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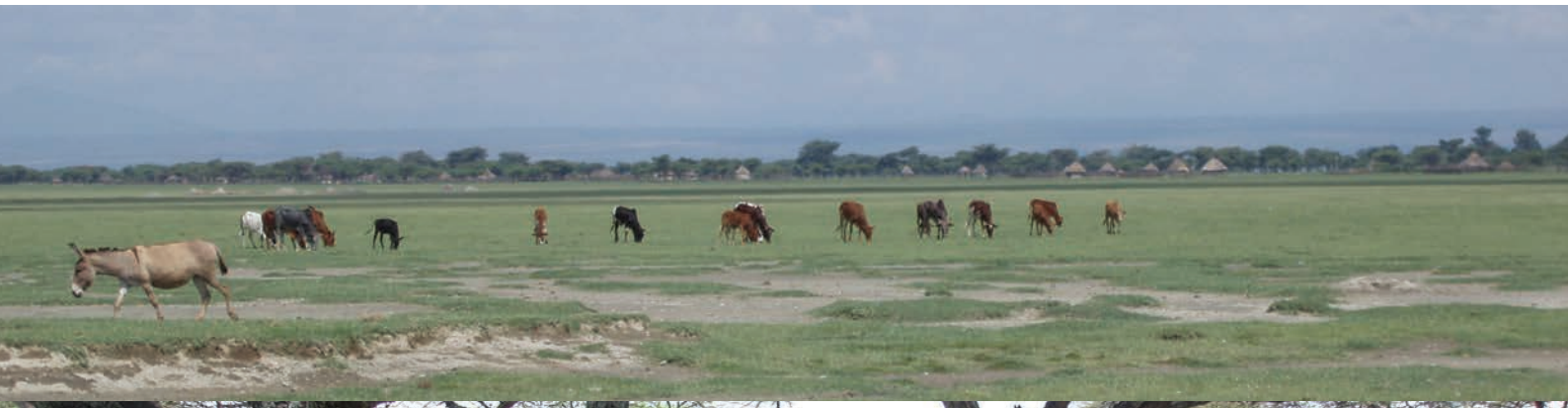

Competing claims on natural resources

Global trends and local case studies

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ISRIC World Soil Information

Competing claims on natural resources

This study has been carried out as part of the project 'Competing Claims on Natural Resources' within the Policy Supporting Research programme of the Ministry of Economic Affairs, Agriculture and Innovation.
Theme International Cooperation, project code BO-10-011-009.

Competing claims on natural resources

Global trends and local case studies

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Abstract

Arets, E.J.M.M, S. van Berkum, C. van Oosten, P.S. Bindraban, R.E.E. Jongschaap, A.J. van Bodegom. E. Stehfest, N. Rozemeijer, V. Geissen, R. Hessel, O.M.C. van der Valk and A. de Jager, 2011. Competing claims on Natural Resources; Global trends and local case studies. Wageningen, Alterra, Alterra report 2236. 96 pages.; 18 figures; 9 tables; 157 references.

Land is serving as a basis for the production of food, feed, fibres, wood, bio-energy, for biodiversity, recreation and many other goods and services ecosystems provide. Additional to that, land can also be used for infrastructure, houses etc., making no direct use of natural resources, but of the physical land structure. While some resources and ecosystem services can be delivered simultaneously, others are mutually exclusive, and therefore tend to compete for land.

Competing claims is a notion that different and/or excessive claims are made on land that may jeopardize its sustained use. Increasing demand for food and energy in the world leads to further intensified use of agricultural land or to the transformation of non-agricultural land into productive agricultural land, with negative consequences for the environment and biodiversity.

The objective for this report was to review global and regional market and policy trends governing land use change and competing claims and to explore the role of local power relations and perceptions of stakeholders for competing claims.

Keywords: Competing claims, food security, natural resources.

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Alterra report 2236
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Summary

Land and its natural resources are the basis for the production of many products, like food, fibres, wood, bio-energy, and also for biodiversity, recreation and many other goods and services ecosystems provide. Some of these products and services can be delivered simultaneously from the same area of land, but often they are mutually exclusive and therefore tend to compete for land. Especially when demand for resources in an area becomes higher than the current supply, competing claims can occur.

The objective of the reported study was to review the global and regional policy trends governing land use change and competing claims and to explore the role of local power relations and perceptions of stakeholders for competing claims.

Three main factors were identified to determine competing claims on natural resources. The first factor is increasing demand for resources and commodities to satisfy global, regional and local objectives. This demand is influenced by changes in demography, market factors and by policies at different levels (e.g. trade policies, policies on international development, conservation of biodiversity etc.). The second factor is related to the requirements for natural resources in terms of quality, sustainability and efficiency of production and timing of production. Finally, the third factor is related to institutional and power processes that govern land use and land-use planning. Demand for land and resources may be strongly influenced by international and regional policies and market trends, while also local circumstances like power relations and local customs play a significant role in competing claims and the outcome of competition for land.

Current situation and global trends
The growing human population to 9 to 10 billion people by 2050 is an important driver for the increasing demand for land and resources. Additionally, increasing GDP and wealth are associated with shifts in dietary preferences and consumption patterns which are expected to result in relatively stronger increase in demand for food, feed and energy. Also increasing urbanisation will change demand for products and its sourcing from local, regional and global markets will be affected.

Also various (international) policies and trade regulations have direct and indirect effects on demand and for certain products and requirements for their quality and timing of production. For instance some of the structural features of the EU Common Agricultural policy has initiated huge imports of feed ingredients from Southeast Asia and Latin America, resulting in competing claims on land in those regions. Policies targeted at increasing the use of bio-fuel, like the EU renewable energy directive generate additional demand for feedstock commodities that can only be supplied by imports from overseas where agricultural land expands into areas previously not used for agriculture. Such changes in land use and extension or intensification of agricultural land may lead to economic and social tensions and increase pressure on biodiversity and other services ecosystems provide.

Model projections indicate that food production needs to double by 2050. The majority of the increasing production must be realised in Sub-Saharan Africa and South Asia as these are the regions where the largest part of population increase will occur and the largest changes in consumption are expected. However, as a result of lack of suitable land and available water some of these regions have only limited production potential and consequently might not be able to feed its population from its own region.

Available land and natural resources are often not equally distributed. Driven by food security concerns, investment opportunities and increasing share of non-food crops, the past years an increasing trend of large scale foreign acquisition of farm land in African countries has been observed. The total area of acquired land usually represents only a small portion of the land, it is targeted at the most fertile lands with irrigation potential and access to infrastructure that is already used by people. Besides providing new development opportunities and benefits for local people there are many reports that large scale acquisition displaces local inhabitants and limits their access to land and water resources, increasing local food scarcity.

Degradation of resources and scarcity of inputs like water and phosphate were also identified to be important drivers increasing the competition for natural resources and land. Poor water and land management may lead to deteriorating soil quality and erosion, eventually leading to reduced land productivity. Increasingly deteriorated soils are less well capable to retain water and have only limited capacity to mitigate impact of fluctuations in rain fall. Climate change is expected to further increase variability , which will have a stronger impact on already deteriorated soils. As a result of these developments variability in production will be exacerbated and global food systems can be expected to become more fragile and poor people more vulnerable to periods of food shortages. The absolute limitations of production factors like water and nutrients, primarily phosphorous is likely to further increase competition

The presented review of global and regional status and trends was mainly focussed on projections of changing demand for commodities and use of land from modelling and assessment studies. Local claims, however, are not only influenced by these (inter)nationally determined demands that can be captured in more rational reasoning in model studies, but also result from local power relations and negotiation processes in which actors act from their own perspectives and interests. Realising a meaningful connection between the international trends reviewed and local realities appeared to be the most challenging matter that still needs further development. A major difficulty is the translation of global developments and forces to concrete actors and stakeholders that undertake concrete actions and put concrete claims on land and natural resources. To get more understanding of the competing claims at local levels, a number of case studies were carried out.

Case studies

The case studies were based on existing material that was re-examined in the light of competing claims and included the impact of urbanisation, industrialisation and modernisation of planning on land-use in China's Loess Plateau, an assessment of competing claims from nature conservation, tourism and local livelihoods in the Limpopo trans-boundary park in Mozambique, a study of the consequences of international timber trade agreements on local livelihoods in Ghana and competing claims on water, land and labour in Ethiopia's Central Rift Valley. All cases are related to policy measures or private investments in the Netherlands or the European Union.

In all the cases both international and local drivers were present and found to be influential. The problems of competing claims were a result of a complex mix of national and international drivers, illustrating the importance of including all levels in assessments of competing claims. An important question in the case studies then becomes; who is the problem owner in the case of competing claims? As competing claims for natural resources are caused by many forces at different scale levels, finding solutions will need the involvement of many actors. In the case studies, however, it was not always clear why actors feel owner of the problem or not. A crucial step for finding solutions for competing claims appears to be negotiation between stakeholders. The case studies showed, however, that negotiation is not often the preferred approach for solving problems.

Considerations for solutions

Many of the global drivers identified result in increasing demand for food and other land based natural resources. The increasing pressure on land and natural resources appear to be the result of different targets and priorities that in many cases conflict with each other's. Global trends and local dynamics are strongly interconnected, but do not follow the same logic, which makes it very difficult to design global responses that are effective for local people. As a result much depends on the functioning of local institutions and power relations between stakeholders.

Solutions can be reached by agreeing how to divide targets and prevent conflicts. Negotiation platforms (like round tables) are considered to be a basis for such agreements, but could potentially lead to displacement of the problem to other areas. Policy responses are often not targeting all the competing claims in an area, but tend to focus on one or a few claims. It will be needed to consider all problems on competing claims in their relations and in one coherent implementation of solutions.

The use of existing technology and technical innovations may play an important role in easing competing claims. Yet, there are many questions that still need to be addressed on what are the agro-eco-technological options and economic conditions under which technology can ease the competing claims and what institutions would be needed help to facilitate transition to a more sustainable production system? These aspects need to be addressed in a more structured way, involving the insights of several scientific disciplines.

1 Introduction

1.1 Background of the project and this review

The food crisis that became eminent during 2008 raised concerns within the ministry of Agriculture, Nature and Food Quality (LNV, currently ministry of Economic affairs, Agriculture and Innovation (EL&I)) about the fact that the production areas and natural resources are claimed for ever more and more purposes. To increase the understanding of processes governing competitive land use, to elaborate the factors that play a determining role, and to assess options for sustainable use of natural resources in different contexts a research project was initiated within the policy support research framework of the ministry at Wageningen UR. The study will evaluate the various land uses within the framework of a sustainable balance of people-planet-profit. Additionally alternative policy choices and possibilities for action will be assessed. The objectives and research questions to be addressed in the research project were identified in an interactive process with relevant policy makers at the ministry

The central question of this research project was defined as 'how can current and future generations be sustainably provided with sufficient food, energy, fibres and ecosystem services when taking into consideration the limited availability of natural resources'.

Building on the original requirements of LNV as listed in the terms of reference (November, 2008) in combination with the results of a number of meetings with LNV policy makers, the following needs for knowledge were identified:

1. Further definition and understanding of the concept competing claims.
   - What do we mean with competing claims within the context of this project?
   - Further quantification of the scale and location of competing claims: 'where do they occur and what is their effect?'
   - In what way are competing claims researched and what are the results of this research?
   - What additional research is needed and how can we position such additional research in relation to ongoing studies?

2. What will be the consequences of various policy targets for food, energy and fibre availability for land and water use, both on global and local scales?
   - Are models available that include variables to model the different claims on natural resources?
   - Is it possible to translate the results of global, more general models to specific local situations of regions, or products in relation to land and water use and competing claims?

3. What are the specific policy and institutional processes in developing countries that are governing land and water use, leading to, or preventing competing claims at local scales?

4. What would be the most sustainable and cost-efficient policy options to address the problems identified above?
   - Will certification schemes be able to guarantee sustainability and reduction of competing claims?
   - To what extent are existing policy frameworks for integrated rural development and sustainable development suited to include these new policy options? Or do we need new policy frameworks?

5. How can lessons learned be used to support local, national and international structures and institutions to solve problems with competing claims?
   – What are options to establish a dialogue with partner organisations?
   – What could be the role of international institutional networks? Are there such networks that could be supported?

To initially structure discussions and facilitate priority setting in the research and answering of the research questions it was decided to first get better insight in:
a. the global and regional market and policy trends that govern land use change and competition between uses,
b. in the role of local power relations and perceptions of stakeholders in competing claims, and
c. how global market trends and local power processes affect eachothers.

These three points are further elaborated in the this report and will subsequently also contribute to the further definition and understanding of the concept competing claims and address issues in research question 1 to 3 of the overall project. Research questions under points 4 and 5 will be further elaborated in separate targeted scenario and case studies.

1.2 Competing claims on natural resources; what and how?

Land is serving as a basis for the production of food, feed, fibres, wood, bio-energy, for biodiversity, recreation and many other goods and services ecosystems provide. Additional to that, land can also be used for infrastructure, houses etc., making no direct use of natural resources, but of the physical land structure. While some resources and ecosystem services can be delivered simultaneously, others are mutually exclusive, and therefore tend to compete for land. Due to the pivotal role of land as input for food and other 'goods and services' this research focuses on competing claims on land.

Competing claims is a notion that different and/or excessive claims are made on land that may jeopardize its sustained use. Increasing demand for food and energy in the world leads to further intensified use of agricultural land or to the transformation of non-agricultural land into productive agricultural land, with negative consequences for the environment and biodiversity.

Global trends resulting in competing claims on natural resources at local level
At the global level we will assess the most important international policies and market trends that will likely have an effect on demand and supply and hence determine claims on resources for food/feed, bio-fuels, fibres (like wood and cotton) and conservation of biodiversity and ecosystem services (Figure 1.1). Such increasing demand for feed, fibre, fuel and protection of ecological vulnerable areas will subsequently increase non-food claims on agricultural land.

The different claims from the market sector are usually regulated by price mechanisms, determining demand and supply for certain agro commodities, natural resources and land. When demand for resources in an area becomes higher than current supply, competing claims can occur among different land-uses. At the same time, also international and EU policies, at least partly, affect the demand for land and resources through target setting, subsidies and taxes. There is a wide variety of underlying causes for these international policies, like for instance existing food insecurity, increasing population or climate change. As example, in the case of climate change, policies are aimed at reducing anthropogenic carbon emissions, for which use of fossil fuels and land conversion to agricultural use are two important sources. Subsequent policies to mitigate the potential impact of climate change have been drafted including for example, higher objectives and targets for use and production of biomass for bio-fuels including subsidies for their production. Such increasing

demand not only directly initiated competing claims, but also the associated increasing prices of food products may influence land use decisions.

