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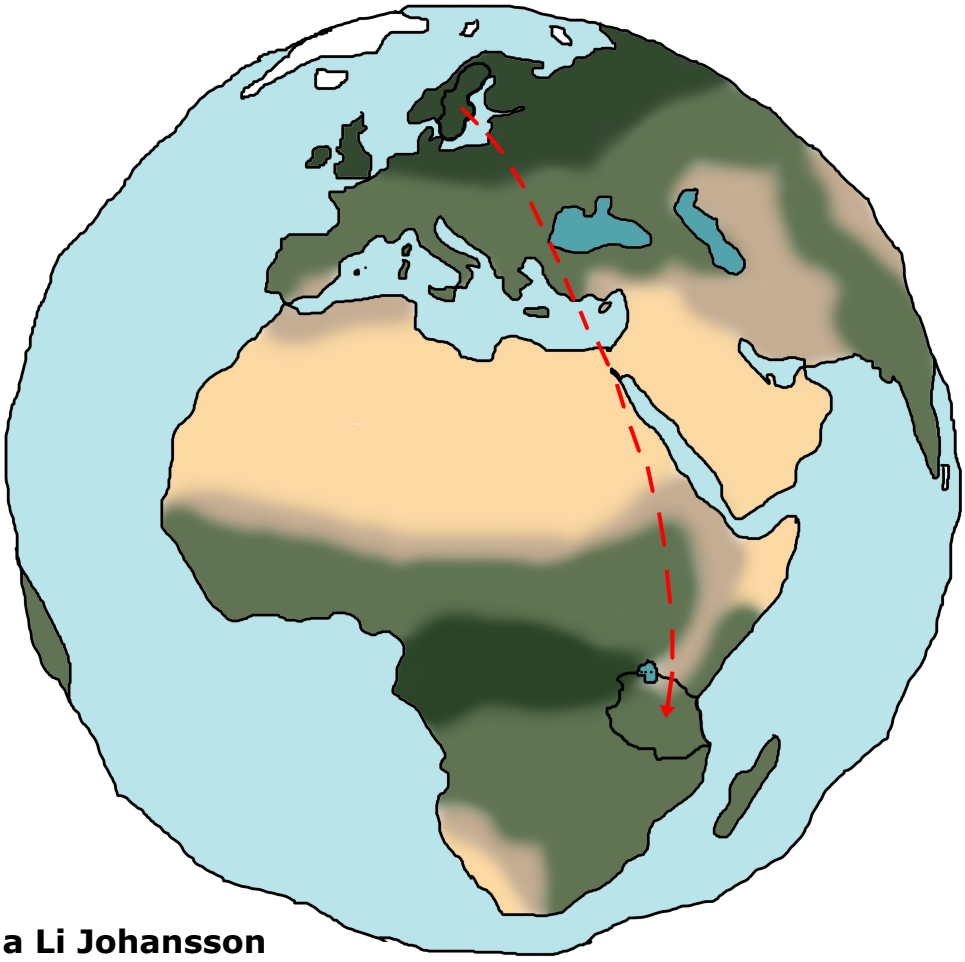
A multi-scale analysis of biofuel-related land acquisitions in Tanzania

With focus on Sweden as an investor



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A multi-scale analysis of biofuel-related land acquisitions in Tanzania

With focus on Sweden as an investing country

A Minor Field Study

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ABSTRACT

The overall purpose of this thesis is to clarify the structure of the land acquisition system in Tanzania especially in relation to biofuels over a 10-year time horizon, with Sweden's role in the system emphasized. Since the land acquisition system is complex, it is important to be able to disentangle this complexity in a structured way across local, national, and global scales in order to shed light on what is driving the investments, and what the positive and negative outcomes are. In order to accomplish this task, a modified multi-level Drivers-Pressures-State-Impact-Response (DPSIR) scheme is applied to information gathered about the land transaction system from field visits, and literature. DPSIR is a causal framework that allows the representation of environment-society relationships to be recast in a tractable format for helping with policy decisions. Each letter of the DPSIR scheme represents an element of the land transaction system at a global, national, and local scale, and in this case is used to tease out cross-scale relationships between system aspects. The scales are linked together through the story of EcoEnergy, a Swedish biofuel company that is acquiring land in Tanzania. Results show that global drivers ultimately lie behind the phenomenon of large-scale land acquisitions in Tanzania and include increased oil prices, climate change, population growth, and policies promoting biofuels. National drivers include climate mitigation strategies, and social and agricultural developments. Locally, business opportunities are important, amongst others. Global pressures include land cover change, altered rainfall patterns, and the competition between food and fuel crops. They manifest themselves nationally and locally through, deforestation, migration, changes in land tenure (national), as well as household displacement, and water extraction (local). Many biofuel companies in Tanzania are currently not active, because they have gone bankrupt, sold the operation, or have trouble starting the business. This is mainly a consequence of the financial crisis in 2007/2008 that led many banks and investors to withdraw from these rather "insecure" investments. Also, investments that are not currently in progress have continuous impacts on the local community since leases normally last for 99 years, thus hindering the small-scale farmer to use the land. National impacts are such as migration, and loss of endemic species and wildlife habitats due to land clearing, but global impacts are not yet apparent. When investments started to increase in the early 2000s, Tanzania did not have proper regulations to control how investors perform, and how to compensate the local population. Tanzania still lacks fully developed regulations for foreign investments, but is trying the investment model "land for equity". EcoEnergy is the pilot project to develop under this model that might bring more benefits for the government, the investor, and hopefully also for the local community. The new model for investments is an example of a cross-scale interaction between the local and national level, as it has been developed to mitigate local negative impacts. This thesis underscores that the driving forces creating the state of biofuel-related land acquisitions are mainly global, while the impacts are mainly local. This also relates to the tendency of global processes to develop gradually over a long time, while local processes develop more rapidly. Since the phenomenon is fairly new, the global long-term implications are not yet visible. It is therefore necessary to elaborate on the potential long-term impacts from the investments, which can be done by modelling future scenarios of key drivers on all spatial and temporal scales such as population growth, financial changes, climate change, and future demand for alternative fuels.

Key words: sugarcane, jatropha, DPSIR, scale, environmental impacts, social impacts

SAMMANFATTNING

Det övergripande målet med denna uppsats är att klargöra strukturen bakom utländska markinvesteringar i Tanzania, speciellt i relation till biobränsleproduktion över de senaste tio åren. Betoningen ligger på Sveriges roll som markförvärvare. Eftersom dessa system är komplexa är det viktigt att kunna reda ut denna komplexitet på ett strukturerat sätt på en lokal, nationell, och global skala, för att belysa vad som driver investeringarna samt vad de positiva och negativa effekterna är. För att åstadkomma detta mål analyseras den information som samlats om markförvärv från fältstudier och litteratur med en modifierad flerskalig Drivers-Pressures-State-Impact-Response-analys (DPSIR). DPSIR är ett verktyg som gör det lättare att klargöra miljö- och samhällsrelationer och används ofta vid beslut och utveckling av policys. Varje bokstav i DPSIR redogör för de olika processerna inom markförvärvs-systemet på global, nationell och lokal nivå, för att se hur dessa relaterar till varandra. De olika processerna länkas samman genom att titta på EcoEnergy, ett svenskt biobränsleföretag i Tanzania, och deras historia sedan de kom till landet. Resultatet visar att det är främst globala drivkrafter som ligger bakom markförvärv för biobränsleproduktion i Tanzania, såsom ökade oljepriser, klimatförändringar, befolkningstillväxt och policys som främjar biobränslen. Drivkrafter på nationell nivå är relaterade till klimatanpassningsåtgärder, samt samhälls- och jordbruksutveckling. På lokal nivå är affärsmöjligheter den huvudsakliga drivkraften. Globala påtryckningar är till exempel förändringar i markanvändning, ändrade nederbördsmönster, och konkurrens över mark som odlas för mat respektive bränsle. Dessa påtryckningar avspeglar sig på nationell och lokal nivå genom exempelvis skogsskövling, migration, markägarskifte (nationella), förflyttning av hushåll och förändrad vattenförbrukning (lokal). Sedan finanskrisen 2007-2008 har många biobränsleinvesteringar pausats, övergivits, eller inte lyckats sätta igång. Detta är huvudsakligen till följd av att långivare och investerare dragit sig ur dessa tämligen ”osäkra” investeringar. Även fast företagen inte är aktiva på den förvärvade marken fortsätter de att påverka lokala samhällen eftersom kontrakten vanligtvis varar under 99 år och därmed hindrar bönder att återuppta jordbruksaktiviteter på marken. Nationella effekter är migration, och förlorade endemiska arter och habitat på grund av skogsskövling. De globala effekterna är ännu inte märkbara. När de biobränslerelaterade markförvärv började ta fart i början av 2000-talet hade inte Tanzania något regelverk för att kontrollera hur investeringar utförs, eller hur lokala bönder ska kompenseras. Tanzania har fortfarande inget etablerat regelverk för denna typ av investering, men ska nu testa investeringsmodellen ”mark för rättvisa”. Modellen går ut på att staten är delägare i projektet, och att avkastningen delas enligt överenskommelse mellan företaget, staten och lokalbefolkningen. EcoEnergy kommer vara det första biobränsleföretaget som testar denna modell, som möjligen kan ge en mer rättvis fördelning av både risker och fördelar mellan alla inblandade aktörer. Den nya modellen är ett exempel på hur händelser på lokal nivå har format en nationell policy för att åtgärda negativa lokala effekter av markförvärv. Denna uppsats förtydligar att de drivkrafter som har skapat det aktuella tillståndet av biobränsleinvesteringar till större del är globala, medan de synliga effekterna är främst lokala. Detta relaterar även till tendensen för globala processer att utvecklas under en längre tid, medan lokala processer utvecklas snabbare. Eftersom denna typ av markinvestering för biobränsleproduktion är ett relativt nytt fenomen, är de globala effekterna ännu inte märkbara. Därför är det viktigt att utforska vilka långsiktiga effekter dessa investeringar skulle kunna resultera i, vilket kan göras med hjälp av modellering av framtida scenarier för betydelsefulla drivkrafter inom alla spatiala och temporala skalor; som befolkningstillväxt (och urbanisering), ekonomiska förändringar, klimatförändringar, och framtida efterfrågan efter alternativa bränslen.

Nyckelord: Markförvärv, biobränsle, Sverige, sockerrör, jatropha, DPSIR

PREFACE

This study was hosted at the Department Physical Geography and Ecosystem Science at Lund University. Financial support was made possible by a Minor Field Study (MFS) scholarship from the Swedish International Development Cooperation Agency (SIDA), while The fieldwork was conducted at Stockholm Environmental Institute (SEI Africa) located at University of Dar-Es-Salaam, between March 1 and May 15, 2013.

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LIST OF ACRONYMS AND ABBREVIATIONS

AfDB – African Development Bank
EIA – Environmental Impact Assessment
FAO – Food and Agriculture Organization of the United Nations
GHG – Greenhouse gas
GoT – Government of Tanzania
PAP – Project affected people
RAP – Resettlement action plan
SEI – Stockholm Environmental Institute
SIDA - Swedish International Development Cooperation Agency
TIC - Tanzania Investment Centre

1. INTRODUCTION

1.1. Biofuel related land acquisitions in Tanzania

Spurred on by pressure to find sustainable energy production alternatives to fossil fuels, many industries have been acquiring land in order to plant crops for biofuel production. Between 2000 and 2010, global biofuel production increased more than six-fold (International Energy Agency 2011). Bioethanol and biodiesel are renewable biofuels that are produced from various crops. Ethanol is made out of crops that contain large amounts of sugar, or other components that can be converted into sugar such as starch or cellulose. These typically include sugarcane, sugar beet, wheat, corn, or various trees. Biodiesel production involves vegetable oils from crops like rapeseed, soybeans, palm oil, and sunflower. Biofuels have created sharply polarized views among the public and policy makers where some endorse their climate-mitigating capacities while others argue for the negative effects on food security by using fertile land and food crops to produce fuels instead of food (Bringezu et al. 2009). The global land use for biofuel production is currently less than 1% of global agricultural land area, but increased demand is likely to contribute to further expansion and amplify the relatively unknown impacts from their production and consequent land use change (Baumanns 2013). In Tanzania, biofuel development is in an early stage, and over the last decade, several foreign actors have tried to start up biofuel projects in the country. Companies are acquiring land with long-term leases (99 years), and the Government of Tanzania has leased out large tracts of land on behalf of biofuel production.

Land acquisitions are seen by many as a foreign investment and a way for developed countries to transfer resources to developing countries (Deininger et al. 2011; Sjöholm et al. 2011). Other see them as a form of neo-colonialism (dubbed "land grabbing"), and in countries or regions without proper rules and regulations, it often results in severe negative impacts on the local environment and population. Many humanitarian organizations underscore the importance of better implementing the land deals as in many cases they have resulted in lost access to land for the local small-scale farmer (Bringezu et al. 2009; Action Aid 2009; Cotula et al. 2009). This is particularly an issue in Tanzania where most farmers manage their land on behalf of the state (Havnevik 2011b). Recent investments in Tanzania have undermined the land rights of the smallholders and many have had to leave the land for the benefit of investing companies. This has had enormous impacts on farmers' livelihoods, and forced some to move. But for others, it has offered new sources of income. Moreover, recent land acquisitions have also shown severe environmental impacts. As most land deals are large-scale and consist of monocultures, they have a negative impact on biodiversity and ecosystem services. Bioenergy production is one of the main agricultural activities for land acquisitions in Tanzania, mainly for large-scale plantations of sugarcane (ethanol production) and jatropha (biodiesel production). These crops require a copious amount of water that is often drawn from local streams, rivers and lakes. Following this water levels are being lowered from intensive irrigation schemes and soil fertility decreases from the heavy use of pesticides and fertilizers. The land contracts rarely mention how much water an investor can extract and allocate during their production, which can lead to unrestricted water withdrawals, with potentially negative impacts on the local environment and livelihoods.

In Tanzania the effects of large scale land acquisitions have rarely been positive for the local communities (Action Aid 2009; GRAIN 2013; Hakiardhi 2011). This has received considerable attention through media, in reports from humanitarian organizations and NGOs, and in research. The relationships and interactions between global, national, and local drivers and outcomes of these land acquisitions makes it a very complex phenomenon, and therefore difficult to monitor. The lack of transparency from investors and (often) corrupt governments makes it even more difficult to keep track of. It is thus important to be able to disentangle this complexity in a structured way in order to shed light on what is driving the investments and what the positive and negative outcomes are. By analysing the current state of the biofuel-related land acquisitions from the perspective of both the investing company and the targeted country it can help explain why the positive outcomes of the investments are so seldom realized.

1.2. Research aim and objectives

The overall aim of this thesis is *to elucidate the structure of the land acquisition system in Tanzania, especially in relation to biofuels.*

Particular attention will be paid to disentangling the cause and effect relationships within the system across local, national, and global scales. This will facilitate an understanding of how global, national, and local events and decisions have impacted on each other, and how these have interacted to shape policy.

Throughout the thesis, emphasis will be placed on Sweden's role as an investor in land.

1.3. Organizational Structure of Thesis

The biofuel related land acquisitions in Tanzania are analysed in a multi-scale Drivers-Pressures-State-Imacts-Responses (DPSIR) framework (Ness et al. 2010). Each part of the D-P-S-I-R forms a chapter. Within in each chapter the three spatio-temporal levels with their associated processes are explicitly dealt with. Biofuel related land acquisitions are presented from both Swedish and Tanzanian perspectives. Finally a synthesizing chapter summarizes the findings by linking the processes on all levels together by presenting the changing state of EcoEnergy since their arrival to Tanzania.

2. BACKGROUND

Biofuels are all fuels derived from organic material, and are renewable alternatives to the diminishing supply of fossil fuels. They are promoted to be a "greener" and more sustainable substitute for fossil fuels as they may help mitigate climate change by reducing net carbon emissions to the atmosphere. Some consider biofuels as carbon neutral, since the plants grown to produce more biofuels absorb the CO_2 released during their use (Amigun et al. 2008). Companies see business opportunities in investing in biofuels abroad, since there are large tracts of land that is not in agricultural use, or because the means of production can be intensified. This is particularly the case in the Global South. Tanzania is targeted for biofuel investments for several reasons. The country is politically stable, there are large tracts of "unused" land, and the government looks favourably on national development through agricultural investments. Sweden is on the other hand a country that is trying to lower its CO_2 emissions, and has had close connections with Tanzania for a long time. Many Swedish missionaries have visited Tanzania since colonial times, and Swedish aid and development work has been pursued in the country since it became independent from Great Britain in 1961. In the 1980s the ties between Tanzania and Sweden were strengthened when the (former) president Julius Nyerere, and the Swedish politicians Tage Erlander and Olof Palme advocated for socialism together. Currently, two major Swedish companies are trying to acquire land for biofuel production in Tanzania: EcoEnergy Ltd. (previously SEKAB) and BioMassive Ltd. EcoEnergy tried to acquire enormous tracts of land for sugarcane plantations in various parts of Tanzania, with an area reaching 400 000 ha, but they have now settled with 20 000 ha as a pilot project. BioMassive acquired 50 000 ha for jatropha but have never started any plantation or clearing of land.

2.1. Biofuels

The main producers of biofuels for transport are the US, Brazil, and the EU. Production is mainly ethanol from maize and sugarcane in the US and Brazil respectively, while in the EU it is biodiesel from rapeseed (REN21 2012).

2.1.1. Ethanol

Ethanol is produced from crops like sugarcane, sugar beets, maize, cassava, sorghum, and wheat (REN21 2012). The main crop for ethanol projects in Tanzania is sugarcane. There is one Swedish company that is currently active in Tanzania for the production of ethanol from sugarcane.

Sugarcane is a tropical, perennial grass that can reach a height of three to four meters (FAO 2013). It is one of the most climate-efficient plants, as production is high with little input, and the crop can produce sugar, electrical power from burning biomass, and ethanol (WWF 2011a). Ethanol is the most common biofuel and accounts for more than 90% of the global production of biofuels. With the multi-purpose use of the crop, biofuel companies can broaden their investments to include electricity, sugar, and fuel.

The sugarcane stalk consists of two parts that include the fibrous outer rind and the inner core, the latter containing most of the sucrose (Choudhary et al. 2012). During

sugar and ethanol processing, the stalk is crushed to extract the juice which has a high sucrose concentration. The processing from sugarcane to ethanol traditionally follows three steps; 1) converting biomass to fermentable sugars, 2) fermenting sugar to ethanol, 3) purifying the ethanol. (Pereira and Ortega 2010; Choudhary et al. 2012). All steps of the process require large volumes of water. Sugarcane processing also generates bagasse, which comes from the squeezing out the sucrose juice from the stalk (Choudhary et al. 2012). This is an important renewable resource that can be used both for ethanol and power production. Another by-product from sugar production is the formation of molasses, a syrupy liquid that contains between 50-55% fermentable sugars. These sugars cannot be upgraded to raw sugar, but can be converted to ethanol in a distillery. Hence large-scale sugarcane plantations typically have the sugar mill and distillery located next to one another in order to reduce transportation costs between the facilities.

Figure 1. Part of EcoEnergy's 200 ha sugarcane nursery in Bagamoyo, Tanzania. Photos: Emma Li Johansson 2013.

2.1.2. Biodiesel

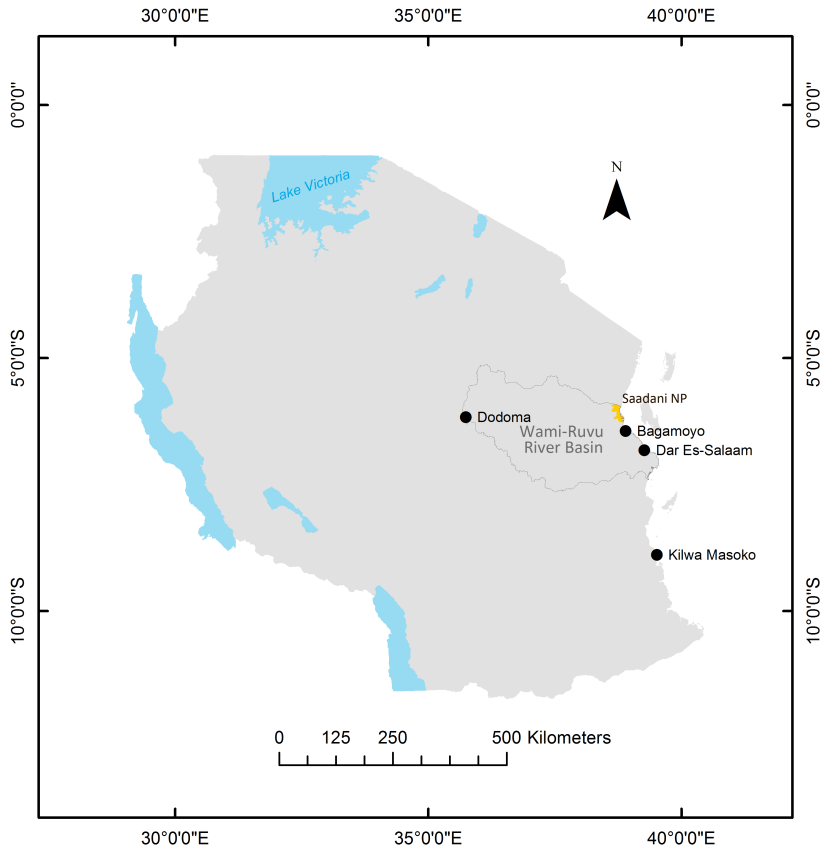
Biodiesel is produced from soybean, rapeseed, mustard seed, palm oil, jatropha, waste vegetable oils, and animal fats (REN21 2012). Jatropha is popular among biofuel companies investing in Tanzania with an interest in processing the shrub's oilseeds to biodiesel. In the mid-2000s there was a boom in jatropha investments (GRAIN 2013). It was believed by many to be the solution in the conflict of using agricultural land for fuel instead of food, since the crop could grow on marginal land and requires little water and fertilizer while still giving high yields. But as any other crop it demands plenty of water and additional fertilizers for profitable yields (GRAIN 2013; Charles 2012). In Tanzania, many of the jatropha investments have been put on hold or never even started. Some projects have been on highly productive land, therefore conflicting with food production. Biomassive is the only Swedish company registered for jatropha production in Tanzania (that seems to never have started).

Figure 2. Jatropha plantaton in Kilwa, Tanzania (abandoned). Photos: Emma Li Johansson 2013.

