViS managed through the Vi Magazine – the voice of the Swedish consumer cooperation - to build enduring support to the ViS mission using both rational and emotional based arguments. Gilovich (1991) argue that narratives are formulated in ways that agree to an individual's reality to the extent that they are in congruence with his/her belief system. Symbols (e.g., characters), causal connections, specific facets of the story, and the language are emphasised while others are levelled and obscured (Gilovich 1991). Jones & Mc Beth (2010) suggests that such identifiers work as cognitive shortcuts, allowing an individual to quickly determine congruence or incongruence with his or her worldview, and that congruence is preferred as we normally protect our understanding of the world. Through the Vi Magazine, ViS kept its members and private donors in the desertification narrative and an obsolete understanding of development cooperation.

ViS's road from a narrowly defined environmental tree-planting project to an international development organization with focus on agroforestry for poverty alleviation and sustainable development was not straight. The progress from paid labour and free seedlings, to local participation and empowerment, was a process that lasted for almost 20 years. ViS's failure to modernize its policy in line with contemporary discourse in development cooperation deepened the clash between ViS and Sida, thus activating the GDA and NGO dilemmas. ViS had to stick to its commitment and agreement with the private donors, and make sure that each tree being paid for was actually planted and survived to enlarge the Vi forest as a green belt against the desert frontier. Meanwhile, free seedlings and paid labour satisfied the target beneficiaries of the Vi projects. The ViS work, and it's funding and implementation strategy was skilfully connected to the worldview of its private donors through the ViS articles in the Vi magazine. This generated a strong public support that in turn increased

ViS-power in the negotiation with Sida. This power advantage, together with ViS's limited knowledge in development cooperation and Sida's policy to acknowledge NGO integrity, helps to explain how ViS could continue to pursue its initial policy concept year after year despite enduring criticism from Sida and negative assessments.

Due to its weak organisational capacity, ViS did not realize that the method and approach employed to meet the immediate objectives influenced long-term sustainability negatively. Instead of building local ownership and empowerment among the food insecure, ViS implementation strategy created dependency on aid. The focus was on what was being done, with less consideration of how it was done. The natural and financial capital among the food insecure improved but not their capability to generate these improvements by themselves

With time the importance of local ownership and empowerment became increasingly evident among ViS, private donors. Seen as narratives, these objectives of development cooperation got a breakthrough – a breach (Herman, 2002, 2003). Jones & Mc Beth (2010) have suggested that; "As a narrative's level of breach increases, the more likely an individual exposed to that narrative is to be persuaded". An NGO with the freedom to be responsive to the needs and interests of its target groups may rather choose to respond mainly to the interests of its individual donors. ViS mission was initially focused on the contribution to ecological sustainability, but its implementation strategy was socioeconomically unsustainable in the long term. The rate of adoption was favoured on the cost of the beneficiaries' empowerment. Gradually the belief of ViS's private donors, and Sida's policy and demands converged (Article I). Still, for many years the ViS implementation strategy had a focus on dissemination of blueprint agroforestry interventions through locally employed project extension agents.

These interactions among global and Swedish policy processes with Sida and ViS policy process had a direct influence on ViS scaling up effort and its outcome. Even though the process resulted in increased perennial vegetation cover and erosion control that contributed to improve ecological sustainability, its contribution to social and economic sustainability was poor. The human capital was improved in technical matters related to tree establishment and agroforestry, but the approach failed to build and strengthen the social capital of the food insecure and the local institutional capital to support and gradually take over and lead the local adoption and scaling up process. Even though the time from investment to accrual of benefits in tree establishment and agroforestry was considerably shortened

through ViS's facilitation of adaptation and integration, the urgent need for food and cash among the poor could only be improved marginally by an increasing availability of firewood, fruits and dry season fodder for livestock.

Today, ViS implement the process through local community based organizations and develop the entrepreneurial and the organisational capacity among the food insecure Vi Agroforestry (2015). The process is also implemented in close collaboration with local governments at different levels. Hence, the ViS have at the present, policies and strategies that balance the need and interests of different stakeholders and contributes to improve social, ecological, as well as economic sustainability of the subsistence system of the food insecure

4.1.2 Insufficient Education and Lack of Time

Lack of education is a critical and well established barrier to the development of food insecure households. Jandhyala (2002) highlighted the importance of education to increase productivity of the people, and thereby their earnings.

The time required for cultivation, collection of firewood, fetching water, and other critical and often reactive tasks leave the poor with no spare time for planned and long term strategic activities that could potentially improve sustainability. A high level of time constraint is typically part of the poor households' decision to invest in environmental conservation. Part of the poverty culture is that the future is discounted at a very high rate. This is an effective formula for accelerated degradation as poverty is the cause as well as the effect of environmental degradation (Murphree, 1993, Dasgupta 1997, Moseley 2001). Lack of time has also been identified as a barrier for the poor to participate in CBFM (Tesfaye 2011, Vyamana 2009).

The large difference in education between executive and ordinary members found among some of the CBFGs (Article IV), becomes a barrier for equal involvement in the decision-making and executive work of Community Based Organisations (CBOs). This inequality is particularly connected to the situation for poor women who often have to use every hour awake for their families subsistence. Lack of education and illiteracy is also more common among women. Hence, even if opportunities are presented, the food-insecure lack the capability and time required to be genuinely involved in CBOs or enabling interventions.

Insufficient education of the majority of food insecure households is related to national policies, the level of available resources, and resource allocation of national and local government to provide education. Development

cooperation and civil society have made considerable contributions to improve availability of education for the poor. Again, policy narratives like empowerment, participation, and local ownership, contribute to the allocation of funds and resources for capacity building and education. The growing understanding of resilience and the adaptive capacity, works in the same direction. The lack of time is linked to the poor return of their natural and human capital as their land most often is marginal to agricultural production (which is linked to the land-tenure system, discussed under 4.1.4 below). The unfair price they are able to obtain for their produce (further discussed below under 4.1.5) also contributes to the poor return. Another interlinked factor is the lack financial capital to buy improved farm implements and inputs that could otherwise have increased their returns.

Lack of time and limited education among the poor stagnate the development of the human and social capital. It impedes a constructive interaction between the food insecure households, the formal and informal learning processes, and governance systems. Hence, lack of time and education is a critical cause that retains the negative interaction between social and ecological systems, levels and scales (Brondizio, Ostrom & Young 2012, Folke 2006), leaving them without the option to halt degradation and recover the value of their natural capital. It becomes a critical barrier for the scaling up process, as it keeps them out of the process in two ways; they do not have time to be involved and their capacity to learn is limited due to lack of or poor ability to read and write.

4.1.3 Unsuitable Legal Status of CBFGs

The legal statuses of CBFG are most often weak and or unsuitable for their operations (Virtanen 2005, Cocks et al 2001, Jones 2004, Johansson et al. 2012). The dual commitment of CBFGs, i.e. their social and business obligations is usually not acknowledged in the legal status of these groups (Article IV). Some CBFG have a legal status as non-for profit organizations and others as business organizations. In Zambia and Ethiopia CBFGs can be registered as cooperatives that acknowledge their social and business commitments.

The main purpose of CBFG is to improve the livelihood of its members and conserve the natural resource based on which they depend. However, most of the groups studied in Article IV faced difficulty in translating their natural and human capital into livelihood for their members. With a legal status as non-profit, CBFGs are not legally entitled to engage in normal business that generates cash profit to its members. Being registered and taxed as a normal business corporation, their social and conservation

commitment becomes a burden in competition with normal business corporations. Low profit margins together with poor entrepreneurial and value adding capacity, makes the CBFGs vulnerable to changes and disturbances. One example is the MAFICO-members' sale of handicraft. Members competed successfully in the local market with their craft until a trader entered with similar products from outside. Hence, the ambiguity caused by the unsuitable legal status provided by government authorities does not offer a good basis for the CBFGs to contribute to the livelihood of their members. This lack of coherence between different governance sectors, economic and social systems, limits the contribution of CBFM to social, economic, and ecological sustainability. It also becomes a barrier for the scaling up of CBFM and involvement of the food insecure as they have to focus their time on activities that give the best return in terms of food and livelihoods.