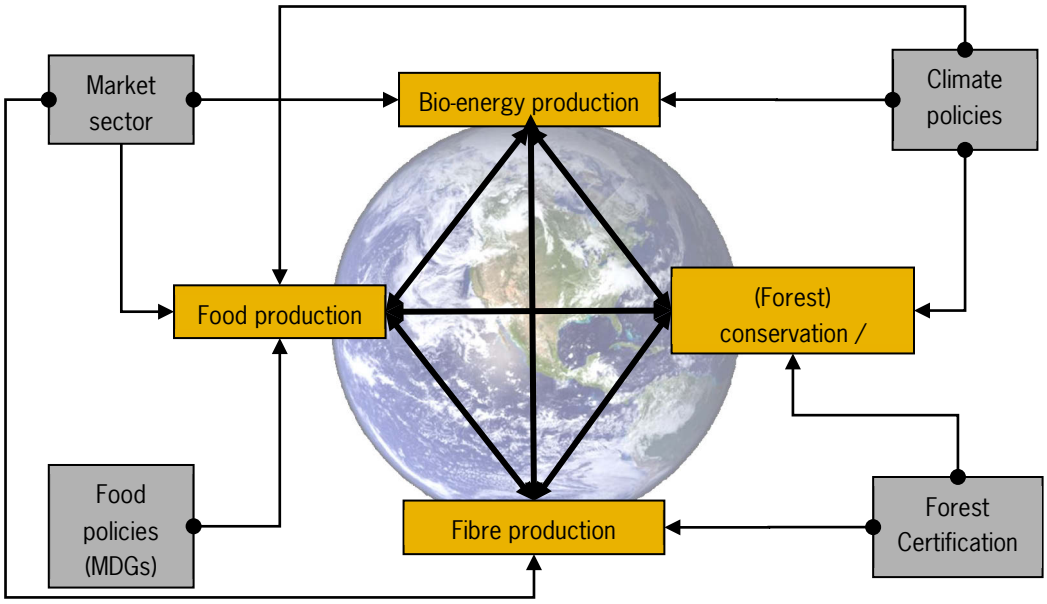

Figure 1.1
Schematical representation of competing claims (some examples in orange boxes) on land and natural resources and the ecosystem goods and services, determined by different sectors (some examples in grey boxes)

Implementation of international and EU policies and market trends thus have the potential to strongly influence decisions and responses at lower organisational levels (Figure 1.2, Giller et al., 2008), while effects in the opposite direction are often much weaker. Eventually local decisions on use of land and natural resources will be largely determined by bio-physical constraints and are strongly influenced by the various forces that work from higher organisational levels downwards to the level of local decision makers and land users. Responses to drivers at one level can become drivers at a lower level. Some global drivers may have a straightforward direct effect on local land-use decisions, while others work through the levels in several steps (Figure 1.2).

Global factors (international trade restrictions, price policy, import/export policy, transnational investments) regional factors (regional trade policy, regional market development, integration) eventually, however, only define a portion of the land use. Also national factors (juridical frameworks, infrastructural development, labour conditions, market policy and migration) and local factors like land ownership, local market circumstances, customs and taboos play a significant role as well. Hence, competing claims at the local level are not simply a matter of tensions between supply and demand affected by (inter)national policies, but also include complex processes related to political, economic and social power balances among stakeholders.

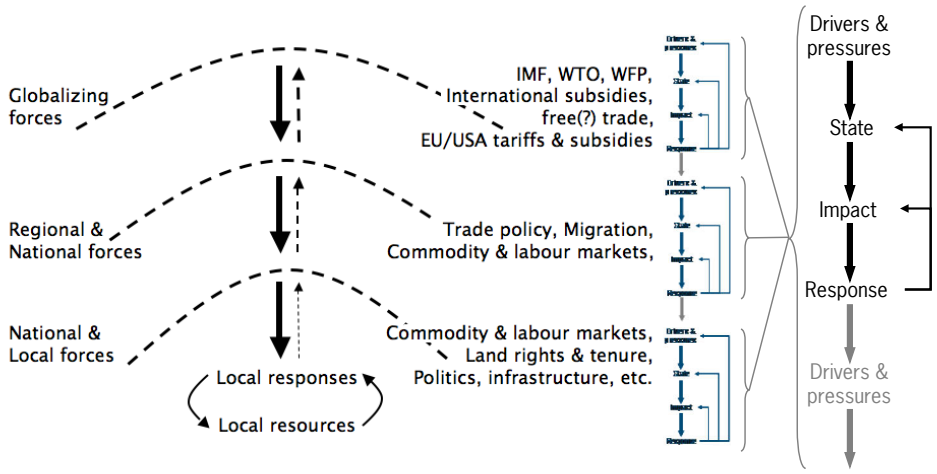

Figure 1.2

The interlinkages between global, regional and local forces and policies structuring the space within which local response and decisions on land use can be generated (after Giller et al., 2008). Drivers and forces at higher organisational levels will have a strong effect on policies and land use decisions at lower organisational levels. On the right a schematical overview of a DPSIR cascade from drivers and pressures that depending on the state of a socio-economic or bio-physical system will result in a certain impact. Responses to this impact or to mitigate or adapt to this impact may create new drivers at a lower organisational level.

1.3 This report

In this report we will address the drivers for use of natural resources as determined by land-use and competition among different claims on natural resources from two scales. At a global scale, based on global assessments and model projections, the most important autonomous drivers (e.g. population growth and climate change), international policies and market trends potentially affecting competing claims and their effects will be assessed. At the same time, based on existing case studies, the most important drivers and power relations determining land-use decisions at the local scale will be assessed. Then, eventually based on an evaluation of differences and overlaps in important drivers and responses it will be possible to judge the relevance and relative importance of certain drivers and responses for determining competing claims. This will improve insight in gaps in understanding of processes at different levels, and can be used to improve tools for analysis at the global and local level.

Global trends market and policy

In a review of existing studies global and regional market and policy trends will be described that influence land use change and are expected to lead to competing claims within the near future. Global and regional model studies can be used to assess the effect of changes in demand and supply of agricultural products and associated land use changes for production of food and to assess environmental changes. By using scenarios such assessment studies are able to provide insights in the effects of alternative policy choices and their effects on the use of natural resources and competition among the different uses. Agro-economic models are used to make projections of global agricultural consumption, trade, production and land use. In these models the basis for changes in demand for agricultural products and other ecosystem goods and services is usually based on changes in human population and economic developments. Supply of agricultural products is usually based on biophysical models with varying degrees of complexity in which productivity is related to availability of resources and technological development.

Many global projections of future supply and demand of agricultural products indicate that in order to feed the world in 2050 the area of agricultural land needs to be expanded. Question is where agricultural land will expand (i.e. in which regions), which type of land (idle, forest with high/low biodiversity, marginal land or other)

will turn into productive agricultural land and what are the consequences in terms of environment and/or biodiversity.

Examples of recent global and regional assessment studies that are used to assess the impact of different policy scenarios on land-use, food security and environmental change based on combinations of socio-economic and biophysical issues include:

- The OECD Environmental Outlook to 2030 (Bakkes et al., 2008; OECD, 2008) that explores possible ways in which the environment and global economy may develop with ambitious environmental policies implemented. The Outlook shows that affordable solutions for environmental problems like climate change, loss of biodiversity and water scarcity are possible, while the costs of policy inaction are likely to be very high.
- The International Assessment of Agricultural Science and Technology Development (IAASTD, 2009) assessed developments in agriculture in relation to policy goals such as reducing poverty and hunger, and preserving quality of environment and biodiversity.
- The Rethinking global biodiversity strategies (ten Brink et al., 2010) study, was carried out within the context of the TEEB programme and explores alternative global strategies aimed at halting loss of biodiversity. Included strategies were aimed at reducing the need for agricultural expansion to feed the strongly increasing human population (e.g. reducing meat consumption; closing the yield gap; and reducing post-harvest losses), improved forest management and more directly by extending extent of conservation areas. Combining these strategies was shown to deliver the largest benefits for biodiversity, but also improving food security and reducing climate change.

Information on models and scenario tools available for studies on competing claims are listed in Appendix 2.

Competing claims and conflict at the local scale

Despite that local claims often are at least partly influenced by regional and international interests they are not only determined by rational reasoning as applied in models, but also result from local power relations and negotiation processes. The actors involved in the local processes all act from their own perspectives, interests and environmental framework. To include this, often uncertain, local reality, understanding of competing claims at the local scale is only possible through an assessment of a number of local case studies.

In general little is known about the processes that directly or indirectly affect claims at the local level. The different actors that are influenced by internal and external drivers are hardly mapped. The variables that affect these actors' decisions, are often unknown, have an uncertain influence or are affected by external factors that are difficult to understand. Local decision making is often controlled by social and political relations and decisions at a higher scale. In an attempt to find a suitable methodology to analyse natural resources related competition and conflict, it has been tried to combine a variety of methodologies focused on landscape dynamics, stakeholder interests, power relations, and processes of political decision making. Various methodologies are available within Wageningen UR, some of which might have to be reshaped within the perspective of competing claims.

Drivers, pressures, state, impact and responses

Most common tool to analyse processes of change within certain spatial contexts is the so-called DPSIR method, developed by Alterra, part of Wageningen UR, which focuses on the driving forces, pressures, actual state, and impact of spatial processes, which triggers a subsequent local response (GAWI, Wageningen UR, 2006).

The Driving forces are processes related to human development (production, consumption, recreation etc.), and potentially creating pressures:
- The Pressures are the direct stresses, derived from these human developments, and affecting the natural environment, i.e. deforestation.
- The State reflects the actual environmental conditions of natural systems (forest environmental goods and services).
- The Impact measures the effects of changes in the State of the environment.
- The Response is the evaluation of actions oriented to solve environmental problems in terms of management strategies.

Analysis of stakeholders, institutions and power dynamics
To understand situations of competing claims and the underlying driving forces, it is necessary to have a sharp overview of the various stakeholders involved, each of which having specific interests and institutional agendas, and might have different responses to the same pressures. Most likely, it is the difference in responses which explains the occurrence of competition, and its potential escalation into conflict. Whether or not competition turns out into conflict, and which stakeholders are most likely to win or lose, might depend on their power to influence the decision making process. Therefore, understanding of local, regional, and global power dynamics related to resources use is necessary to make sense of complex realities and unpredictable outcomes. The complicating factor is that generally, local decision-making processes are not necessarily based on economic trade-offs, but politically defined, and influenced by social and political power relations exceeding the local level through complex networks across levels and scales. These trans-local networks usually are little transparent, yet they do define local decision-making and its outcomes.

Overview
The market and policy trends and impact of competing claims on land at global and regional scale are reviewed in Chapter 2. This assessment draws on existing literature and model assessment highlighting the most significant claims. The responses and decisions towards conflicting claims by local stakeholders are identified and analysed by a number of case studies in Chapter 3. These case studies were based on existing research carried out within Wageningen UR and re-examined for competing claims using the DPSIR approach, and in one case also detailed stakeholder analysis.

2 Global trends and policies with different claims on natural resources

2.1 Introduction

Dynamics of land-use change and claims on that land and its natural resources are often based on economic motives. Growth of population with rising incomes resulting in changes in consumption, changing diets with increasing shares of livestock products and migration from rural to urban areas is among the most important drivers of developments in the demand of agricultural food products. In addition to these more 'traditional' drivers is the demand for agricultural commodities for the use of bio-energy (primarily of bio-ethanol from maize and sugar cane and biodiesel from oilseed crops). Growing demand and production of bio-energy has been the result of recently increasing prices of fossil fuel and the policies in the USA and EU to direct the share of renewable energy in total energy consumption as part of their strategic energy and climate policy. Also other countries (e.g. Argentina and Brazil) promote ethanol and/or biodiesel production. Although the use of grains for the production of bio-fuels is still only a small share of well below 5%, the production of ethanol from grain is mainly promoted or planned to be promoted in the major grain exporting countries. This may lead to a decrease in the availability of agricultural raw materials for exports and thus on the world market with possible consequences for international prices if production falls short of demand growth.

In this chapter we will focus on the global trends and global policies that will have an effect on the use of natural resources and competition among the different uses. Although the overview is at a global scale, regional and local variation between different continents, regions or countries are regarded important. Where needed and possible geographic differences will be highlighted and explained.

2.2 Demographic and socio-economic developments

Population development

The outcomes of projections of future human population development depend largely on the assumptions and the models used. All projections, however, estimate human population to strongly increase during the next 20 to 40 years. The current population of approximately 6.7 billion people will increase approximately to between 8 to 10 billion people in 2050 (UN, 2009). The mid-range projections of the UN population division project an increase to 9.2 billion people by 2050 (Figure 2.1; UN, 2009). It is not only this strong increase that will have an effect on use and competition for natural resources, but also differences in distribution of this rise in population will have implications. The projected increase of the global population of 1 billion people from 2007 to 2020, will mainly be realized in Asia (50%) and in Africa (30%) (UN, 2009), while there will be nearly no increase in the current high-income countries.

Also the place where these people live is rapidly changing. In 1950 only 29% of the population lived in urban areas, while currently this is around 50%, which is projected to further increase to 60% by 2030 (Hilderink et al., 2009). Also here there are important differences among the different global regions. In 1970 urbanisation in East Asia, South Asia and Sub-Saharan Africa was only around 20%, while these are expected to increase to 60, 40 and 50% respectively by 2030 (Hilderink et al., 2009). This will have consequences for the ways people get food and for the functioning of local supply. Increasing food prices will probably have less impact on rural populations that can rely on subsistence farming, while farmers producing for the market may even profit from such increases.

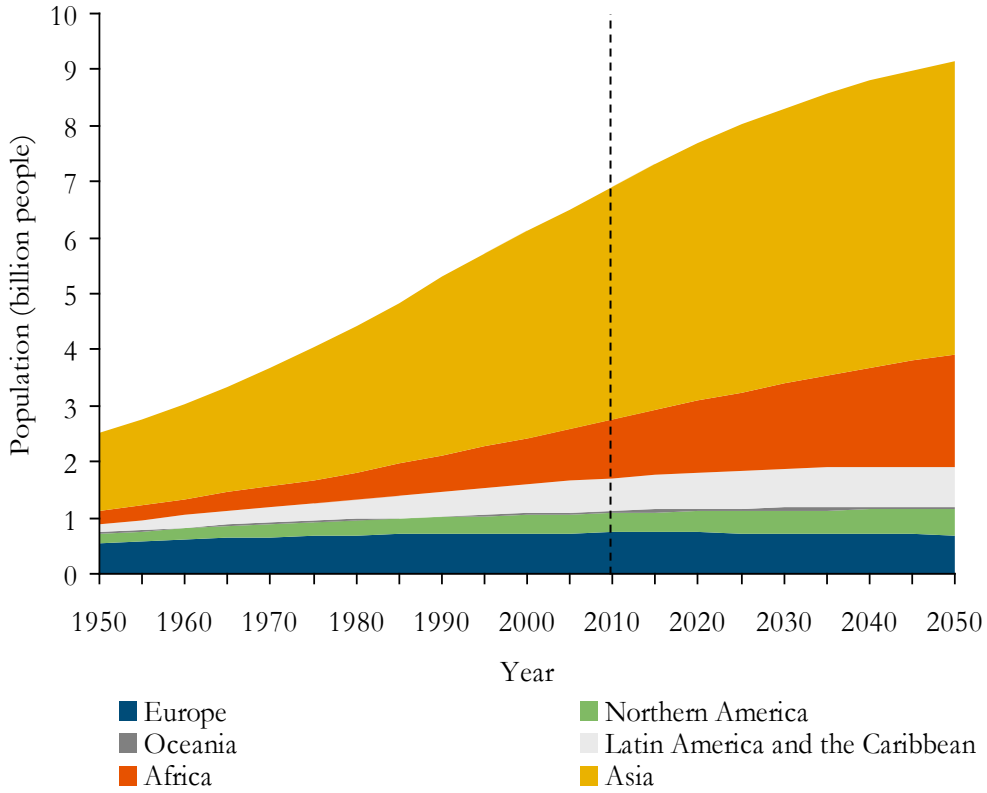

Figure 2.1

Human population growth in developed and developing countries. Data shown are mid range projections as carried out by the UN population division (data source: UN, 2009).

Economic development

Over the last 50 years economic development defined as an increase in real income has been strong, but also unevenly distributed between countries and continents (Maddison, 2007). Recent medium term macroeconomic projections have been affected by the global economic crisis, particularly in 2008 and 2009. A turnaround is projected for 2010, but this includes lower growth rates for most countries than in the years before the economic crisis began. Nevertheless, international organisations like OECD, FAO and IMF revised their outlook assessments upwards in the second half of 2009 as signs of economic recovery became clearer (IMF, 2009; OECD/FAO, 2009). Long-term assessments of economic development indicate that by 2050 world GDP would almost be multiplied fourfold compared to the 2005 level (van der Mensbrugghe et al., 2009).