2.2. Area description of Tanzania

2.2.1. Climate and geography

There are four major climate zones in Tanzania. They are the coastal area and immediate hinterland with tropical conditions, the central plateau with hot and dry conditions, the highland areas which are semi-temperate, and the lake regions that have a moist climate conditions. There are two rainy seasons in the north lasting from November to December and from March to May. In the south there is one rainy season lasting from November to March. The average annual precipitation over the nation is 1042 mm, while mean annual temperatures range from 17 to 27 degrees Celsius depending on location (Agrawala et al. 2003). Flooding and drought are the most frequently occurring natural hazards. Figure 3 is a map of Tanzania and places mentioned in this thesis.



Area: 947 300 km^2

Agricultural area: 355 000 km^2

Population: ~ 47 million (July 2012 est.)

Median age: 18.7 years

Life expectancy: 53 years

Labour: 80% agriculture, 20% industry and services

GDP per capita: $1700 (Sweden $41 700 and DR Congo $400)

Figure 3. Map of Tanzania and areas mentioned in the thesis

2.2.2. Social, agricultural and energy data

In terms of per capita income, Tanzania is one of the poorest nations in the world. Out of the labour force, 80% are working in the agricultural sector where the primary crops grown are cassava, maize and bananas (FAOSTAT 2013). Tanzania generates about 90% of the energy from biomass in the form of fuelwood and charcoal (Tanzania Traditional Energy Development and Environment Organisation (TaTEDO) 2011; Mshandete 2011). Petroleum and electricity (from hydropower and natural gas) accounts for about 8% and 1.2% respectively, and the remaining 0.8% comes from coal, biogas and other renewable energy sources (Figure 5). The country is not only poor, but is also experiencing rapid population growth (Figure 4) and urbanization, which is putting pressure on land and water resources (National Bureau of Statistics 2013).

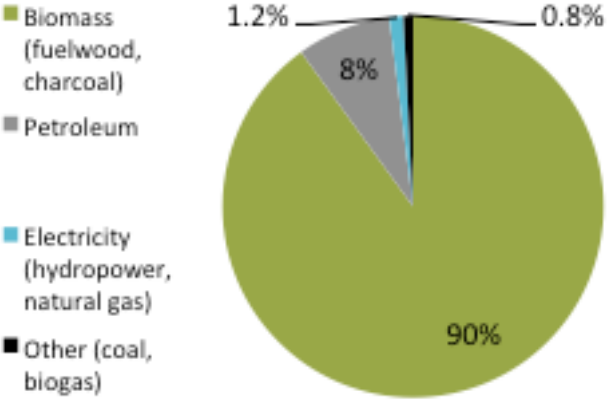


Figure 5. Energy sources in Tanzania (Tanzania Traditional Energy Development and Environment Organisation (TaTEDO) 2011; Mshandete 2011).

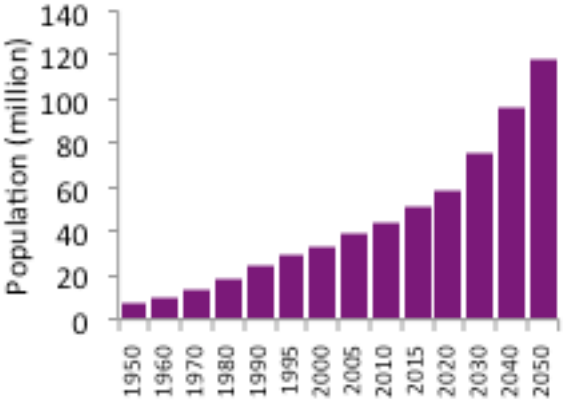


Figure 4. Past, current, and projected mid-year population (US Census Bureau 2013).

2.3. EcoEnergy: a Swedish Company in Tanzania

EcoEnergy is a Swedish biofuel company that is acquiring land in the Coastal Region of Tanzania, about two hours north of Bagamoyo. The company has connections to SEKAB who started the process of acquiring land in 2006, but sold their existing plantation to EcoEnergy in 2009.

2.3.1. The area acquired by EcoEnergy

The land supporting EcoEnergy's future sugarcane industry is located at the previously state-owned Razaba farm. The Razaba farm lies on the uplifted and dissected coastal plain of Eastern Tanzania. The terrain stretches from the coastal mudflats in east, rising to about 30-40 m above sea level at the western border. The soils of the main central areas are based on old sand dunes with grey sandy soils (locally called mbuga), and alluvial sands and clays along the Wami River and the Ruvu River in the north and southeast, respectively (Figure 6). The topsoil is sandy and susceptible to erosion. All soils in the area are low in soil organic matter, phosphorous and potassium. (National Environment Management Council 2008).

The climate is tropical with high annual temperatures and two rainy seasons. The average annual temperature ranges between 20° C to 32° C, with June to August being

the coolest season and December to Mid-March being the hottest. The rainfall pattern is bimodal, with long rains during March to May/June, and short rains during September/October to December. The annual average precipitation in the area is about 800-1000 mm, and the long rains account for approximately 60% of the annual rainfall. The short rains are unreliable and poorly distributed spatially. The driest months are from June to September and monthly rainfall is generally less than 50 mm. (National Environment Management Council 2008).

The Razaba area is a semi-natural woodland with bushland, dry grassland, forest thickets, seasonally flooded plains, cultivation plots, and a few modified mangroves and riparian forest remnants. The northern part of the project area contains various species of African ebony (major source of income for the tourist industry in Tanzania), while the majority of the area is covered with acacia woodlands. The riparian vegetation is dominated by fig trees (indicating abundant groundwater). During the rainy season the streams lead to the formation of temporary swamps, causing siltation. There are some ponds and dams left in the area since it was a cattle ranch. These water sources are important for biodiversity, as well as for wild and domestic animals in the area. The acquired land borders Saadani National Park and contains several endangered plant and wildlife species, as well as species of commercial value. The most important timber tree species in the area are African ebony and Tamarind, and the most rare and endemic species are found within the forest thickets and riparian vegetation in the northern part of the project area. The area is also important for migratory bird species and more than 20 different large mammals. Almost all mammal species are at lower risk according to the IUCN Red List. However, Lion and Hippopotamus are listed as vulnerable, and the African Elephant as near threatened (National Environment Management Council 2008).

Figure 6. Location of the (future) EcoEnergy sugarcane plantation.

3. METHODOLOGY

Land acquisitions for biofuels are structured and analysed at the global, national, and local levels using a multilevel DPSIR framework. This is one of many tools to analyse the cause-and-effect relationships between social and environmental factors of a system. The temporal extent of the study is restricted to about 10 years, the time frame beginning with the advent of large-scale land acquisitions up to the very near future. By identifying the *driving forces, impacts, pressures, current state,* and *responses* of both environmental and social systems for each level, it is possible to understand the relationships between system components across scales (Ness et al. 2010; Oran 2006). The study is qualitative, based on an extensive literature review and 20 semi-structured and informal interviews with key actors. The questions asked varies for each interviewee, depending on what information is sought.

3.1. The multi-level DPSIR framework

The Drivers-Pressures-State-Impact-Response (DPSIR) framework was developed and adopted by the European Environmental Agency (EEA) in 1999, with the main aim to systematically identify policy options and evaluate the efficiency of the responses (Ness et al. 2010). It is an expansion of the Pressure-State-Response (PSR) framework previously developed by the OECD, and the Drivers-Pressures-Response (DPR) framework developed by the United Nations Commission on Sustainable Development (Carr et al. 2007). The DPSIR is an interdisciplinary tool that provides structure when looking at cause-effect relationships between interacting components of socio-ecological systems (SES). Figure 7a is a generalized diagram that shows how the Drivers-Pressures-State-Impact-Response are linked in a causal chain, starting with the drivers. The driving forces exert pressures on e.g. the environment, which in turn affects the current state. The current state impacts the SES whereas societal responses are developed to feed back to the whole causal loop. Figure 7b is an example of a DPSIR causal loop with increased atmospheric greenhouse gases as driving force (Rounsevell et al. 2010).

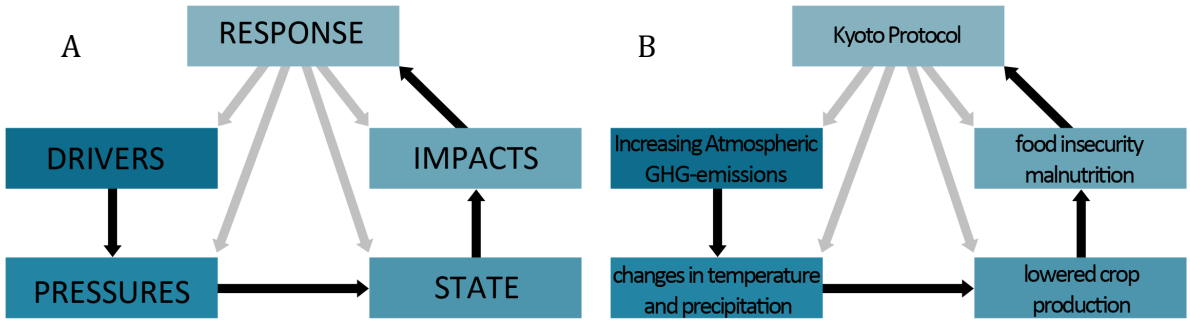


Figure 7. a) A generalized DPSIR scheme showing the linkages between the drivers, pressures, state, impacts and response. b) Example of a causal loop for increasing atmospheric greenhouse gas emissions as a driving force. (Ness et al. 2010)

Hägerstrand claims that the core issue for environmental management is to understand the cross-sectoral human and environmental activities, both temporally and spatially (Ness et al. 2010; Hägerstrand 2001). The approach should thus deal with "nested domains", which builds on hierarchical understanding of how activities on macro and

micro scales are connected and interact with each other (Figure 8a). The hierarchical approach of Hägerstrand is merged with the systematic DPSIR framework, in order to analyse environmental and social issues by looking at temporal and spatial interactions on different scales. This methodology has been described by Ness, Anderberg and Olsson (2010), and is referred to as a multi-level DPSIR framework.

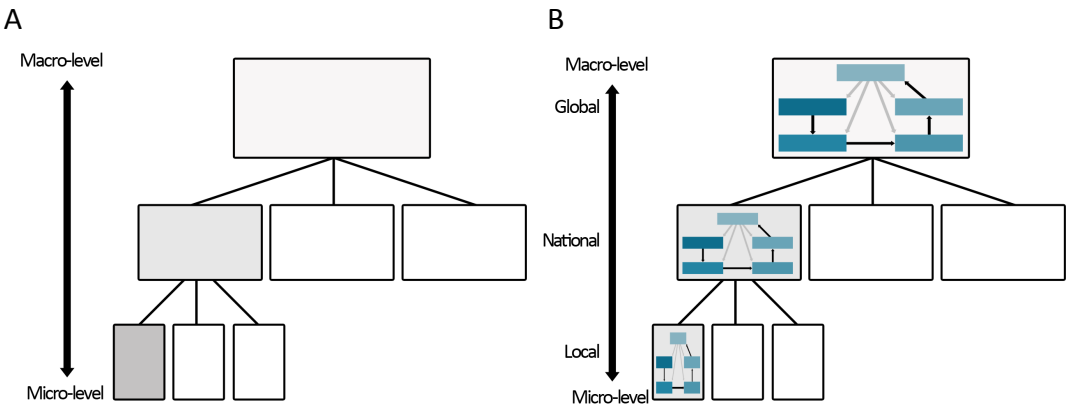


Figure 8. a) Generalized schematic of Hägerstrand's system of nested domains. b) Merging of DPSIR and Hägerstrand's system of nested domains. (Ness et al. 2010; Hägerstrand 2001)

In this thesis the structure of the multi-level DPSIR has been modified. Instead of framing the issue of land acquisitions for biofuels with one DPSIR analysis for each scale (Figure 8b), each part of the DPSIR have been analysed with a hierarchal approach (Figure 9). The model has been modified in order to cover both Sweden as an investing country and Tanzania as a targeted country in a manageable way. The hierarchical approach of the analysis includes both spatial and temporal aspects, where large-scale global processes tend to be slower, while small-scale local processes tend to be more rapid. Hence, global processes develop (and last) over a long time and changes slowly while national and local processes develop (and last) over a shorter amount of time and also change more rapidly. The modified multi-scale DPSIR enables the categorization and analysis of processes on various scales, as cross-scale relationships, as well as cross-scale interactions. An example of a cross-scale relationship is *global* climate change where dry (wet) regions tend to get drier (wetter), which manifests itself as a change in rainfall patterns on a *national* scale, and as droughts and floods on the *local* scale. While cross-scale interactions refer to when two or more processes have an effect on each other. For example the *global* demand for biofuels cause *national* land acquisitions, and *local* deforestation, which in turn feeds back to the *global* scale by carbon release to the atmosphere and contributes to global warming. The modification also enables processes on one scale to be presented without having a relation to processes on other scales. Meaning that a local pressure can cause local impacts without interacting with national or global processes. An example of this is the increase in local water demand, causing local implications for various water users (however stemming from large-scale processes like population growth and urbanisation).

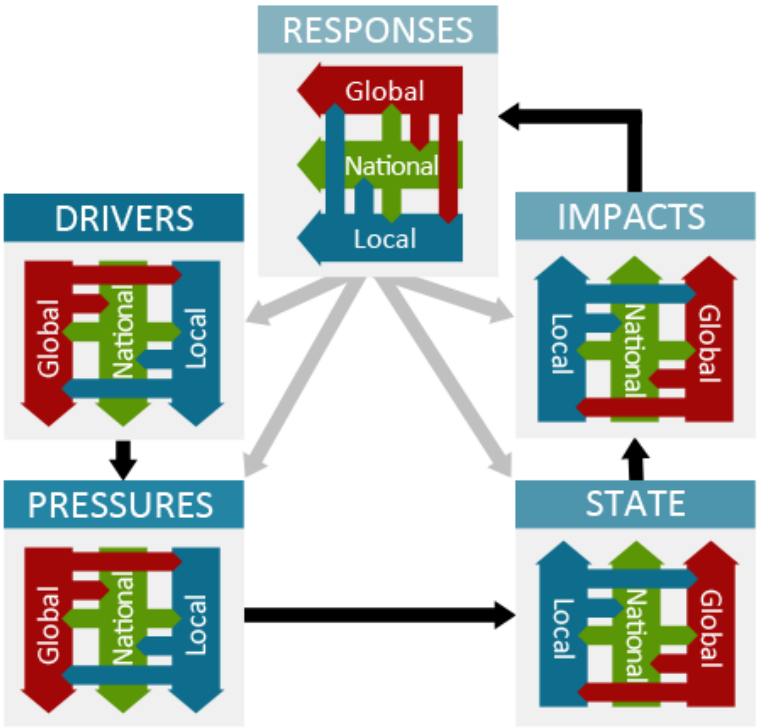


Figure 9. Modified multi-level DPSIR, with and without cross-scale relationships, and interactions.

3.2. Data

This study builds on the available literature, and interviews. The questions and processes have emerged cumulatively as the investigation progressed. The study is a combination of informal interviews, observations, visual media like photography and video. Since the Swedish company that has acquired land for jatropha never started any production, a Dutch investment was visited to be able to look at the effects from jatropha plantations. This was also an investment that had such negative social and environmental impacts that the Government of Tanzania decided to put a hold on land acquisitions for biofuels until a regulatory framework was developed.

3.2.1. Interviews

Data about biofuel-related land acquisitions in Tanzania was collected during a field campaign between the 1st of March and the 15th of May 2013. Semi-structured and informal interviews were performed on approximately 20 key informants who possessed the particular knowledge sought:

- Local NGOs: Haki Ardhi, WWF.
- Governmental institutions: Ministry of Water, Wami/Ruvu Basin Office, Tanzania Investment Centre, (TIC).
- The Swedish biofuel company that is acquiring land in Tanzania (EcoEnergy). Their water consultant and outgrower developer, and their consultants for resettlement issues (IDC, International Development Consultants).
- Pastoralists that are affected by the EcoEnergy project.
- Village chairman representing the village Mavuji, affected by an abandoned jatropha project.
- "Random encounters" to crosscheck information or highlight differing perspectives on land acquisitions.

3.2.2. Databases of land acquisitions

Data on biofuel related land acquisitions is taken from two databases with collections of large-scale land deals (> 200 ha): GRAIN and Land Matrix (GRAIN 2012; Land Portal 2013). These data are used to crosscheck the database with the interviewees. The land acquisition data is used to construct network models in order to visually support the DPSIR analysis.

GRAIN has 416 deals with the main focus on food crops. Land Matrix is more extensive with 1006 deals, with a greater emphasis on flexible and fuel crops. Land Matrix is continuously being updated with companies being edited, added, and removed.

4. DRIVERS

Driving forces are processes which shape the human activities to move towards or away from a desired target (Ness et al. 2010). For biofuel related land acquisitions in Tanzania these are driving forces that help explain the current state of the deals, and can be divided into direct and indirect drivers. The direct drivers are related to the growing demand for biofuel investments while the "indirect" drivers are the forces that hinder the full implementation (but still cause the current state of the deals). This chapter will elaborate on these driving forces at the global, national, and local scale. Figure 10 is a flow chart that clarifies how driving forces on various scales are related to each other, or just have an immediate impact on the current state of biofuel investments in Tanzania (without a relationship to processes on another scale). This diagram shows that global processes are the main driving forces of biofuel-related land acquisitions. Table 1, Table 2, and Table 3 summarizes the driving forces that are found for each scale, both direct and indirect. The findings are based on available literature and information gathered from interviews.

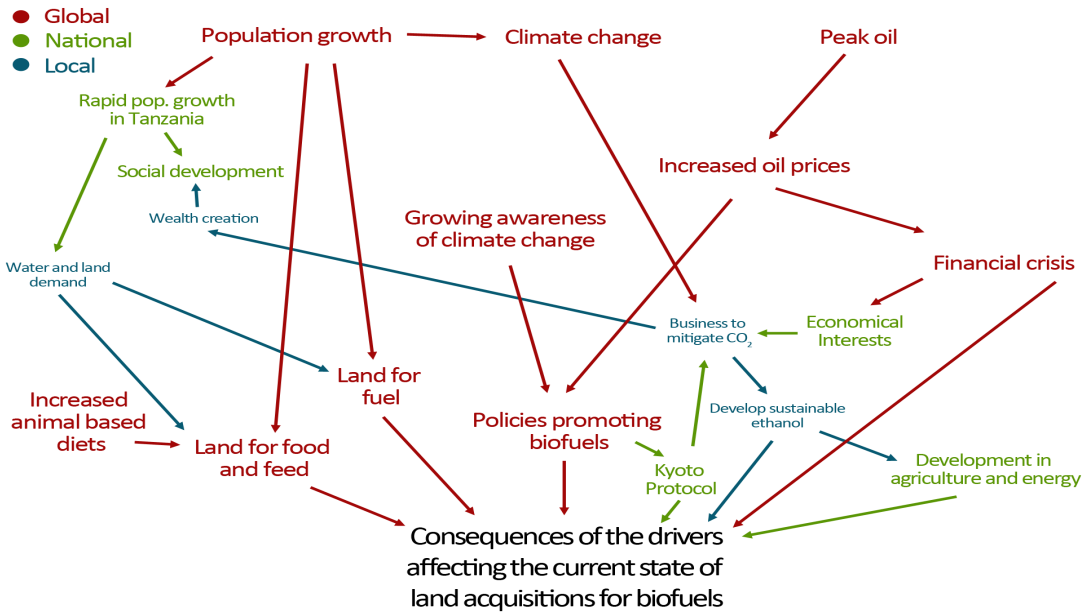


Figure 10. Flowchart of direct and indirect drivers that explain the current state of land acquisitions for biofuels. The different scales are distinguished by colour; global (red), national (green), local (blue). Cross-scale relationships are seen where a process in one colour points to a process in another colour.

4.1. Global

Table 1. Drivers that either trigger or prohibit land acquisitions for biofuels on a global scale.

Drivers of land acquisitions for biofuels	Direct/Indirect driver
Increased oil prices and "peak oil"	Direct
CO_2 mitigation	Direct
Policies that are promoting biofuels	Direct
Financial crisis	Direct and indirect

Climate change	Direct and indirect
Population growth	Direct and indirect
Increased animal based diets	Indirect

4.1.1. Direct drivers

The main driver that helps explain the rapid expansion of land acquired for biofuel production is the growing demand for renewable energy, which in turn is driven by increasing oil prices, coupled to a diminishing supply of fossil fuels (Songela and Maclean 2008; Yee et al. 2009; Havnevik 2011a). Additionally, growing awareness of climate change and concerns about increased atmospheric CO_2 from fossil fuel combustion has triggered the demand for renewable and "environmentally friendly" sources of energy (Yee et al. 2009). Policies for targets and blending quotas have triggered biofuel demand in various countries, associated with mandates of blending biofuels into vehicle, and targets of higher levels of biofuel use (REN21 2012).

The European biofuel demand is a major driver of land acquisitions for biofuel crops because of the high dependency on the import of raw material for fuel production. The demand is expected to increase over the next decade as a response to the EU's target[1] to generate 20% of its energy from renewable sources by 2020. In 2009 the EU Renewable Energy Directive (EU-RED) entered into force, establishing a mandatory 10% use of renewable energy in the transport sector while in 2012, the European Commission published a proposal to limit the biofuels from food crops to 5%. There are predictions that the global use of bioethanol and biodiesel will nearly double from 2005-2007 to 2017 (Bringezu et al. 2009) mainly because of an increased demand from the US, Europe, China, and Brazil, but also other countries that are currently evolving towards biofuel consumption like Indonesia, Australia, Canada, Thailand, and the Philippines (Bringezu et al. 2009). In 2007 The U.S. passed the Energy Independence and Security Act, which expanded the use of renewable fuels for transport.

4.1.2. Direct and indirect drivers

The most important indirect driver that helps explain the current state of biofuel companies in Tanzania is the financial crisis in 2007 and 2008, that led to that many banks and private investors pulled out of their agreements and had an immediate effect on the companies long term plans.

Population growth is partly driving the global rush for land, and partly prohibiting it; countries like China and India are securing their future food supply by growing food crops for export (Anseeuw et al. 2012). But more people also boost the competition for land and water, and there is a debate about if land should be used for fuel or food production when the world has more people to feed. Higher meat consumption also requires more land for food and feed, rather than fuel (Bringezu et al. 2009). Climate change is also partly driving the increased demand for biofuels, but it can also be considered a constraint. The more variable and unpredictable climate with intensified droughts and floods have lately affected global production quotas of ethanol negatively (REN21 2012). Climate change can thus be seen as a direct driver of biofuel investments

[1]EU Renewable Energy Directive (EU-RED): http://ec.europa.eu/energy/renewables/index_en.htm

at a global level, but on a national or local scale acts as an indirect driver by constraining the full implementation of the investment.