4.1.4 Unsecure Ownership and User-rights

Insecure use and ownership rights, and resource access of the CBFGs (Russell & Franzel 2004) and smallholders further reduce their ability and incentives to make long-term investments, obtaining credits, and entering into joint venture based on their natural capital. The perceived risk of failure is a critical part of the decision to make long term investment such as in tree planting, agroforestry, and soil and water conservation. Women are particularly disadvantaged as land often belongs to their husbands' relatives. Hence, when a woman loses her husband she often also loses her right to the land she have cultivated for her family's subsistence. This traditional cultural practice becomes a disincentive for women to use their valuable labour for soil conservation and tree planting (e.g. Havnevik & Skarstein 1997).

A serious consequence of unsecure access and ownership rights is that it limits the capability of the CBFGs and their members to implement their long-term plans, e.g. investment in marketing, value adding, and transport facilities. The social and natural capital found among the studied CBFGs was in general very good, as well as their members' commitment to protection and conservation. However, without long-term strategic investments it is difficult for CBFGs to improve the value of and take advantage of their social, natural, and human capital to a level that contribute to improved livelihood of their members, let alone to build their adaptive capacity. It is unlikely that the strong commitment found among the CBFG-members will remain without livelihood improvements. The poor strategic and entrepreneurial capability found among many CBFGs

and smallholders make them vulnerable to economic risks and changes. In longer-term, this lack of economic resilience will have a negative impact on ecological resilience. In spite of their strong commitment to conservation and protection of their natural capital, food insecure members that face deficient livelihood improvement with their high level of time preference, stand no other choice than to decrease or end their engagement in CBFG activities.

4.1.5 Unfair Share of End-consumer Price

Many of the studied CBFGs and their members face difficulties in obtaining fair prices for their cash crops. Some of the studied groups in Article IV listed the local middlemen as one important threat to their development in the participatory SWOT analysis (Johansson et al. 2012). One important cause is the considerable asymmetry in bargaining power between the food insecure/CBFGs and local middlemen/businessmen that usually capture a lion share of the local value. This is not only a problem in Africa (de Olivera et al. 2009 in Brasils, Hernandez et al. 2011 in Mexico, Hoque et al. 2012, in Bangladesh Komaki 2012 in Thailand, Ram Singh 2013 in India). The transport facilities and group marketing capacity that most of these groups lack are critical disadvantages in their efforts to negotiate for a fair price. The urgent need for food is another weakness that is cunningly exploited by the middlemen (Article IV). These disadvantages are again related to the inability of the food insecure and their organizations to carry out long term investments. The lower price the CBFGs and food insecure obtains for their cash crop the more land and resources are required for their subsistence and to generate a surplus that can help them to develop beyond their present situation.

The excessive power of local middlemen indicates that local market systems are not functional. For example, goods sold by members of the Uwamiru CBFG in Tanzania were offered a price by the local middleman that was 10% of the price it was sold for at the market in Dar es Salaam, located less than two hours away from the Uwamiru location. This suggests that true competition between local market actors was absent. The proportion of the middlemen's share in the cases referred to above, e.g. 78% in Mexico (Hernandez et al. 2011) and 65 % in India (Ram Singh 2013) also indicate that this problem also exist in more developed countries and that the local market system is the main problem rather than the global market system. In general, the underlying causes to this barrier including social, governance, and economic systems with interactions across scales and levels, are too complex to be further elaborated in this thesis.

The solution to this barrier carries the largest and most immediate potential for poverty alleviation, with direct impact on the human capital of the food insecure and their natural capital. If they were to gain half of the middlemen's examples above, the value of their labour and natural capital could be considerably improved as assets for building their livelihood. It is difficult to see how the economic resilience of the subsistence system and the livelihood of the food insecure could possibly be improved without a robust solution to this barrier. With the poor return from the use of their human and natural capital the incentives for the food insecure households to engage in investments for future gains, like tree establishment, soil conservation or protection is low. Insecure ownership and access rights to their natural capital further reduce their motivation as it increase the risk of the investment. Hence, ecological resilience is also negatively affected both by decreasing motivation to contribute to conservation activities and because more resources are needed for sustain livelihood. Many of the CBFG included in Article IV had a good organisational structure and constitution with many partner organisations. With lack of incentive for the food insecure households to participate in the CBFG, it is likely that their tight time schedule forces them to end their involvement with the consequence that their social capital will be considerably reduced. This is particularly the case for poor female members. A lot of enabling efforts have been invested in most of these groups with the aim to help the most vulnerable, yet it may be precisely they who will benefit the least.

4.1.6 Incoherent Policies, Extension Niches and Beliefs

The Forests Reserved Trees Order (Anon 2013) is aimed to restrict the cutting of certain indigenous high quality timber species like the Pterocarpus angolensis in Tanzania. This policy has been enforced by the forest service mainly in the woodland savannah (Miombo). The same order was also found to influence farming households' perception of tree ownership in the lake zone of Mara Region. (Article II and III). Farmers were unsure that the trees they plant on their land were theirs, and if they would be allowed to harvest the trees when they have matured.

People in Mara also believed that trees should in general not be planted on arable land because they reduce crop production, which is true for many tree species. This local belief was further reinforced by the condition for obtaining improved crop varieties. After more than three years in operation, the ViAFP project discovered that the government extension service told farmers that seeds of improved crop varieties would not be distributed to farmers with trees on their cropland (Article II and III). Hence, instead of

being complementary, distribution of improved crop varieties came to be in conflict with agroforestry development – and the activities of the ViAFP project came in conflict with the government extension service. The conflict was solved through improved collaboration with the extension service. But to change the belief among the farmers took time and required the involvement of leaders and adaptive research. Furthermore, households and extension staff had general belief that trees should only be replaced after they have matured and harvested.

Legislation against exotic species is more common as compared to indigenous species, particularly against the genus Eucalyptus. In Kenya the "prohibit the introduction of any part or plant specimen, whether alien or indigenous, dead or alive in any river, lake or wetland". This is further elaborated in the KFS (2009) guideline to the environment Act (article 42, paragraph 1d) that trees, especially eucalyptus, ought not be planted in "wetland, marshy areas, riparian areas (areas around lakes, ponds, swamps, estuary and any other body of standing water)" Otuba (2012). Similarly, the regional government of Tigray banned the planting of Eucalyptus on farmlands in 1999 with the aim to reduce the negative environmental consequences associated with Eucalyptus and to increase food production (Jagger & Pender 2000). In South Africa, eucalyptus plantations has been removed from the riparian zones (ICRAF, 2006) to promote natural forests and grasses with the motivation that they use less water to regenerate. Similar actions are under consideration in Uganda and Rwanda (Jagger & Pender 2000, Nduwamungu et al. 2007, Oballa et al. 2005). These policies were developed following a claim that Eucalyptus consumes excessive amount of water, thus causing water bodies to dry out (Otuba 2012). The issue of Eucalyptus is controversial, and it is possible to find scientific evidence for and against its effect on the environment.

These are example of how incompatible policies formulated at national level can restrict the scaling up process at local level. Households become confused and uncertain about what is right and wrong, which increase their perception of risk in relation to tree establishment. A majority of the households in Mara believed that all trees belonged to the government regardless of species, who established them and where. The conflict between the distribution of improved crop varieties and agroforestry also obstructed households' understanding of the benefits of agroforestry to food production. Considerable time and collaborative efforts were needed to solve these conflicts between policies, beliefs, and extension messages, i.e. to change the perception among the smallholders in Mara. These inconsistencies obstructed the scaling up process and the actual integration

of tree establishment and management into the farming system as integral activities in the seasonal farm calendar (Article III).

Due to lack of collaboration and a holistic perspective in research and policy formulation, poor communication and collaboration; extension messages and information provided to the smallholders are incoherent. Such contradictions increase farmers' perception of risk in relation to long-term investments. Issues widely recognized to be critical to adoption of agroforestry, such as risk and uncertainty, the impact of labour, and market or tenure policies, have rarely been investigated (Mercer et al. 1997, Pattanayak et al. 2003). The food insecure live under a wide range of uncertainties and risks. With their time constraint and negative margins it is understandable that investments for long term gains have a low priority in their plans. What is needed is to build their capacity to handle these uncertainties and risks and to really know what is right and wrong in relation to the policies that govern their access to livelihood assets. Inconsistencies in this respect seriously impede the scaling up process as it limits the possibilities of the food insecure to optimize the combinations and integrations of agricultural and perennial crops for improved and diversified food and fodder production. It impedes the smallholders' possibilities to improve the value of their assets and to improve social, economic, and ecological sustainability of their subsistence system.