Projections of annual economic growth show strong differences between different world regions. Projections from before the economic crisis show that between 2010 and 2030 the per capita income in Latin America and the Caribbean will almost double and in East Asia will triple. Also in South Asia and Sub-Sahara Africa growth will increase, but at a much slower rate, with per capita income steadily growing (Hilderink et al., 2009, based on World Bank, 2005). Growth in high-income countries is projected much below the average rates in developing countries. Consequently, the latter group of countries will have a much larger share in global output in 2050, up to 55% compared 20% in 2005.

Changing consumption patterns

Consumption patterns and diet preferences usually are strongly related to economic development and income of consumers. The general trend is that with increasing income the consumption of livestock products increases (Nellemann et al., 2009). Over the past decades the average daily per capita intake of calories has

strongly increased, with especially strong increase in consumption of wheat, sugar, vegetable oils and meat (Figure 2.2, from Nellemann et al., 2009). Remarkable differences between regions in the world exist in land requirements to secure food production and consumption, indicating the regional dependency of such drivers, especially when considering crop land availability (Jing et al., in press).

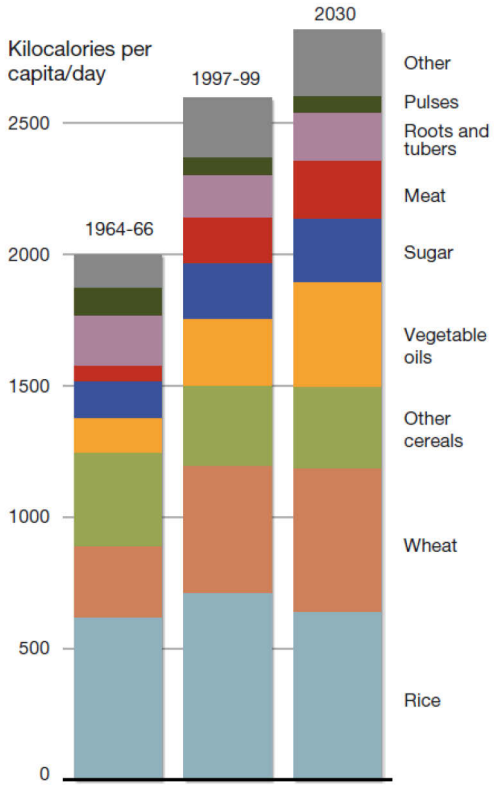

Figure 2.2

Changes in historic, current and projected diet composition for an average person (from Nellemann et al., 2009, based on FAO data).

Cereals account on average for more than 50% in the average human caloric intake (Figure 2.1), while for poorer people this share may be even higher. Additionally, production of meat proteins requires much more land than the production of vegetable proteins (Jing et al., in press; Stehfest et al., 2009; van Vuuren and Faber, 2009). In developing countries, livestock production largely depends on pasture consumption from low productive rangelands, thereby requiring larger areas, especially because conversion ratios between feed and livestock products are low in these areas (Jing et al., in press). As a result globally about 70% of the total area that is in use for agriculture is used for livestock grazing (Table 2.1 in section 2.4), while only 27% of the area is used as cropland and on the remaining 3% permanent crops are grown. As nearly half of the total global cereal production is used for meat production (Keyzer et al., 2005) this results in approximately 80% of all agricultural area being used for keeping livestock, and production of animal feed and fodder (FAO, 2006; Van Vuuren and Faber, 2009). The projected increase of global average meat consumption to over 52 kg per capita per year (Keyzer et al., 2005) may thus strongly increase the total demand for specifically cereal production and grazing lands (Jing et al., in press; Keyzer et al., 2005).

Yet, Bindraban et al. (2010a) show that the total amount of additional water needed for food production cannot be obtained only from the rainfall reaching our arable lands, including the expansion of irrigation. Hence,

grasslands will have to play an important role in collecting water for the production of food. While humans cannot consume grass, ruminants can convert this inedible plant to high quality food, i.e. red meat. Exploiting this production potential (see also Steinfeld et al., 2006) may not be easily attained but inherits a number of other benefits as well. The consumption of meat by food insecure people will drastically improve their health status. Death of pregnant women and children due to anaemia can be prevented relatively easily by consumption of a little meat to complement unbalanced diets. Improvement of grassland soils leads to sequestration of carbon and thus mitigates global warming. Up to 40% of the biomass produced in grasslands may be allocated to roots, which help to improve soil structure. Deep rooting African grasses in South American grasslands have been shown under some conditions to increase soil carbon. Improved soils store water better and that strengthens the buffering capacity of soils to overcome (short) periods of drought. Well managed grasslands can be even more effective in preventing erosion than forests or crop lands and in addition sustain the quality of soils and increase the availability of soil water for grass production.

2.3 Global and EU agricultural and biofuel policies

Agricultural policies may have strong effects on demand and supply of agricultural commodities and food as they affect relative prices of these goods and the inputs necessary to produce them, like land. Agricultural policies are widespread; very many countries in the world implement some kind of agricultural policy. Here, we focus on a few key elements of EU policies that affect agricultural and land markets most

Agricultural trade policies
The Common Agricultural Policy (CAP) of the European Union has affected production and land use in the European Union by encouraging the production of agricultural commodities through price support and/or direct farmer income payments coupled to agricultural production. Because the policies affect relative prices, shifts in agricultural production occurred towards commodities supported and away from those products that were less or not supported. When the CAP was established in the 1960s, products of major importance to the EU members were more heavily protected by import levies than other products of less importance to the agricultural sector. One of the consequences has been the non-taxed imports of feed ingredients that, as a package, substitute for the highly protected and therefore relatively expensive feed cereals. Such feed ingredients are for instance tapioca and soybean oilcake, imported from South-east Asia (Thailand) and Latin America (Brazil and Argentina) respectively. Until recently, the Blairhouse agreement limited oilseed production in the EU. At present, however, this agreement does not seem to pose restrictions on expansion of oilseed production due to decoupling of subsidies and direct payments and abolishment of the obligatory set-aside regulation. Despite the fact that the production potential, i.e. land and water availability of the EU suffices to be self-sufficient in the provision in feed (Bindraban et al., 2008; Bindraban and Rabbinge, 2011), increasing demand of the EU livestock sector for competitive feed sources has resulted in huge inflows of these feed commodities, increasing competing claims on land in the countries of origin (e.g. van Berkum and Bindraban, 2008).

Bioenergy
The recent increase in the price of oil and policy incentives motivated by these high prices as well as environmental concerns have led to the recent high demand for biofuels. The only mature, integrated biofuel market in practice is Brazil's cane-based ethanol market. Biofuel production in the EU, the United States, Canada, Australia, India and China is driven mainly by policy measures, including tax exemptions, investment subsidies and obligatory blending of biofuels with mineral fuels.

Given current policy developments and the limitations of availability of only first-generation biofuels, increased biofuel production due to 'pure' market forces and/or 'policy' may have significant impacts on agricultural markets, including world prices, production, trade flows and land use. Linkages between food and energy

production include the competition for land and other production inputs, while an increasing supply of by-products of biofuel production, such as dried distillers grain, oil cake and gluten feed, affects animal production through increasing supply and therefore less expensive inputs to animal production. Furthermore, a biofuel boom raises concerns about the impacts of potential increases in food prices on low-income groups of the population as well as the possibility of biodiversity loss due to increased use of land. Importantly, the claim on land for production of biomass, either edible or non-edible crops, will directly or indirectly push the agricultural frontier further into savannah or forest (Gibbs et al., 2010; Searchinger et al., 2008), resulting increased emissions of greenhouse gasses and loss of biodiversity, and leading to major debates on the effectiveness of the obligatory blending targets for biofuels as a means to curtail climate change (see Commissie Duurzaamheidsvraagstukken Biomassa, www.corbey.nl).

Banse et al. (2008) show that enhanced demand for biofuel crops under the EU Biofuels Directive has a strong impact on agriculture at both the global and the European level. The incentive to increase production in the EU will tend to increase land prices and farm incomes in the EU and in other regions. Domestically produced biofuel feedstock will only partially meet EU demand and the EU will incur a higher agricultural trade deficit. Biofuel crop production and land use will expand in land-abundant countries (NAFTA and especially in South and Central America) due to increased exports to the EU. The resulting higher feedstock prices will reduce biofuel consumption outside the EU. However, at a global level, biofuel use increases and crude oil demand decreases, leading to a decline in the world price of oil. The expansion of agricultural land use on a global scale, and especially in land abundant South America, may indicate a decline in biodiversity. The study emphasizes that results depend on the trend in the crude oil price

Banse et al. (2008) is one of the first attempts to estimate consequences of EU biofuel policies for land use changes in other parts of the world, exploring some methodological improvements in the modelling tool applied, which need further empirical base. For instance, the linkages between the energy markets and the agricultural markets are complex and need further inquiries and data exploration in order to enhance `the quality of the model simulations. Also, Banse et al. (2008) focus only on first generation biofuels from agricultural crops. It is presumed that advanced conversion technologies for second-generation biofuels, which will use a wider range of biomass resources from agriculture, forestry and waste materials, will reduce some of the negative effects of first generation biofuels, such as less competing claims on agricultural land for food and/or fuel. At the moment, however, second-generation biofuels cannot be produced at a commercial level, while opinions differ about its role in the future of energy production (Bindraban et al., 2009a; Hoogwijk et al., 2005; Smeets et al., 2007).

2.4 Demand and production of agro-commodities

Food production

Population and income projections suggest food production needs to increase 50% by 2030 and to double by 2050 (FAO, 2006). The main increase must be realized in Sub-Saharan Africa and in South Asia, as these are the regions where the largest part of population increase will occur and the largest changes in consumption patterns are expected (Bindraban et al., 2009b; Nellemann et al., 2009). Increasing yields are expected to contribute to agricultural production growth but given the crop and livestock productivity trends, the studies point at the necessity of substantial additional land for use in agriculture to feed the world on the longer term. Raising productivity to levels where only water availability is limiting would increase productivity by 4-6 times in Sub-Saharan Africa, but this for most areas is unrealistic in the short run. Additional land might be available, yet only with huge social and ecological consequences.

Projections by a number of independent studies for future agricultural land use reveal an increase in arable land use for the 2 to 3 coming decades of 200-300 million hectares. These projections have been made

without considering the obligatory targets of bio-fuel policies. These policies will increase agricultural land use even further.

The WRR (1995) estimated the supply to demand ratio for global regions. Regions considered homogenous in socio-economic terms by the UN were considered. The production potential based on production ecological approaches of those regions were calculated taking the availability of natural resources into consideration, i.e. weather, crop and soil characteristics. The demand for food was based on three different diets, a healthy vegetarian diet, an affluent meat rich diet and a moderate diet. These analyses revealed that the resource availability, primarily suitable land and available water were limiting production potential indicating that Eastern and Southern Asian countries might not be able to feed its population from its own region. Other global regions, such as Latin America and Europe, have surplus capacity (Bindraban and Rabbinge, 2011). This suggests that global redistribution of food is essential to secure food.

Demand for feed for livestock

With the changing consumption patterns, shifting to more meat consumption as the demand for feed for livestock will increase over the next years. Currently the USA, Brazil and Argentina are the main suppliers of soybeans, meal and oil and dominate on the export side of international trade. A quick expansion of production in the USA in response to increasing demand for soybeans is not plausible: expansion has to come from increasing yields or from crowding out other crops as there is no land in the USA presently unused that may be easily used for agricultural purposes. Other crops such as maize are more attractive than soybeans from an economic point of view; the position of maize has been enhanced in recent years due to the increasing demand for the crop as bio-fuel. The increasing demand for soybean products in China and other Southeast Asian countries will not lead to much expansion of the area as other crops are either more economically attractive (in combination with agronomic circumstances). Therefore, the supply response to continuously increasing demand for soy products will likely be realised in Latin American countries like Brazil, Argentina and Paraguay, by applying new land for agricultural purposes, shifts between crops and/or more intensive use of agricultural land (FAPRI, 2009). For these three countries FAPRI (2009) projects that in 2019 the area for soy production will have expanded by 10 million hectare.

This means that many hectares of tropical forest and other ecologically vulnerable non-agricultural land may be transferred into agricultural land, with huge ecological and social impacts (e.g. CBD, 2010; Kamphuis et al., 2011; van Berkum and Bindraban, 2008). As can be observed from Table 2.1, land use differs greatly per region, and globally on the 13 billion ha land surface, 3991 Mha (31%) is forest land, 4949 Mha (38%) is agriculture land (30% arable and 70% grassland) and 31% is classified as ‘other land’ (FAOSTAT, 1997-2003).

As can be observed from Figure 2.3, evolving diets with more livestock products require more land (at actual productivity levels and current population size), which is more difficult to find (red colours). A growing population will increase the pressure on land use for crop production. Countries that have too little financial means available to assure food security will try and expand their production areas, and have to invest in productivity increasing measures.

Table 2.1.
FAO Land Use classes and average area 1997-2003 (FAOSTAT, 1997-2003).

Region	Sub region	Total Area	Water	Forest	Cropland	Perm. crops	Grazing land	Other land
		(Mha)	(Mha)	(Mha)	(Mha)	(Mha)	(Mha)	(Mha)
Africa	Eastern	636.1	30.8	168.4	50.4	6.2	237.5	142.9
	Middle	661.3	11.6	298.8	21.0	3.2	133.9	192.8
	Northern	852.5	14.4	79.2	40.6	4.5	192.6	521.1
	Southern	267.3	2.1	30.3	16.2	1.0	150.7	67.1
	Western	614.4	8.2	79.2	69.7	10.2	186.8	260.2
	Subtotal	*3031.5*	*67.1*	*655.9*	*197.8*	*25.1*	*901.4*	*1184.1*
Asia	Eastern	1176.0	29.6	227.5	139.2	11.9	524.9	242.9
	Central	400.3	7.6	12.0	31.4	0.7	250.3	98.3
	Southern	687.8	47.5	91.5	218.7	12.9	95.3	221.9
	Southeastern	449.3	14.5	217.7	63.2	30.1	16.7	107.1
	Western	483.1	2.3	19.4	43.2	5.2	226.5	186.4
	Subtotal	*3196.5*	*101.5*	*568.1*	*495.7*	*60.9*	*1113.7*	*856.6*
Europe	Eastern	1882.6	77.0	852.1	199.7	4.8	116.5	632.5
	Northern	175.0	10.7	70.3	15.3	0.1	23.3	55.1
	Southern	131.6	2.0	43.0	31.8	10.2	28.3	16.3
	Western	113.9	2.1	33.3	30.0	1.5	25.3	21.7
	Subtotal	*2303.2*	*91.8*	*998.7*	*276.9*	*16.7*	*193.5*	*725.7*
America	Caribbean	23.5	0.6	5.7	5.7	1.6	4.6	5.3
	Central	248.6	3.4	89.5	31.1	4.2	91.3	29.0
	South	1783.6	23.8	852.4	102.0	13.6	459.1	332.7
	Northern	2002.6	136.1	612.3	196.9	9.1	277.0	771.2
	Subtotal	*4058.4*	*163.9*	*1559.9*	*335.7*	*28.6*	*832.1*	*1138.2*
Oceania	Australia and New Zealand	800.9	5.9	173.0	22.4	0.3	445.6	153.7
	Melanesia	54.1	1.1	34.7	0.4	0.8	0.6	16.4
	Micronesia	0.3	0.0	0.2	0.0	0.1	0.0	0.1
	Polynesia	0.9	0.0	0.3	0.1	0.1	0.0	0.3
	Subtotal	*856.1*	*7.0*	*208.1*	*22.9*	*1.4*	*446.3*	*170.5*
World	Total	13445.6	431.4	3990.7	1329.0	132.6	3487.0	4075.0

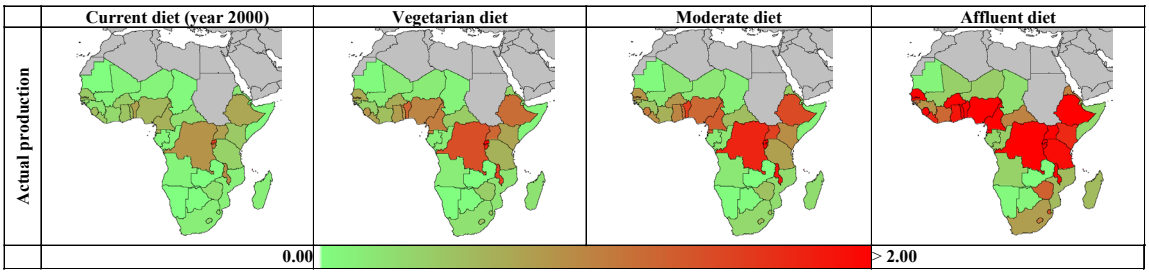

Figure 2.3
Cropland requirements at actual production levels per country in SSA and with different diets (current, vegetarian, moderate and affluent) expressed as fraction of available agricultural land. Source: Plant Research International.