4.2. National

Table 2. Drivers that either trigger or prohibit land acquisitions for biofuels on the national scale.

Direct/indirect drivers of biofuel investments			
Sweden		**Tanzania**	
Kyoto protocol	Direct	Social development	Direct
Economic interests	Direct	Agricultural development	Direct
		Energy sector development	Direct
		Rapid population growth	Indirect

4.2.1. Direct drivers of Swedish companies

Agribusiness, carbon sequestration, energy, or forestry for wood and fibre are what drive Sweden's foreign investment in land (Land Portal 2013; GRAIN 2012; Sjöholm et al. 2011). These can be lumped into two broad categories:

1) Economic interests: to achieve economic growth through agribusiness, and to secure resource availability of wood and fibre.

2) Climate interests: to compensate for CO_2-emissions by replanting trees abroad, and to increase the access and production of biofuels.

Sweden is one of the 56 countries that are responsible for 90% of global CO_2 emissions. To meet climate change targets established by the Kyoto Protocol, greenhouse gas emissions from Sweden need to be reduced (Minx et al. 2008). Furthermore new ways to reduce greenhouse gas emissions within the country are underway and could explain why Swedish actors wish to expand outside the borders. The increased use of biofuels in Sweden is a result of trying to meet the 2003 EU Biofuels Directive[2] which is a part of the Kyoto Protocol, with the ambitious goal of eliminating oil imports by 2020 (The European Parliament and the Council of the European Union 2003). The directive promotes the use of biofuels in the transport sector. Incentives like these have contributed to the development of buses running on biofuels, for which SEKAB was the main producer and importer (Kroh 2008). Swedes are anxious to use ethanol because of its supposed climate-friendly characteristics. Though most of the ethanol that is used in Sweden today is produced in Brazil (Berndes et al. 2010), biofuel companies are now aiming at Eastern Africa to be able to advance the production of "sustainable ethanol". This is not possible in Brazil since the market is firmly entrenched and therefore resistant to change (Carstedt 2013). Other reasons for aiming at Eastern Africa are the

[2] Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:123:0042:0046:EN:PDF

relatively stable political situation, as well as beneficial tax rules, cheap labour, and availability of land (WWF 2011b).

4.2.2. Direct drivers of Tanzania as a targeted country

The Government of Tanzania (GoT) welcomes foreign investors because they see possibilities for an increase in income, new job opportunities, and a lower demand for expensive import of diesel and petrol (WWF 2011b). They see international investors as a potential solution for helping to eradicate poverty by direct agricultural development or through farmer out-grower schemes, which is when farmers produce and sell crops in contract with a company. Tanzania has a lot of productive land that is not in use for agriculture. The FAO has estimated that there is about 30 million hectares of unused land that potentially could be cultivated for fuel crops but there is a large uncertainty attached to this number. The unused land is fairly easy to access by foreign investors since the state is the ultimate custodian of the land, and if an investing company is believed to have the country's interests in mind, the president will grant access, even if the land is already in use by other farmers (Olyang'iri 2013).

Many of the companies that invest in Tanzanian agriculture are interested in achieving food and energy security for themselves by exporting the produce. Virgo (2009) observes that countries like Saudi Arabia and China began to look for farmland abroad after the spike in food prices in 2007-8. Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), and International Institute for Environment and Development (IIED) concludes in their joint report that the production of bio energy is a key driver of the recent land acquisitions (Cotula et al. 2009). In Tanzania, the official data on land deals are poorly documented, particularly regarding land deals earmarked for food production (Chachage and Baha 2011). During recent years biodiesel and bioethanol activities have increased considerably in Tanzania, because they are seen as a potential new source of income from agriculture and stimulation of rural economic growth (Sulle and Nelson 2009). This in turn encourages the private local and foreign investors to establish bioenergy projects but geared towards exports rather than satisfying local energy demands (Martin et al. 2009; Sulle and Nelson 2009). Tanzania is in need for alternative fuels themselves as they currently are one of the major importers of fossil fuels in East Africa. With increased demand and price on petroleum this poses a burden on the country's economy (Mshandete 2011). The dominance on traditional biomass energy is linked to poverty and lack of access to alternative fuels, and many see an opportunity to tackle these two issues together (Wolde-Rufael 2006). The sector is still in its infancy, and as of 2009 there was no commercial biofuel production in Tanzania and no biofuel policy (Martin et al. 2009).

Tanzania is experiencing rapid population growth and Figure 11 shows the current and projected population for each region of Tanzania, visualized in a cartogram where each region expands proportionately with growing population. The increased population also exerts pressures on land and water resources in Tanzania, as well as increasing the demand for more food and energy. The growth is biggest in Dar Es Salaam, and the city has in the last ten years almost doubled in population from 2 487 288 in 2002 to 4 364 541 in 2012 (National Bureau of Statistics, 2013). If the city keeps growing with the same average annual growth rate it will have a population larger than 15 000 000 already in 2035. The water supplied to the city of Dar Es Salaam is drawn from the Ruvu River, which is already the most water stressed river of the country.

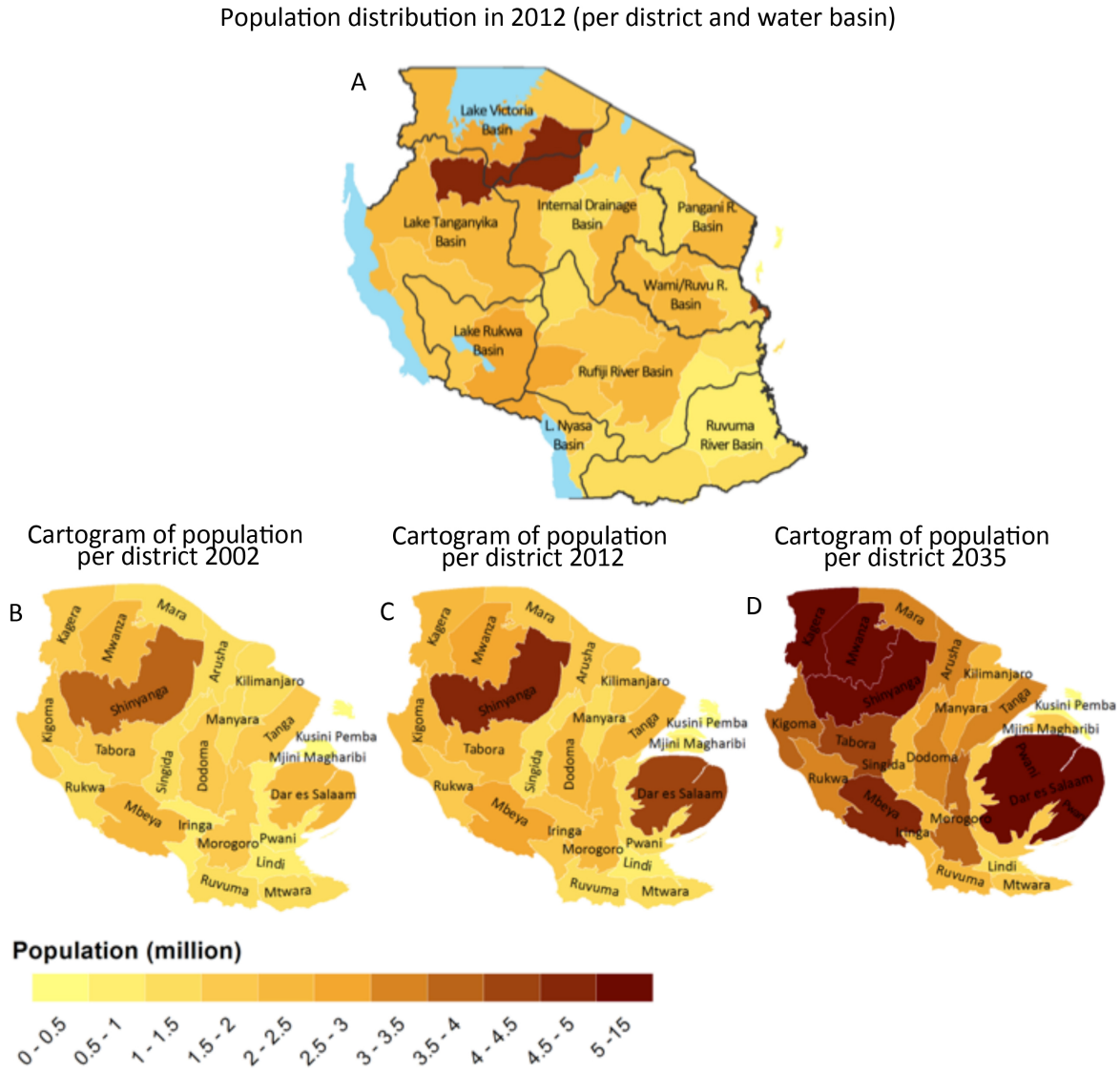


Figure 11. Illustration of how the population is growing in different districts of Tanzania, exerting more pressure especially on water basins around Dar Es-Salaam and Lake Victoria. a) The current population and how it is distributed within the 9 Water Basins of Tanzania, each region is visualized according to its geographical size and coloured to represent its current population (2012). b) Cartogram of the population of each region in 2002, where each region's size is distorted to represent the size of the population. c) Cartogram of the population in 2012. d) Cartogram of the projected population of 2035, calculated with the same growth rate of each region as between 2002 and 2012.

4.3. Local

What is driving the EcoEnergy's sugarcane project can be understood by combining the drivers presented in previous chapters; the Swedish investors' urge to make a business out of producing sustainable ethanol to replace fossil fuels, and the Tanzanian governments urge for agricultural development and foreign investment.

Table 3. Drivers that either trigger or prohibit land acquisitions of the Swedish biofuel company EcoEnergy on the local scale.

Drivers of land acquisitions for biofuels	Direct/Indirect driver
Business	Direct
Develop sustainable ethanol	Direct
Wealth creation	Direct
Water and land demand	Indirect

4.3.1. Direct drivers

EcoEnergy's mandate is the establishment of a new industry to find alternatives to fossil fuels. This is to be done at a state owned cattle ranch outside of Bagamoyo, two hours north of Dar Es Salaam. However, their primary plan to grow sugarcane for ethanol export has changed in favour of the production of sugar for the local market (Carstedt 2013). They see themselves as pioneers in land acquisitions as they try to develop long-term win-win-situations by addressing the problems with unsustainable ethanol production. They seek to achieve this using the following sustainability criteria; to develop domestic markets, to strive for ecological and social sustainability and to develop a new CO_2-neutral industry. The reason for targeting Tanzania is because the Brazilian ethanol market is too "strict" and developed to experiment on how to change the ways of production. Tanzania is open for any kind of investment in land and agriculture, and the introduction of new technologies is welcomed. EcoEnergy do not lease or buy the land they acquire, but will be the first company to implement the *land for equity* model in Tanzania. This model has been developed as a response to the difficulty of setting current or future prices on land and to hinder accusations of grabbing or colonization. The model builds on an agreement between the investor and the government in that 10% of the revenues will go to the government from day one, to increase to 25% after 18 years. The reason for choosing Bagamoyo is because of its carbon poor soils. A soil of low carbon content also releases little carbon to the atmosphere when ploughed. The government also allows them to use ethanol driven Scania trucks, which would not be possible in Brazil as they want to supply their own local vehicles running on ethanol produced in place. The primary intention of the sugarcane plantation is to produce sugar, ethanol and electricity for the domestic market, and to provide new livelihood opportunities for skilled, semi-skilled and unskilled labour in the region. Long term future plans could however be to export ethanol to the European/Swedish market.

The local farmers are mainly subsistence farmers, and are driven by any other option that can create better living conditions and alternative incomes (Senyagwa 2013). Many farmers in the area around the EcoEnergy project have decided to become outgrowers, because they see opportunities of wealth creation from this new strategy. Outgrowers are farmers that are producing and selling crops (e.g. sugarcane) directly to a company.

4.3.2. Indirect drivers

In a study about water resource management and development of the Wami/Ruvu Basin, the Japaneese International Cooperation Agency (JICA, 2013) provide information

about the current and future water use in the basin where EcoEnergy's sugarcane farm will be located. The population of the Wami/Ruvu River Basin was in 2011 estimated to 7.28 million (60% urban, 40% rural) and is projected to become approximately 12.58 million (59% urban, 41% rural) in 2035 (Figure 12). This almost doubling in population in about 20 years will most likely put new pressures on land and water resources.

The EcoEnergy farm will be located in the coastal region of the Wami-Ruvu River Basin, whose population is projected to increase from around 750 000 currently to 1.3 million in 2035. The current population of Dar Es Salaam is 3.7 million, and is projected to increase to 7 million during this time according to Japan International Cooperation Agency (JICA) (2013). Population growth alone threatens the rivers in the catchment with increased water demand both upstream and downstream. Today only 3% of irrigable land is irrigated but is projected to increase as the GoT is giving higher priority to irrigation as a strategy for food security and cash crop production. The current water use for irrigation of the whole Wami-Ruvu River Basin is estimated to a little less than 550 million m^3/year, and is projected to increase to 1270 million m^3/year up to 2035 (Japan International Cooperation Agency (JICA) 2013). Figure 13 shows the projected change in water use within the Wami-Ruvu catchment until 2035, with the major increase being in agriculture.

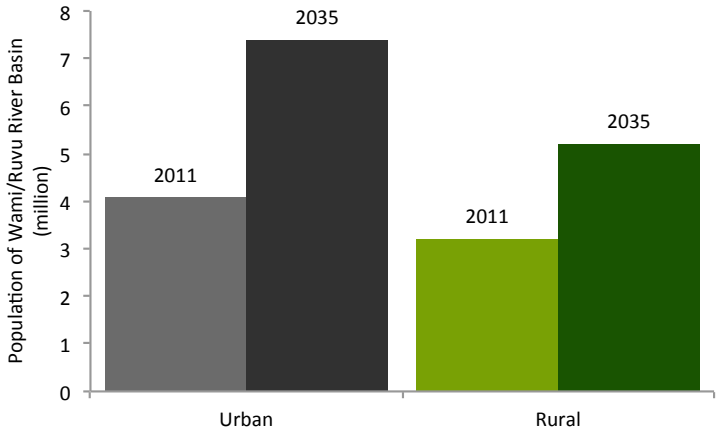


Figure 12. Urban and rural population growth in the Wami/Ruvu river basin.

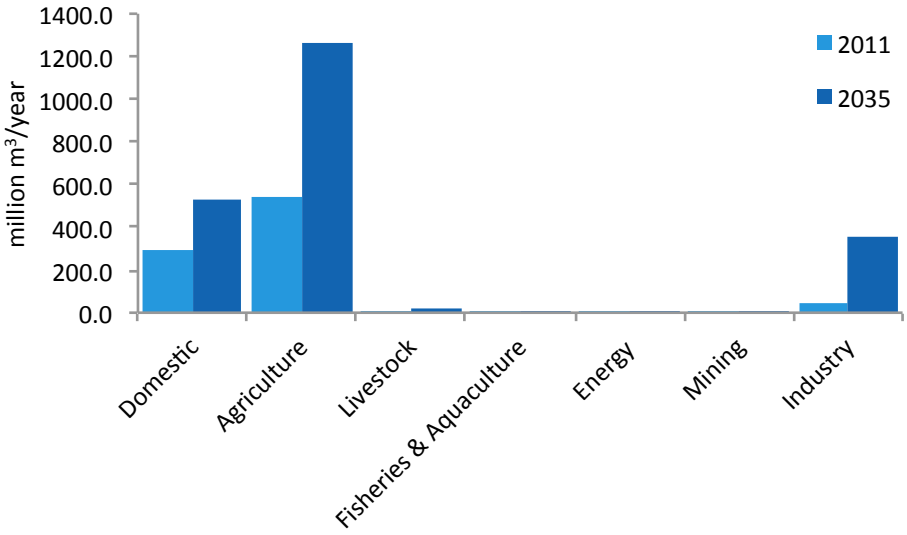


Figure 13. Current (2011) and future (2035) water use from the different water users in the Wami/Ruvu River Basin.

5. PRESSURES

Pressures represent both the positive and negative consequences of the driving forces (Ness et al. 2010). The pressures are in this case social, financial, and environmental changes and further affect the current state of biofuel related and acquisitions in Tanzania (Figure 14). The pressures on various scales are presented in Table 4, Table 5 and Table 6.

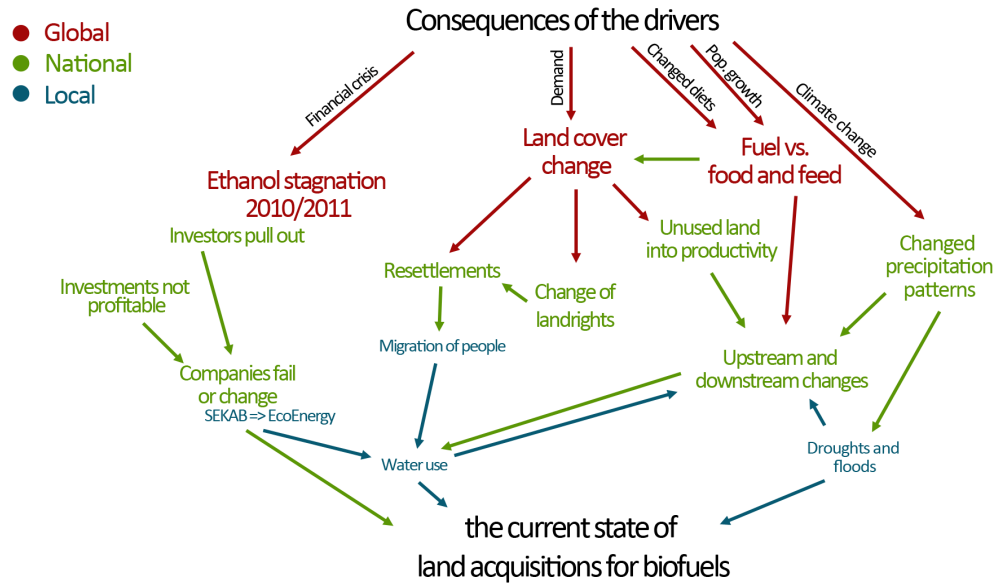


Figure 14. Consequences of the direct and indirect drivers that put pressure on the current state of land acquisitions for biofuels. The pressures are linked in a flow chart, and the different scales are distinguished by colour; global (red), national (green), local (blue).

5.1. Global

Table 4. The global pressures being a consequence of the drivers and further affecting the current state of biofuel related land acquisitions.

Global pressures	Consequence of
Land cover change	Higher demand of food, energy, etc.
Fuel vs. food and feed	Population growth, changed diets
Ethanol stagnation 2010/2011	Financial crisis
Changed precipitation patterns	Climate change

5.1.1. Land use and land cover change

Between 2000 and 2007 the global production of ethanol for transport fuel tripled from 17 billion to more than 52 billion liters (Bringezu et al. 2009), while biodiesel production expanded eleven-fold from less than 1 billion to almost 11 billion liters. There are predictions that the global demand for biofuels will increase to more than 170 billion liters in 2020 (GRAIN 2013; OECD 2013). At current production levels this would convert an additional 40 million hectares of land, on top of the 36 million hectares

planted globally in 2008, an additional area equal to the size of Sweden (GRAIN 2013; Bringezu et al. 2009).

Proponents of large-scale biofuel projects emphasize how these projects can help eradicate poverty, have a positive effect on the global carbon balance, and improve the environment. However, many biofuels cause greater environmental pressures than fossil fuel-use itself, especially with regard to eutrophication, acidification and biodiversity loss (Bringezu et al. 2009). Biodiversity loss is mainly a result of habitat reduction not only stemming from cropland expansion, but also from invasive species and nutrient pollution. The nutrient emissions to water and air impact species composition in these ecological systems. Land cover change for large-scale intensive agriculture impede ecosystem services that the natural ecosystems otherwise provide (Foley et al. 2005). The removal of natural vegetation and increased use of fertilizers has lead to water quality degradation in many regions globally, and some irrigated lands have become heavily salinized. Up to about 40% of global cropland experience soil erosion, reduced fertility, or overgrazing. The rapid loss of natural ecosystems causes long-term losses of ecosystem services, many which are important to agriculture worldwide. The biofuel development will most certainly add to the agricultural water use that currently uses about 70% of global fresh water. The water use for biofuel feedstock will lead to competition with food production, especially in water scarce areas that require irrigation. (Bringezu et al. 2009).

Land use plays an important role altering the global carbon cycle, and since 1850 about 35% of anthropogenic CO_2 emissions has come from land use (Foley et al. 2005). Biofuel crops are grown to mitigate global CO_2-emissions but the transformation of land from tropical or coastal forest or wetlands to grow feedstock might result in an increased carbon release to the atmosphere (Songela and Maclean 2008). Carbon sequestration is a natural ecosystem service and deforestation might result in a larger carbon release than what is saved by the replacement of fossil fuels by biofuels. Life cycle assessments (LCA) for biofuels show that ethanol from sugarcane has the highest greenhouse gas (GHG) savings, but varies from case to case (Bringezu et al. 2009). Negative GHG savings (increased GHG emissions) are often a result of converting natural land to large-scale monocultures, especially when large carbon stocks (like forests) are removed. Modelling studies show that large-scale clearing of tropical forests affect climate largely through water balance changes, and suggests that deforestation creates a warmer and drier climate and thus contributes to global warming (Foley et al. 2005).

5.1.2. Farmland allocated for fuel, food, and feed

The improvements in agricultural yields have in the past grown faster than the global population (Bringezu et al. 2009). Yields are still improving, and global average crop yields are expected to grow at the same rate as population between 2000 and 2030. However, the global food demand is changing to diets with a higher share of animal products, which require more land than diets based on commodities like cereals, roots and tubers, and pulses. Change in dietary preferences globally are putting more land under cultivation for feed production, and the land requirements for fuel crops will be added to this, leaving less land available for food production (Bringezu et al. 2009). The diversion of farmland for biofuel production instead of food has raised the international debate for food vs. fuel, arguing for and against the development of biofuels. Additionally, many of the land acquisitions for food production are not for the local

market but for export, depending on if the investor is in agribusiness or food security (Olyang'iri 2013). This statement is often counteracted with the argument that the market economy contributes to new possibilities and livelihoods, and that the farmer can now buy their food at the market. But previous stories tell us that these livelihoods are given to well-educated people from other areas, rather than the local small-scale farmer that would need the livelihood option.