4.1.7 Changing Climate

Members in all of the eleven CBFG studies by Johansson et al (Article IV) perceived the changing climate and its consequences as a risk for the future development of the group and their livelihood. Apata et al. (2009) found the production of arable food crop to be seriously affected by recent change in the local climate in south western Nigeria. They (ibid.) highlighted the lack of response to the change and the need for policy, social, agronomic, and technical interventions. The perception of climate change among apple growers in north-western India is shaped by their broader historical relationship with the environment as well as the local knowledge of crop-climate linkages (Vedwan 2006). As a consequence of persistent crop failure the apple growers have started an association to enhance their bargaining power in the market to improve their income. In Zimbabwe, Grothmann (2005), showed how farmers are unwilling to adapt to variation in climate even though they are provided with good quality weather forecasts before they plant their crop. Most farmers choose to continue with the preferred crop (maize) even though the forecast tell them that they should plant a more drought tolerant crop (millet). With increasing

extension efforts, farmers have started to use the forecasts in their farming decisions.

These experiences of climate change indicate that the failure of the wealthier part of the world to reduce their GHG-emission has had negative effect on the livelihood and perceptions of people living in localities very far from the main source of the problem. The changing climate with increasing frequency and amplitude in variability increases the need for interventions that improve the adaptive capacity, particularly for the most vulnerable. Although the changing climate has had serious implications on the natural capital with negative consequences on the human, physical, and financial capital, it generates motivation and opportunities to improve social capital, as in the case presented by Vedwan (2006), (i.e. farmers associations), and physical capital exemplified by the case of Grothmann (2005, i.e. weather forecasts being available to smallholders). Brondizio, Ostrom & Young (2012) highlight the importance of social capital to facilitate cross level environmental governance for ecological resilience. From the perspective of the SLA the importance of social capital in the building of livelihood increases with increasing vulnerability. The apple growers' response to persistent crop failure in north-western India was to form an association to increase return of their natural and human capital (Vedwan 2006). Cash et al. (2006) stressed the need to build social capital (including institutional capital) that improves knowledge coproduction, negotiation, and mediation capable of managing complex interlinked systems. The development and facilitation of high quality and location specific weather forecast with and for smallholders in Zimbabwe is a good example of such knowledge coproduction and mediation. The examples from Nigeria (Apate et al. 2009), India (Vedwan 2006), and Zimbabwe (Grothmann 2005) show the need of interaction between different forms of capital – how social including institutional capital can develop in respond to changes (in these cases to climate change) and generate physical and financial capital that improve the value of human and natural capital as assets for improved livelihood. In this view, the social (and institutional) capital developed through the CBFG (Article IV) and the collaborative learning process described in Article III, represent practical solutions through which the food insecure households can be involved in knowledge coproduction, negotiation, and mediation for managing the complex interlinked systems in which their subsistence systems are entangled to improve its social, ecological, and economic sustainability.

4.1.8 Lack of Democratic Legitimacy of CBFG-Executives

Most of the CBFGs presented and analysed in Article IV were found to have problems of leadership. This has also been reviled in other studies (e.g. Molnar et al. 2007 and Shively et al 2010). One important cause being the poor education among ordinary members in relation to that of the executive members. The executive members were overwhelmingly comparatively well educated men. In some cases the executives were found to be the only members in the CBFG with sufficient education and skills to take on the qualified tasks they were elected to carry out. Most of the ordinary members and in particular the poorest members were found to lack self-confidence, education, and skills to be considered in the election process to positions in the executive committee of their group. There was no strategy or structure found among the studied CBFGs to gradually improve member and gender equality. As a result, the executive in these CBFGs were often re-elected even though there were signs of mistrust between ordinary members and the board indicating lack of actual democratic legitimacy of the executives. In the worst case scenario, ordinary members may become demoralized and exploited rather than empowered.

Without specific interventions, efforts aimed at empowering the poor may end up to mainly benefit the local elites. Three factors have been suggested to be vital for generating outcome that lead to sustainable livelihoods for poor people (see Manor 2000), i.e. bodies elected at lower levels need to have:

- adequate funds
- adequate power,
- functional mechanisms that ensure accountability of elected representatives to citizens and that of lower level bureaucrats to elected representatives

Even if these three factors were identified for the public sector they are also important for civil society organisations.

The capacity of the groups to improve their financial capital was in most cases weak. The devolution of power to the groups from government authorities to control and benefit from the natural capital was fragmented with time limits and unsettled agreements. Even though the constitution of all CBFGs included in the study (Article IV) stipulated a rotation of executives with clear term-limits it was not functional in some cases due to the problem mentioned above. Several studies have demonstrate the need for community based participatory arrangements that can ensure equitable benefit sharing and sustainable development among forest dependent

communities (e.g. Forsyth, Leach & Scoones 1998, German et al. 2010, Shiferaw 2006). Hence, there is an urgent need to strengthen the social and human capital among the CBFGs for them to develop into organisations that are capable of contributing to equality and a resilient subsistence system that improve the livelihood of their members.

4.2 Bridges: Opportunities and Strengths

4.2.1 Improving Policy Environment for CBFM

Members and partners in eight of the eleven CBFG are included in the study presented in Article IV regarded the improving policy environment for CBFM as an important opportunity for the future development of their group. One result of this development, together with decentralization policies and local needs, is that CBFGs are becoming increasingly common in eastern and southern Africa; (FAO 2011, Odera 2004).

Community-based and participatory approaches to management of natural resources and forests are supported in international processes and documents, including the Forest principles and Agenda 21 (UN 1992), the Convention on Biological Diversity (CBD) 1992, and the processes within the United Nation Forum of Forests (UNFF). At the regional level, in eastern and southern Africa, initiatives that encourage the creation of CBFGs include the Africa Forest Law Enforcement and Governance, and the Southern African Development Community (SADC) forestry protocol.

Many countries in eastern Africa have adopted policies at the national level that open the way for community forestry and the establishment of CBFGs (Molnar et al. 2007, CIFOR 2008,). In Ethiopia, local communities hold power in joint management arrangements with district authorities. Legislation in Uganda includes explicit statements concerning collaboration and partnerships between government and communities. In Tanzania, CBFM is included in the formation of Village Land Forest Reserves (VLFRs) and the Forest Act. Kenya government authorities require smallholder and communities to be organised into CBO for them to receive user rights in national forests. In Zambia local joint forest management involving CBFGs is included in the Forest Act. However, the execution and success of these policies at the village level has varied (FAO 2011, Odera 2004).

The global policy processes have contributed to regional and national policy change. The global and regional policy processes have been an important driving force behind the national policy development in favour of CBFM. The increasing number of CBFGs that has developed as a result of

these policy processes, holds good opportunities for forest dependent food insecure communities to manage their natural capital more sustainably, contributing to improve social, ecological, and economic sustainability of their subsistence systems.

4.2.2 Improving Transport and Communication Infrastructure

In Article IV, members in eight of the eleven studied groups and their partners regarded the improving road infrastructure as an important opportunity to their future development. A total of US$ 45 billion a year is spent on infrastructure development in Africa. The largest share of US$ 29.4 billion is contributed by the public sector (US$ 9.4 billion in investment and US$ 20.4 billion in operation and maintenance). The private sector invests US$ 9.4 billion and US$ 3.6 billion is contributed as overseas development assistance. Infrastructure investments in Africa contributed from countries outside OECD amount to US$ 2.5 billion (Foster & Briceño-Garmendia 2010). Still, Africa's infrastructure is in general lagging behind that of other developing countries. One reason for this is the relative low rate of urbanisation (35%) and population density (36 people per square kilometre).

The information and communication technology (ICT) has improved tremendously over the last two decades worldwide and also in Africa. With decreasing costs, mobile phones and network have become accessible even to the rural poor. In Article IV, It is shown that CBFG members and their partners in eight of the eleven studied groups listed improving communication infrastructure as an important opportunity for their future development. Reforms in the mobile segment have transformed access, quality, and cost of information communication across the whole continent in less than ten years. Mobile network coverage is above 90% in urban areas and is growing fast in the rural areas (Foster & Briceño-Garmendia 2010).