Supply of food

OECD, FAO, FAPRI and IFPRI all have a long history of global and regional perspective studies for agriculture describing mainly prospective developments in food demand and consumption, implications for nutrition and undernourishment, changes in agricultural production and trade, and developments in the use of natural resources for agriculture. The most recent 2009 studies project significant production increases as a response to increased demand for food, feed and biomass in the world, although demand growth seems to outpace supply increase, because real prices of major agricultural commodities are projected to increase by 10-30% over the next ten years.

The availability and productivity (via technological development) of production factors labour, land, capital and knowledge (human capital) determine supply of agricultural commodities. Major trends in these factors are:

- Agriculture is largely labour intensive in many developing countries. In emerging countries the share of agriculture in total employment declines, as capital and knowledge intensive economic activities increase.
- Agricultural land expands in some regions in the world like in Latin America and South-east Asia at the cost of tropical forest and other ecological vulnerable areas.
- Agricultural production per capita grows gradually in the world, but there are many differences between continents and regions.
- Technological innovations (product or process innovations) result into increased labour and/or land productivity, but often also lead to further intensive use of land and/or increasing scale of production. Technological innovations can help to solve environmental and/or energy problems. Biotechnology may importantly contribute to help increase the production potentials in countries/regions with less favourable production conditions (e.g. drought) or improve efficiency of land and other scarce inputs. The application of genetically modified crops though still meets a lot of societal resistance in Europe.

Despite a slowdown of agricultural productivity growth in recent years prospects for increasing agricultural productivity through advances in technology and innovation in farming techniques are assessed positively. For instance, Huffman (2009) reviews agricultural technologies for cereal, oilseed and selected vegetable crops and for livestock production developed and applied in developed and select developing and transition countries. The study refers to new technologies developed for crops to steadily improve yields in major cereals and oil seeds through more effective control of insects, weeds, fungi, and diseases and the introduction of new genetically engineered (GM) crop varieties with integrated pest resistance and herbicide tolerance. Together with changes in cultural practices and increasing use of more effective and (to the operator) more comfortable planting and harvesting equipment these technologies have contributed greatly to increased yields in, especially, North and South America. Technical improvements in livestock production are a result of genetic improvement of animals, improved disease control, structures and management practices. The diffusion of artificial insemination in almost all farm animals has been a major factor leading to genetic improvement as well as through selective cross breeding.

Huffman (2009) points at the fact that in developed countries public and private agricultural research capital and public agricultural extension are major determinants of agricultural productivity. However, more and more technological developments are due to private investments (e.g. seed companies) while real public expenditures on agricultural research in OECD countries have been declining rather than increasing. Piesse and Thirtle (2009) emphasise the dependency of developing countries on technology transfers (o.a. through world's leading national agricultural research stations, NARS) from developed countries due to their poor research capacities, lack of supportive institutions, incentives and policies to encourage productivity increases. These countries would be at risk from productivity stagnation if they do not attract private technology providers.

Given that investments in public (and private) agricultural research have their impacts with a long lag, many studies like Huffman (2009), Piesse and Thirtle (2009) and IAASTD (2009) urge to significantly increase public

expenditures on agricultural research in order to make agricultural productivity significantly higher a decade from now.

Food production losses

Across the food chain production losses are accountable for a substantial percentage (20-30%) of agricultural produce that is lost for food intake and for other uses (Figure 2.4). The nature of these losses differs per region. In developed countries, food production losses mainly occur in the food processing chain (loss of produce to prepare specific products), over-date waste and plate waste. In developing countries, food production losses mainly occur in post-harvest (storage) processes resulting from poor storage and infrastructure and limited market access. Precise data on losses through the food chain are, however, largely missing, or dated (Parfitt et al., 2010). An estimated 50% for developing countries (e.g. Lundqvist et al., 2008) is one of the most cited accounts, but loss estimates strongly vary among regions and products. For instance losses for rice were estimated at 6-24% for West Africa (Parfitt et al., 2010), while those for more perishable fruits and vegetables were much higher. Pre- and post-harvest losses by rodents would affect almost 280 million of the undernourished and bring diseases that can be catastrophic to the livelihoods of the poorest of the poor Meerburg et al., 2009.

Technically it will not be very difficult to reduce such losses. In many areas in Africa and developing countries more in general, however, food chains supplying local urban markets are often characterised by many intermediaries and poor infrastructure and information leave farmers isolated from local and regional markets (Parfitt et al., 2010), challenging the proposed 33% reduction in Central Africa.

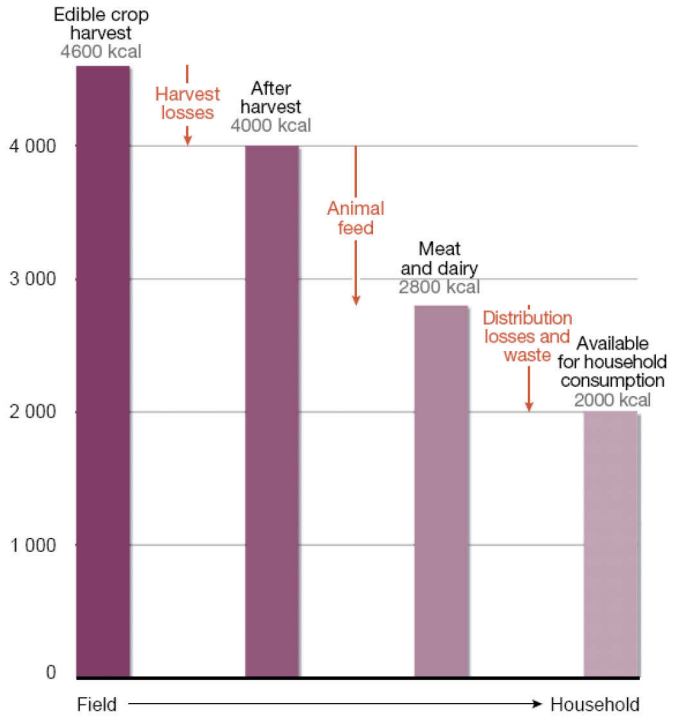

Figure 2.4

Estimate of losses and conversions at different stages of the food supply chain (from: Nellemann et al., 2009).

Pre- and post-harvest losses proportionally increase the land requirements to produce the required volumes of agro-commodities, and all attempts to reduce these losses contribute to the alleviation of competing claims.

2.5 Biodiversity and ecosystems services

Biodiversity and ecosystems provide many vital goods and services for the benefit of people and society, such as food, fibre, water resources, climate regulation and flood mitigation. The concept of ecosystem services was extensively elaborated for the first time within the framework of the Millennium Ecosystem Assessment (MEA, 2003, 2005). It links human well-being to goods and services that ecosystems provide. Ecosystem in this context refers to both natural and human managed ecosystems, including agricultural systems, as sources of services (MEA, 2003). It includes both tangible and intangible benefits humans get from ecosystems. Besides goods and services that represent a direct economic value and trade opportunities, there are also services that don't represent a direct economic value, but still are important for ecosystem functioning, agricultural productivity and human well-being in general.

Four different types of ecosystem services were distinguished (Figure 2.5, MEA, 2003, 2005); supporting services that mainly regulate ecosystem functioning, like nutrient cycling and soil formation and net primary production (NPP):

- provisioning services that usually provide tangible, tradable goods with an economic value, like food, fresh water, fibres and wood, and fuel;
- regulating services that are already less tangible, but determine human living conditions by regulating ecosystem processes and e.g. agricultural productivity, through climate regulation, water regulation and purification, disease control, and pollination;
- cultural services that provide non-material benefits through for instance offering spiritual enrichment, cultural heritage, sense of place, and determining social relations.

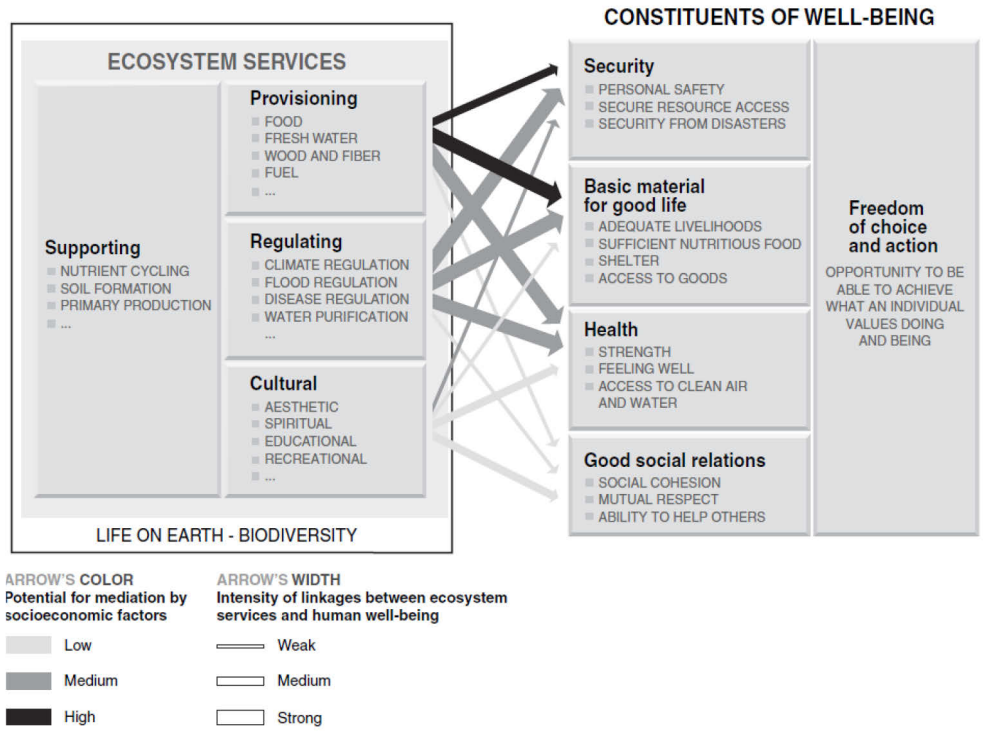

Figure 2.5
Linkages between ecosystem services and human wellbeing (form: MEA, 2005).

Biodiversity is an important factor determining availability of certain ecosystem services. Changes in biodiversity will have effects on how the ecosystem functions and the services it is able to provide (Schulze and Mooney, 1993). The link between biodiversity and level of services the ecosystem provides are nevertheless complex (Diaz et al., 2005; Kremen, 2005; Luck et al., 2009). Most of the services appear to depend mainly on relatively few functional components of biodiversity (Balvanera et al., 2006; Diaz et al., 2005; Jackson et al., 2007). There is, however a more direct link between level of biodiversity and ability of ecosystems to respond to environmental and anthropogenic changes, with more diverse system generally being more resilient to changes (Diaz et al., 2005; Tilman, 1996; Winfree and Kremen, 2009).

Based on a review of economic data and scenario projections of economic and land-use developments Braat and Ten Brink (2008) estimated the global economic losses of not meeting the 2010 target to halt the loss of biodiversity and subsequent loss of ecosystem services to be around 50 billion Euros per year. Between 2000 and 2010 this would be just under 1% of GDP, but by 2050 the losses would be equivalent to approximately 7% of global consumption. Projected welfare losses would, however, strongly differ between regions with 17% in Africa and 24% in Brazil and other Latin American countries. A large share of these losses is related to loss of climate regulation functions and carbon storage, which has global consequences.

As a result human appropriation and management of ecosystems leads to a simplification of the ecosystem in which a few desired or opportunistic species thrive, while the majority of species will decline (Braat and ten Brink, 2008; ten Brink et al., 2007). When productivity of one or a few (agricultural) species is intensified, usually some of the ecosystems services are replaced by human activities, such as the substitution of soil fertility based on nutrient cycling with application of artificial fertilizers (e.g. Van Jaarsveld et al., 2005). As a result agricultural production is increasingly based on a relatively small number of high yielding crop varieties and livestock breeds. On the longer term this will increase vulnerability to diseases with potentially large impacts on food security (Heal et al., 2004).

Although some services are mutually exclusive and therefore tend to compete for land, other services can be delivered simultaneously. If efficiently managed, maximisation of provisioning of food and wood and fibres can potentially be combined with delivery of other ecosystem services that are needed for ecosystem functioning and for regulating the bio-physical environment humans depend on. This will need an integrated approach of land use planning, preferably at larger spatial scales. Eventually over-exploitation and over-simplification of ecosystems will lead to degradation of the system and to loss of services provided by the ecosystem (Braat and ten Brink, 2008). Such losses have drastic consequences for the livelihoods and well-being of the people that directly depend on these services. Particularly in poorer rural areas people directly depend largely on natural resources for sustaining their livelihoods and provisioning of environmental services.

With the (expected) increasing demand for agro-commodities in the coming decades, the consequences for biodiversity and goods and services ecosystems provide are uncertain. Generally, ecosystem goods and services are considered a lower priority than food security. This is often presented as an obvious choice. Yet, biodiversity and ecosystem services play an essential role in the livelihoods of many people and are crucial for functioning of ecosystems, including healthy agricultural systems. Negative feed backs on agricultural productivity can be expected if essential services get lost. Also in sustainability assessments based on economic evaluations of land use, ecosystem services that currently have no market value are likely to be ignored. As a result conservation of biodiversity and ecosystems in economic assessments is often only taken into account as cost factor, putting limitations on (agricultural) productivity. A way to appreciate the actual value ecosystem services represent and to restore the function of market processes would be to put a price to services ecosystem and biodiversity deliver (Braat and ten Brink, 2008).

2.6 Foreign land acquisition

Many developed and some developing countries have an ecological footprint that is beyond the bio-capacity of their land area (WWF, 2008). As a result these countries import large quantities of agricultural commodities from African and Latin-American producers. The past five years showed a trend of increasing, especially large scale, foreign acquisition of farm land in African countries (Cotula et al., 2009). For instance in Ethiopia roughly 600,000 ha of land was acquired between 2004 and early 2009, which is about 1.39% of all land suitable for rain fed crops (Figure 2.6, Cotula et al., 2009). Most foreign acquisitions are based on private investments, but these often receive governmental support, while government-owned investments still represent significant part of all investments.

The main driving forces behind these large scale land acquisitions are food security concerns in investor countries, investment opportunities, and increasing share of non-food crops in agricultural production, primarily for bio-fuels. Especially the peaks in food prices in 2007 and 2008 and associated uncertainties in food availability triggered government backed deals for land acquisition to improve food security in the investor countries (Cotula et al., 2009; Nellemann et al., 2009). At the same time the increasing agricultural commodity prices appears to make investments in agricultural production an increasingly attractive and profitable business.