5.1.3. Stagnating ethanol production

In 2011 the ethanol production stagnated for the first time since 2000 (Figure 15) and this stagnation can partly be explained by the financial crisis that occurred in 2007 to 2008 and is a consequence of the declining investments in new sugarcane assets and plantations (REN21 2012). The decreased production was also due to unfavourable weather and high world sugar prices. Africa accounts for a tiny share of the world production of ethanol, but saw a slight increase in production during 2011 relative to 2010. The global production of biodiesel on the other hand expanded in 2011 (mainly from soybean production in the US). Even though biofuel production stagnated during 2011, the interest and demand of these fuels are still increasing globally. (REN21 2012)

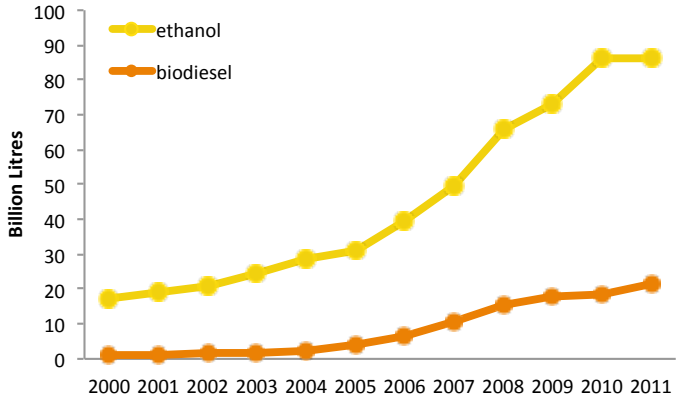


Figure 15. Trends in global ethanol and biodiesel production 2000-2011.

5.2. National

Table 5. National pressures that are a consequence of the various driving forces affecting biofuel related land acquisitions in Tanzania.

National pressures	Consequence of
Deforestation	Tanzania wanting investment in "unused land"
Change of land rights	Land rights must be transferred from the village assembly to the government to investing company
Migration and resettlement	Change of land right
Changed conditions for the land acquiring companies	Financial crisis, water users, growing population, changed rainfall patterns

5.2.1. Transformation of "unused land"

Tanzania holds a lot of arable land that is not under production, and foreign companies have the assets to transform, in monetary terms, unproductive areas to productive land. There can be good outcomes of the investments if the agreements are kept, such as technological transfers, infrastructure improvements, capacity building and so on. On the other hand, if promises are not kept, or if the project goes bankrupt, the local

population is suddenly very vulnerable to change. Hence, one of the biggest pressures is on the local people that change their livelihoods because of the investing company.

The main pressures from land investments are related to land cover change that puts a pressure on the environment from clearing large areas of forests on behalf of water intense irrigated monocultures (Sulle and Nelson 2009). The clearing of natural forests is also of big concern in Tanzania, as currently large areas of high biodiversity value are cleared for biofuel plantations (coastal forests have an especially high level of endemism) (Songela and Maclean 2008). The farmers are very dependent on their surrounding environment and its ecosystem services, and land cover change also alters the ecosystems, in particular biodiversity and water availability, accessibility and quality. The main crops that are promoted for fuel production in Tanzania are jatropha and sugarcane. Jatropha is supposed to be planted on marginal lands where food crops cannot grow, due to its ability to withstand drought (Action Aid 2009). However, a study by Action Aid (2009) reveals that the land allocated for jatropha in some cases has been very productive, hence putting pressure on land that would otherwise be available for local food production. Water is one of the major resources for biofuel crops, and for companies investing in sugarcane one of the first concerns is water availability. As Tanzania is fairly water abundant and these kinds of investments are preferably targeted to this country. As more and more large-scale production and processing for biofuels are implemented, new pressures are put on surface and groundwater resources (Action Aid 2009).

5.2.2. Change of land rights

In Tanzania all land belongs to the state, but there are three land tenure categories created under the *Land Act*; village land, reserved land (conservation areas), and general land (Figure 16) (Ministry of Lands Housing and Human Settlements Development 2013). Currently about 2% of the land is general land, this is mainly land within cities and is owned and managed by the government. Village land is under the authority of a village assembly, and the villagers have the collective ownership. Today about 70% of the land is classified as village land and this is to protect the rights of the small-scale farmers. Only around 20% of the village land is "used", and therefore the Government of Tanzania is inviting foreign investors to develop this land. The fraction of unused land is based on a letter that was sent out by the Government to all districts of Tanzania that said they should list all the land that is not being used (Hussein 2013). There was no explanation about why they needed this list, but the information given is now the background information the Tanzanian Investment Centre (TIC) use to tell foreign investors where to look for land. However, how much land that is actually available can be discussed since TIC has poor documentation of changes in available land in their "land bank". Areas that are

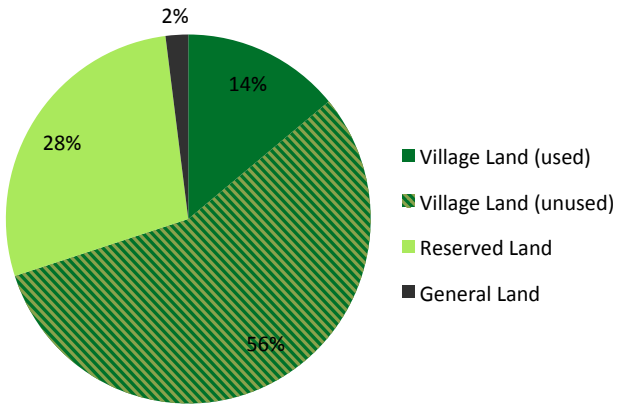


Figure 16. Land tenure categories in Tanzania, proportions from the Ministry of Land (Ministry of Lands Housing and Human Settlements Development 2013).

registered as “unused land” might, for example, be new conservation areas (Senyagwa 2013).

The general land law does not allow foreign companies to own land, so the Tanzania Investment Centre must own the land in order to issue the land right to the investor (Masalu 2013). Therefore in the process of leasing out this land, it must be transferred from village land to general land. The general land is under the administration of the Ministry on Land (the government), and the transfer from village land to general land must get the approval from the president (UR 2013). When transforming village land to general land, the land rights of the villagers are threatened, and more land is under direct control of the state. If a project fails, the land does not go back to being village land, but remains state owned general land (Msemo 2013).

5.2.3. Migration and resettlement

The land acquisitions are causing migration and resettlement since the land is cleared for the foreign investor. This affects the pastoralists in particular, and they are forced to look for new grazing land after being pushed away from various investors (Lane and Pretty 1990). In Tanzania the pastoralists are not recognized as indigenous people. Their way of living is seen as old-fashioned and the general opinion is that they should engage with commercial production instead of the traditional livestock holding (Bedford 2013). Most of them are not registered on the land they use because they shift location depending on land and water resources, and also because they lack the knowledge of the importance of being registered on land. Without registration it is hard to prove their right to the land and receive fair compensation.

5.2.4. Changing conditions for companies that acquire land

Many European companies that acquire land rely on loans from various investors, shareholders, and banks, and if the source of capital disappears the company is likely to go bankrupt. The financial crisis in 2007 and 2008 had devastating effects on companies that were about to acquire land, or already up and running. Many investors disappeared or pulled out during this time, and companies have had a hard time finding new investors since then because of the economic risk to invest in land abroad. The companies and their projects are therefore very vulnerable to global financial changes. Another factor that is changing the financial conditions of biofuel investments in Tanzania is the profitability of certain crops. For instance BioShape and Sun Biofuel are both companies that started growing jatropha but that did not find the crop profitable and sold/left the area to other foreign investors (Chachage and Baha 2011).

Water availability in the water basin is altered due to a growing population and also an increasing number of large-scale agricultural companies (National Environment Management Council 2008). This may have significant consequences on the water availability in downstream reaches as well as seasonal river flow. Changed seasonal water availability is a present as well as a future concern, and the effects from climate change are already evident in some parts of Tanzania. Climate change is predicted to exacerbate agricultural production risks by shifting the already volatile long-term weather conditions. Many studies conclude that future rainfall patterns are uncertain, and suggest that some parts of Tanzania will receive less rainfall, and some more (EcoEnergy 2012). One study suggests a seasonal shift in rains, with less rainfall earlier in the season and stronger rains later in the season. The long-term effects from a change

in rainfall patterns could have a negative impact on all water users, and lead to a low river flow in October and November, specifically during a "dry year" (EcoEnergy 2012).

5.2.5. Pressures on Sweden

The pressure on the environment in Sweden is either alleviated or stays unchanged since the land use change is made in Tanzania. There is however an economic risk for the companies that are investing in biofuel production abroad, and unpredictable future changes can potentially put companies into bankruptcy or in administration.

5.3. Local

Table 6. Local social and environmental pressures, affecting biofuel related land acquisitions in Tanzania.

Local pressures	Consequence of
Environmental and social pressures in the area about to be acquired by EcoEnergy	Migration, charcoal production
Increased water extraction	Population growth, especially in Dar Es Salaam
Unreliable rainfall	Climate change

5.3.1. Environmental and social pressures in the area acquired by EcoEnergy

The biggest social and environmental pressure in the area where EcoEnergy will start the sugarcane plantation is currently not a consequence of any action the company has made but rather a consequence of the lack of action. Since it was known that a foreign company was about to acquire the land, people started buying plots of land within the area, and people moved in for charcoal production. The migration to the area is a consequence of people being forced off their land by other foreign investments, coupled with the (false) hope of being compensated by EcoEnergy after being moved. The company is still waiting for full permission to the land from the government, and has been waiting for a couple of years.

The uncontrolled migration of charcoal producers is currently the biggest concern for the pastoralists in the area as the new settlers quickly degrade the environment, and rape and kill their children and wives. Many pastoralists wonder what is going on with the land, and who should be responsible for controlling the rapid influx of new people. Charcoal production is highly unsustainable and had in 2012 resulted in a loss of about 40% valuable forest, flora and fauna since 2009 in the Razaba farm area (African Development Bank Group 2012). If these activities are not controlled in a better way by the authorities, it is very likely that valuable biodiversity will be lost in the next couple of years affecting endangered animal species and local ecosystem services.

5.3.2. Increased water extraction in a seasonally water stressed area

The current water users of the lower Wami River are subsistence farmers, pastoralists, and the ecosystems themselves. The water extractions will eventually include the EcoEnergy farm and the outgrowers, since their primary source of irrigation water will be the Wami River (National Environment Management Council 2008). Hence, the water will have to be shared and managed between more users (Figure 17). The situation in the Wami/Ruvu Basin started to change already 20-50 years ago due to an increased

number of water users, and large-scale farming activities in the basin (Faustine 2013). It is the most water stressed basin in Tanzania upon which 70% of the country's population depends. Dar Es-Salaam gets its water supplies from the Ruvu River (Japan International Cooperation Agency (JICA) 2013).

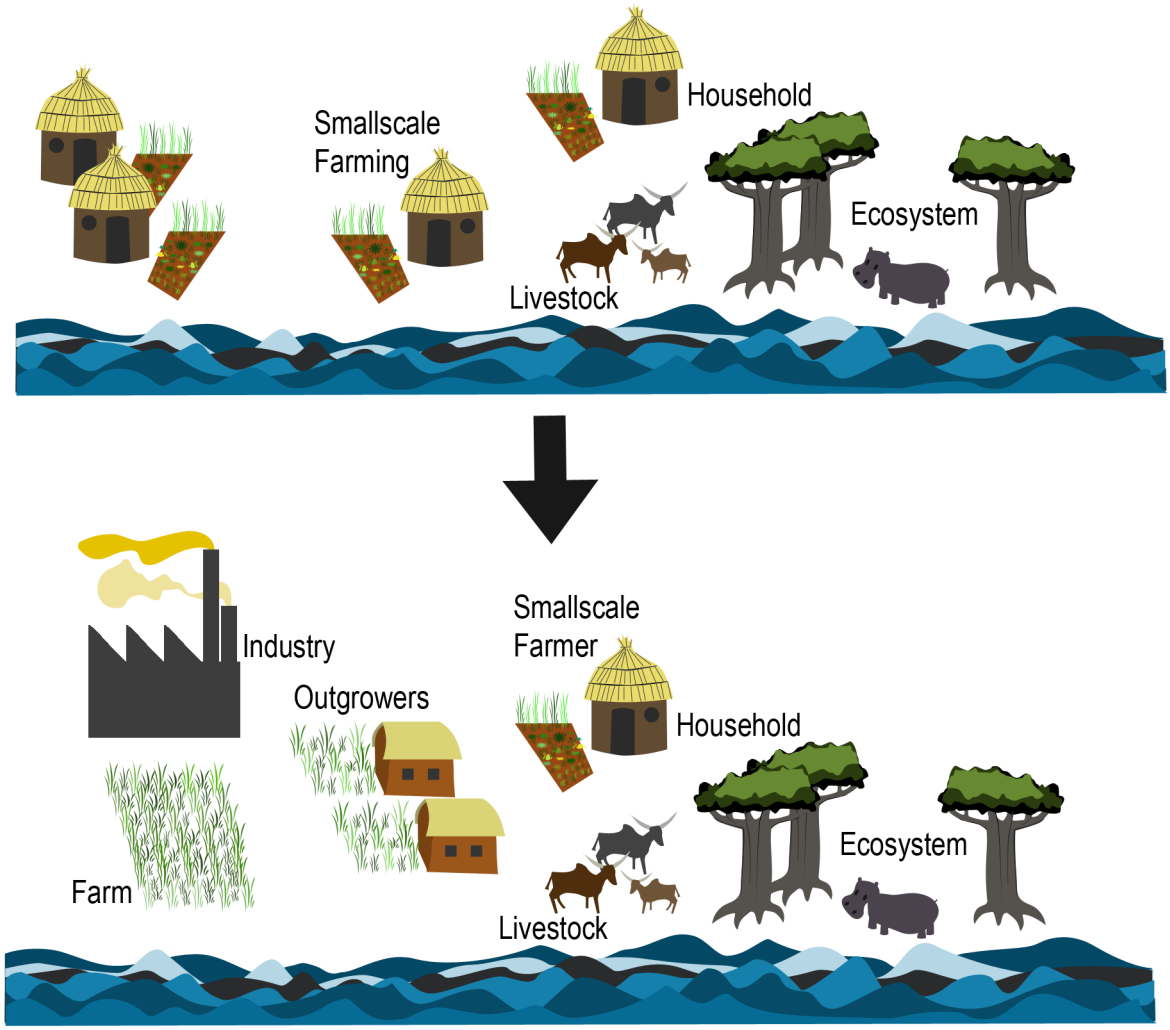


Figure 17. Illustration of the water users of the lower Wami River before and after EcoEnergy has implemented their sugarcane farm and developed outgrower farmers for sugarcane production.

The EcoEnergy farm must also harmonize with the upstream users, as they are at the lower reaches of the Wami-Ruvu River catchment and are under pressure from water management upstream. Hence, the water availability might affect EcoEnergy and their water demand for production (Figure 18).

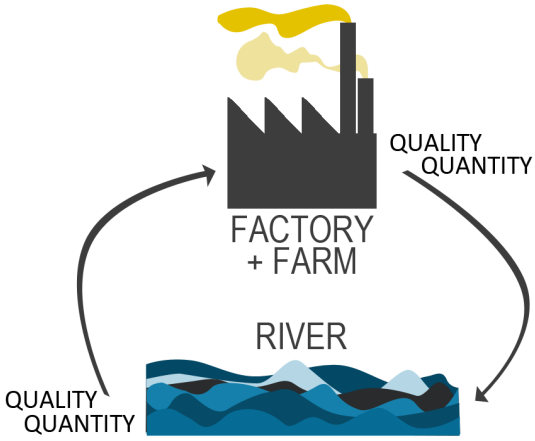


Figure 18. Industry as pressure on river, and river as pressure on industry.

5.3.3. Local effects from climate change

The local effects from climate change are difficult to quantify, but will most likely change the circumstances of the water availability, and therefore also affect the EcoEnergy project. The irrigation water will be extracted from the lower Wami River, both by the large farm and the outgrower farmers. The water recharge has already become more uncertain because of climate change and unreliable rainfall in the rainy seasons (Faustine 2013). The Wami/Ruvu Basin Office has identified low water flows during dry years as a barrier to social and economic development in the basin. They have also recognized that climate change might further reduce flows in the dry season and increase the flows during the rainy seasons, worsening the periods of floods and droughts.

Since the location of the farm is close to the coast, there might be a long-term risk of salt-water intrusion. Both from climate change causing lower groundwater recharge, and sea-level rise (Mujawahuzi 2013). But also due to the lower river flow levels caused by the increased extraction. However, in the short term, there are no risks for saltwater intrusion to the EcoEnergy farm area (Schramm 2013).

6. State

The state describes the current condition of the environment, or the observed changes of the system caused by the drivers and pressures (Carr et al. 2007; Kristensen 2004; Ness et al. 2010). The state is a product of the drivers and its following pressures that further causes social and environmental impacts (Figure 19).

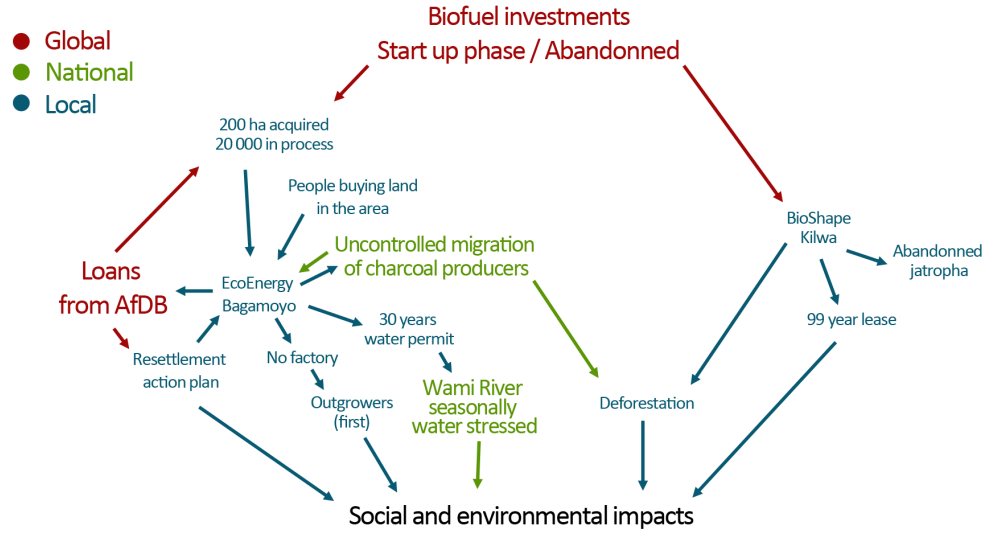


Figure 19. Flow chart of the current state of EcoEnergy Bagamoyo and the abandoned Bioshape project in Kilwa.

6.1. Global

6.1.1. Swedish global land acquisitions

In 2012, an area of land equal to 1.02 million km^2 had been acquired globally by investors since the early 2000s, according to Land Matrix (2012**Fel! Bokmärket är inte definierat.**) and GRAIN (2012**Fel! Bokmärket är inte definierat.**). Swedish actors were registered to be responsible for just over 2% of this area, and with 2 253 805 ha Sweden almost ranked in the top ten of land acquiring countries. This area increases to 2 349 305 ha when Swedish shareholders in foreign companies are included. The main targeted areas are Eastern Africa and Eastern Europe. Eastern Africa is subject to land acquisitions related to production of energy crops, and Eastern Europe is a region for agribusiness. With an update of the Land Matrix database in 2013 the acquired land from Swedish investors decreased to 1 330 896 ha as companies adjusted their numbers. The major change was for SEKAB whose land acquisitions were reduced from 981 200 ha to 37200 ha of sugarcane and sweet sorghum production. However, SEKAB is not the correct company name since they sold their African business to EcoEnergy in 2009. In reality they have acquired 200 ha where they have a sugarcane nursery, and are still waiting to acquire about 20 000 ha for the main sugarcane production. The drastic change with the update of the Land Matrix database underscores the current issue that the plans for biofuel investors change rapidly. Figure 20 shows all Swedish investments in land abroad that have been registered in GRAIN, Land Matrix and a report from Sjöholm et al. (2011).

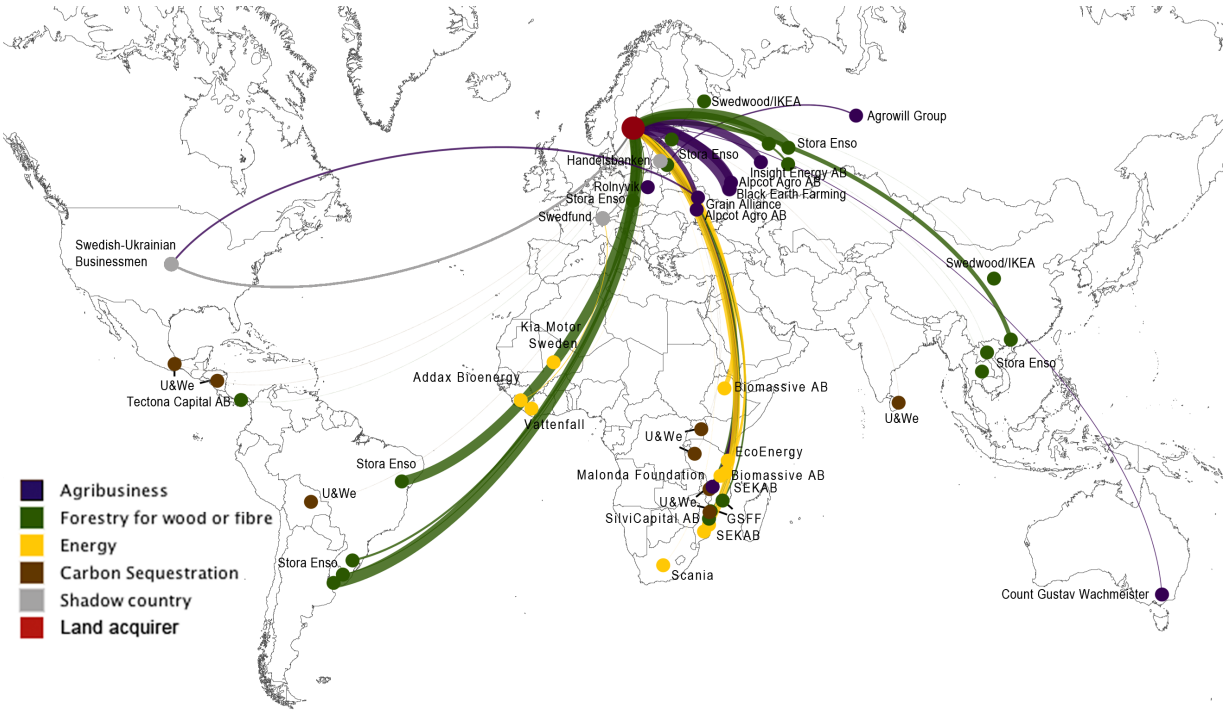


Figure 20. Network of Swedish land acquisitions and investments in land abroad. The colour of the lines and nodes represent the assigned sector of the investing company while the thickness of the lines are scaled to the area of the acquired land. Where there is no line, the area of the acquired land is unknown. The grey lines and nodes represent land acquisitions where Swedish companies are shareholders, but where the main investor is registered in another country (The US, Switzerland). See large figure in appendix.