Global to local economic interests has been the driving force to make this physical capital available in the rural areas. The progress in infrastructure has improved the access of the rural poor to education, markets, health, and service in general. It improves their access to alternative productive opportunities (Estache 2003). López (2003) suggests that the development of infrastructure can have a positive impact on the income and welfare of poor people over and above its impact on average income. One important reason is that improved infrastructure reduces transaction cost and production cost (input) (Gannon & Liu 1997).

In Argentina and Brazil, access to roads and sanitation has proved to be a decisive factor for income convergence in the poorest regions (Calderón & Servén 2004). Improved road access to the market has also been found to improve the value of the assets of the poor (Jacoby 2000)

The growing availability of ICT in rural areas is a critical key in the building of the entrepreneurial capacity, access to markets, and market information of the rural poor. The improving access will in general extend the social capital, and access to informal education will build the human capital. Improved road access to markets will contribute to lower the cost of input, and access to market information contributes to improve the capacity of the poor to bargain for a better price for their product.

Hence the growing infrastructure in Africa, notably ICT and transport, holds a great potential for the poor to improve the economic return of their natural and human capital. This in turn, improves their capacity to make investment to improve productivity and efficiency.

However, without strong and transparent organisations, there is still a risk that this opportunity may be controlled by financially and socially stronger actors. There is worldwide evidence of how the vulnerability of the poor, their urgent needs, lack of education, and social capital is exploited by powerful businessmen and corporations (see 4.1.6. above). There are examples of how roads constructed into previously inaccessible areas have resulted in deforestation and ecological degradation of forests. People, organisations, and institutions act on national to global scale changes in policies and economic opportunities (Geist & Lambin 2002). Geist & Lambin 2002 argue that agricultural expansion, wood extraction, and infrastructure are the most important causes to deforestation

4.2.3 Growing Demand for Forest Products and Interest in Plantation Forestry

The most important driving forces behind long-term global demand for wood products include (FAO 2009):

- Growing world population: the world's population is projected to increase from 6.4 billion in 2005 to 7.5 billion in 2020 and 8.2 billion in 2030.
- Global economic growth: global GDP is projected to grow from about US$ 65 trillion to almost US$ 100 trillion by 2030.
- Change in environmental policies and regulations will exclude forests areas from wood production.

The interest to invest in forestry has increased considerably over the last ten years. The strong physical asset base makes forestry attractive for investors in times of financial uncertainty. The rate of value increase of

trees and forest plantation is fairly in line with pension fund liabilities. As an example, the annual returns of the US Timberland Investments have averaged 14.9%. For more than 20 years, forestland has surpassed the broader equity markets. Because of its relatively low volatility, forestry also enjoys better risk-adjusted returns. Another important advantage of forestry is that its returns are uncorrelated with investments in other asset classes. This economic logic is an important reason behind the rapid afforestation in China, Europe, the USA, India, and parts of South East Asia (Campanale 2009)

An important driving force behind the growing interest to invest in forest plantation in the South, is the increasing demand for bioenergy and potential for carbon credits (Mercer et al. 2011, Westholm et al. 2009, Anon. 2008b). Members in six of the eleven studied groups presented in Article IV and their partners regarded carbon trading and credit as an important opportunity for their future development. As agroforestry holds a genuine potential to contribute to climate adaptation, mitigation trading of the sequestered carbon could be an additional opportunity for economic benefit for the rural smallholders (Nair 2010). It is unlikely, however, that carbon credits on its own will motivate smallholders and forest dependent communities to establish, as well as keep and protect trees and forest on a wider scale. Though, if envisage in relation to the other opportunities discussed above carbon credits may just be what is needed to make the boll roll for a better livelihood for forest dependent communities.

However, to secure social, economic, and ecological sustainability of these efforts' external interests and access needs to be regulated, and the capability and rights of the poor improved and protected. Elson (2012) present a concept for this regulation, enabling investments to strengthen the local people, i.e. "Investment in locally controlled forest". Without such interventions there is a considerable risk that the outcome of these growing opportunities will fail to benefit the poor (Elson 2012).

4.2.4 Action Research for Socioeconomic and Technical Adaptation

In collaborative knowledge production researchers work with practitioners to solve pressing problems that emerge in the practical work. This is similar to action research (McNiff 2013), which is:

- contextual and small-scale, identifying and analysing problems within a specific situation.
- participatory as it uses collaborative analyses by teams of practitioners and researchers.

- evaluative and reflective as it aims to produce change and improvement in practice.

In the eastern province in Zambia, farmers involved in agroforestry through the Sida financed SCAFE (Soil Conservation and Agroforestry Extension) program complained over the poor survival rate of tree seedlings. A lot of labour was used for weeding, fencing/protecting and watering of seedlings after field-planting. A proposal and design of an experiment was made with farmers, extension service, and researcher. As smallholders normally produce only a few seedlings each season (20-200) and the transport distance from nursery to planting site is usually short, it is easy for them to apply different treatments in the nursery as compare to larger commercial nurseries. The variation in site conditions between different planting sites in agroforestry is considerably larger as compared to conventional forestry. Hence, matching seedlings to conditions on the planting site is more important as compared to conventional forestry. Furthermore, the small number of seedlings produced per season in combination with the limited land available to the food insecure, makes it possible for them to know in advance where seedlings are to be planted. To this end, experiments were established using different combinations of levels in cultivation time and stock density in the nursery. This produced seedlings of different size in relation to container size; from large seedlings with a small container to small seedlings with a big container as well as large seedling with large containers, and small seedlings with small containers. This rang of nursery treatment was then tested in the field on productive and weedy sites and on sites with exhausted soil and less competition from weed. The result of this research is presented in Johansson (2001) showing that survival and initial growth rate of tree seedlings can be improved if the combination of cultivation time and stock density/container size used in nursery is optimised to match the conditions on the planting site. With a faster start, seedlings can reach a stage at which they can withstand the stress from pests and browsing animals much sooner and with less labour input, as compared to seedlings that are produced without consideration of site conditions on the planting site. This is one example to illustrate the potential of collaboration between development practitioners, smallholders, and researchers to improve effectiveness and sustainability local subsistence systems.

5 General Discussion

5.1 Method Discussion

The The theoretical and analytical frameworks used in the thesis have been developed from those used in the included articles (Article I-V). The Sustainable Livelihood Approach (SLA) has been used as the main approach in the analysis. Sustainability and sustainable development is central to SLA. Later contributions to develop SLA, have also introduced resilience and socio-ecological interaction to the approach (e.g. Brondizio, Ostrom & Young 2012). One important reason for using SLA for the analysis of barriers and bridges to the scaling up of agroforestry and community based forestry among food insecure natural resource dependent communities, is its attribute to nuance and problematize the context of livelihood, sustainability, and development with its interactions. Ashley and Carney (1999) express this as the analysis of livelihoods as a place within a holistic framework covering institutional and policy processes at different levels. With the addition of resilience, this quality of SLA has been strengthened and expanded to clarify the ecological aspects and relationships of sustainable development. The SLA also helps to understand the need for a holistic approach, in which the building of social and human capital and capability is emphasised in development (Chambers & Conway 1992), as compared to disciplinary approaches, notably in economics, that most often focus more or less exclusively on economic growth (Ellis 2000).

Policy narratives are, as has been shown in Article I, important to the development cooperation and sustainable development context. Negotiation is one way in which policy narratives, the logics and policies of government donor agencies, and NGOs influence sustainable development. The scaling up process of agroforestry and community based forestry for the food insecure is multidimensional and involve different sectors and

multiple levels of governance. Additionally, the landscape approach is a good framework for understanding and solving complex problems that involve multiple scales and levels. Another reason for me to use the landscape approach is my practical experience from the scaling up process in Mara region, Tanzania with the ViAFP. A conventional extension strategy for scaling up developed out of necessity into a collaborative process including different scales and level.