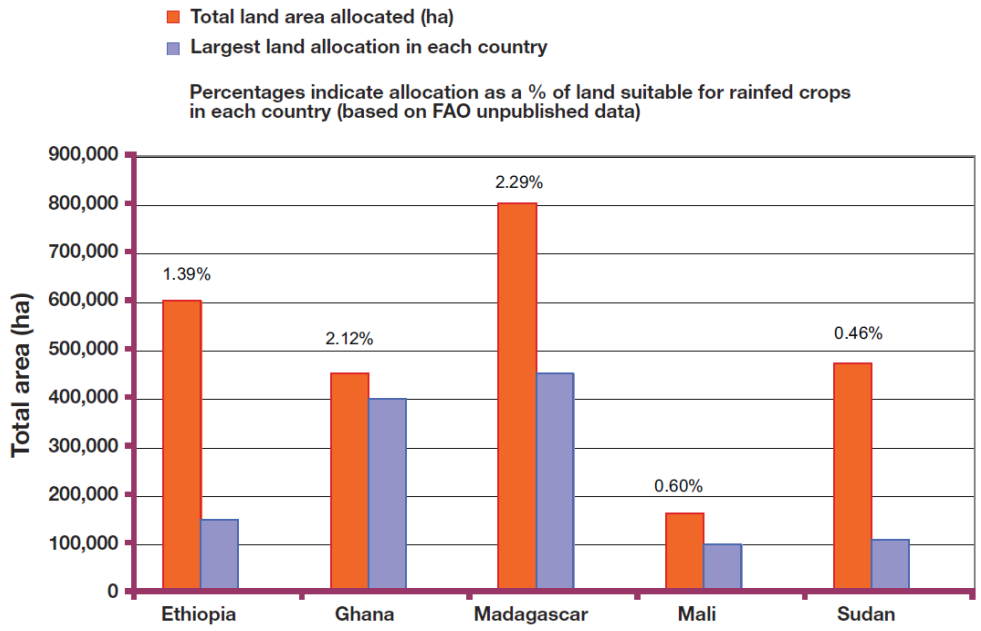

Figure 2.6
Land area allocated to investors, 2004 - early 2009. From Cotula et al., 2009.

In the recipient countries land acquisitions may create both new opportunities and risks. The ultimate outcome for peoples' livelihoods will largely depend on the terms and conditions of the deals. Most important benefits for the people in the host countries result from investments in agricultural production in terms of capital and technology transfer, creation of employment and investments in infrastructure.

In general large-scale land claims remain a small proportion of total land suitable for agricultural production in any one country. Most of the remaining suitable land, however, is already under use or claimed, often by local

people who have no formal, limited or unclear land tenure rights. As a result much of the land offered to other countries and companies is already claimed for use by the indigenous population (Robertson and Pinstrup-Andersen, 2010). At the same time foreign acquisition is especially focused on the most valuable lands with irrigation potential or close to markets (Cotula et al., 2009). More widespread marginal and abandoned land generally lack adequate water resources or are inaccessible from markets. Since a majority of the rural people in sub-Saharan Africa depend on subsistence agriculture for their livelihoods (Elasha et al., 2006; OECD/FAO, 2009), foreign land acquisitions may result in local people losing access to vitally important resources for food security. Consequently large scale acquisition displaces local inhabitants and decreased their access to land and water resources, potentially increasing local food scarcity (Robertson and Pinstrup-Andersen, 2010). Also in many host countries investors are lured with large tax incentives, while the majority of the products is exported. Because infrastructure developments alone are usually not sufficient to compensate for forfeited livelihoods of local people, these countries realise no net macro-economic gains from such investments (Robertson and Pinstrup-Andersen, 2010).

Agreements and conditions for land acquisition are usually reached in negotiations between the host country and investors. Yet the most important stakeholders, the people living in the area without a political voice, usually are no party in these negotiations (Robertson and Pinstrup-Andersen, 2010). If no arrangements are made for employment of local farmers and/or guaranteeing local food security, the resulting scarcity of high quality arable land will result in increasing resistance and may eventually result in increasing risk of conflicts over available resources.

2.7 Soil degradation

The quality of soils is essential in determine the productivity of land in combination with the available rainfall or irrigation water. The productivity varies greatly depending on soil type and even over short distances due to natural and human interventions. Improper land management leads to degradation, i.e. the reduction in the capacity of the land to provide ecosystem goods and services over a period of time for its beneficiaries. More specifically it relates to decline in availability of nutrients, disaggregation of soil particles affecting characteristics like the water holding capacity of soils, loss of organic matter and reduction in biological activity (e.g. Bergsma et al., 1996; Shen and Hess, 1983). Erosion, salinization, waterlogging, flooding, or increased drought risk, as well as the establishment of weedy and invasive plants affect inherent soil productivity.

The largest part of world soils are deficient in one or more types of nutrients, while marginal soils generally contain limited capacity to retain water and nutrients. Nitrogen is supplied under natural conditions from soil reserves that will however be depleted leading to soil degradation when insufficient replaced. Phosphorus and potassium need to be mined and processed for use as fertilizers. Concerns have been raised about the limited availability of P for future food production, with estimates of economically exploitable P resources to be depleted within 100 (Smit et al., 2009) to over 300 years (van Kauwenbergh, 2010). Increasingly micro-nutrients are found to limit crop production and need macro-attention in our fertilization strategy (PE&RC, 2011). Micro-nutrient deficiencies could have been human-induced; increasing deficiencies are for instance detected with increasing intensity (of NPK use) in India, while micro-nutrient deficiency shows up sporadically in many African production systems where NPK use has been low up to now.

Stoorvogel et al. (1993) have shown that the nutrient balance for the African countries is severely negative jeopardizing the production potential of the continent. At an average grain yield level of 1.1. ton ha^{-1}, and a nitrogen content of about 1.5% a total of 17 kg N ha^{-1} is subtracted from the soils that ought to be replenished. Average fertilizer application in Sub Sahara Africa is however about 10 kg ha^{-1}. Manure may add

some fertilizer to this equation for arable land, but these nutrients are again removed of grazing lands leading to it deterioration when these grasslands are not replenished.

Soil organic matter content in soils collapse after conversion of natural lands to stabilize at a lower level (Figure 2.7). Conversion of grassland into cropland for instance also leads to large emissions of GHG (Schlesinger, 1990), while poor management lead to severe degradation, associated with a decline in soil carbon. The rate of soil and land degradation can be very high with dramatic effect in a few years' time only. The productivity of soils can be improved also. Contrary to degradation these processes may take decades if not centuries.

Degradation of the world's land resources therefore jeopardize the basis for sustained food security and other land use and for sustaining ecosystem services. The global assessment of human-induced soil degradation (GLASOD) has shown that 15% of the world's total land area (13% light and 2% severe and very severe), mainly resulting from erosion, nutrient depletion, salinization and physical compaction (see Figure 2.8, Oldeman et al., 1990). Whereas degradation of land has detrimental effects on agricultural productivity, little quantitative information is available about the exact nature and extent of degradation. New methodologies are currently being developed, but due the high complexity of the phenomenon, no unambiguous quantitative results are available yet (Bai et al., 2008).

At the national scale, Chen (2007) reports that small portion of land loss is associated with the direct conversion of the land into urban areas estimated at one Mha y^{-1} at the beginning of this century, but that soil pollution and waste disposal affect much larger areas. He estimates 20 Mha of land to be polluted by heavy metals causing grain yield loss of some 10 Mt and acid deposition deteriorating soil quality through reduce soil pH or aggregate stability. Waste also leads to water pollution; 78% of the streams crossing urban areas have become unsuitable for drinking, while 3.6 million ha is irrigated with polluted water.

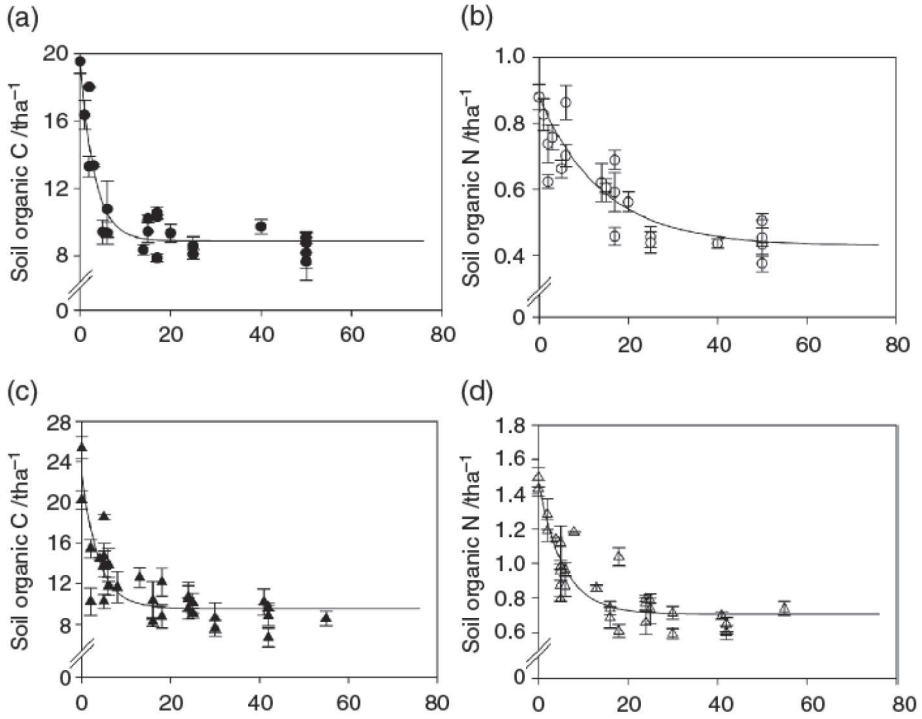

Figure 2.7
Changes in organic matter of woodland soils cleared for arable cropping. From: Zingore et al., 2005.

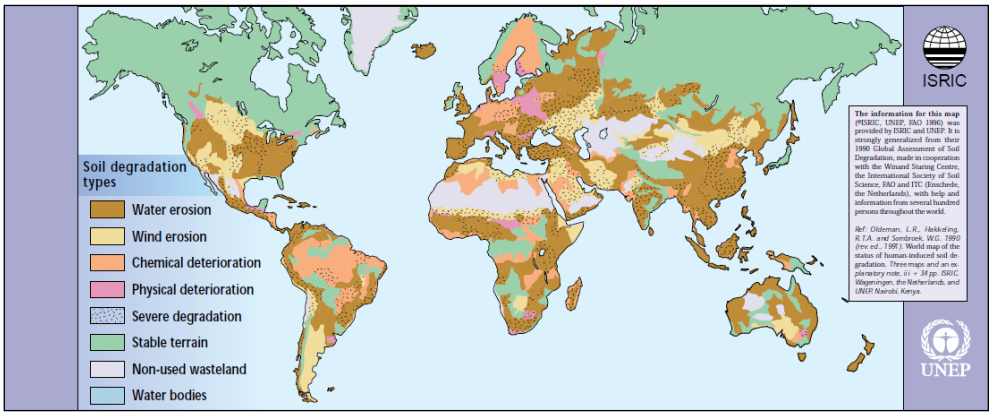

Figure 2.8
Human Induced Soil Degradation types (Oldeman et al., 1990).

Land conservation and rehabilitation are essential parts of sustainable agricultural development. While severely degraded soil is found in most regions of the world, the negative economic impact of degraded soils may be most severe in countries most dependent on agriculture for their income. Land and soil degradation have adverse impacts leading to displacement of production regions, reduction in crop productivity and in increased variability in production, adding to the complexity in the food system and re-orientation in competition for natural resources.

2.8 Climate change

The impact of climate change on the productivity of land is expected to vary greatly with increasing and decreasing productivity in particular regions, e.g. in Northern and Southern Europe, respectively (Olesen, 2006). These differences may lead to an even greater divergence between areas with surplus and insufficient production potential, influencing policies and trade on food. Importantly, variability in production under unfavourable production conditions will be exacerbated by changing climatic conditions, especially more (unpredictable) erratic rainfall patterns. Increased variability and harsh conditions will increase production risk creating an unstable food system. Extreme climatic events such as years of extreme drought, excessive rainfall leading to flooding or days with extreme temperature can have dramatic effects on production, and there is emerging consensus that the semi-arid regions will experience a high degree of climate variability in the future (Held et al., 2005). Most studies (e.g Liu et al., 2008; Parry et al., 2004) produce alarming results, with production per capita not keeping pace with population growth.

Here Eastern Africa is described in more detail. Since in East Africa domestic production is the most important source of food (e.g. Elasha et al., 2006; OECD/FAO, 2009), future constraints in crop production will strongly affect food security and may lead to under nutrition. In a context of anticipated climate, bio-physical, economic and social changes Liu et al. (2008) projected that also in the future Ethiopia, Uganda, Rwanda and Burundi remain hotspots for food insecurity.

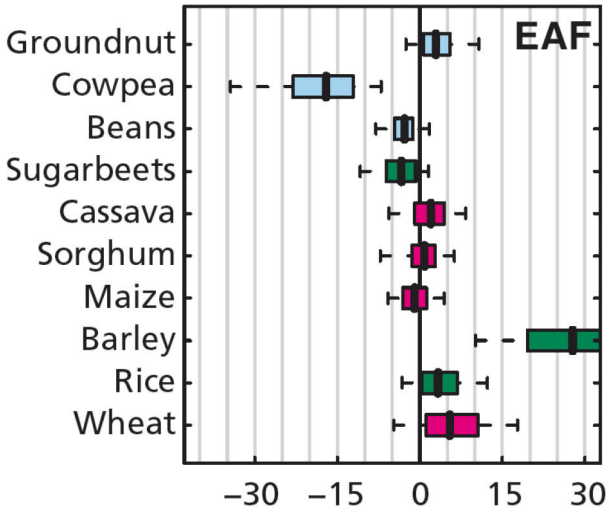

Figure 2.9

Projected climate change impacts on agricultural production in 2030 as percentage change from average 1998-2002 yields. Pink indicates high hunger importance ranking, blue indicates intermediate ranking and green less important. Importance ranking is based on a combination of the importance of the crop in East-Africa, i.e. how many people depend on it, and on it's sensitivity to climate change (from Richardson et al., 2009, adapted from Lobell et al., 2008). Climate change driven changes in crop production of important crops, on which many people depend, are thus ranked highest.

Based on criteria for importance of projected sensitivity to climate change of crops Lobell et al. (2008) assessed the most important crops that need prioritized adaptation investments for different world regions. Of the assessed crops in East-Africa especially cassava, sorghum, maize and wheat would need prioritized adaptation investments (see Figure 2.9, from Richardson et al., 2009, adapted from Lobell et al., 2008). Wheat is expected to show increased production, but projections using different models showed large variation, making this prediction very uncertain with some projections showing decreased production. Because wheat is an important food source, it was classified under high adaptation priority (Lobell et al., 2008).

Other model projections show that climate change will strongly reduce the yield of wheat, while at the same time the yield of millet was projected to increase (Figure 2.10, Liu et al., 2008). Currently the average temperature during the cropping season is already above the optimal temperature for wheat, which generally lies between 15 and 20 °C. With increasing temperatures crop yields will thus be further reduced (Liu et al., 2008).

Besides agricultural products many people in East Africa depend on food products from (semi) natural ecosystems and agro-forestry production systems. Moreover these ecosystems essential in provisioning other services like drinking water and erosion control. As a result of climate change, the area of suitable habitat for species is expected to shift and/or decrease. As a result, ecosystem services that rely on sub-Saharan plant diversity, including foods and fibres, like nuts, fruits, gum and timber and locally used plant based medicines are likely to decrease. Usually areas which sustain higher levels of biodiversity generally are much more resilient to such environmental changes (Diaz et al., 2005; Tilman 1996; Winfree and Kremen, 2009), while degraded systems are much more vulnerable to climate change.

Climate change and weather extremes may request different agro-commodities to be produced in those regions where these effects are most pronounced, but where agronomic practices and production systems are not yet optimized on resource use efficiency.