Table 7. The registered deals from GRAIN (2012) and Land Matrix (2012, 2013). After being edited to remove duplicates from merging two sources, and assigned a sector.

	GRAIN 2012 + Land Matrix 2012		GRAIN 2012 + Land Matrix 2013	
Sector/Investors	Hectares	Number of deals	Hectares	Number of deals
Agribusiness	**1010605**	**14**	**1010605**	**14**
Agrowill Group	40000	1	40000	1
Alpcot Agro	402200	8	402200	8
Black Earth Farming	326000	1	326000	1
Count Gustav Wachmeister	15700	1	15700	1
Grain Alliance	40000	1	40000	1
Insight Energy AB	180000	1	180000	1
Rolnyvik	6705	1	6705	1
Bio Energy	**1146700**	**10**	**52700**	**4**
Addax Bioenergy	15500	1	15500	1
Biomassive AB	150000	2	0	0
SEKAB	981200	7	37200	3
Forestry	**192000**	**3**	**267591**	**4**
GSFF	192000	3	192000	3
Malonda Foundation	0	0	75591	1
Total	**2349305**	**27**	**1330896**	**22**

The rapidly changing nature of the data is only within the biofuel sector for Swedish land acquisitions (Table 7). According to the databases, the company acquiring the most land in the energy sector is *SEKAB*[3]. This company began to require large areas in the mid 2000's for ethanol production from sugarcane, and wanted to initiate projects in Tanzania and Mozambique. Now their main focus is on a pilot project in Bagamoyo, Tanzania. *Biomassive AB* was a company that wanted to produce biodiesel in Tanzania from jatropha but this project seems to have ceased or never started. *Addax Bioenergy* is a Swiss company that is funded by *Swedfund* to start up a large-scale sugarcane project for "sustainable" ethanol production in Sierra Leone. A Swedish investor in bioenergy that is not registered in any of the databases is *Vattenfall Biomass Liberia AB* that were 30% shareholders of *Buchanan Renewables Fuel in Liberia*, who process old rubber trees for biomass (Sjöholm et al. 2011). The purpose of this is to mitigate Vattenfall's carbon emissions and to help fulfil their new vision to make electricity "clean", with the goal to be carbon neutral in 2050 (Steinweg et al. 2013). While writing this Vattenfall pulled out as an investor, which caused the whole project to collapse, and all contracts with the farmers were cancelled. The area was left deforested, the people left jobless, and Vattenfall lost about 1.3 billion SEK (approximately 2 million dollars) in the deal. Also, the Land Matrix database was updated once again (June 10th), to include *Stora Enso* and the *Diocese of Västerås* for land acquisitions for forestry.

[3] SEKAB is no longer acquiring land, but sold its operations to EcoDevelopment/EcoEnergy.

6.1.2. Global land acquisitions in Tanzania

Tanzania is one of the countries where most land is acquired globally. According to the 2012 versions of the GRAIN and Land Matrix databases it ranked number 12 of globally acquired land with 2 771 233 ha since the early 2000's corresponding to 3% of acquired land globally. The country that was registered to be acquiring the most land in Tanzania was Sweden for biofuels (followed by India for food). The numbers changed with the updated version of the Land Matrix database in 2013. The total amount of acquired land in Tanzania decreased to 1 709 937 ha, and from 69 to 52 deals. The current state of land acquisitions in Tanzania according to Land Portal (2013) and GRAIN (2012) is visualized in Figure 21 that shows the land acquisitions for various crop types and from what country the investing company is from. Most land deals are for growing flexible and fuel crops, but the largest area in total is acquired for food crops (Table 8). Flexible crops are those that can be used for many purposes; for food, fuel, feed, energy, and what the crop is used for is determined by factors like market price and demand, and the interest of the company. Many companies that are growing flexible crops are biofuel companies.

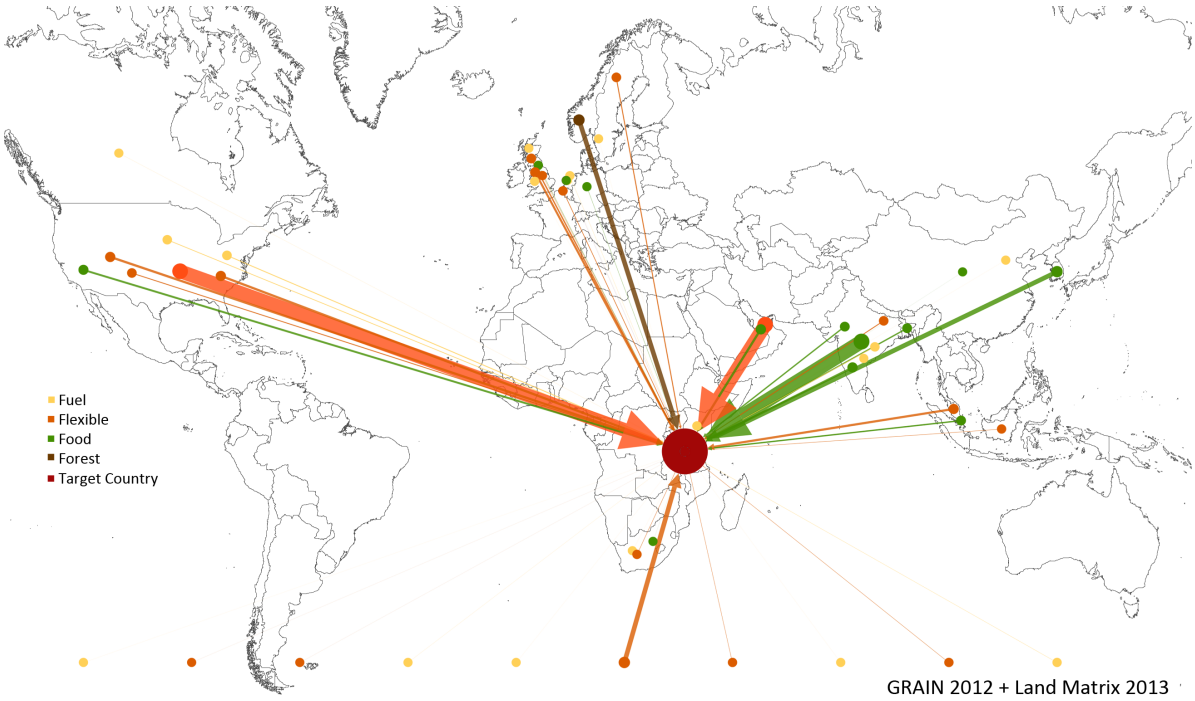


Figure 21. Network of land acquisitions in Tanzania by global actors. The thickness of the line is proportional to the area of the acquired land. The investments are mainly for fuel, flexible, and food crops but also for forestry for carbon sequestration. The nodes along the bottom of the map are registered companies but miss information on the country of origin. Also see large figure in appendix.

Table 8. The registered deals from GRAIN (2012) and Land Matrix (2012, 2013) after being edited to remove duplicates from merging two sources, and assigned a sector.

	Grain 2012 + Land Matrix 2012		Grain 2012 + Land Matrix 2013	
Crop type / crop	# Deals	Hectares	# Deals	Hectares
Biofuel	**21**	**263663**	**15**	**77400**
Croton	2	30000	1	20000
Jatropha	17	223900	13	56900
Not Stated	2	9763	1	500
Flexible	**24**	**1272594**	**18**	**444276**
Corn	1	101000	1	101000
Oil Palm	11	223394	9	214076
Sorghum	2	70000	1	45000
Sugar Cane	9	858200	6	64200
Sweet sorghum	1	20000	1	20000
Food	**14**	**673533**	**13**	**663818**
Barley	1	5000	1	5000
Crops	2	353700	2	353700
Not Stated	1	1000	1	1000
Rice	5	193818	5	193818
Rice and wheat	1	50000	1	50000
Rice seeds	1	300	1	300
Rice, pulses, corn	1	30000	1	30000
Seeds	1	30000	1	30000
Sugar	1	9715	0	0
Food, Flexible	**3**	**325117**	**2**	**300117**
Corn, beef, poultry, biofuel	3	325117	2	300117
Forestry	**1**	**100000**	**1**	**100000**
Trees	1	100000	1	100000
Flowers	**3**	**12000**	**0**	**0**
Flowers	3	12000	0	0
Tourism	**3**	**124326**	**3**	**124326**
Not Stated	3	124326	3	124326
Total	**69**	**2771233**	**52**	**1709937**

6.2. National

6.2.1. Cancelled, changed, sold, and incorrect biofuel land deals

For Tanzania, the number of deals was reduced by 32% of what was reported in 2012, while the total acquired area was reduced by 51%. The reasons for the reduction are partly because the databases had reported some companies twice, for example Illovo

Sugar is the same as Kilombero Company, but also because many companies have failed in their projects (having either never started, abandoned the land, changed production, or sold the land off to another company). However, the overrepresentation of reported land acquisitions does not mean that there is much less land acquired in Tanzania. Many companies that are well known in Tanzania are not reported in the databases, e.g. British SunBiofuel and Dutch BioShape (both for jatropha, both failed). The Tanzanian Investment Centre also states that there are about 300 different foreign companies that are registered on Tanzanian land for agricultural investments (Senzia 2013). About 40 companies have expressed their interest in biofuel cultivation, and about 436000 ha have currently been earmarked for biofuel investments (Makoye 2013). The land acquisitions by biofuel companies are visualized in Figure 22 where the thickness of the lines represents how large area that is acquired and the colour represents the crop. All nodes are labelled with the company name, and they are placed in the approximate area of the originating investment. The bottom row of companies did not have any acquiring country registered, and the companies from Malaysia and Indonesia did not have any company name registered. The data are edited to remove duplicates and incorrect company names. Some companies have been added from interviews, and companies that are not actively engaging in any production are still kept because they are most likely landowners for 99 years, even though they are not present on site.

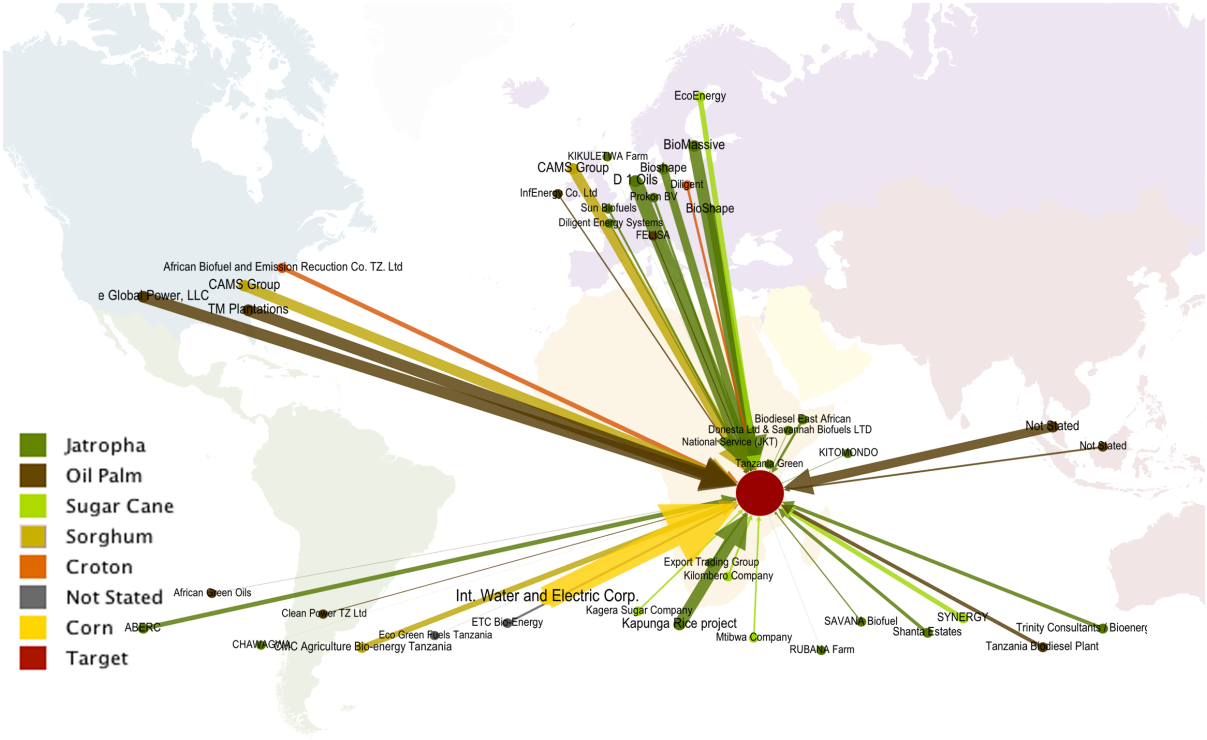


Figure 22. Network of all land acquisitions for fuel and flexible crops in Tanzania. See large figure in appendix.

Examples of companies that have failed are BioShape and Sun Biofuel. They are both companies that began growing jatropha but did not find the crop profitable and sold the land and/or left the area (Chachage and Baha 2011). The projects failed, and in both cases the land has been transferred from village land to general land and cannot be accessed again by the villagers who previously owned the land, since the land lease is 99 years from the day the deal was signed.

Almost all jatropha projects in Tanzania have failed, either because the companies realized the crop was not profitable or because a shareholder pulled out of the deal after the financial crisis (Schramm 2013). The only biodiesel company that is still in operation in Tanzania is EcoCarbone (previously Diligent), and is also the only company that has had positive effects on rural livelihoods. EcoCarbone continued after Diligent went into administration in 2012 after the investor pulled out. The business builds upon buying oilseeds from small-scale farmers that grow jatropha as hedges for their farm plots (Gevaert 2013).

6.3. Local

6.3.1. The current state of EcoEnergy

EcoEnergy was established in 2008 to take over 200 ha of sugarcane plantations in Bagamoyo, Tanzania, that were initiated by SEKAB in 2006. SEKAB is a communally owned Swedish company that intended to acquire land in both Tanzania and Mozambique to develop a *new* industry for sustainable ethanol production. The initial plans have gone through many changes since then because of global, national and local drivers, pressures, and responses to changing circumstances. The initial plan of SEKAB was to produce ethanol for export, on a total area of 400 000 hectares of land in the Rufiji Basin. This deal was cancelled in February 2009 due to financial problems after the global financial crisis (DN 2009). After a lot of media attention about a public company "grabbing" land in Eastern Africa, SEKAB sold all of its African plants in 2009 to their own co-worker, Per Carstedt. As a private company they are nowadays called *EcoDevelopment* and go under the name *EcoEnergy Tanzania* for their investments in Tanzania.

EcoEnergy is focused on implementing numerous "sustainability" criteria; domestic market (first), ecological sustainability, social sustainability, and CO_2-neutrality. To achieve this, the production strategy has also taken a turn, and the company will no longer produce ethanol for export but rather sugar for the local market. From the bagasse they will produce ethanol to run the trucks on the farm.

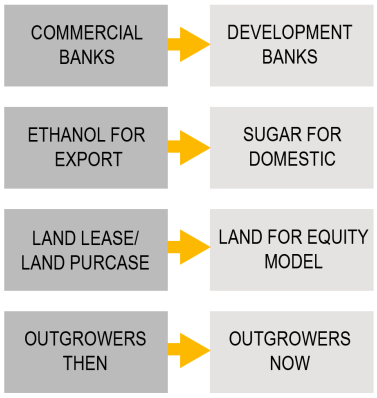


Figure 23. How EcoEnergy has changed their strategies since 2009.

The loans for the investments were supposed to come from commercial banks, but after the financial crisis these banks pulled out and EcoEnergy had to look for money elsewhere. So they turned to the development banks. The African Development Bank (AfDB) approved of giving out a loan only if they had financial back up, so they turned to SIDA to see if they could be the "creditor" if the planned investment would have future financial problems. According to the company they have got a "yes" from SIDA, but other sources say that the agreement is not completed yet and is part reason for why the project has not yet started (Noel 2013). The change from commercial- to development banks seems to be one of the main reasons why EcoEnergy has reconsidered their planned industry (Figure 23). To get the loan and to get started they also had to follow certain principles of financial, environmental, and social guidelines. This has postponed the start-up of the

sugarcane farm, since they have had to conduct environmental and social impact assessments, and come up with mitigation strategies for future impacts.

Since SEKAB/EcoEnergy came to Tanzania, there have been some changes in how the GoT handle foreign investments in land. The GoT is trying out the "Land for equity"-model, and they are now using EcoEnergy as a pilot project. EcoEnergy therefore sees themselves as "pioneers in land acquisitions", as they are the first company in Tanzania to try this model.

In 2008, EcoEnergy was promised 170 km^2 of land from the GoT to start their production north of Bagamoyo, about 100 km from Dar Es Salaam. The Bagamoyo site is seen as a stepping-stone to get production started in the other areas, and they now have a "demo farm" of 200 ha sugarcane, with sub-surface drip irrigation close to Bagamoyo, outside the Razaba farm area. This irrigation technique is said to not function at a large scale but the demo farm is supposed to show that it is possible.

Figure 24. Notice board at entrance to Razaba Farm, telling farmers to not move in or buy land in the area. The migration and purchasing of land is increasing rapidly. Photo: Emma Li Johansson 2013.

In 2011 a notice board was put up where you enter the Razaba Farm area (Figure 24), saying:

"CAUTION!
Do not buy land within the Razaba farm. The Razaba farm area includes areas of Makaani, Makurunge, Gama and Wami River. This is a government farm and is already on the final process of being transferred to EcoEnergy.

Don't get conned.
By the Bagamoyo District Commission."

As of June 2013 there are still no sugarcane plantations in the project area, and no factory is built as the project is still waiting for a financial closure. The number of people in the area has increased rapidly since it was widely known to be project land in 2008, and is still increasing in an uncontrolled rate. According to Schramm (2013) the migrants think they will be compensated if they own a piece of land in the project area.

6.3.2. Outgrowers

While waiting for the financial closure and the factory to be built, the "outgrower team" has started to educate the future outgrowers (Figure 25). This means that the primary plan to start with the big farm, and then develop outgrower schemes in the second phase has changed (Schramm 2013). Today the famers in the villages around the Razaba farm have approximately four ha of land each, but according to the people developing the outgrowers, the farmers only have the capacity to put one hectare in production. The general idea of the outgrower scheme is to help small-scale farmers to form a company so they can invest in technology making them able to crop more land than they do today. This is done in three steps:

1. By changing attitudes, that they can produce more
2. By creating competence
3. By applying the knowledge in field

This whole process takes about 5-6 years, and the process has now started by teaching the farmers how to set up a business. One of the villages has also started to grow rice on 2 acres (~0.8 ha) in order to learn how to irrigate in the most water and energy efficient way. The field is located very close to the Wami River, from where the irrigation water is pumped with a gasoline- driven pump. In the near future the field is planned to expand to 4 hectares, and then to reach the long-term goal of 100 ha.

Figure 25. The "outgrower team" is educating the farmers to set up a small business and learn how to irrigate. The crop is currently rice but will be sugarcane once the factory is constructed. Photos: Emma Li Johansson 2013.

6.3.3. Resettlement and migration

When the Razaba farm was first surveyed for the EcoEnergy Project (at the time using Tanzanian Law only), it was deemed 'without people'. This is incorrect as there have been villagers living in the area throughout the time of Razaba Ranch. Pastoralists have been in the area since the Razaba farm was shut down in 1994 (Barbaig pastoralist elder 2013). The small-scale farmers in four villages: Kaloleni Biga, Gobole, Gama and Bozi have now been recognized and counted for compensation. Two more villages are now scheduled for a census by the Government and compensation will be made according to IFI[4] compliance. In the Resettlement Action Plan (RAP) both pastoralists and charcoal producers have also been recognised with a variety of mitigation measures to off-set Project induced Impacts (Bedford 2013).

The number of people living in the project area is hard to estimate because of fast migration. However, the people that were in the area before it was project land are well identified and they will receive compensation. According to a social survey carried out in December 2010 and January 2011, there were between 170 and 370 households in the EcoEnergy project area in 2010 (Senyagwa and Arvidson 2011). The influx of new residents was rapid, and in less than a month (19 Dec – 17 Jan 2010/2011) approximately 100 new households were settled. People moved in despite authorities visiting in December and informing settlers that they will have to move out. According to the consultants dealing with the resettlement there are 11 pastoralist families that are recognized to have lived in the area before 2008, and there are also pastoralists that

[4] IFC Performance Standard 7 Indigenous People.

currently use the land seasonally when water resources are scarce (Bedford 2013). The charcoal producers are currently more than 250 within the project area. According to Tanzanian law, the number of people living in the area is about 450, but this law does not take the pastoralists into consideration. If counted according to international guidelines the number of people affected by the project is about 1200, as it also includes pastoralists, charcoal producers and seasonal users.

Within the EcoEnergy project area there are 11 Barbaig pastoralist families belonging to the Datooga tribe (Bedford 2013). Together they own about 1750 head of cattle, which use the water from the various dams around the old Razaba Ranch. Some of the pastoralists have grazed their cattle around the Razaba Ranch since it shut down in 1994, and some have come from Hanang, an area in northern Tanzania, after being pushed away by various land acquiring companies (Lane and Pretty 1990).

6.3.4. State of the Wami River and water rights/permits

Tanzania has nine river basins and the Wami-Ruvu is one of the coastal river basins, containing both the capital Dodoma and the big city Dar Es-Salaam (Kalugendo 2013). The basin is generally water abundant, but it is becoming more water-scarce because of climate change and population growth, especially in the drier months because of the shorter and more infrequent rains. The main source for irrigation for EcoEnergy will be water from the Wami River, in the lower Wami-Ruvu catchment (Figure 26). The river divides the Sadaani National Park from the project area and is important for hippos and crocodiles, but also other fauna that uses its freshwater. (National Environment Management Council 2008).

Figure 26. The state of the Wami River in late March, a habitat for various bird species, hippos, and crocodiles. Photos: Emma Li Johansson 2013.