5.2 Context and Interactions

5.2.1 The Degradation Trajectory

Eight critical barriers were identified that had a negative influence on the scaling up process and its goal of social, economic, and ecological sustainability. At the international level, donor policies and the GDA-NGO negotiation process for funding, may delay critical NGO policy changes that could have improve effectiveness and the impact of the funds received. The negative effect of climate change is identified among all CBFGA as a critical barrier to their development. At the national and sub-national scale the lack of education, time, and secure land-tenure among the food insecure, is a fundamental impediment to social and economic development that also has an indirect negative effect on ecological sustainability. Lack of market access among the poor and lack of regulations that limit the exploitation of their vulnerability are national level barriers that have a negative impact on economic, social and ecological sustainability. Contradicting policies, uncoordinated extension approaches and messages, and unsecure land and tree tenure increase actual and perceived risk of long-term investment with a negative effect on adoption and ecological sustainability. Ultimately, poor adoption will also keep food insecure households from gaining benefits connected to the potential economic and social benefits of agroforestry and community based forestry. Lack of education and time also has a negative influence on the food insecure households' ability to be involved in community based organisations.

Brondizio, Ostrom & Young (2012) highlighted the challenges facing environmental governance due to the increasing connectivity of resource-use systems and the increasing functional interdependency of ecological and social systems. The poorest farmers are usually tilling the most exhausted and marginal land in a village. In the case of the Mara region lake zone, an increasing population and demand from growing urban areas for energy (charcoal) and food, result in increased pressure on the natural capital available to the poor. Still with the unfair share received from

middlemen most of the potential increase in profit is exported out from the villages and the landscape. Continuous cultivation on arable land and uncontrolled grazing, cutting of trees and shrubs on communal uphill lands, increases in line with the tragedy of the commons (Ostrom 1990). This leaves the soil bare and prone to degradation (see Figure 6). As the soil becomes increasingly exposed to the sun, soil temperature increases as well as the turnover of organic matter (Tan 2009, Young 1989). During heavy rain the soil structure starts to deteriorate, resulting in decreased infiltration and water holding capacity (Hudson 1995). As a consequence, overland flow increase and the nutrient rich topsoil is gradually washed away. The severity and speed of this process increases with the increasing water volume velocity downhill (Hudson 1995).

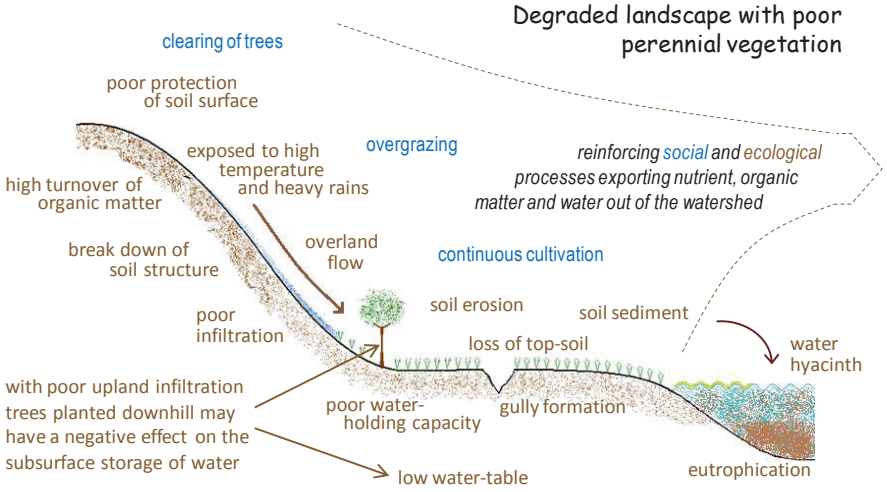

Figure 6. Schematic illustration of the negative social and ecological interaction causing degradation in the Mara lake zone landscape, Tanzania

The eroded soil ends up suspended as sediment in Lake Victoria. This severely increases eutrophication of the lake and results in uncontrolled growth of the water hyacinth, which in turn, decrease oxygen levels in the water. This has a negative effect on the fish populations in the lake (Timmer & Weldon 1967). Hence, the production of crops, fodder and fish decrease, which in turn forces the food insecure smallholders to cultivate their land continuously without fallow. With decreasing uphill resources of fuel wood and grazing, crop residues and cow dung becomes an important source to satisfy the household need for fodder and firewood.

These examples illustrate the viscous circle of interaction between social and ecological systems, which is further reinforced by the increasing severity and frequency of rainstorms and prolonged droughts due to climate change (Toulmin 2009). Still, even though the food insecure may observe these negative interactions, they are left with few other options than to continue their course of action. This is because of their constant struggle to fulfil their most urgent needs, as well as their lack of capability. Unsecure ownership and user rights, together with incoherent policies, extension niches, and beliefs increase households' perception of risk of failure in long-term investment, which also influence their motivation to be engaged in CBFM, agroforestry, and soil and water conservation. The strong negotiation power of local middlemen in relation to that of the food insecure also contributes to increase the risk and decrease motivation for long-term investments. The most serious barrier that is keeping the food insecure from being involved in the enabling efforts and community-based organisations like the CBFGs, is their low level of education and lack of time. Hence, taken together these barriers contribute to keep the poor trapped in a vicious circle of degradation, and lack of food and time - poverty becomes the cause as well as the effect of environmental degradation (Murphree, 1993, Dasgupta 1997, Moseley 2001).

5.2.2 Turning to a Sustainable Trajectory

Both the study of the Mara project (Article II and III) and the study of the eleven CBFGs (Article IV), show that barriers often lie in the institutional and social-cultural contexts. To handle and solve these kinds of barriers requires a deeper understanding of the dynamics of the adoption processes of the respective study areas (Pollini 2009, Ajayi et al. 2007). In the decision to continue using a technology or not, lies not only biophysical, technical and economic considerations, but the prevailing socio-cultural contexts such as customs, obligations, beliefs, and supportive governance (policies and enabling investments) are also important. Variation in this respect within a project area and the multiple interactions make extension work demanding. Efforts and involvement beyond the project itself is required in order to adapt and integrate interventions and practices into the local subsistence systems. A number of studies (e.g. Franzen et al. 2004, Cooper et al. 1996, Franzel & Scherr. 2002, Place et al. 2002, Sanchez 1995, Pollini 2009, Mercer & Miller 1997, Pattanayak et al. 2003, Ajayi et al. 2007, Kiptot et al. 2007, Mercer 2004, Tesfaye 2011) show how these complex challenges affect dissemination and development of interventions

with the dual objective to halt degradation and improve livelihood such as agroforestry and community based forestry.

Considering the lake zone in Mara as an example, CBFM can help to change the degrading course on the uphill communal land and agroforestry on the downhill farm land. However, the way in which these practices are promoted and established is critical to the social, economic, and ecological sustainability of the process. The scales and levels involved, sequence and pattern in which the practices are introduced and established are vital, in addition to the methods used for awareness creation, capacity building, technology development, adaptation and integration, organisational development and institutional integration.

As tree litter contain slow, intermediate, and fast decomposing matter, its contribution to soil organic matter and physical properties of the soil is more enduring compared to herbaceous non-woody plants (Figure 7)..

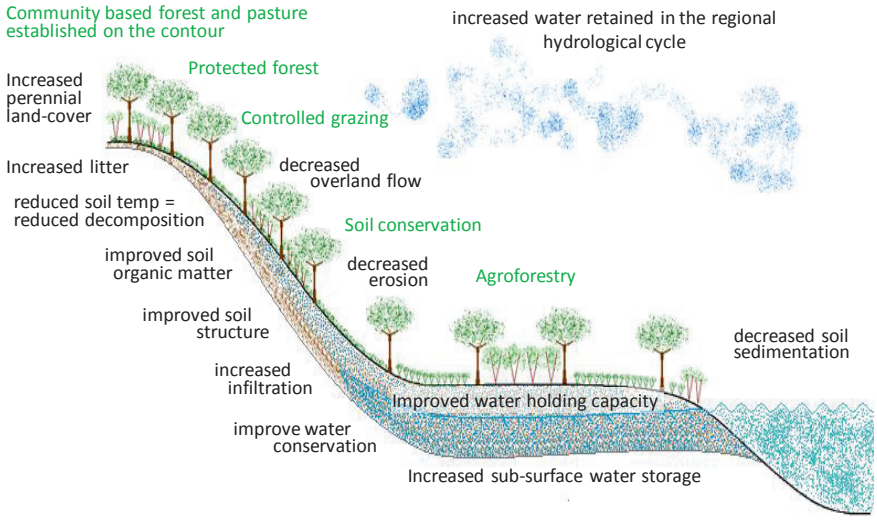

Figure 7. Schematic illustration of the positive social and ecological interaction in a landscape resulting from involving households in community-based forestry and controlled grazing, to protected forests uphill and integrate agroforestry, soil and water conservation in their farming systems.