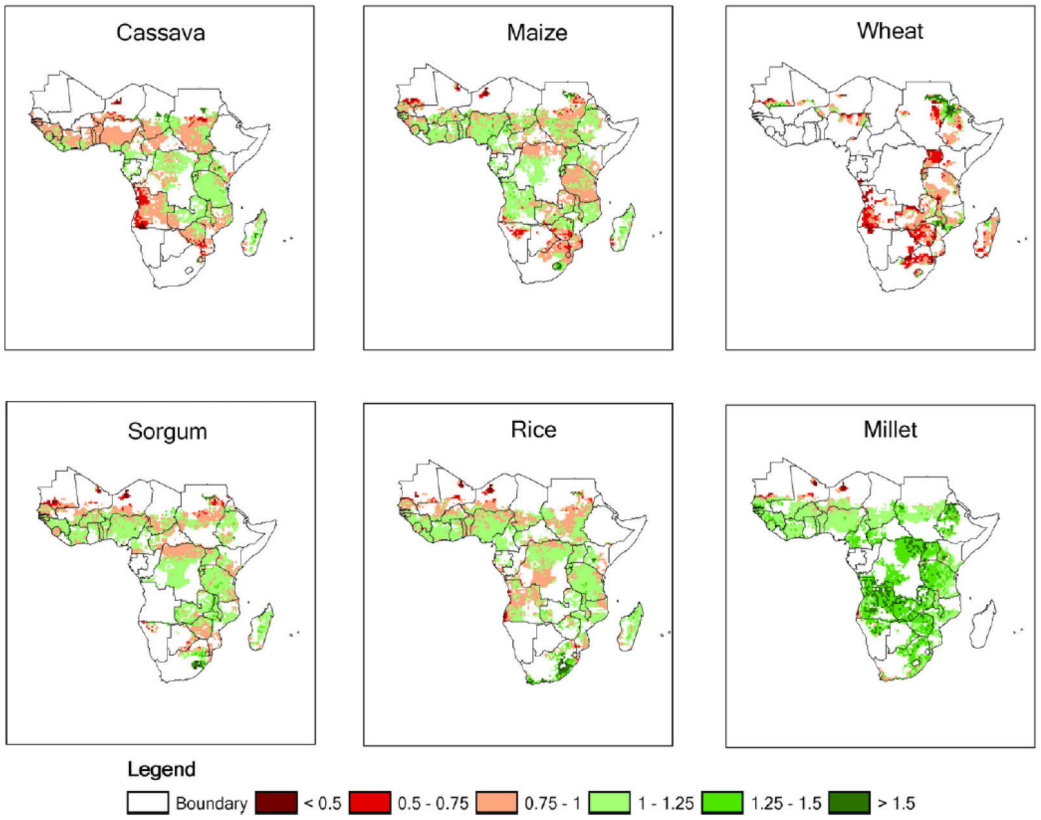

Figure 2.10

Impact ratio of climate on crop yield in 2030 in sub-saharan Africa under the SRES B2 emission and climate change scenario. Other SRES scenarios showed similar trends (from Liu et al., 2008).

2.9 Effects of input scarcity like phosphate and water

Despite increasing global demand for non-renewable phosphate rock both in the short and longer term, and its critical role in food production, global phosphate scarcity is missing from the dominant debates on global food security and global environmental change. For example, phosphorus scarcity has not been mentioned explicitly in OECD, FAO and IFPRI documents on food supply projections. Smit et al. (2009) analysed the requirement for phosphorus for different food and fuels scenario's and arrive at availability, given minable reserves know in 2009, for some 75 to over 300 years, although recently reserve deposits being estimated to be much larger (van Kauwenbergh, 2010). The same holds for water, which is assumed just to be available in most projections. The scarcity of these essential inputs will however have a significant impact on the food production potentials, through their increasing prices, which subsequently may increase significantly (e.g. Eickhout et al., 2006; Koning et al., 2008).

This appears particularly worrisome for phosphate as, next to a physical and economic scarcity there is a geopolitical scarcity arising from 90% of the world's remaining high-grade phosphate rock reserves being controlled by just five countries (a majority of which are subject to geopolitical tensions) can limit the availability of phosphorus on the market and raises serious ethical questions. Apart from that, there should be quite some possibilities to increase the efficient use of phosphate as according to Cordell (2010), conducting a global phosphorus flows analysis found that only 20% of phosphorus in phosphate rock mined for food production actually reaches the food consumed by the global population due to substantial inefficiencies and losses from mine to field to fork. Also with respect to water a huge variety of farm management, advisory and technology approaches are being used by OECD countries to improve agricultural water resource

management (OECD, 2009). Technology and especially biotechnology may importantly contribute indirectly to improve physical water productivity, for instance by targeting rapid early growth to shade the soil and reduce evaporation, breeding drought and temperature resistant varieties or breeding for resistance to diseases, pests and salinity (IWMI, 2007).

Increasing water use in food production

Changing consumption patterns towards more meat based diets will have large consequences for agricultural water use. For instance in China, it takes 2,400 - 12,600 litres of water to produce a kilogram of meat, while the production of a kilogram of cereal needs only 800 - 1,300 litres (Liu and Savenije, 2008). In China the effect of dietary change even has a stronger impact on agricultural water use than would be expected from the population growth. Where population between 1961 and 2003 almost doubled, the per capita water requirement for food production rose by a factor 3.5 (from 255 m^3 to 860 m^3) during the same period (Liu and Savenije, 2008)

In a recent study on the water use of bioenergy crops (Gerbens-Leenes et al., 2009), it was concluded that water use for bioelectricity is more efficient (≈50-100 m^3 GJ^{-1}) than water use for biofuels (≈100-200 m^3 GJ^{-1}), where only a fraction of the biomass is used for bioenergy production. Bioethanol from sugar/starch requires half the amount of water required for biodiesel production from vegetable oils. Although the methodology applied is heavily criticized, especially for dedicated biofuel crops (Jongschaap et al., 2009), it provides some directions and quantifications that may be of interest.

The demand for water for food production will increase dramatically. Estimates show that an additional amount of up to 5,000 km^3 will be needed to feed a population of 9 billion people with a moderate diet. This translates to an equivalent amount of water needed for the production of a cereal crop with a yield level of 5 ton/ha on a total surface of 1,000 million hectares (Bindraban et al., 2010b). Hence either the agricultural area should be dramatically expanded or the water use efficiency on the current agricultural lands should be boosted. Often water related solutions are sought in irrigation for which water from natural sources should be abstracted. However there is much scope for enhancing water use efficiency and there is great opportunity to enhance rainfed agriculture. Fertilization often appears to be the best irrigation! Water availability is often not the most limiting factor for crop productivity and agricultural land use. Of course, marginal areas with too little rainfall limit crop growth, but increasing water use efficiency by alleviating other limiting factors such as water holding capacity and soil fertility, or combating crop yield reducing factors, such as the attack of plagues and diseases, has a scope of increasing crop productivity by 3-4 times in development regions. Water use efficiencies in developed regions are quite high, as a result of appropriate crop management.

3 Competing claims on natural resources: a case study approach

3.1 Introduction

In the previous chapter, attention has been paid to the occurrence of competing claims at the global level. Global trends and processes have been assessed by making use of the various macro-economic models developed to this end. A range of claims were described, together with the potential competition these might trigger.

Competition over the access to and control over natural resources is a key factor explaining the many resource related conflicts of today. Mismatches between what ecosystems can sustain and what the political, socio-cultural and economic environment demands occur at all levels. Increased connectedness of global economies reveal these mismatches clearer every day, yet examples are not difficult to find (biofuel versus food; agricultural production in deforested areas versus clean air; subsistence fishing versus commercial fishing, etc.). Stakeholders from all levels are increasingly involved in a global competition on land and water. Especially in the South, where natural resources form the economic basis of poor people's livelihoods, its loss of access and control result in serious deprivation (Giller, 2005).

3.2 Choosing the case studies

Four initial case studies (Table 3.1) have been selected, representing a variety of competing claims and conflicts, on the various continents. As already mentioned, all case studies are based on existing material, but have been re-examined in the light of competing claims. All four are related to policy measures or private investments in the Netherlands or the European Union, to allow for a feedback to EL&I/EU policy makers.

Table 3.1
Case studies, themes and analytical tool used.

No	Case study	Themes	Main analytical tool used
1	Competing claims on land in the Loess plateau, China	The impact of urbanization, industrialization and modernization on land use in China's Loess Plateau	DPSIR
2	Transboundary nature conservation: the case of the Limpopo transboundary park, Mozambique	Competing claims on land: nature conservation, tourism development and local peoples' livelihood	DPSIR
3	Illegal or incompatible: Managing the consequences of international trade agreements on local livelihoods in Ghana	International timber trade agreements and local livelihoods (WUR-DGIS partnership)	DSIR and detailed stakeholder analysis
4	Competing claims on land and water in Ethiopia	Competing claims on water, land and labour in Ethiopia's Central Rift Valley (WSSD Partnership, BO 10 006 023 02)	DPSIR with emphasis on analysis of claims on different resources

Given the large number of potential cases from existing studies carried out at Wageningen UR, resource persons within Wageningen UR were asked to write down their experiences from a 'competing claims perspective'. A limitation of this was that there was no experience on what a 'competing claims perspective' exactly is and what methods for investigation should be used to describe the competing claims.

3.3 Short description of the case studies

In this section a short description will be given of the four cases. See the Appendix 1 for the full stories.

Loess Plateau in China

The rapidly degrading Loess Plateau in China and subsequent sedimentation of the Yellow River has caused a serious threat of floods in its surrounding area, which offers home to 150 million people. Discharging the sediment requires substantial river flow, which will put further limits on the amount of water to be used for irrigation and industry. As a response, the construction of check dams, terracing and afforestation have been practiced for decennia. Most recently, government directives were issued to 're-green' the Loess plateau and convert farmland into forest. Although effective, these measures are not in favour of the millions of small-scale farmers, who depend on agriculture to sustain their livelihoods.

Major drivers of degradation are a combination of rapid population growth, and the region's rapid economic development which has led to increased extraction of oil and coal, extended road networks, industrialisation, urbanisation, and intensified agricultural production. The competition for water and land is further enhanced by the bio-physical characteristics of the Loess Plateau, and current changes of climatic conditions. The Chinese government is committed to tackle the problem of soil erosion and siltation of reservoirs and river beds, and has started far-reaching programmes to do so. Many of the programmes are developed in close collaboration with the Dutch government and the European Union. These measures however, do not solve the problems of all stakeholders involved. On the contrary, they rather increase the number of claims on a reduced territory. By prohibiting grazing and growing crops on steep slopes, the livelihood options for local populations have become considerably smaller, and unlike before, people have to face the threat of food insecurity. Moreover, increased exploitation of oil and coal reserves have notably increased competition on the valuable land, and increased the pressure on local people's livelihoods. The government has undertaken a variety of compensation measures such as the provision of tools and machinery to intensify existing farming practices on the remaining lands, and establishing orchards. However, the effects of these measures highly depend on local institutional arrangements, which have not yet been put in place, therefore the outcome is still highly unpredictable.

Great Limpopo National park Mozambique

In Southern Africa, the creation of trans boundary parks is generally seen as an opportunity to both increase national incomes through the attraction of foreign investments and tourists, and to conserve natural resources and biodiversity at the same time. The Dutch Prince Bernhard Foundation is one of the founders of the Peace Park Foundation, which facilitated the establishment of the Great Limpopo Transfrontier Park between South Africa, Mozambique and Zimbabwe. The establishment of the park was made possible through financial assistance from, amongst others, the Netherlands. Although originally not intended, the establishment and extensions of the park led to resettlement of thousands of families in Mozambique. Although well planned for, resettlement led to a massive loss of land and livelihoods, and increased claims on the resettlement locations, which were already inhabited and exploited by autochthonous populations, multiplying claims over land and water. Moreover, government measures and private initiatives around the park area have led to a gradual conversion of land into commercial sugarcane plantations to feed the rapidly growing demand for biofuels.

The process has resulted into new flows of transboundary migrants, the so-called 'conservation refugees', who seem to have no reasonable alternative option than to leave.

The drivers behind the creation of massive transfrontier conservation areas are international organisations motivated by a combination of nature conservation, regional peace building and socio-economic development, and private investors searching for transnational business opportunities. With the underlying assumption that conservation stimulates development through tourism, and benefits both communities as well as private investors. The actual aim of community participation and benefit sharing however, seems far from being achieved. Instead, forced resettlement, increased claims on land and water at the park boundaries, increased conflicts related to land rights and wildlife encroachment, and new flows of migration have been the results.

EU-initiated FLEGT process in Ghana

In Ghana, the issue of deforestation is high on the agenda. Drivers of deforestation are a booming national economy, and an ever increasing international demand for tropical timber. Additionally, policy and governance failures enhance further degradation of the forests. The EU FLEGT (Forest Law Enforcement, Governance and Trade) Action Programme recognises that the EU shares responsibility with tropical countries to combat illegal logging and its associated trade. The programme proposes the development of Voluntary Partnership Agreements (VPA) to eliminate illegally-produced timber from partner countries through a timber licensing scheme. In September 2008, a VPA has been signed between Ghana and EU.

A major challenge in its implementation is the expected tension between the programme, which has a rather technocratic approach to counteract illegal logging through transparent and accountable legality standards, and a more rights based approach which focuses on the need for a more equitable distribution of forest benefits amongst local stakeholders. This dichotomy shows the dual focus of EU/LNV, which on the one hand argue that international trade protocols are effective instruments to contribute to sustainable NRM in producing countries (thus reducing the ecological footprints of consuming countries), and on the other hand argue that forests are vital ingredients for local peoples' livelihood hence driving the international poverty alleviation agenda. It presently looks as if these two policy angles are conflicting: while the successful implementation of a timber licensing scheme secures the formal legality of exports to Europe, the opportunity costs are borne by the poor forest fringe communities in producing countries such as Ghana.

This case study shows that the impact of deforestation is not the same for all stakeholders involved; some stakeholders are losing, while others are winning in terms of economic and/or political power. The VPA features on the agenda of many stakeholders, although their affiliation with the objectives and operationalization of the mechanism differs, depending on the underlying political, economic and institutional interests. Therefore, the introduction of an internationally driven regulatory instrument not necessarily concurs with the economic and institutional interests of key societal groups, and even increases the competition on tropical forests.

Central Rift valley in Ethiopia

The Central Rift Valley of Ethiopia is marked by a rapid decrease of water resources and deterioration of its wetlands. This is mainly due to the extraction of water by agricultural production systems which have been changing over time. A rapidly growing population and increased urbanisation are causing increased pressure on land, water and biomass. A government policy to create an economic hub by introducing favourable investment conditions in the area has attracted export-oriented irrigated horticulture and floriculture. These labour intensive production systems not only demand massive amounts of land and water, but also demand human labour, which is in direct conflict with local food production.

Traditional livelihood strategies of the local population entail a strategic combination of animal husbandry, and rain-fed agriculture. The more recently introduced irrigated farming systems include closed horticultural and

floricultural greenhouses, developed by foreign investors (predominantly from the Netherlands) and focus exclusively on the export market. The impact of large scale horticulture not necessarily brings about negative impacts in terms of poverty, since they provide employment opportunities. Several horticultural companies have adopted Corporate Social Responsibility (CSR) strategies and provide labourers with reasonable salaries and social services. However, their presence has created an influx of migrant workers, all in the need of food, water and shelter, which has indirectly increased pressure on the available resources.

In 2006, the Central Rift Valley Working Group was initiated, as an attempt to create a multiple stakeholder dialogue, to come up with a joint vision and a consented land use plan. Although the Working Group has contributed positively in terms of stakeholder consultation, its outcome was hampered by a lack of institutional support, a low sense of urgency amongst the majority of stakeholders, and an absence of a linkage to higher policy levels, to embed locally defined strategies into wider governmental policy frameworks. More transparent information flows, increased capacity, and joint action at all levels are urgently needed in order to avoid further competition and escalation of latent conflicts around the scarcely available natural resources.