The basin board give water permits (previously water rights) to the different water users (Kalugendo 2013). Every user needs to pay for a permit, but far from everyone has one and extract water anyways. The permit enables the basin board to manage the river with pollution control and water availability, but to successfully do this they need help with monitoring from the various water users. There are many big agricultural companies along the Wami River and it is important that each water extractor consider the one downstream. In the previous Water Act (rules and regulations regarding water) nothing was mentioned about the duration of a *water right*, and if a water user got a water right it lasted forever. Since the new Water Act in 2009 this law has changed, and every water user with or without water rights must apply for a *water permit*, and the water permit has a duration. After 2009 the water permits lasted one year before they

had to be renewed. Thereafter the basin board thought to make it more long term, aiming at 10 to 30 years. However, the uncertainties of climate change on water availability reduced this duration to five years. When EcoEnergy applied for their water permit they would not agree on a 5-year permit, and they were given 30 years with conditions; that the basin board decide otherwise in times when water is scarce. Not everyone get 30 years water permit, and there are no guidelines on how long the duration of the permits should be (Kalugendo 2013). The reason that EcoEnergy did not accept five years is because with that little time they would not get any loans to get started (Schramm 2013).

7. IMPACTS

The impact is a measure of whether the change in state (see previous section) has had positive or negative social or environmental effects (Rounsevell et al. 2010; Ness et al. 2010). In this case the impacts are related to the changes in the current state of biofuel related land acquisitions in Tanzania, and how these changes affect social and environmental systems. The potential future impacts of EcoEnergy are presented in order later address mitigation strategies in the responses chapter. Figure 27 shows that the impacts from biofuel-related land acquisitions are mainly local. But this is also due to the ten-year time constraint of the analysis.

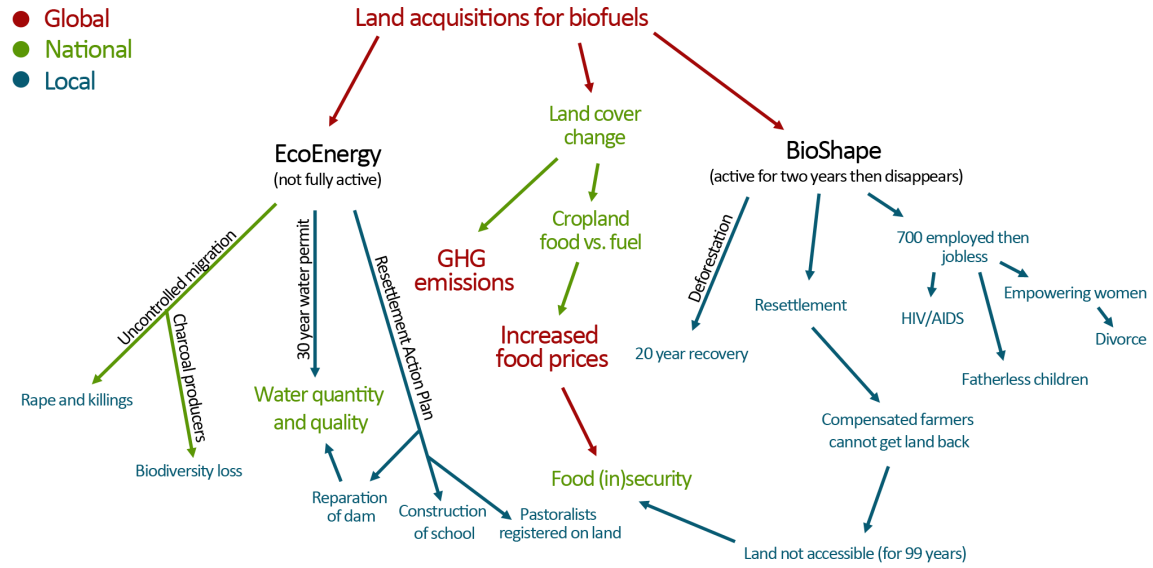


Figure 27. Flow chart of impacts caused directly and indirectly by biofuel related land acquisitions in Tanzania.

7.1. Global

Since the phenomenon of biofuel related land acquisitions began in the early 2000s, the large-scale global impacts are not yet fully evident. This is mainly due to the tendency of global processes to develop gradually over a long time. Many reports describe the potential global impacts that could be realized in the future if the current trend continues. German et al. (2010) identifies a few key (local) impacts that are seen globally from six case studies in sub-Saharan Africa, Latin America, and Southeast Asia. This is namely that the promises made by investing biofuel companies have not been materialized. Impacts that are often highlighted in various reports are such as deforestation, and a lost access to land for the local rural communities.

7.1.1. Environmental impacts

The greatest global impact from land conversion for biofuel production is increased deforestation, and its consequent impacts on reduced biodiversity (Borras and Franco 2012; Bringezu et al. 2009). Forests currently cover around 4 billion hectares, which is about 31% of the Earth's land surface (FAO 2010). The two largest terrestrial carbon pools on Earth are soils and plant biomass that together contain about 2.7 times more carbon than the atmosphere (Fargione et al. 2008). Population growth and the demand

for land for food, feed, fibre, and fuel are continuously increasing the annual rate of deforestation, which the past ten years reached a rate of about 5.2 million hectares per year (FAO 2010). At this pace it would take 775 years to lose all of the world's forests. In 2008 biofuel crop production covered about 26.6-35.7 million hectares (Bringezu et al. 2009), and it would take an additional 44.3-116 million hectares to meet the predicted biofuel demand of 2020 (GRAIN 2013). The clearing of natural vegetation and the subsequent release of carbon stored in soil and vegetation may take decades to replace with the new plantations, and whether biofuels lead to carbon savings or not depends on how they are produced. This makes greenhouse gas mitigation effects of biofuels questionable since the release of stored carbon in many cases is larger than what is saved. The net CO_2-impact of biofuel plantations varies from case to case depending on the carbon content of the converted land. Converting rainforests, peatlands, savannahs, or grasslands on behalf of food crop-based biofuels releases 17 to 420 times more CO_2 than the annual greenhouse gas reduction that biofuels provide by displacing fossil fuels (Fargione et al. 2008). The global impact on climate change is an increased CO_2 release to the atmosphere, which counters the initial motivation for growing biofuels on acquired land.

Other environmental impacts from land clearing include soil erosion, lowered water quality, and loss of biodiversity (Mshandete 2011). Biodiversity loss is a result mainly from cropland expansion, but also from the introduction of exotic invasive species, and nutrient pollution from the excessive use of fertilizers (Bringezu et al. 2009). A loss in global biodiversity makes ecosystems more vulnerable to long-term disturbances like climate change, and less able to recover (Rockstrom et al. 2009). One of the most important services is the process of pollination, that provides food crops and helps reproduce wild plants on which other services or service-providing organism depend (Kremen et al. 2007). About one third of crop production depends on animal pollination, and 60-90 % of plant species need a pollinator.

7.1.2. Social impacts

"Increased investment may bring macro-level benefits (such as GDP growth and improved government revenues), and may create opportunities for economic development and livelihood improvement in rural areas." (Cotula, et. al 2009)

Many proponents of biofuel-related land acquisitions claim that the investments have the potential to provide rural development, but the fast and large-scale expansion has been questioned on various fronts, including food security, impacts on small scale farmers, and increased competition for water (Gao et al. 2011). The net social impacts of land acquisitions are related to displacement or dislocation, where the global rural poor are relocated from their previous land to less fertile land (Borras and Franco 2012). Another common impact is that the livelihood strategy is changed to become an outgrower farmer for the investing company. The outgrower arrangements have been far more beneficial for the small-scale farmer globally than the resettlement schemes that in many cases have created conflicts.

The increased demand for biofuels affects global food security in two ways; by using arable land, and by raising global food prices. The increased demand for biofuels leads to an increase in global cropland requirements (Bringezu et al. 2009). Beyond clearing

forested land for biofuel production, it is not uncommon to convert land previously used for food production, for these purposes (food production most often for domestic or subsistence use) (Borras and Franco 2012). If biofuels are grown on current cropland for food production, this will affect food production. The diversion of food grains and oilseed to biofuel production is one of the main catalysts for the spike in world food prices (Mitchell 2008).

The targeted regions for land acquisitions are mainly in the Global South in counties that already experience widespread food insecurity (Borras and Franco 2012). This situation will potentially worsen with the increasing number of foreign investors in agriculture. It was evident during the food crisis of 2007-2008 that the countries that are the least self-sufficient and most dependent on international markets were most severely affected by increasingly volatile food prices. The targeted countries produce more food, but the food is more often exported than consumed locally. The proponents of biofuel-related land acquisitions or outgrower schemes claim that the improvements in agriculture that come with an investment will help the small-scale farmer to put more of their land in production to produce both biofuel crops, and food crops.

7.1. National

In poor countries with relatively abundant land like Tanzania, the investors may play an important role in catalyzing rural development. An investment is crucial for the small-scale farmer to be able to change to a more calorie-efficient production in order to reduce the yield gap (Mansaray 2012). When a land transaction is conducted equitably, biofuel investments could improve the Tanzanian economy by providing energy security and employment opportunities. Together with economic growth and government revenues, the investment may raise the rural living standards (Cotula et al., 2009). But in reality this has not yet happened in Tanzania. Many actors (non governmental) make the same statement, which is that a foreign investment has not yet been for the benefit of the local people (Bedford 2013; Olyang'iri 2013). With the current (lack of) policies and legal frameworks, Tanzania is not able to regulate the fast development of foreign investors (Gordon-Maclean et al. 2010). This is part reason for why development aspects have not been met, and also why a foreign investment has not yet been for the benefit of the local communities or the environment (Olyang'iri 2013)

"The environmental impact of biofuel plantations could involve water scarcity and deforestation, particularly in coastal areas. The potential impact of biofuel production on the price of food crops in Tanzania is already a major concern. Most important for local communities, however, is a loss of rights over customary lands, and the way this could negatively impact local villagers' livelihoods." (Sulle and Nelson 2009)

The large-scale plantations in Tanzania have in most cases lead to a loss in biodiversity, and caused social problems mainly by changing land rights on behalf of more concentrated land ownership (WWF 2011b). Abandoned biofuel projects still impact on the local communities since the villagers do not get the land back and lose the access permanently (Senzia 2013). In some cases new companies take over the acquired land and make different agreements than the first one with the local community. There are at least two companies that share the same story in Tanzania; the Dutch biofuel company BioShape, and British Sun Biofuels. They came in 2006/2007 to acquire land for

jatropha plantations, promised infrastructure and livelihood improvement for the local communities and employed about 700 people. Within a couple of years they went bankrupt, left the area, and immediately fired the employees. BioShape abandoned the land while Sun Biofuels sold to another owner (Cohen 2011). Both companies caused long-term negative social and environmental impacts over a very short amount of time, and this prompted the Tanzanian government to put a hold on biofuel investments until better guidelines were developed. The impacts from BioShape are presented in the section dealing with the local- impacts because of the national importance of the event, and its many negative environmental and social impacts locally.

7.1.1. Environmental impacts

Tanzania currently has areas of high biodiversity that are unprotected and under threat for being converted to biofuel production. This includes, for example, the East African coastal forest, which has a high level of endemism (Songela and Maclean 2008). The establishment of plantations in this area could cause a direct loss of biodiversity (and therefore ecosystem services) as well as cultural values. In addition to the direct biodiversity loss from land clearing, there is also an indirect loss of species from habitat fragmentation (Songela and Maclean 2008), which means that the animals' seasonal migration routes are cut off by removing important vegetation. Elephant migration routes to find water in the dry period has been disturbed on the East Coast of Tanzania as a result of deforestation from charcoal burning, and for land clearing for large-scale jatropha cultivation (Malugu 2013).

Intensive farming for biofuel production has large implications on soils and water bodies as it most often causes soil erosion. This problem is worsened in areas of Tanzania that experience periods of droughts and heavy rains, resulting in a loss of organic soil nutrients and soil depletion as well as eutrophication of surface waters. Almost all land acquisitions in Tanzania are heavily dependent on irrigation, often for water intense crops like rice and sugarcane (GRAIN, 2012). The agricultural practices often are more water intensive than the traditional techniques, and upstream diversion and consumption lower both the quality and quantity of water for downstream users (Mehta et al. 2012). The change in water use often causes water stress and aggravates land degradation in targeted areas, which in turn undermines local livelihoods and triggers conflicts (Anseeuw et al., 2012).

There is uncertainty regarding the energy efficiency of biofuel crop production in Tanzania, especially when it comes to the cultivation of jatropha. Jatropha is a fairly "new" crop and the quantities of fertilizers and pesticides needed for commercially viable yields are not well explored (Songela and Maclean 2008). The crop is promoted to grow on marginal degraded land in order to avoid competition with food crops, but up until now, most jatropha cultivations in Tanzania have been on very fertile land (Action Aid 2009). The low profitability of large-scale jatropha cultivation has stopped many investments in a short amount of time. Sugarcane is promoted as an energy efficient crop, at least in flooding areas where there is a natural retention of nutrients (Songela and Maclean 2008). This is unlikely to be the case in many parts of Tanzania due to the pronounced dry seasons in which energy will be needed for irrigation systems. If the amount of fossil fuel-based energy required to produce biofuels is higher than the "green" energy that comes out, the initial driver of producing biofuels in Tanzania can be questioned. Some projects that intended to mitigate CO_2-emissions by growing jatropha

for biodiesel production have left the areas deforested and replanted with large-scale monocultures after realizing that the profit was as not as expected, or because of other financial problems. Hence, the projects have likely resulted in a net loss of carbon to the atmosphere and also caused biodiversity loss. Not achieving the primary positive impact to mitigate CO_2 and also causing other negative side effects.

7.1.2. Social impacts

Numerous scientific articles, newspaper articles, and reports mention similar social impacts regarding resettlement, unfair and insufficient compensations, and issues of food insecurity because of the loss of land (Purdon 2013).

When a company acquires land for biofuel production in Tanzania, the first issue is to resettle the people currently living in the area. The farmers are often compensated by cash and displaced to less fertile areas. The resettlement causes national migration of farmers and pastoralists to other "unused" territories, which has created new conflicts over land between migrated and already settled farmers. The pastoralists are particularly vulnerable and rarely get compensation for their land loss since they are not registered on land because of their nomadic way of life. The GoT does not adequately recognize nor protect the rights of the pastoralists. Conflicts also arise because of unfair or insufficient compensation from the investing company. Even though many biofuel companies are not active on the ground, the land is still in their ownership (often with a 99 year's contract) and villagers are not allowed to use the land. One argument to not "give the land back" is because the farmers have already been compensated (Village Chairman 2013).

Crops like sugarcane, palm oil, sweet sorghum and sunflower are assigned as raw material for biofuel production in Tanzania (Action Aid 2009). These crops are directly linked to national food security, not only in terms of use but also because of the appropriation of land and labour resources that are involved in the production process. If agricultural development was focused on food crop production instead of biofuel production it could feed the whole of Tanzania and still have surplus for export (Action Aid 2009).

7.1.3. Impacts on Sweden

With foreign investments, Sweden can produce crops that cannot grow at home because the climate is too cold. Examples include sugarcane for ethanol. By expanding its businesses abroad Sweden gets a positive "land budget", can secure a supply of raw material, while generating revenue from the investments. If the biofuel production begins and biofuel is exported to Sweden, it will also have positive impacts on the country's CO_2-mitigation.

7.2. Local

This chapter will present the impacts of the Swedish biofuel company EcoEnergy. They have not yet started large-scale sugarcane production, nor have they built a factory, and therefore the *direct* impacts from the plantation are not yet evident. There have however been large social and environmental changes in the area since the company established itself there, and the consequences of this are referred to as *indirect impacts*. Also *future impacts* are described in order to discuss the responses and mitigation

strategies of the company. The impacts from a Dutch biofuel company BioShape are briefly presented in order to exemplify *direct* local environmental and social impacts from a jatropha investment.

7.2.1. Social and environmental indirect impacts

EcoEnergy emphasizes the positive impacts that the project will have on the local people in the area, with new job opportunities and new sources of income. However, the first issue the company will have to deal with before even starting the main industry is how to resettle and compensate the people that live in the area, as well at the people that use the area seasonally. Additionally the company has to deal with the rapid migration of charcoal producers.

Until project agreements have been concluded and a resettlement action plan (RAP) has been implemented, there will be continued conflict between the pastoralists, local villagers and farmers. Conflict between these resource sharers is common all over Tanzania and this is not caused by the project and resettlement. However, the increased migration to the area is currently enhancing these conflicts. The rapid migration can partly be explained by people's awareness that an affluent company is about to acquire the land of the previously state-owned ranch, as well as an effect from being dislocated from land by other foreign companies.

The current concerns from the project can be understood by listening to the pastoralists at a pastoralist meeting held on the Tuesday cattle market (16/4 2013). One of the Barbaig elders says that pastoralists fear two major things from the land acquisition; the loss of water sources and grazing places for their cattle. However, their most significant, current worry is for their wives and daughters that are being raped and in some cases killed by charcoal producers that have recently migrated into the area. As the government still owns the land and do not recognize the rights of pastoralists, the above concerns cannot be addressed until the land is in control of the project and the RAP is fully implemented. As a result people want to know what will happen to them, what the current status of the company is, and when the project will start. They also want to know who is supposed to control the rapid changes that are currently going on in and around the project site even before the project starts. Since the area was declared to be project land for EcoEnergy, it has changed rapidly. People are buying land in the area with the belief that they will be compensated, and the number of charcoal producers is rapidly increasing. There is at the moment no control or management in the project site that would prevent people to move in.

Another Barbaig elder raised the question how the farmers still could have power over the land when neither the farmers nor the pastoralists are the landowners. He raised his concern over water resources and said that what would kill them is to not get access to the water in dam 4, the only dam with water all year around. The farmers are fencing off the dam and the elder posed the question if the fencing could be prevented before the dry season starts, something only the landowners can prevent.

The RAP developed by independent consultants for EcoEnergy has had some positive impacts. For example, the restoration of a dam outside the area has begun, and a school for the pastoralists is going to be built. The restoration of the dam is a mitigation strategy so pastoralists that seasonally use the dams at the Razaba Farm want to stay

out of the area. Also a school is being built for pastoralists and orphans, where EcoEnergy will pay for all school material (not the construction). The conflict over the acquired land has also created peace between the two pastoralist tribes Masaai and Barbaig. The pastoralists have been registered on land (outside the area) and will be allowed the south west corner of the project area and use two of the dams.

7.2.2. Future environmental impacts

If the project proceeds as planned there will be an immediate loss of biodiversity from land clearing for sugarcane. This could have long-term effects on endangered plant and wildlife species because of the lost habitat and disturbed migration routes (National Environment Management Council 2008). If the plantation increases soil erosion and soil degradation, there is a risk for increased siltation of the Wami River, which would affect the coastal mangrove forest negatively. A change in water level and pollutants could also impact the downstream mangrove. However, charcoal producers are currently deforesting the land. They are, at the moment, the main reason for biodiversity loss of the area, and destroy the possibilities for conservation of endangered species.

The water extraction for sugarcane irrigation will have different effects on water availability in different seasons, and will have the biggest impact during the dry seasons. The most recent environmental impact assessment (EIA) by consultants for EcoEnergy indicated that the water volume needed for irrigation would leave the river empty during some months of the dry season, the driest and average/maintenance years. Water availability could also be impacted by a change in water use upstream by other users (as the project area is in the lower water basin). The impacts from lowering the river surface with increased water extraction, coupled with effects of sea level rise from climate change might lead to salt water intrusion further inland. Predictions for the scenario of zero flow in the river and the highest tide of the ocean show that saline water will not reach the farm or the outgrowers (EcoEnergy 2012). However, the predictions are not long-term estimates because of the uncertainty regarding the extent of sea level rise (Schramm 2013). As a response to the EIA, the company agreed to reduce their proposed activities and small dams and an off-river storage and water saving technologies instead.

When the farm is in full operation, a significant amount of fertilizer will be used (EcoEnergy 2012). Sugarcane has high potassium requirements and will be planted in areas of low soil fertility. More fertilizers will be used at the start to help build up organic matter in the soil. If not managed properly, this might lead do environmental degradation through soil and water pollution. Some herbicides will be used to kill off the grass and weed cover. Any pesticide that is intended to be used must be carefully evaluated for potential negative effects. The wastewater from the sugar factory may pollute soil and water and surrounding biodiversity if not managed properly. The main source for pollution is vinasse and sewage. Vinasse is the main wastewater from the sugar industry and has a high chemical oxygen demand (COD) and biochemical oxygen demand (BOD), which makes it hazardous to the environment. (EcoEnergy 2012).

7.2.3. Direct impacts from a jatropha investment

Bioshape Ltd. is notorious in Tanzania for having caused disastrous environmental and social impacts. The land acquisition ignited the Tanzanian government to put a hold on biofuel investments until better guidelines were developed.

BioShape is a Dutch company that, in 2007, planted jatropha for biodiesel production outside of Kilwa, south of Dar es Salaam in the Lindi District. The area had land-sharing boundaries with forest reserves and served as an important corridor for elephants (Malugu 2013). The company cleared an area of 8100 ha containing 1000 ha of dense coastal forest to plant jatropha. When Bioshape came to Kilwa they said they would stay for at least 30 years, and promised them access to clean water, education, free school lunches, health services, electricity, footballs, and a big meeting hall (Village Chairman 2013). In 2007 the villagers agreed to the investment as they thought this could be to their benefit. With the villagers agreement 16000 ha was transferred from village land to general land. The company was given a 99-year lease of the most fertile land in the area, and they will be the landowners until the GoT decides differently. The displaced farmers were compensated in cash and relocated to another area with less fertile land. In 2007 BioShape set up the nursery and planted 50 ha of jatropha seedlings to use for the main farm. They cleared 500 ha for a test plot, and also started preparing 700 ha for the main farm. A sawmill was set up to make timber of the forest that was removed to clear the areas and the whole nursery was cleared and large parts of the test farm. The timber was sold, but no one seems to know where it was exported (most say Europe). In 2009 the project stopped because of problems after the financial crisis. The company left without warning (Figure 28).

The project did bring benefits. For two years the jatropha plantation employed around 700 people, both women and men (Village Chairman 2013). Bioshape also bought a truck, built a house for the village office, and furnished it with chairs and tables (Bashir 2013). The impacts on the environment were negative as large areas of dense forest were cleared (the forest will take about 20 years to re-grow (Hussein 2013)). The social impacts can be understood from the sudden increase of babies with absent fathers, the increased HIV prevalence and increased divorces. Most importantly, the 700 employees lost their job.

After the company left in 2009, some of the farmers also left, moving back to small-scale farming as before. The main problem today is that the land is under a 99-years lease awarded to BioShape (Village Chairman 2013). The farmers are not allowed to do anything with the land including farming it for food crops or to continue the jatropha business. The village is trying to get the land back, but it is not possible since the farmers that were on the land have already been compensated. Besides farming, the forest was used to generate material for construction, charcoal production and hunting. In December 2012 the company wrote a letter to the village saying that they would come back. The village chairman said that the village would welcome the company back so that they can fulfil their promises, and that they cannot agree or disagree on their return, as they are the owners of the land.