Improved physical properties, like soil aggregate structure and porosity, enhance infiltration and water holding capacity of the soil. Increased infiltration results in less overland flow and increase sub-surface water storage. A more stable soil structure and decreasing overland flow will in turn decrease the erosion of topsoil. A more favourable soil condition with higher content of organic matter and water improve soil micro fauna and flora. With the complementary effect of nitrogen-fixing trees, these

improved conditions recover and increase supporting habitat for different species. Depending on density, species, and local conditions, trees can contribute to improved undergrowth, and soil and water conservation

However, if trees are planted without consideration of landscape and watershed characteristics, the expected benefit may be turned into negative results. Trees planted in the wrong place in relation to sub-surface water flow and storage may lower the water table and decrease the available water for other more shallow-rooted plants, e.g. food crops, having a negative impact on local livelihood. On the other hand, with these concerns considered in the planning and establishment of trees, afforestation and reforestation, the effect on above ground and sub-surface water flow and storage can be considerably improved. Infiltration will increase when trees are planted in rows or stands along the contour, starting uphill moving downhill. The positive effect can be further enhanced with live fences and perennial fodder strips established along the contours together with the introduction of controlled grazing. A growing and expanding perennial vegetation cover increases above and below ground carbon sequestration. Connectivity between biotopes should also be considered in the planning and establishment of contour forest and woodlots as it will contribute to habitat functionality and thus biodiversity conservation.

Without a holistic perspective, considering social and ecological interactions with a landscape or catchment perspective, scaling up ‘sustainable practices’ among the food insecure may end up being unsustainable regarding ecological, social, and economic terms. It is easy to go for solutions that produce visible and obvious results, and that satisfy donors requirement and the urgent needs of the poor with less consideration on how the implementation affect sustainability in the long term - just as ViS’s initial implementation strategy (see 4.1.1.). Another example is the dissemination of improved high input crop varieties including inorganic fertilizer and pesticides that may increase production temporarily. The dry spells that occurs with increasing frequency (due to climate change) after the onset of the rainy season, is one of the most serious reasons to the lack of food among the food insecure. This is because the poor are most often left to cultivate land that is marginal to arable production. Their soils are exhausted with almost no organic matter or fine texture particles that can hold water to bridge the dry spells. Although, the addition of soil nutrients is critical for sustainable production increase, its effect on food production will be considerably limited without improving the water-holding capacity of the soils under the serious conditions of which the poor operates. When it comes to nitrogen it is more economically viable to use nitrogen fixing

plants or farmyard manure, which also contributes to improve soil organic matter and thereby improving the critical water-holding capacity. With improved water-holding capacity the water contained in the soil decreases the risk for crop damage during the dry spells. Phosphor is also a critical limitation to food production on exhausted soils. There are large deposits of rock-phosphate in East Africa that can contribute to solve this barrier without the need for foreign currency, i.e. a more sustainable solution.

Insufficient education is the most critical barrier that keeps the food insecure in poverty. This barrier is further aggravated by the lack of time they have to engage in activities that can improve their situation. They are caught in a daily struggle to obtain their most basic needs. This is particularly true for women. Together these two facts becomes a basic and general impediment for the food insecure to improve their livelihood. Therefore it is critical that any effort to improve their situation takes this into account and start stepwise with interventions that:

- are easy to learn,
- give benefits as soon as possible,
- contribute to cover the most critical needs,
- have the highest possible rate of success,
- are viable in the long term, and
- could be complemented with additional steps that works even better for long term sustainability.

To elevate education among the food insecure is an extensive and demanding mission that takes decades before tangible and long-term sustainable livelihood improvements can be achieved. Because collaborative knowledge production is a process that involves different dimensions and sectors in the development process to progress towards multiple aims simultaneously, tangible impact can be achieved much sooner. Collaborative knowledge production brings all stakeholders involved with the food insecure households together to formulate and work on a common course of action for their development. This gives them a perceived and actual collective coherence that will motivate an increasing number of households to take their time to participate. Knowledge, solutions and practices will be produced with them to address their urgent and long-term needs and problems.

The involvement of policy makers, and official and unofficial leaders makes it possible for them to understand the need and the situation of the food insecure, as well as the barriers that hinders their development. In the Vi AFP case, many important barriers could only be discovered and handled or solved when collaboration had been improved (see Figure 8),

such as conflicting policies, extension messages and beliefs. Long (2001) and Long & Long (1992) have argued for the importance of interactions between people, technologies, and institutions to avoid conflicts. Sanginga et al. (2007), Sood & Mitchell (2009) have stated that good collaboration improves coordination of the activities of different stakeholders streamlining extension, adaptive research and extension messages

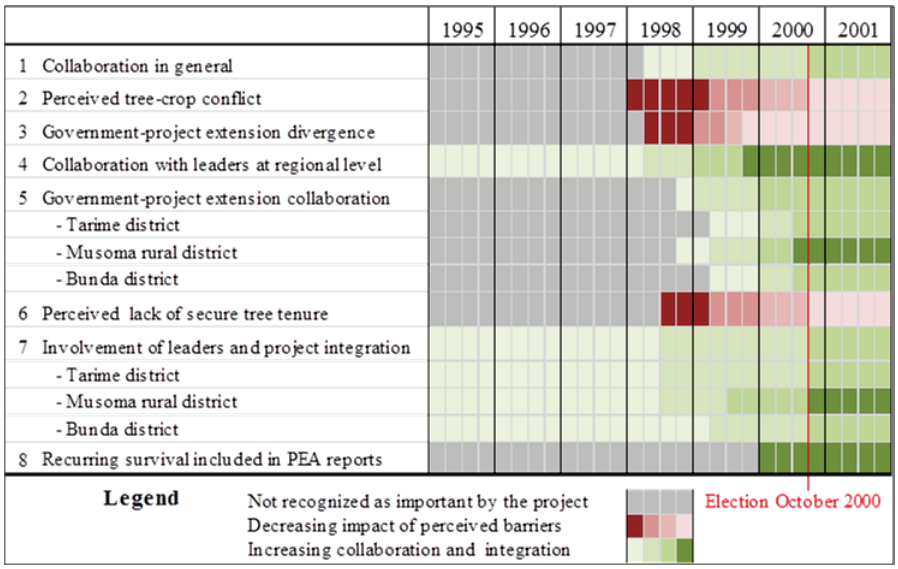

Figure 8. Changes and chronology of perceived barrier, project intervention and collaboration during the scaling up process of agroforestry in Mara region.

The perceived lack of tree tenure among farming households had its origin in the Forests Reserved Trees Order Anon (2013), which originally aimed to restrict the cutting of certain high quality timber species in the Miombo woodland. Politicians, traditional leaders, and government extension all had to agree and bring the same message to households in order to convince them that the trees they plant on their land are theirs. Similarly, the disagreement between project extension and government extension concerning establishment of trees on arable land, reinforced the perceived conflict between trees and crops among farming households. The effect of this conflict could gradually be solved through improved collaboration between government and project extension. On-farm experiments were established with pilot households through the involvement of the research team from ICRAF field station in Shinyanga. These experiments demonstrated the advantages of agroforestry, including

the benefit of soil improving trees to food production, not only to the households but also to politicians, other local leaders, government officials, and project extension staff.

Through the collaborative learning process, important, simple, and appropriate solutions were invented and developed, decreasing the actual and perceived labour cost and risk. One example is the use of cassava fields to protect and harvest water for tree seedlings. As a crop of cassava remains in the field considerably longer than other crops, seedlings planted in a cassava field are protected from post-harvest grazing for a much longer period compared to seedlings planted with other crops. Tree seedlings were planted in relation to tied ridges using the furrow for water harvesting. Timing and spacing of soil improvers in relation to different crops and weeding practices were also optimized in the collaborative process, involving the perspectives of farmers as well as agricultural and agroforestry researchers, and extension services. This way, compatibility and synergies between the tree component and other components of the local subsistence systems were gradually enhanced and became more evident to the farmers.