3.4 Pressures from global to local

A main feature of the concept of 'competing claims' is the idea of pressures from global to local and the responses and the different levels. In all four cases recent changes have resulted in increased pressure on natural resources. This pressure has aggravated competition on available natural resources, forming a basis for latent conflicts to escalate. In the following we will try to distinguish global and national/local forces which put a claim on natural resources.

The *global* forces affecting the four cases can be described as follows:

- In the China Loess Plateau case important driving forces are population growth and rapid economic development. The latter is a result of China's integration into a globalised world with its market economy. The situation is also influenced by climate change, which is also driven by international (and national) forces. These rather 'anonymous' forces are not directly related to one group of stakeholders.
- In the Mozambique/Limpopo case the international forces are international organisations that aim to conserve nature and therefore want to limit the access by local people to certain protected areas, not increasing the pressure on other areas. Together with nature conservation, tourism is promoted. There is also a growing demand for biofuels which has led to a gradual conversion of land into commercial sugarcane plantations
- In the FLEGT case in Ghana the pressure from outside are the international timber market and the EU who demands that the timber exported to the EU is from legal origin. The EU and Ghana have signed an agreement which it is stipulated among other things that a system will come in place to assure legality of timber (LAS-Legality Assurance System) and that efforts will be made to improve forest governance. This EU demand is a response to concerns of the general public and pressure groups inside EU countries.
- In Central Rift valley (Ethiopia) case the main forces from outside are market forces. A government policy to create an economic hub by introducing favourable investment conditions in the area has attracted export-oriented irrigated horticulture and floriculture. This has put extra pressure on water resources. A question is whether the use of labour for intensive commercial horticulture is not in conflict with local food production.

National and/or local forces can be summarized as follows:

- Loess Plateau/China: Major drivers of degradation are a combination of rapid population growth and the region's rapid economic development which has led to increased extraction of oil and coal, extended road networks, industrialization, urbanization, and intensified agricultural production.

- Mozambique/Limpopo: The national government promotes tourism activities which have a negative effect on the livelihoods of local communities. Policies have lef to non-voluntary resettlement of local populations. However, there is a lack of data which analyse the impact of tourism on local people.
- FLEGT/Ghana: an important driver of deforestation is the booming national economy: timber is not only asked for by the international market (e.g. the EU) but also the national market. Incomes are rising and people partly spend their money on construction of new houses or improvement of existing ones and timber is an important input for these.
- Central Rift (Ethiopia): national drivers for increasing claims on water and land include population growth and the adoption of an Agricultural Development led Industrialization Policy since 1990. This policy includes favourable investment conditions and soft loans for horticulture. There is also a much older claim on woody biomass for the production of charcoal benefiting local populations but causing deforestation. Grazing of livestock has led to the shortage of good feed and overgrazing of common pasture. Urbanization is a recent phenomenon.

The provisional conclusion is:
- In all cases both national/local drivers and international drivers are present and influential. Problems of competing claims indeed are a result of a complex mix of local, national and international drivers. So it does not make much sense to consider in analysis of the situation and responses only either the international or the national/local level.

3.5 Responses from global to local

Responses are policies and efforts from different actors to mitigate the competing claims on the resources, or adapt to the new situation. Most importantly here are responses from governments at different levels, donors and international organisations.

Responses at international level include:
- Loess Plateau China: there is influence from outside in the form of support from EU and the Dutch government to the Chinese government by providing funds to projects.
- Mozambique: the issue of biodiversity conservation is taken care of (in combination with tourism development) but in fact for the issue of competing claims there is no response from the international level.
- FLEGT case in Ghana: FLEGT is an EU policy response to the disappearance of forests globally, leading to limit imports in the EU of [especially tropical] timber to timber that has been produced and marketed in a legal way. The FLEGT policy has not specifically been developed for Ghana, but it includes certain social safeguards for local populations. The policy stresses legality issues more than rights issues. FLEGT is not the only international program for improving governance of the forest sector. There are several related policy development processes.
- Rift Valley Ethiopia: The case study is based on several reports produced by Wageningen University and Research centre. This research was funded by the Dutch Ministry of Economic Affairs, Agriculture and Innovation (EL&I). The research is a response to perceived problems on the use of water for horticulture. Also the organisation of a multi-stakeholder workshop is part of this research. The objective of the workshop was to develop a joint land use plan. It is not clear whether this research has led to concrete responses.

Responses at national level:
- Loess Plateau China: the government has developed a policy of compensation payments for fruit and cash tree planting during the first eight years after establishment. Later on the government introduced a subsidy for improvement of croplands. The program to resolve the erosion and land degradation problems is far reaching, but payments may not be sufficient for local farmers.

- Limpopo/Mozambique: the policy includes promotion of tourism and resettlement of populations in order to reduce the pressure on nature reserves, but thereby increases pressure on other land. The policy is only a very partial response to the issue of competing claims.
- FLEGT/Ghana: the national government cooperates with the EU in order to make the FLEGT initiative a success in Ghana. However, there are hardly any drivers from inside the government to promote a badly needed sector reform.
- Rift Valley Ethiopia: there are all sorts of water regulatory bodies, but there is no coordination and no policies in place to deal with the issue of water scarcity. There is no sense of urgency.

Some conclusions as to responses:
- The responses found in the various cases are not always responses to the question of competing claims, but rather responses to sub-problems related to competing claims, or responses to a specific global problem.
- Responses from national and international levels are sometimes really directed at issues of competing claims, but they do not consider all competing claims relevant for the local level. So the measures might seem to be effective, however, perceived from the local level they are not. Especially for local populations relying on local resources availability they have not been effective, even counterproductive, with negative consequences for those being excluded from local resources use.
- Global trends and local dynamics, although strongly interconnected, do not follow the same logic, and are hard to capture in linear causalities. Much depend on the functioning of local institutions, and power relations between stakeholders, each of which having their own interests, and being embedded into trans-local networks of economic and political nature.
- Apparently, it is very difficult to design appropriate responses to counteract competing claims. One of the reasons is a lack of a coherent analysis at the basis of policy responses for competing claims. Local action does not seem to be very effective since local claims are also driven by external forces, hence measures have to exceed the level of local stakeholders' reach. While responses from higher levels seem to be disconnected from local realities, making them counterproductive, with negative impact for those stakeholders most directly affected by competition and conflict. They fail to take into account the complexity of economic and political forces, and are not properly monitored to measure real impacts at the local level.
- The exercise reveals the importance of power dynamics, which not only define the occurrence of competing claims, but also define whether or not competing claims turn into conflicts. Stakeholder analysis in Ghana has revealed stakeholders' interests underpinning their claims, and largely determining their responses.

3.6 Methodologies for analysis of competing claims in local cases

The four case studies strongly differ not only in terms of context, but also in terms of methodology used. In all four cases, the DPSIR method has been applied to identify the actual state of the area, its drivers, and the nature of the impacts and responses. But the analysis has not been done in exactly the same way: for example, in the Mozambique case it has been applied consequently and in the Ethiopia case in a much looser way.

In all four cases it has been possible to identify the state of the area, its drivers, behind, its impacts and responses. It was however far more difficult to identify stakeholders, assess their specific interests, and identify their potentially conflicting responses to change. This is a pity indeed, since these are the factors providing the key to understanding competing claims at the local level. In the case of the Voluntary Partnership Agreement in Ghana, the author notices that 'Mapping the competing claims on forests in Ghana and analysing the underlying interests of stakeholders as attempted in this case study gives an indication to what extent any

of these scenarios can become reality. The responses to the degrading state of the forests in Ghana differ by stakeholder grouping with at extreme ends civil society 'as spokespersons' of disenfranchised communities and to an extent the EU calling for a full-fledged reform while the Forestry Commission and the industry prefers to retain the status quo. The power dynamics in the sector will therefore largely determine which scenario becomes reality' (Rozemeijer, 2009).

Stakeholder analysis, institutional analysis and the analysis of power relations have been applied in two of the cases only, and not in the same way. Although attempted, the other authors lacked the insight knowledge of local conditions to make a proper analysis of stakeholders, institutions and power relations. This is a consequence of taking existing case studies that were originally conducted for other purposes than identifying competing claims. However, implementation of new studies would have been a lengthy and costly operation.

In the case studies no use has been made of quantitative methodologies including the use of models. Models in principle could serve to investigate the impacts of different scenarios on the environment and specific stakeholders. They could also serve as a means to raise awareness on the need to address competing claims, because to model could show that a business as usual scenario would lead to an unacceptable future from a point of view of *sustainability* and/or *equity*. Models are often developed for analysing situations at higher levels, for example a whole region within a country, a country or a sub region of a continent and finally at global level. In order to make such models applicable to more local situation, more detailed information is needed. It is also important to make the connection between such models and power/stakeholder issues.

Some conclusion on methodologies:

- The DPSIR methodology provides a certain insight as to the different claims on natural resources (land, water, biodiversity etc.). However, when it comes to the creation of policy responses or action perspectives, the generated information is not enough.
- Analysing the underlying power dynamics (social, political, economic, and institutional, within and across scales) is essential and requires additional methodologies to generate the necessary understanding. Most of the existing studies underestimate the importance of power dynamics, and therefore fail to shed light on the issue of competing claims.
- The role of models in analysing local competing claims should be investigated. It is also important to better connect models with the outcomes of more qualitative investigations (e.g. stakeholder analysis and analysis of power).
- In summary, understanding competing claims and conflicts on natural resources requires a deep insight in local, and trans-local processes, demanding the following steps to be undertaken:
    - Map and analyse competing claims from the perspective of environmental processes, taking into account its drivers, state, impact and responses (DPSIR methodology);
    - Map and analyse competing claims from a multiple stakeholders perspective, to understand environmental degradation and marginalisation as linked to stakeholders' interests, relationships and underlying power dynamics;
    - Map and analyse competing claims from a multiple scales perspective, recognising the inter-linkages between processes at the global, regional, national and local scales; use modelling to get an overview of the current state of competition between claims, raise awareness on the necessity to tackle claims in an integrated way, and provide information on possible impacts of different scenarios.

4 Synthesis and conclusions

4.1 Summary of the current situation

Based on the insights gained in the previous chapters we identify three main components determining competing claims on natural resources. The first component is the global demand for commodities. This global demand is influenced by market factors and by policies at several levels. These factors determine the amount of products or land that are needed to satisfy local, regional and global objectives. The second component is related to the requirements for natural resources, with specific emphasis on land claims, to location of production, production quantities and efficiency and timing of production. Finally, the third component is related the institutional and power processes governing land use and land-use planning.

In Chapter 2 the most important global (market) trends and developments and policies were introduced that result in various, often competing claims for land and natural resources.

An important driver for increasing demand for resources will be the *growth of the human population*, which has been projected to increase from the current 6.7 billion people to a projected 9 to 10 billion people by 2050. In combination with a strong increase in GDP and wealth, and associated shifts in consumption patterns and dietary preferences, a relatively stronger increase in demand for food, feed and energy is expected. Because relatively more people will be living in urban areas will affect the demand for specific products and its sourcing from local, regional and global markets will be affected.

The EU common agricultural policy, with its objective of providing it's farmers with a reasonable income, implies financial support to agricultural commodities of major importance to the EU farming community. The structural features of EU's CAP initiated huge imports of feed ingredients like tapioca and soybean products from South-east Asia and Latin America, inducing competing claims on land in those regions. The targets set in the *EU renewable energy directive* generates additional demand for feedstock commodities that can only be supplied by imports from overseas where agricultural land used for these commodities expand. This expansion will be putting ever more pressure on natural habitat and is likely to result in loss of biodiversity and/or decline of ecosystem services if agricultural activities expand into areas previously not used by agriculture.

Model projections indicate that *food production* needs to double by 2050. The majority of the increasing production must be realised in Sub-Saharan Africa and South Asia as these are the regions where the largest part of population increase will occur and the largest changes in consumption are expected. However, as a result of lack of suitable land and available water some of these regions have only limited production potential and consequently might not be able to feed its population from its own region.

Biodiversity and ecosystem services are another factor to be taken into account. Ecosystems provide many goods and services for the benefit of people and society. These services include direct sourcing of food products (i.e. fruits, wild meat (or bush meat), etc.), fibres, biomass and clean drinking water. If conversion of forest land into arable land is considered as a strategy to improve food security for the future, then also the food provisioning role of forests and other (semi-) wild ecosystems have to be taken into account, and most importantly the regulatory function and services of these ecosystems. For remaining forests it is important to make the provision of bush meat and other nutritive products sustainable. This implies regulation of hunting of animals, fishing and exploitation of other nutritive products from forests, wetlands and coastal areas.

In developing countries many people directly depend on these and other services for their livelihoods. Also these services are vital to guarantee and enhance agricultural production through their contribution to abiotic factors like climate regulation, flood mitigation and availability and timing of sufficient water, and through their balancing and buffering mechanisms for biotic factors, like bee populations. Negative feed backs on agricultural production can be expected if essential services get lost as a result of monotonous land use and continued degradation of ecosystems. Some services can be simultaneously delivered, including food production services, although often land is managed with a focus on one or a limited set of services, often those services that represent a market value. Where services are mutually exclusive or exclusively managed they tend to compete for land. Globally the costs of not meeting the 2010 target to halt the loss of biodiversity and subsequent loss of ecosystem services is projected to increase from 1% of GDP in 2010 to 7% by 2050.

Driven by food security concerns in investor countries, investment opportunities, and increasing share of non-food crops in agricultural production, primarily for bio-fuels, the past five years showed a trend of increasing and large scale *foreign acquisition of farm land in African countries*. Although the total area of acquired land usually represents only a small portion of land suitable for agricultural production, most of the acquired land is already in use by local people. As these people often use their customary rights but lack formal land tenure rights, foreign land acquisitions may result in local people losing access to vitally important resources for food security essential for maintaining their livelihoods. Also these land acquisitions are primarily targeted at the most fertile lands with irrigation potential and easy access to infrastructure and markets. Consequently large scale acquisition displaces local inhabitants and decreased their access to land and water resources, potentially increasing local food scarcity and deteriorating their livelihoods.

Foreign acquisition and investments, however, can also provide new development opportunities and benefits for local people, mainly from capital investments in production and technology transfer, creation of employment and investments in infrastructure. A prerequisite for these opportunities to materialise is that terms and conditions of the deals are targeted to help facilitate local development.

Yet, the most important stakeholders, the people living in the area without a political voice, usually are no party in these negotiations. If no arrangements are made for employment of local farmers and/or guaranteeing local food security, the resulting scarcity of high quality arable land will probably result in increasing resistance and may eventually result in increasing risk of conflicts over available resources. Increasingly civil society organisations voice the concerns of local populations in international debates.

Resources degradation is yet another driver that increases the competition for natural resources, in particular land. Poor land and water management may lead to a range of soil related processes deteriorating soil quality. Erosion leading to loss of soil because of insufficient ground cover, pollution due to excessive and unnecessary use of agro-chemicals, rejection or unavailability of agro-chemicals like fertilizers to replace nutrient subtraction from the soils by crop removal, all contribute to reduced land productivity. Poor and deteriorating soils are less well capable to retain water and nutrients and with that less capable to act as a buffering medium to mitigate the impact of fluctuations in rainfall. Climate change is expected to further increase variability. All these developments will exacerbate the already high variability in production making the local and global food systems more fragile and poor people more vulnerable to periods of food shortages. Competition will be further increased because of the absolute limitations of natural production factors such as water and nutrients, primarily phosphorus.

4.2 How to analyse and approach competing claims?

The review of effects of global trends and policies for claims on natural resources was mostly based on results from modelling and assessment studies. The socio-economic and biophysical models used for these quantitative projections allow assessment of trends in demand and potential supply of agro-commodities, bio-energy, interactions and feedbacks between different land-uses and in some cases also their impact on biodiversity and ecosystem services (see Appendix 2). These approaches can also be used to evaluate the effect of certain biodiversity policies on production and prices of agro-commodities and food security issues. Economic models and data are mainly focused at the demand side of the problem and at institutional regulations. The biophysical model are mainly focused at synergies in production and conservation of resources. The results thus mainly show competing claims from a perspective of changing demand and supply of commodities, but do not include issues related to institutional process and power dynamics, which the case studies in Chapter 3 have shown to be another important component of competing claims, especially at the local scale level.