Figure 28. Legacy of the Dutch company Bioshape: an abandoned jatropha nursery and a sawmill. Photos: Emma Li Johansson 2013.

8. RESPONSES

The responses define the institutional efforts addressed to correct the problems of any of the previous four stages (Ness et al. 2010). The responses often take the form of policy- or planning actions either through adaptation or mitigation. In the case of biofuel-related land acquisitions there are several responses that are attempting to correct the current problems on global, national and local levels (Figure 29).

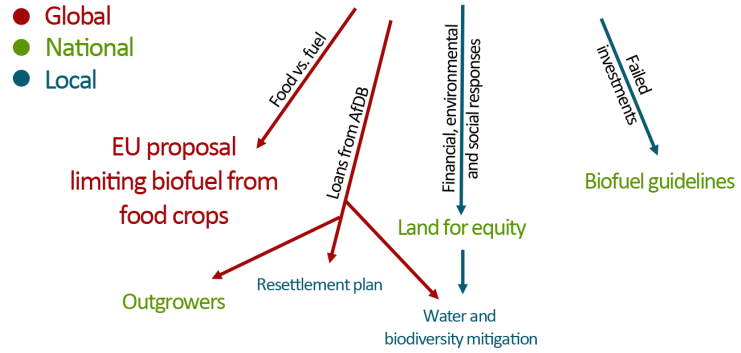


Figure 29. Flow chart of institutional responses to change or mitigate the current state and future impacts.

8.1. Global

8.1.1. Policy responses

The Directive 2009/28/EC on renewable energy sets ambitious targets for all Member States, such that the EU will reach a 20% share of energy from renewable sources by 2020 with a 10% share of renewable energy in the transport sector. As a response to the issue of land conversion from food to fuel production, the Commission published a new proposal in October 2012. The proposal is to limit the use of food-based biofuels to 5% to meet the 10% target in the transport sector. However, there is nothing in this regulation that aims to change the fact that jatropha is grown on land that otherwise could be used for food crops

There are not yet any global policies for biofuel related land acquisitions, most likely because of the slow institutional processes on this level.

8.2. National

8.2.1. Biofuel guidelines

The commercial biofuel sector is relatively new in Tanzania, and has emerged rapidly. The government is promoting the investments but there has been no policies or guidelines constraining the bio-energy sector (Mwakaje 2010). The impacts of biofuel investments in Tanzania has started to appear and stories like Bioshape in Kilwa (see in previous chapter) initiated the Tanzanian government to put a hold on biofuel investments until proper guidelines were developed. In 2010 the *Ministry of energy and minerals* released the first guidelines for sustainable liquid biofuel[5] development. The guidelines include a section for land acquisitions where the temporal and spatial factors are regulated accordingly;

[5] Document can be accessed from http://www.tnrf.org/node/21700

- The land tenure for biofuel production is 25 years. The initial land tenure will be five years to demonstrate the seriousness of the investment, and the extension of the period depends on the crop type.
- The maximum land size per investor is 20 000 ha.

There are no guidelines from the Swedish side, but the media pressure is high. If a company is doing something unethical, media quicky reports the transgression, thus pushing companies to make better decisions.

8.2.2. Land for equity

A policy that is recently promoted in Tanzania is the land for equity model, a strategy that facilitates lowering the conflicts over land between the company, the government, and the local community.

"We need investments in Africa, but we need investments that benefit above all the African people"
- Anna Tibaijuka, Minister of Lands

Tanzania's Minister of Lands, Housing and Human Settlements Development, Anna Tibaijuka, has recently been pushing for a new land regulation called "Land for equity." it is not an official regulation yet but will be tested on EcoEnergy as a pilot project. In an interview with UR (2013) she emphasized that Tanzania needs the land for its people, but also that the land needs to be developed, and that the productivity of the land can be improved with appropriate investment and expertise. The problem entails the means by which this can be achieved. Land for equity builds on a partnership between the investor, government, and local community where benefits are shared from the land lease. In the pilot project with EcoEnergy the government will get 10% of the shares at inception, and 25% after 18 years (Carstedt 2013). The agricultural investments are mainly for economic growth and development of Tanzania, but need to be balanced with social development in order to avoid conflict with the rights of the people that are currently on the land (UR 2013). Hence, an investor would not be allowed to *only* develop agriculture but would also need to develop employment and income for the local people so the commercial farms do not conflict with food security.

8.2.1. Outgrower schemes

An outgrower scheme, or contract farming, is an agreement between the investing company and the small-scale farmer. This is a common strategy for companies to acquire land abroad by either relying on outgrowers only, or to combine large-scale production with some outgrowers. The agreement is that the company will purchase a certain quota for an agreed-upon price. Commonly the buyer and producer also agree on a certain quality of the yield, as well as adherence to a delivery schedule. From the company's perspective this strategy is beneficial since it is often more time and cost efficient than setting up a brand new plantation (The Oakland

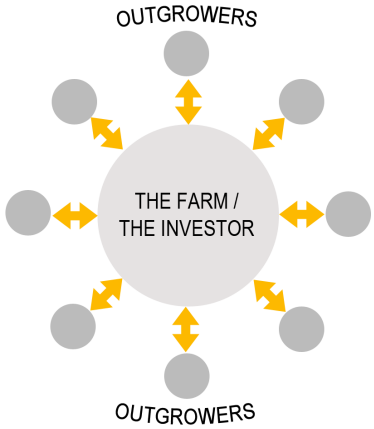


Figure 30. The Nucleus-Outgrower model. Strongly preferred by the Government of Tanzania.

Institute 2011). If the companies enforce good agricultural practices they ensure high productivity, and because of this they commonly provide training, agricultural inputs, mechanical services and irrigation water, in order to boost productivity. This strategy is promoted by the Government of Tanzania and many development organizations, and is seen as a business strategy that is good for all involved parts. The Government of Tanzania strongly prefers an outgrower scheme called Nucleus-Outgrower model (Figure 30). The "nucleus" symbolizes the main farm/investing company, and the outgrowers ensure minimum capacity utilisation. The outgrowers on the other hand benefit from training, inputs, building equity and skills, and exhibits higher productivity and motivation. However, they also become dependent on the nucleus to buy the commercial crop from them (UR 2013).

8.3. Local

8.3.1. Development banks and land for equity

As EcoEnergy turned to development banks for loans, they must follow certain standards regarding financial, environmental and social issues. As a pilot project for "land for equity", they were allocated 20 000 hectares of land under the condition that the government maintain 25% of the revenues from the land. They also have to provide services to improve agricultural extension and markets for sugarcane for the small-scale farmers around the farm (UR 2013). In this way the government of Tanzania hopes to fight poverty and create employment beyond profits to the agricultural company.

After applying for loans from development banks, the company plans have changed. The primary production is planned to be sugar for the local market, not ethanol for export. But with a neoliberal capitalist market the most profitable commodity will most likely dominate the productive land (Bello and Baviera 2010). At the moment there is more profit selling sugar for the local market than to export ethanol, and since the company is building a "flexible factory" they might switch to ethanol production in the future if the profit is higher than with sugar.

8.3.2. Water and biodiversity mitigation

In previous environmental impact assessments performed by independent consultants, the negative impacts EcoEnergy will have on water and biodiversity have been stressed. The short-term solution to deal with months of water shortage and exceedingly large water extraction from the Wami River will be mitigated with an off-river storage reservoir that is filled during months of water abundance (EcoEnergy 2012). This dam will be located within the EcoEnergy plantation and have a volume of 3.2 Mm^3. For the outgrowers, another dam will be developed that will provide extra water during extreme drought situations. The volume of this dam is planned to be 1.2 Mm^3. The total water storage capacity that will be developed under the project is thus 4.4. Mm^3, and will be used when water shortages occur in the Wami River. The company also sees a long-term solution in water availability by constructing a dam upstream. The building of the dam is not even in the planning phase today, but there is an interest from the Wami River Basin Office to get started. The Basin Board has identified that the low flows during dry years impede future socio-economic development, and has also recognized that climate change might further reduce the flows during the dry season and increase the flows during the wet season. Since there is a big "loss" of fresh water to the ocean

during the wettest months, conservation and management by a dam could contribute to socio-economical development of the Wami/Ruvu River Basin (EcoEnergy 2012). The issue of water quality will be mitigated through treatment and recycling within the farm, in this way the polluted water will not be returned to the river (EcoEnergy 2012). The water will be managed by; wastewater recycling and reuse, wastewater treatment, dry cane washing, recycling of vinasse, and sanitary wastewater and oily wastes.

The negative impacts on wildlife are to be reduced by having ecological corridors in the north part of the farm area, an area that overlaps with the Saadani National Park. This is to not interfere with migration routs of endangered species.

8.3.3. Resettlement action plan

In order to qualify for loans using international funds, EcoEnergy has to develop and implement a Resettlement Action Plan (RAP) in compliance to international standards[6] to qualify for the loan. Independent Resettlement Consultants, IDC Ltd., have been contracted to undertake the RAP (Bedford 2013).

The new mitigation plans transcend normal Tanzanian Law, which only recognizes "unexhausted improvements" on the land and compensates with "*replacement value less depreciation"*. Charcoal producers and pastoralists are not taken into account for any form of compensation under Tanzanian Law. Another "first" in resettlement in Tanzania is that those impacted have a choice of receiving compensation in either "in-kind" (replacement with improvements) or "in-cash". Normally, the compensation in Tanzania is made as in-cash only. The company has to put more time and money into the socio-economical impact assessment, which will be more expensive and time consuming in the short-term. However, it is better in the long-term in order to avoid upcoming conflicts with farmers wanting more cash after the value of the land has increased (Senyagwa 2013).

The current practice by the GoT when dealing with resettlements from land acquisitions is to compensate the values of lost assets *in cash*. According to Tanzanian law assets that are compensated for are:

- Land (current market value)
- Houses (current market value less depreciation),
- Crops (current market value)
- Trees (current market value)

The international best practise makes compensation at '*replacement value with improvements' and* promotes "in kind" compensation. Projected affected peoples (PAPs) are being given a choice of either cash compensation. For those who chose 'in kind' this includes:

- Livelihood Restoration including the provision of land of equal productive value improved seeds and improved techniques

[6] IFC Performance Standard 5 Land Acquisition and Involuntary Resettlement and AfDB Resettlement Policy

- Livelihood Replacement – skills training and entrepreneurial development for economic diversification
- Improved housing
- Access to public services and infrastructure
- Support and assistance to host communities
- Access to the PAP Development fund which holds the differential between the GoT rates and replacement value with improvement.

Whereas this is far more expensive, it does aim to ensure equitable development and provide socio-economic benefits for all those impacted by the Project. With regards to the residential and economic resettlement sites provided they must ensure:

- Access to clean water
- Access to education and health
- Access to infrastructure
- Access to markets and livelihoods
- Sufficient land to restore or replace livelihoods
- Land of equal or better productive value
- Maintaining social cohesion
- Must be accepted by the project affected people

If the relocation site does not include some of the criteria, the company must complement with what is missing, e.g. roads, access to public facilities etc.

In a consultation meeting with the pastoralists in 2011, the eleven pastoralist families located within the Project site with approximately 1750 head of cattle stated their preferences with regards to mitigation measures on resettlement included:

- To stay in the area
- To get access to veterinary services for their livestock
- To have education for their children

The company will need to mitigate their impacts on the pastoralists' access to water and land in two ways. By allocating project land for the pastoralists within the area, and by making the seasonally migrating pastoralists want to stay outside. To meet the conditions of the 11 pastoralist families within the project site, an area of 2400 ha has been allocated to the pastoralists containing two dams (Dam 3 and Bozi Dam). They will both be de-silted to ensure year round access to water. The company also needs to mitigate measures for those that use the dams within the Project site seasonally, this includes:

- Registration at Fukayosi and Kidamole Villages
- Access and shared use of the dam at both villages
- Repair cattle dips and construct cattle troughs in Fukayosi

The pastoralists outside of the project site have been allocated 5000 ha of land for grazing, an area that will be shared with Masai pastoralists. The need to share the land has had positive impacts on the relationship between the Masai and Barbaig tribe, as it

has lead to discussions, peace, and agreements to live side by side. The Government has provided money to de-silt the dam at Fukayosi with a 20% contribution from the villagers (according to normal practice) Cattle troughs will be constructed to ensure that the cattle do not contaminate the dam and cause conflict. The cattle troughs will be rebuilt in an area where water can be diverted from the dam by gravity (hence, no pumping), and will accommodate a few thousand cattle (Kizito 2013).

Currently, a team of consultants employed by EcoEnergy are working with the pastoralists to help them set up a joint account to start building the bordering school. The pastoralists from different villages (including some outside the project area), have agreed on how much money they will have to contribute. They are now discussing who will be the responsible for collecting the money from each village. The pastoralists themselves will contribute with 20% of the costs, and the GoT will pay the additional 80%. EcoEnergy will provide soft investment such as added value items, like books, computers, generators, and other material a school needs (Gafufen 2013). The fact that the pastoralists are demanding a school is a sign empowerment since they traditionally would not want to send their children to school. The school is generally seen as undermining their traditional way of living, as their children might not return to pastoralism. But the view of these pastoralists has changed. During the pastoralist meeting one of the eldest briefed the others about the importance of the school, and said that if they don't put their children in school they will lose the future of their children (Barbaig pastoralist elder 2013).

9. SYNTHESIS AND DISCUSSION

The multi-level DPSIR analysis on biofuel related land acquisitions reveals that global factors ultimately lie behind the phenomenon of large scale land acquisitions in Tanzania. These drivers include increased oil prices, climate change, population growth, and policies promoting biofuels. These global drivers manifest themselves on a national level, and a country's wealth (or need of CO_2 mitigation) primarily determines whether it becomes an acquirer or acquiree of land. There are also driving forces that prohibit the full implementation of the "land deals", such as the global financial crisis in 2007/2008, and a growing population with more animal based diets that also demand more land and water for food production, thus "competing" over these resources. The land acquisitions for biofuel crops in Tanzania put pressure on land and water sources, mainly by deforestation and irrigation. The biofuel investments cause social pressures by displacing small-scale farmers from their land, and the farmers lose their land rights until the lease is over (the length of the land leases are 33, 66, or 99 years). Even if the lease expires it does not mean that the land will revert to village land, since as part of the deal it is transferred to general (government owned) land. The companies are also put under pressure by changing climate conditions such as unpredictable rainfall patterns that may more often result in floods and droughts thus increasing the risk of crop failure. Many biofuel companies in Tanzania are currently not active, because they have gone bankrupt, sold the operation to another company, or have trouble starting up the business. This is mainly a consequence of the financial crisis in 2007/2008 that led many banks and investors to withdraw from these rather "insecure" investments. The impacts from the investments have appeared rapidly, and are visible at the local level (but are similar over the whole nation). One of the main findings from conducting fieldwork in Tanzania is that many land acquisitions for biofuels have either stopped or never started, mainly because of financial problems or slow decision-making at the national level. Even the non-active companies cause negative environmental and social impacts on the local level, since the land is no longer in the hands of the local farmers. There is a loss of endemic species from deforestation, and increased concerns about water extraction for irrigation. Even inactive companies impact indirectly on the environment and society; by increased migration to areas (hoping to get compensated by the company), and by not allowing people back on the land even though it has been abandoned. There are not yet any global environmental or social responses to the phenomenon, nor global regulations for these kinds of investments. The lack of global responses might be a demonstration of how global institutions tend to be more "slow" than national and local.

9.1. Cross-scale relationships

The application of the modified multi-level DPSIR model reveals that there are some cross-scale relationships between the global (slow), national (intermediate), and local (rapid) processes. These relationships are visualized in the flow charts produced for each part of the DPSIR where an arrow in one colour points to a process in another colour (Figure 10Figure 14,Figure 19Figure 27 Figure 29). One example of a cross-scale relationship is the increased *global* demand for biofuels (also for food, and feed crops). The investments for biofuels in Tanzania have forced pastoralists and small-scale farmers off their land, causing *national* migration. This is noticed by the investor on the

local scale, and is one of the explanations for the long start-up process of EcoEnergy's sugarcane farm. After EcoEnergy applied for loans from the African Development Bank, they need to deal with the resettlement of both pastoralists and small-scale farmers before getting the loan (due to *global* standards). The resettlement is a time consuming process, in particular because there is continuous migration to the area by settlers involved in charcoal production. The settlers are currently the cause of most negative social, and environmental impacts *locally*. There are currently no *national* (or local) regulations that restrict people to enter the land (more than a sign where you enter the area). Neither EcoEnergy nor the Government of Tanzania takes the responsibility to deal with this issue, which has huge implications for the *local* people who already live in the area since the Razaba farm shut down. The charcoal production feeds back to the *global* level by releasing CO_2 to the atmosphere from *local* deforestation, due to the heating of wood. If the timeframe of this study was to be extended, there might be a link between the global impacts from deforestation to an increased need for climate mitigating strategies, which is one of the main drivers of the phenomenon in the first place. This would create a feedback loop between all processes mentioned above, and the cross-scale relationships would develop into cross-scale interactions.

Figure 31 is a condensed version of the thesis findings, and links together the essential parts of the (modified) multi-level DPSIR in order to help elucidate how global, national, and local processes collectively create the current state of biofuel-related land acquisitions in Tanzania. The figure has both a temporal and spatial axis; the y-axis is the temporal axis visualized as a timeline starting when EcoEnergy (then SEKAB) came to Tanzania in 2006, and ending at the time the fieldwork was conducted (March to May 2013). The x-axis shows the main events that have occurred on the global, national, and local scale during this time, and how these have influenced one another and created the current situation. As an example, when EcoEnergy came to Tanzania (then as SEKAB) the focus was on ethanol production for export (national). This would contribute to global atmospheric CO_2 mitigation, and benefit Sweden's carbon mitigation targets (global-to-national). The company had problems starting the business, mainly because of economic issues after the financial crisis in 2007/2008 (global-to-local). While looking for other investors, the land for biofuel production was settled with migrating pastoralists, small-scale farmers, and charcoal producers (national-to-local). The company applied for loans from the African Development Bank, which "forced" EcoEnergy to make a new environmental impact assessment (EIA), and resettlement action plan (RAP) to get funding (global-to-local). This process is time consuming, and meanwhile, the Government of Tanzania started to develop guidelines for biofuel investments. The Government now wants to try a new land acquiring strategy referred to as "land for equity", that will be tested on EcoEnergy as a pilot project (national-to-local). During these years the current focus has changed from ethanol to sugar production for the domestic market, mainly because of the currently high market price on sugar (local-to-national), and that the "land for equity" strategy that demands that the production is primarily for domestic use (national-to-local).

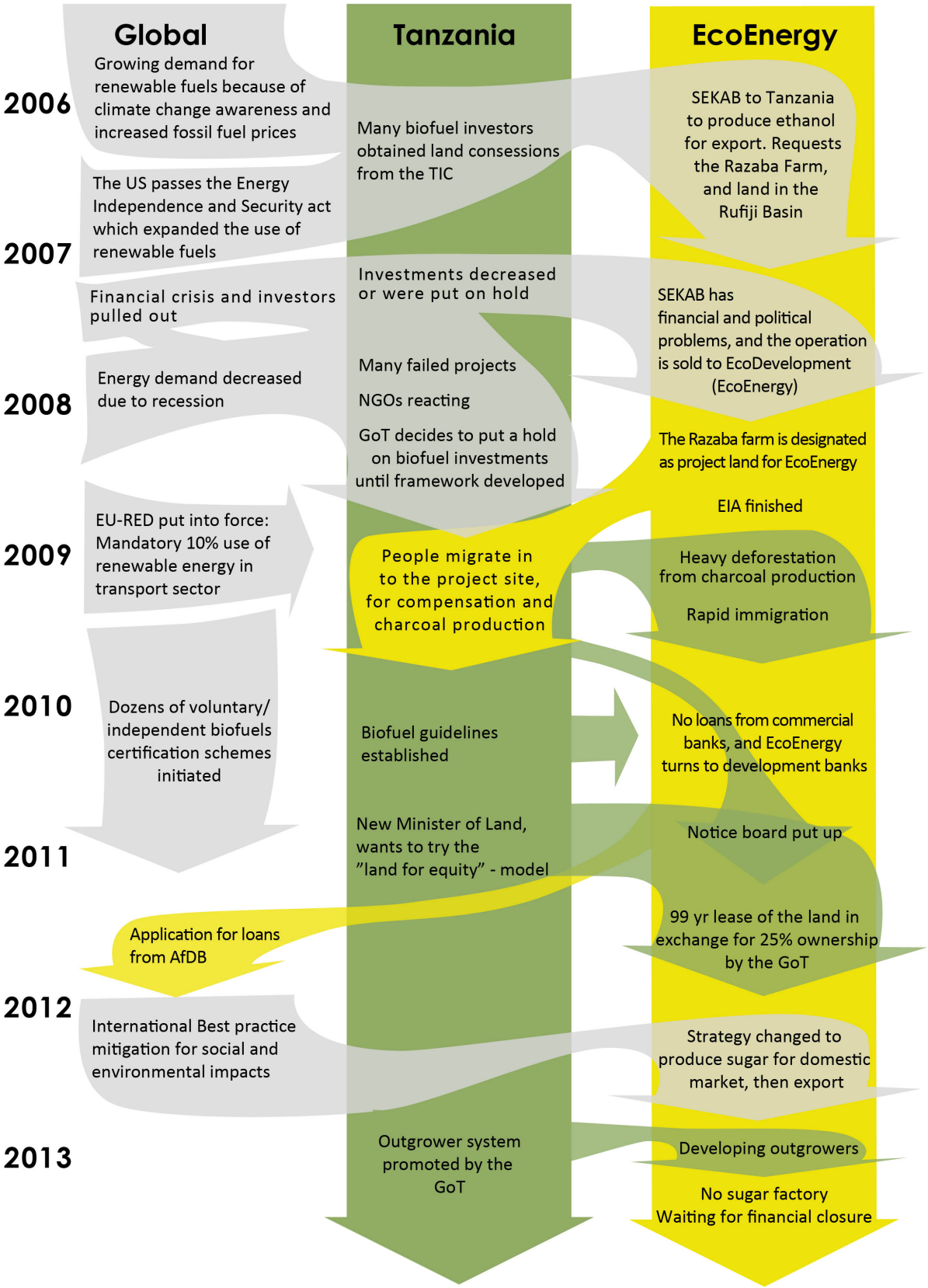


Figure 31. Linking the global, national, and local level together by looking at changes for the land acquiring Swedish biofuel company SEKAB/EcoEnergy through time.