It is through collaborative knowledge production that opportunities can come to benefit the food insecure households. All involved bring in their expertise in the collaborative process (Daniels & Walker 2001, Cheng & Fiero 2005). To build partnership for constructive collaboration and mutual learning, requires trust and understanding among partners. Inequalities in power and capacity need to be dealt with, i.e. by building equity through empowerment and acceptance (Lickers & Story 1997, Holmes et al. 2002, Pollock 2004). To build the required trust and equality needs patience and time (Borrini-Feyerabend et al. 2004). With this, new knowledge and solutions can be produced in which the capacity, values, and locally based experience of the food insecure becomes incorporated. Knowledge production is according to Carlsson (2008) both the production of new knowledge and local capacity building, including learning about the needs and interests of different stakeholders. To build interconnectedness beyond the local level with regional, national, and international levels, a neutral platform is required. Knowledge production, sharing, and scaling up can then be pursued with a genuine representation of the food insecure households, including pilot households that represent the different conditions in the landscape (see Figure 9). In the ViAFP case of Mara, a collaborative platform was established at the Mara regional level. All stakeholders agreed on integrated soil fertility management to be the

defining framework (Nowotny 1999) for the knowledge production process in Mara.

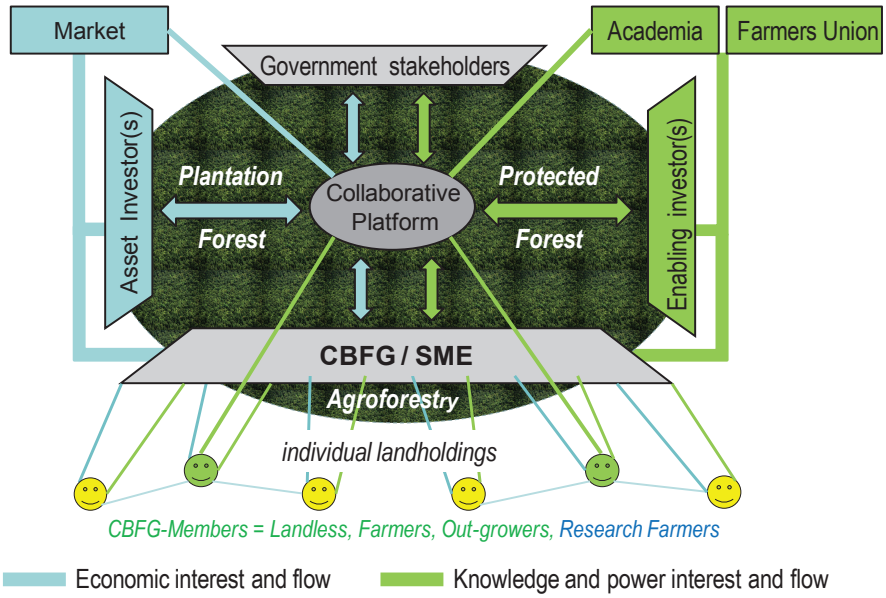

Figure 9. A Schematic illustration of a multilevel social learning and governance platform including civil society, government, market and academic stakeholders in collaboration with the food insecure through their community based forest group (CBFG)/Small medium enterprise (SME).

Four hundred farmers had on-farm experiments established on their land in 40 villages across the ViAFP project area in year 2000. Farmers had designed the treatments of the experiments together with the researchers, the project and the agricultural extension service. The main purpose of these experiments was to find optimum combinations of soil improving shrubs of different species with the common crops in Mara region. Planting time and spacing of soil-improvers and crops was varied in the different treatments. Optimising the combination of cultivation time and spacing of seedlings in home nurseries to match different site-conditions (see section 4.2.4. above), could also be perused in this collaborative set up.

Researchers connected to such a platform can also follow the development process, using learning through on-going evaluations (Svensson et al. 2002, 2009) that facilitate and support participants work to develop socially, economically, and ecologically sustainable solutions and practices. When there is a need for external input of knowledge, the academic actors will bring in and present this knowledge from similar

situations, analyse possibilities for synergy and settle trade-offs between urgent needs and long-term social and ecological sustainability. There might also be issues identified during the work, such as the role of women in the process. This can then be studied by the evaluators and prepared for a discussion in analyses seminars. The outcome of the evaluation will provide critical information to donors, enabling and asset investors. With this information the process can be judged, and the need for top-down governance intervention decreases considerably. Instead higher governance levels have an opportunity to gain in tacit and real knowledge. With this neutral and regular information feed, the policy incompatibility dilemma of government donor agencies and NGOs explained in section 4.1.1. can be resolved. The NGO will be more enabled and free to adapt to the need of its beneficiaries and local conditions. It will also significantly contribute to improve transparency and downward accountability. Neutral information about the development process will contribute to make coercive negotiations distributive. Brondizio, Ostrom & Young 2012 stress the need for monitoring systems that can provide continuous and timely feedback of changes, and contribute to make use of adaptive processes. This is particularly important in social-ecological systems with a high level of functional interdependence characterised by tipping points that may trigger rapid nonlinear changes if surpassed. In situation as that of the food insecure, with no or negative livelihood margins, it is important to be able to foresee such changes in order to respond promptly, particularly in environments prone to climate change.

Vi AFP managed to scale up agroforestry to almost 20,000 households in the Lake zone of Mara Region with surviving evidence on their farms. One of the key success factors was the approach of collaborative governance and learning, involving local leaders, government extension service, adaptive research team, and other NGOs (Articles II and III). The social capital that was gradually developing critical barriers to the scaling up process, could be collaboratively solved. Agroforestry interventions were integrated with the improved technologies promoted by the agricultural extension service and with interventions for soil conservation. The ultimate aim of the social learning process is that the community will learn how to steer development towards agreed sustainability targets (Leeuwis & Pyburn 2002, Keen, Brown & Dyball 2005, Wals 2009). The resulting interventions contributed to improve ecological and social sustainability. The social capital and capabilities gained through their involvement in the process, opened up a new dimension for the food insecure to use their land and labour.

Four bridges were identified and analysed (in section 4.2. above) in relation to the adoption and scaling up of agroforestry and CBFM in eastern Africa:

- Improving policy environment for CBFM.
- Improving transport and ITC Infrastructure.
- Growing demand and interest for forest products and plantation forestry in the South.
- Adaptation of nursery management to site conditions.

These bridges represent opportunities for successful scaling up towards social, economic and ecological sustainability. However, the question is if these bridges will contribute to improve the livelihood for the food insecure and halt environmental degradation and climate change

Those who have the capability to simultaneously take the best advantage of the growing demand for wood and NWFP products, carbon credits, and improving transport and communication infrastructure, will be the most successful. The food insecure households have in addition a number of barriers to overcome for them to succeed as entrepreneurs. The enabling policy environment for CBFM that is growing in many African countries is an obvious opportunity for the food insecure households to improve their livelihoods through community based forestry and agroforestry, while improving ecological sustainability. This requires, however, that these enabling policies are genuinely and consistently implemented. If the growing global interest for investment in forest plantation in the South will help or hinder sustainable development for the poor, depends on the implementation of enabling policies and investments for CBFM and agroforestry development.

The landscape approach has so far not been seriously practiced in a large scale over a sufficient time span for the scaling up of agroforestry and community based forestry to tangibly alleviate poverty and ecological degradation. The Mara case presented in Article II and III is an example of an approach that is on its way to becoming something similar to a landscape approach. Negative interaction had started to shift into positive integration between human society and nature. However, due to change of management the vertical process was blocked prematurely before the established collaboration had become locally institutionalised as social capital. The most viable learning experience of the Mara case is how the approach grew out of local necessity to solve barriers that hampered the scaling up process (Figure 8). In the regional forum, that was formed to coordinate the diverse development efforts in Mara, all agreed to work under the common theme of integrated soil fertility management.

The experience from Mara and many other studies (Ostrom 1990, Long & Long 1992 Daniels & Walker 2001, Long 2001, Sanginga et al. 2007, Sood & Mitchell 2009, Pollini 2009), show the importance of a collaborative and holistic approach, including the landscape approach (DeFriesa & Rosenzweig 2010, Sayer et al. 2013 in the scaling up process of sustainable resource use systems and practices to generate sustainable development among food insecure communities, whom depend on natural resources for their subsistence. Collaborative knowledge production, learning, and governance involving multiple scales and levels of scales, is critical for the development of social capital and organisational capacity among the poor for them to benefit from and contribute to sustainable development (Daniels & Walker 2001, Brondizio, Ostrom & Young 2012). The strength and local ownership of the social capital grows as the collaborative process is maintained to develop trust and equality among partners (Lickers & Story 1997, Holmes et al. 2002, Pollock 2004), but patience and time is required (Borrini-Feyerabend et al. 2004). With time, the generated social capital and organisational capacity can be used for coordinating and managing increasingly complex social and ecological processes and interactions over multiple scales and levels (Ostrom 1990, Sayer et al. 2013, Brondizio, Ostrom & Young 2012). The collaborative process will involve the food insecure in growing partnerships and networks, while their capacity to be involved is being built. This will make them increasingly capable to constructively address barriers and bridges to their development and break the vicious circle of poverty and degradation into a sustainable trajectory in which their subsistence system, instead of degrading the environment, contributes to build their capital assets and help them to translate them into a sustainable livelihood.

5.3 Comparing Development Trajectories among Continents

Agroforestry is most commonly known from the tropical regions. Traditional agroforestry systems have been practiced for more than a century throughout the tropics, including many African countries. The Chagga home garden around Kilimanjaro (Fernandes et al. 1984) and the enset coffee homegarden of the south and south west of Ethiopia (Admasu & Struik 2001, 2002, Tadesse, 2002, Almaz Negasha et al. 2002, Tesfaye 2005, Wirsum et al. 2006), are two of the most studied traditional African agroforestry systems. These are localised and are usually not included in the advanced value-adding processes and commercialization. Presently

most of the traditional agroforestry homegarden practices are affected by economic development and growing market opportunities that make farmers to shift towards monoculture production of cash crops (Tesfaye 2005, Gessesse 2008, Tesfaye 2009, Mersha 2013).

Agroforestry systems also have a long tradition in Europe. In Western Europe many refined local agroforestry systems including localised value adding, have been developed historically (e.g., Agnoletti 2013). These systems have continuously been refined over long time spans and benefitted smallholders. However, many of these ancient traditional systems are now being transformed and some are on the verge to be dismantled (Angelstam et al. 2011). For instance, agroforestry practises in Sweden gave way to cultural oak landscapes traditionally used for animal husbandry, including grazing and hay-making (Bergmeier et al. 2010). At present, such landscapes exert high diversity of saproxylic beetles (Ranius et al. 2005), butterflies (Bergman et al. 2004, Bergman et al. 2007), and lichen species (Paltto et al. 2010) associated to oak wood pastures (Paltto et al. 2011). However, such landscapes are often threatened by insufficient or non-existent traditional land management (Paltto et al. 2011) and thus commonly abandoned, or in need of restoration measurements (CAB 2005). Traditional agroforestry systems also exist in Eastern Europe that has survived the transition through the period of feudalism, socialism to the present open market. In Ukraine and the Russian Federation, local rural residents are highly dependent on personal home gardens and non-wood forest products that they collect from the forests. The products, which they get from the gardens and forests, are used for personal consumption and for gaining additional income (Mahapatra & Shackleton 2011, Stryamets et al. 2012, Stryamets et al. 2014). Most of those products like berries, mushrooms, and vegetables are sold freshly, without value-added procedure (Hartel 2014).

An important opportunity to learn more about how to scale up new agroforestry development projects is comparative transdisciplinary studies among places in regions with different social and ecological systems (e.g., Angelstam et al. 2013). Comparisons can also be made in how to maintain and revive traditional village systems, integrating forestry and agriculture in time and space. A number of important questions and issues can be tested and highlighted in comparative studies among continents: What are the driving forces for transitions from traditional village systems based on agroforestry towards monoculture cash crops? What are the consequences for genders and power relationships among stakeholders? How can value be added to wood and non-wood forest products to benefit rural

communities? How was this handled in other parts of the world and what was the result? What is the role of traditional village systems' biocultural values as green infrastructures for rural development? What can be learned from family forest association's experiences in Africa and Europe? To address these questions calls for improved development collaboration between South and North, as well as West and East.

6 Conclusions

Eight main barriers and four main bridges that influenced the scaling up process of agroforestry and community based forestry among food insecure households were identified and analysed. All resulted from interactions among social, political, and economic structures and processes at multiple levels. These interactions influence the scaling up process and the development of sustainable subsistence systems. Insufficient education and lack of time were serious impediments for the food insecure to actively participate in enabling activities and CBFGs. Incoherent policies, extension niches and beliefs, unsecure ownership, and powerful middlemen added to an already high level of risk with a negative effect on the motivation to invest time and labour in CBFM and agroforestry. Insufficient education also affected ordinary members' capacity to be involved in the executive work of CBFGs. This undermined transparency and accountability of these groups. Powerful middlemen, unsecure ownership and user-rights seriously limited the ability of the CBFGs to make long-term strategic investments and contribute to the members' livelihoods. Changes in policy narratives and negotiations for funding negatively affected NGO-policy development and sustainability of NGO-led development efforts at the local level. Improving policy environment for CBFM, growing demand for forest products, transport, information and communication infrastructure development, are viable bridges for sustainable development in rural Africa. Collaborative knowledge production and learning is an approach through which the social capital and organisational capacity of the food insecure households can grow, enabling them to constructively address these multidimensional interactions to work in their favour. The use of this approach, i.e. a landscape approach, holds the opportunity through which subsistence systems can be transformed from causing degradation to promote sustainable development and livelihoods.

Acknowledgements

Articles II and III have been the most important contribution to improve my transdisciplinary capacity in my area of specialisation. During the development of these articles I got valuable and critical guidance, knowledge and inspiration from Robert Axelsson and Per Angelstam from the Forest-Landscape-Society network's hub in Skinnskatteberg who share my interest to transdisciplinary knowledge production. I want to extend my sincere gratitude to them for giving me the transdisciplinary perspective by being part of the FORMAS strong research environment about diagnoses and treatments of green infrastructures using landscape approach. I would also like to extend appreciation and gratitude to my co-authors Ngolia Kimanzu, Samuel O. Sassi, Eliza Bwana and Robert Otsyina. Special thanks to all involved in the scaling up process in Mara to the former Regional Commissioner of Mara Nimrod Lugoe, project colleagues Rose-Mary Mwlinga, Celestine Mafuru, Phillipina Shayo, Neema Kitila, Xhanfon Bitala, Damian Silas, Maisha Mwaisengela, and the project extension agents. I also thanks to ViS and Tor Nyberg for the approval of the access to data from the Vi Agroforestry Project in Mara.

I express my sincere thanks to my co-authors of Article IV Anders Roos, Peter Gondo, Christine Nantongo and Daniela Kleinschmit. I shared most of the work to develop the article with Anders and with important input from Daniela, Peter and Christine. I carried out the field work together with Christine and Peter. I would also like to extend my sincere appreciation to Prof. Godwin Kowero, Dr. Yonas Yemshaw, Dr. Mahamane Larwanou and Everlyn Lubembe of the AFF for their valuable and constructive support in planning and organizing the field study and the review workshop in Nairobi. Special thanks to all the members of host community-based forest groups and their partner organizations and all those assisting in arranging the workshops in the respective countries who

shared their time and experiences with us. Also, special thanks to Per Björkman and Thorsten Celander for their valuable support.

I want to extend my sincere gratitude to Reidar Persson and Jan-Erik Nylund who inspired me, helped with their wide knowledge and some financial support without which I would not have continued beyond my licentiate exam. I am grateful to professor Ole Elgström who introduced me to political science including negotiation theory and methods. Ole, Reidar and Jan-Erik assisted me with important ideas and knowledge in the study of ViS's negotiation process for funding (Article I).

Finally but not least, I would like to give my thanks to the School for Forest Management and its staff in Skinnskatteberg that have assisted me to complete my exam.

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