Maybe it is the lack of interactions (or communication?) between actors and forces on the various scales that have created the current state of many *failed* biofuel-related land acquisitions in Tanzania. Almost all cross-scale relationships are unidirectional, and there are few interactions feeding back to the initial processes. The cross-scale interactions that have been found in this study are the global-and-local process of EcoEnergy's request for loans from the African Development Bank, and the response back to the local level that the company needs to implement socio-economic and environmental mitigation strategies in order to receive the loans. There are also cross-scale interactions between national-and-local, as the national "land for equity" policy affects EcoEnergy to produce sugar, energy, and power for domestic use, thus feeding back to the national scale as a response to the new policy. This exemplifies the importance of national and global policies and guidelines, in order to enable bidirectional interactions, and potentially more successful land acquisitions.

9.2. Evaluation of the multi-level DPSIR framework

The DPSIR is a helpful tool for structuring and categorizing the different components of biofuel-related land acquisitions in Tanzania. However, the disaggregation introduces phenomena whose understanding requires broad interdisciplinary knowledge. Future improvements would therefore involve collaboration with researchers from various disciplines, and to perform more extensive fieldwork to enhance the ground truth knowledge. Other benefits from using the DPSIR framework is that the answers to fundamental questions are teased out (what are the driving forces, the social and environmental pressures, the current state, the social and environmental impacts, and societal responses?), thus enabling a more efficient treatment of the more intractable aspects regarding the processes and interactions between them.

There are several limitations of the DPSIR framework. Common critique is that the tool cannot account for changing dynamics of the system in question, nor capture trends over time without repeating the study with the same indicators at regular intervals. Carr et al. (2007) criticise the "hierarchy of authority" in the DPSIR framework; that those who can address the "root causes" and affect the driving forces stand on top of this hierarchy and consist of a few national governments, multinational and international organizations. With the traditional DPSIR approach the actions of the individuals and local organizations are left out. Conversely, Hägerstrand's (2001) system of "nested domains" enables processes on the upper (global) level to influence the levels below. With this approach the national level acts as a filter through which the global-to-local and local-to–global levels interact.

The multi-level DPSIR framework is a combination of the traditional DPSIR framework and Hägerstrand's system of nested domains, and was developed in order to better deal with the range of spatio-temporal scales and the complexity of multiple and interacting stressors (Ness et al. 2010). But adding spatial and temporal hierarchy to the DPSIR approach also complicates the analysis, and one of the difficulties with the multi-level DPSIR is to limit the scope of the analysis. The original structure of the multi-level DPSIR is not a perfect organizational method for analysing biofuel-related land acquisitions from both a Tanzanian and Swedish perspective. This is mainly because the narrative becomes interrupted and repetitive, and some processes are not possible to tackle for

both countries on all scales in all categories, which results in some gaps. This was noticed for the "Swedish" processes in the pressures and impacts sections. Gaps would also appear for global impacts and responses, since they are currently none (at least not within the scope of this thesis).

9.3. Modified multi-level DPSIR

In the original multi-level DPSIR model (Ness et al. 2010) a DPSIR is produced on each level, where the macro-meso-micro levels (here represented with global, national, local scale) are connected with the meso-level. In the case of biofuel-related land acquisitions there might be configurations where a process on one temporal and spatial scale can help explain the current state of biofuel-related land acquisitions, without being related to a process on another level. In the modified multi-level DPSIR, the different scales are not dependent on each other, meaning that the processes are not forced to interact with each other, or emerge from the "top" hierarchy (global scale). The different levels simply represent processes that are spatially and temporally unique, but still impact on the current state of biofuel related land acquisitions in Tanzania. However, if there are cross-scale relationships or interactions these are also presented in the modified multi-level DPSIR. If a process is non-existing from the Swedish or Tanzanian perspective it can be left out without interrupting the narrative. It was also found to be important to modify the multi-level DPSIR, in order to allow global-to-local, and local-to-global interactions. An example of a direct global-to-local interaction is when EcoEnergy applied to receive loans from the African Development Bank. They thereby had to follow *global* guidelines for *local* resettlement, and compensation for the *local* small-scale farmers and pastoralists. Another direct link between the local-to-global levels is *local* deforestation and its impacts on *global* climate change from lowering the carbon storage in vegetation and releasing CO_2 to the atmosphere.

The flowcharts help to visually disentangle the relationships between the processes on the different scales within each category of the DPSIR, but they do not reveal cross-scale relationships between the categories (drivers, pressures, state, impacts, and responses). Therefore the final synthesizing figure (Figure 31) was developed in order to connect processes on all scales, irrespective of whether process is a driver, pressure, impact or response, with the temporal scale incorporated. This gives an overview of the changing state of biofuel investments in Tanzania with processes on all scales presented. For future research the flowcharts could be transformed into causal loop diagrams, and be used for modelling with scenarios of key drivers, such as population growth, economic growth, "lifestyle" change, and technological change, as suggested by Baumanns (2013). This improvement could contribute to the understanding of land use change and the interaction between the ecological and social systems, in order to deal with the current global challenge to increase services provided by the ecosystem, while not undermining important ecosystem services (Foley et al. 2011).

9.4. Limitations of study

The data on biofuel related land acquisitions in Tanzania is incomplete, uncertain, and quickly changing as was evident while analysing the current state of biofuel-related land acquisitions. Even people actively working on these issues in Tanzania are not certain of what the current status of the foreign companies is. Therefore it is difficult to provide reliable data, and the visualizations and tables are based on the best data available.

Adding hierarchy to the analysis increased the difficulties and confusion of deciding under what category a process should be placed. Climate change is a prime example of this. On a global and national scale it is a driver of land acquisitions for biofuels, but on a local scale it acts as a pressure, represented by unreliable rainfall, or droughts and floods. The time constraint of the analysis (approximately 10 years) makes it difficult to discuss global impacts, because of their gradual development. At long time scales climate change could also be classified as an impact from biofuel investments and land conversions, since the carbon release in many cases is bigger than the savings. A process can be a driver, pressure, state, impact, and even response depending on perspective (e.g. from the investing company, the local people, or the environment). Climate change can thus be a pressure on the company by increasing the risk of crop failure because of unreliable rainfall, as well as an impact on the environment from the investment itself. Another example of this added complexity to the analysis is population growth, which is a driver of land acquisitions for biofuels on the global scale, but is a pressure on the company on a local level because of the increased need for both land and water. This competition for resources put pressure on both the local population (by the company) as well as the investing company (by the increasing population). Migration is an example of a national impact from land acquisitions that is a local pressure on the environment, society, as well as the investing company. The impact from one land acquisition becomes a pressure for another land acquisition.

The slow global processes, and the more rapid national, and local effects have made the various states of biofuel investments hard to trace and predict. In particular indirect global drivers like the financial crisis, which is one of the main explanations of the current (inactive) state of biofuel investments. What happens slowly on a global scale might impact rapidly on the local biofuel investment. Since the leases of the investments are long-term (up to 99 years) they are likely to be affected by climate change, increased or decreased biofuel demand, or by new financial crises. Since foreign land acquisitions are still a fairly new phenomenon in Tanzania there are many long-term impacts that are not yet visible with much conjecture about potential future impacts. A way to elaborate on this work and take it further would be to extend the time horizon and look at long-term impacts, risks, and vulnerabilities, for example with a 99 year aspect (the time of a land lease). This approach would enable the elaboration of potential long-term pressures and impacts on biofuel companies from global climatological, and economic changes and its consequent environmental and social impacts.

The advantage of the approach taken in this thesis is in the reduction of bias by including views from many different actors and interest groups such as NGOs, researchers, the Government of Tanzania, the investing companies, as well as the affected people on ground. This was not without difficulties, as issues of corruption and lack of transparency made it hard to know who to trust. Since there is not much information on the local level, the data gathered from interviews and from EcoEnergy's own reports are often referred to throughout the thesis.

9.5. Conclusion

The overall aim of this thesis was to elucidate the structure of the land acquisition system in Tanzania, especially in relation to biofuels, and to disentangle some of the cause and effect relationships within the system across local, national, and global scales. The study accomplished this aim by revealing that mainly global large-scale processes drive the rapid increase of biofuel-related land acquisitions in Tanzania, while the impacts are mainly localized. Population growth, climate change (mitigation), and also the global financial crisis in 2007/2008 are forces that both facilitate and constrain the implementation of biofuel investments. The land acquisitions create both social and environmental pressures leading to land cover change such as clearing large areas of forest, and forcing small-scale farmers off their land. Most biofuel-related land acquisitions in Tanzania are devoted to the cultivation of jatropha (biodiesel) and sugarcane (bioethanol), and about 20 biofuel companies have acquired land in Tanzania, but no more than one (EcoCarbone) is currently active. This is caused by the global financial crisis as many investors disappeared and the companies went bankrupt. Some companies have sold the operations to other biofuel companies, and some have financial problems starting the business. The impacts from the failed investments are environmental and social, and have resulted in large deforested areas, and lost long-term ownership of the land for the local small-scale farmers. The increased interest from foreign biofuel investors in land has been more rapid than the Government of Tanzania have been able to manage. Regulations are being developed, but are not yet law. A new way of acquiring land will be tested on the Swedish investor EcoEnergy, called "land for equity", in which the revenues are shared between the company, the government of Tanzania, and the local community.

This analysis facilitates the understanding of how global, national, and local events and decisions have had national, and local impacts and also how these impacts have shaped national policy. The thesis provides insights into the social, economic, and ecological processes that shape biofuel-related land acquisitions, by discussing gradual versus rapid dynamics. These dynamics are important within land system science, in order to understand what processes shape land use transitions (Rounsevell et al. 2012). For future research it would therefore be interesting to look at potential long-term impacts from biofuel-related land acquisitions by modelling future scenarios. What are the long-term risks for both the acquirer and acquiree, regarding climate change, population growth, and economic changes? How will the increased demand for water, and land for biofuel production alter the sources used for food production?

"Biofuel-related land acquisitions" is a controversial topic with many actors supporting different views. The environmentalists and local villagers usually oppose land acquisitions, and refer to it as "land grabbing", while biofuel producers and the Tanzanian Government advocate the benefits of "investments in land". With insights from field experience, and contact with local people, there is definitely a desire for rural development in Tanzania. Investments in agriculture can be one way for people to get out of poverty due to new job opportunities. The investments can also improve current yields, and have positive effects on national food security. There are vast areas of land that can be developed in favour of agriculture, and foreign companies have the assets to do this. But something to keep in mind is that "business is business", and the companies' primary goals are not to do development work, or save the environment (it is rather a potential by-product). Another question is if the export oriented investments for food,

feed, and fuel crops really can accomplish more than job opportunities in Tanzania. What about their own needs for food, feed, and fuel? Land acquisitions according to current practices must stop, as the positive impacts that the companies claim to bring are not realized. Also, the long-term social and environmental impacts are uncertain, and the risks must be mitigated before the mistakes are made. This could possibly be brought about by focusing more on outgrower schemes, rather than forcing people to give up their land-rights to the state, and by focusing on food crops needed within the country, rather than biofuels for export.

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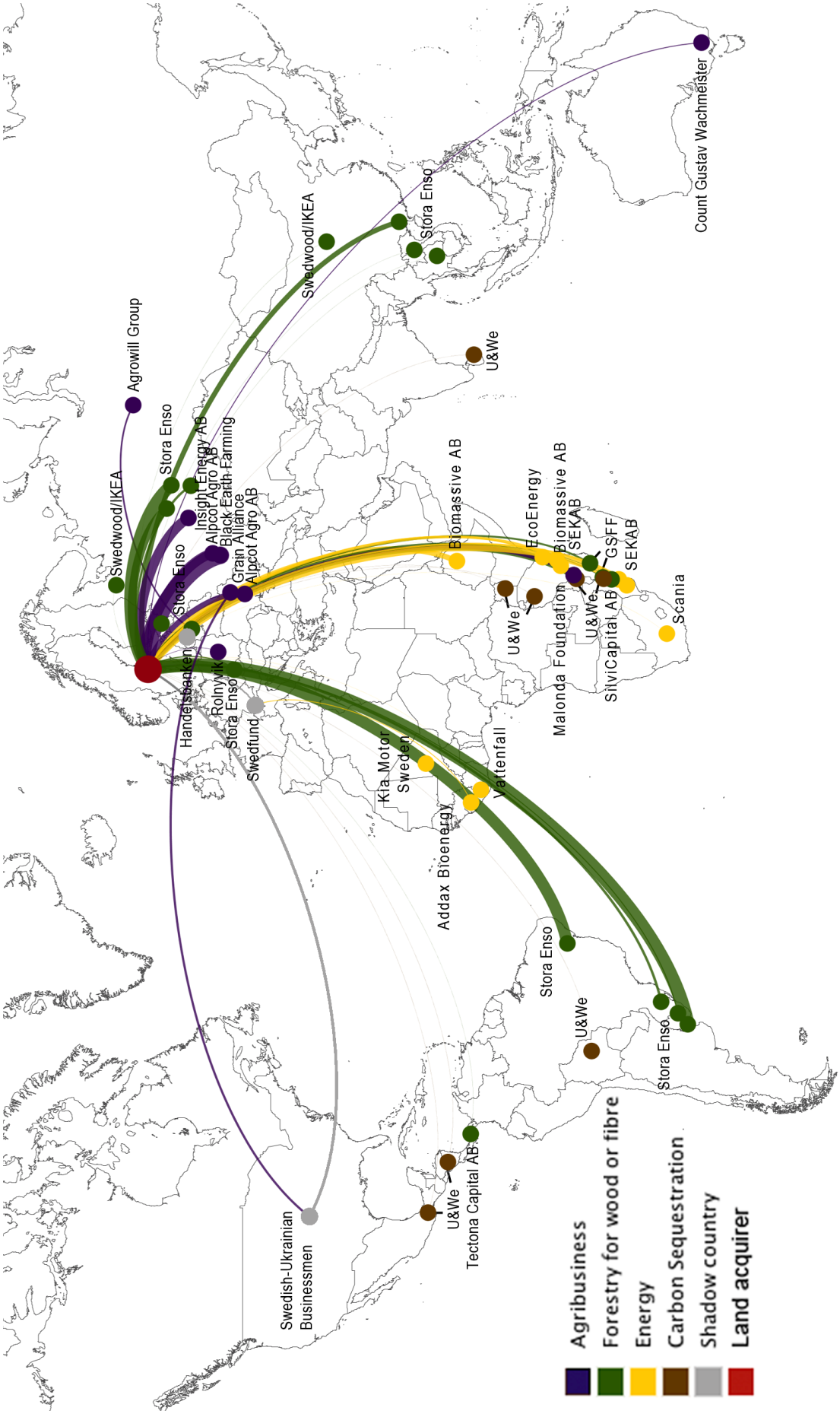
Appendix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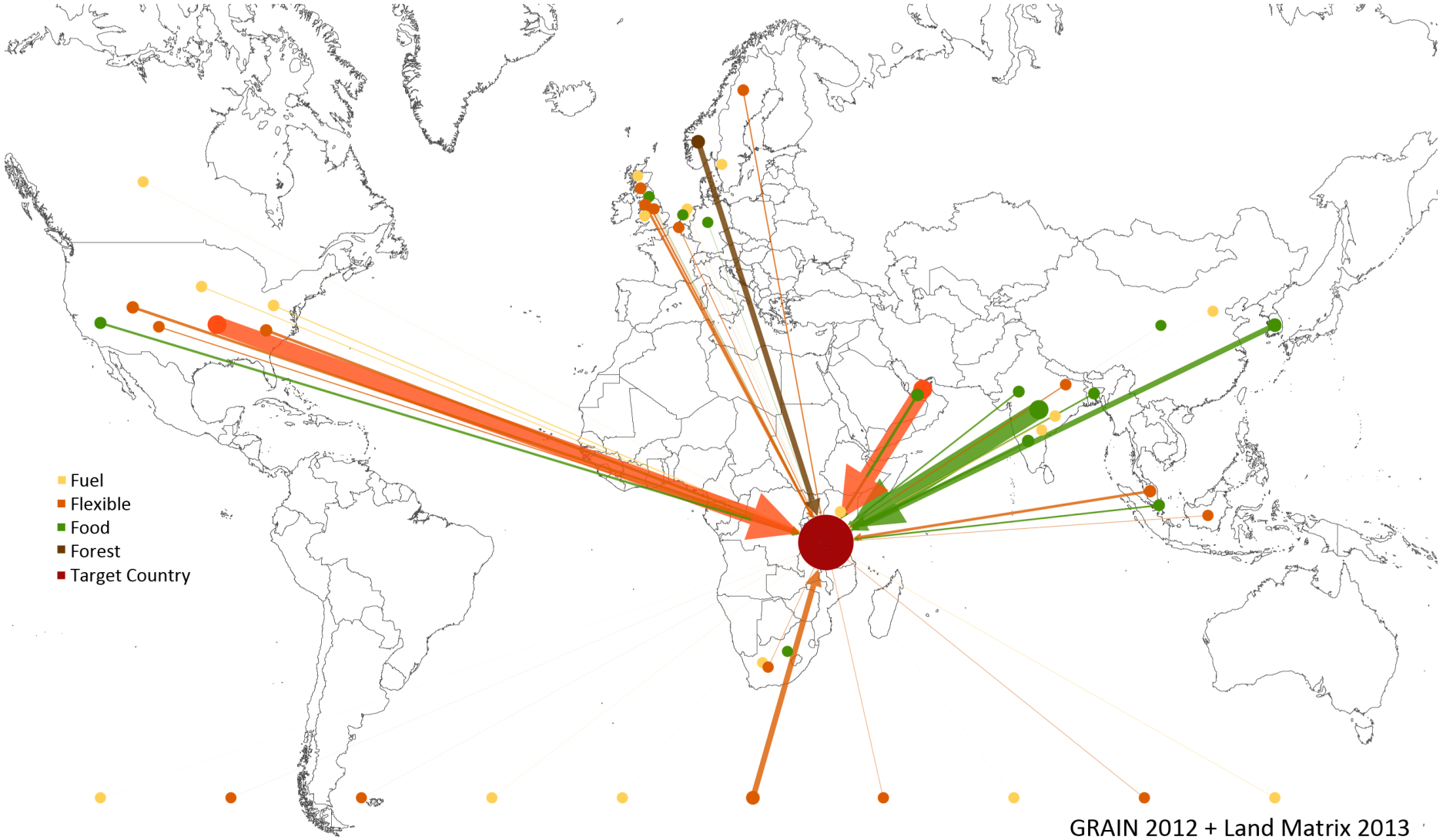
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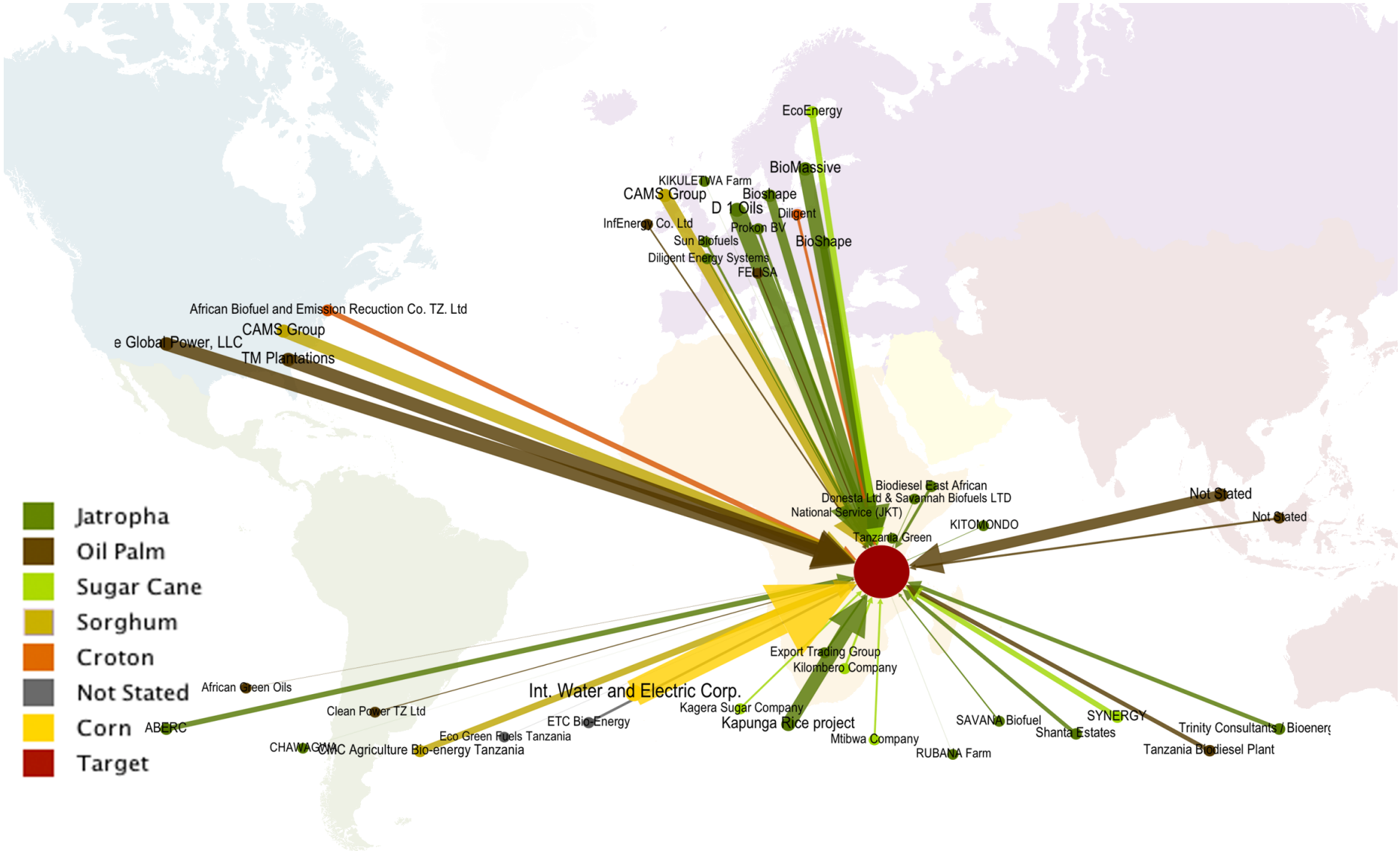
GRAIN 2012 + Land Matrix 2013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TM Plantations
Biodiesel East African
Donesta Ltd & Savannah Biofuels LTD
National Service (JKT)
KITOMONDO
Tanzania Green
Not Stated
Not Stated
Export Trading Group
Kilombero Company
African Green Oils
Int. Water and Electric Corp.
Clean Power TZ Ltd
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ETC Bio-Energy
Kapunga Rice project
SAVANA Biofuel
SYNERGY
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RUBANA Farm
Tanzania Biodiesel Plant
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Sorghum
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Target

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