Realising a meaningful connection between international trends and local realities appears to be a most challenging, and yet to develop, matter. How do these influence each other? A major obstacle is the transformation of global forces to concrete actors or stakeholders that undertake concrete actions and make concrete claims on natural resources. Currently more qualitative modelling approaches are being developed to get a better grip on the effect of institutional change and power relations. These approaches, however, are not yet integrated in the global and regional modelling exercises. It is not said that the presently used global models should encompass all the institutional factors to better tackle the power relations and neither that these models need to be down-scaled to capture more detailed country situations (as these models have merits in terms of providing a relatively simple global consistent analytical framework, although with a rather high level of aggregation and macro-perspective). This also applies to biophysical production models. Yet the linkages between the different scales of analysis should be enhanced.

Who is the problem owner in cases of competing claims?
Problems of competing claims for natural resources are caused by many forces at international, national and local level, impacting on demand for and/or supply of agricultural commodities. Generally it will not be possible to identify one group of actors who has interest in the outcome of the forces that impact on competition on land. To solve the problems, actions that are aligned at different levels will be necessary. This implies the involvement of many actors. Then the question is: Who should take the lead, who is the main problem owner? In the case-studies it is not always clear why actors feel owner of the competing claims problem or not. Some examples:

- In the Ethiopia case there seems to be lack of sense of urgency from the international side, while international forces are having a serious direct impact (although other actors also exercise impacts) on the natural resources, caused by a clearly identifiable group of actors: international horticulture companies.
- In the China case the government surely feels responsibility and acts accordingly. There is also an international response, while the international (or global) forces, viz. climate change and better connection to the international market, are not caused by a concretely identifiable group of international actors.
- Both in the Ghana and Ethiopia case there is a certain lack of awareness, or to a certain extent a lack of a sense of urgency at governmental level. So problems of lack of coordination and lack of good governance at national and local level are not tackled effectively.
- In the Mozambique case international NGOs support the establishment of protected areas, but apparently do not undertake many actions as to the consequences for local people and the areas around the protected areas.

It can be concluded that the different cases do not provide us with a clear and coherent answer to the question posed above. Identification of main problem owners appears to be complicated. The evolving process

of globalization further pressing the competing claims to increase and with that calling for a comprehensive governance structure to incorporate actors at different levels with an unambiguously identified problem owners.

It has to be borne in mind that this issue is different from the issue in the next section. The party (or parties) that take(s) the lead can follow different approaches in solving problems of competing claims.

Different paradigms in solving competing claims

The four case studies describe different approaches as to how national and international policy makers deal with competing claims, and try to avoid them turn into conflict. Some examples:

- The strong government intervention to reduce further degradation of the Loess Plateau in *China* is in sharp contrast to the politics of *Mozambique*, where communities have been removed from the newly created Great Limpopo Transfrontier Park, and resettled into other areas, without thoroughly considering the consequences: the areas around were already inhabited and exploited by other actors, thus increasing the competition on land and water.
- The EU policy to combat illegal logging in *Ghana* is emphasising the need to come up with a technically sound verification system for 'legally produced' timber. However, there are also prudent actions to promote participation of stakeholders in the FLEGT process. Also in Ethiopia the (first signs of a) multi-stakeholder approach are visible in the Central Rift Valley to balance unequal water use by different stakeholders, and turn competition into complementary use.

This brings us to four general paradigms to counteract tensions over access and use of natural resources, which can be summarised as:

1. 'Leave it to government', where (global) government and experts make unilateral decisions to resolve NRM conflicts;
2. 'Leave it to the community', where participatory and decentralised development is promoted as a response to top-down approaches as applied from either a 'socialist' or 'capitalist' perspective in the past;
3. 'Leave it to the market', assuming that change in access to and control over resources can be left to market forces, as a matter of demand and supply;
4. 'Leave it to us', including a range of interactive approaches based on social learning, actively engaging different groups in society in a communicative process of creating strategies for improvement.

The first paradigm has been strongly opposed by advocates of good governance, particularly from civil society side, promoting alternative bottom-up approaches and participatory development. The second has failed to link local resources problems to higher institutional levels beyond the power leverage of community members. The third offers no guarantee that the ecological and social objectives of sustainable development are met. The fourth approach might be effective, in the sense that social learning is more than just 'community participation', and actively involves understanding the limitations of existing institutions and mechanisms of governance and experimenting with multi-layered, learning-oriented and participatory forms of governance. Yet it is hard to find examples where this approach has been successfully applied, and in the end this common understanding should still be converted into concrete policies, strategies and actions.

Giller et al. (2008) in their conceptual paper on competing claims emphasises the need for *negotiation* between the different stakeholders an approach which seems to fit most under approach 4. The use of different types of knowledge in these negotiation processes is further elaborated in Polman, De Blaeij and

Slingerland (in prep.)[1]. The four cases presented in this publication have been selected because they exemplify competing claims at different levels. They have *not* been selected because they would have followed a 'competing claims approach' to solve the problems. We can ask ourselves the question: was there any negotiation process going on in the four cases?

- Loess Plateau China: there are no signs of a real negotiation process. Probably there has been negotiation between the Chinese authorities and external donors on the way external support would be realised. It is supposed that the Chines government does consider the interests of local stakeholder, which in a centrally regulated state like China is vital because farmers themselves hardly have power to defend their interests.
- Limpopo/Mozambique: no signs of a negotiation process. The approach seems rather top-down. The cases study concludes with the observation that it is an open question why no effort or no sufficient communication took place to build capacity of local people to improve their livelihood working as tourist guides or working in other areas of the tourist business. So there was hardly any communication, let alone a process of negotiation.
- FLEGT/Ghana: the EU demanded from the government of Ghana that a meaningful participatory process took place in preparation of the Voluntary Partnership Agreement. This process is supposed to be continued in the implementation phase of the Agreement. However, whether all relevant stakeholders mentioned in the case study, are really present on a continuous base at the negotiation table, is doubtful.
- Rift Valley Ethiopia: there has been a multi-stakeholder workshop but this seems a one-off activity and not part of an integral process for policies, planning and actions.

We can conclude that in situations of competing claims *negotiation* is not often selected as the preferred approach for solving the problems. The selection of an approach is important and almost always based on political paradigms. Much depends on the specific situation and it is questionable whether one approach will fit in all situations.

4.3 Some considerations when looking for solutions

Overall the global drivers identified result in a strongly increasing demand for food and other land based natural resources and the way they are produced and delivered. The increasing pressure on land and its natural resources and resulting competition appears to be the result of many targets and priorities that, in many cases, conflict with each other's. For instance the increasing demand for cheap flowers in Western Europe, result in conflicts with food production in Ethiopia and Kenya.

It is very difficult to design global responses that are effective for local people. Global trends and local dynamics, although strongly interconnected, do not follow the same logic, and are hard to capture in linear causalities. Much depend on the functioning of local institutions, and power relations between stakeholders, each of which having their own interests, and being embedded into trans-local networks of economic and political nature.

Solutions can be reached by agreeing how to divide the targets and prevent conflicts. Negotiation platforms like round tables are considered to be a basis for such agreements. However, in many cases, such agreements lead to the displacement of the problem to other areas. For instance the moratorium on expansion

[1] Nico Polman, Arianne de Baeij and Maja Slingerland (in prep.). Theories using different types of knowledge essential in negotiation processes aiming to resolve competing claims on natural resources. LEI, Wageningen UR, the Netherlands, 22 pp.

of soya in the Amazon region, as agreed on within the round table on sustainable palm oil , appears to result in increasing expansion of soya into natural areas in Paraguay.

We saw that policy responses are often not targeting all the competing claims in an area, but rather are focused on one or a few claims: food security, the need for legally produced timber, nature protection, or water. It is apparently very difficult to consider all problems on competing claims in their relations in one coherent vision, policy and implementation of solutions. One can imagine many reasons why the situation is like that:

- International players are glad that 'finally' they found an area where they can start their initiative : flower growing, 'legal timber', nature protection etc. So there may be the idea: let's get to work.
- The government of the host country is happy because the international initiative brings in money and activity: development.
- Sometimes people do not look across the fence of their own activity and hardly perceive that their activities influence other sectors, or simply they do not care.
- Our society (ministries, NGOs, private sector) is organised according to disciplines and economic sectors. It is very difficult and complicated to come up with a coherent analysis of a competing claims situation, and based on that, a coherent intervention strategy.
- Balancing the different claims seems to be a first responsibility of the government of the host country. It has to design and implement a proper land and resource use planning. However, international demands and market forces may simple be too big and too powerful to be handled by the - often badly equipped - government. This may be true, but who determines when that point has been reached and outside players become - at least morally - (co-)responsible for a proper balancing of the claims?

The idea that negotiation between stakeholders is necessary is very important in the concept of Competing Claims. However, the case studies showed that negotiation is not often selected as the preferred approach for solving the problems of competing claims. The selection of an approach is important and very political. Much depends on the specific situation and it is questionable whether one approach will fit in all situations. Besides, in practice there is not yet much experience how to do this process of negotiation at different levels

Solutions may be reached at different levels and at different ends of the value chains of natural resources. These solutions should be focused at the sources of competition:

1) Demand of resources, which is determined by the various, often competing objectives of different stakeholders. Working on the demand side may also imply that in order to resolve competing claims on resources in a certain region in a (developing) country, international demand for products from that region will have to be decreased or regulated, or that ways have to be found to use the resource more efficiently (for example less losses in transport and processing of the raw material, or more emphasis on recycling of materials in consumer countries). In order to make such changes it is necessary in developed countries to change consumer behaviour and behaviour of food suppliers. Making these groups more sensitive for sustainability issues is a fairly new research topic (see Backus et al., 2011).
2) Production, with more efficient production and use of natural resources. More can be produced at the same or even smaller areas, reducing pressures on land. Also combination of uses and development and integrated land-use planning with more ecological synergy among uses will reduce the incompatibility competition between different land uses.
3) Streamlining institutional processes and regulations of land-use planning. While this may result in a geographic shift of the problems, combined with increase productivity, the ultimate trade-off can be more transparently negotiated and responsibilities shared.

Role of technological change and institutions
In thinking about solutions how to ease competing claims on land, the use of existing technology and technical innovations may play an important role. There are yet many questions that need to be addressed. What are the agro-eco-technological options and the economic conditions under which technology development can help to ease the competing claims on land (e.g. increasing land productivity and water use efficiency, reducing high global levels of food waste, biotechnology, livestock intensification? What are important institutions to (help to) facilitate transitions to a more sustainable production system (e.g. government interventions, property rights, access to knowledge, credits etc.), and under what conditions would these institutions be successful?

These aspects are hardly addressed in a structured way and would need the insights of several scientific disciplines. Bindraban et al. (2009) point at the potentials in Africa and propose a package of related measures in the biophysical, social-economic and institutional area that should help to increase the agricultural productivity in that continent. The World Bank (2006; 2008) addresses the importance of institutions for a proper functioning of the market, taking into account the respective role of government and private actors in the economy. With key references mentioned above, this literature may give ample thoughts on policy options that can facilitate efficient and effective use of new technologies that help easing competing claims on land and lessen the pressure on ecosystem goods and services.

A significant increase is needed in public expenditures on agricultural research and the implementation of resource use efficient production systems and technologies, in order to make agricultural productivity significantly higher, especially because investments in public (and private) agricultural research have their impacts with a long time-lag.

4.4 Towards an action perspective

Until now the concept of 'competing claims' has been largely used as an *analytical framework,* to better understand today's problems of unsustainable resource exploitation, land degradation, deforestation, biodiversity loss and poverty. The concept however could also be used as a *management framework*: visualising the competing claims of stakeholders and the power dynamics between them, allows for a better management of (emerging) conflicts, and put in place the necessary negotiation frameworks and skills to balance local entitlements, national development interests and global concerns with sustainable utilisation strategies.

This action perspective of managing competing claims will depend very much on the analysis of context and power relations between the stakeholders and the availability of information and knowledge. Generally we can distinguish five response categories: regulatory responses, market incentives, innovation, capacity development, and participatory approaches. These categories are neither presented as stand-alone approaches nor are they presented as the predominant domains of government, private sector, the academia, civil society, consumers and local communities respectively, but more so as elements of integrated innovation and change processes. Rather, innovation and change needed to deal with competing claims towards sustainable development is by definition a multiple stakeholder process. This also implies that solutions to the problem of competing claims have to be found at different levels, e.g. in countries where products, originating from the area affected by the competing claims, are processed and consumed.

Regulatory approaches -while rules and regulations governing the natural resources sectors are sometimes causing conflict (by design or by not being implemented) a regulatory framework can also contribute to balancing competing claims. Examples are policies for more equitably sharing costs and benefits of resource conservation. Another example is the purchase of land for conservation (a compensation mechanism) or similarly the 'hiring' of land and resources for conservation through conservation contracts. Such contract

establishes a direct link between the wish of an interested party to conserve biodiversity and the payment to resource managers (e.g. a government authority, a community, an individual farmer) to provide a conservation service (Lette and Rozemeijer, 2005).

Interesting examples of regulatory approaches are Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA). These are instruments to balance the impact of - often industrial - activities on the environment and sometimes on society as a whole (social and environmental impacts combined). These instruments still take one sector as the starting point and look for ways to diminish and/or mitigate negative impacts on other sectors. However, they could be and are useful in certain situations of 'competing claims'.

Market incentives - the market demand for environmental goods and services may offer opportunities for more equitable sharing of access to and control over the use of natural resources (balancing competing claims). International consumer demand for 'fair trade'; the 'green economy'; 'responsible tourism' is prompting a critical analysis of 'unfair' claims and offers 'bonus prices' for the opposite bringing along market-driven innovation and change toward more sustainable development ('people, planet and profit'). Furthermore, the above described market demand is sometimes accompanied by a changing outlook of the (international) corporate sector through 'social responsibility agreements'; 'the social entrepreneur' and corporate global responsibility.

Innovation - competition between claims on land and resources could benefit from both technical and institutional innovation. Both the scientific community (through research) and the stakeholders (through social learning processes) have potential to balance claims on these resources by increasing yields, improving harvesting techniques, improving farming systems, introducing new natural resources management mechanisms, benefit sharing mechanisms, information management systems, decision-making mechanisms, etc. But innovation can also take place further in the value chain, for example by diminishing losses during storage and processing, and by recycling materials in consumer countries (if applicable).

Capacity development - including empowerment and advocacy. There are no competing claims without claimants, and there are always claimants who are better at claiming than others. Any attempt to balance this process is to build the capacity of stakeholders, not only of 'losers', but also of 'winners' who may be unaware of the consequences of their claim-making power. Training and organisation development are key ingredients of capacity development, the process by which individuals, organisations and institutions enhance and organise their systems, resources and knowledge. The degree of capacity development is reflected in their abilities, individually and collectively, to perform functions, solve problems and achieve objectives. Capacity development is therefore an important ingredient of empowerment. And, when specifically targeted to marginalised groups, an important element of advocacy strategies. Capacity development may also imply raising of awareness of food suppliers and consumers in developed countries on sustainability issues and the need to get raw materials from sustainable sources.

Participatory approaches - competing claims on natural resources are largely man-made rather than caused by resource scarcity. Addressing these claims and finding solutions may benefit from participation of stakeholders (from local to global). Jointly made decisions may be more effective and sustainable in the long run than formal top-down approaches. Participatory approaches such as joint visioning, joint problem analysis and joint scenario development generally help to inform and more equitably balance decision-making, invoke collaboration and institutionalise solutions. More egalitarian and network-based communication among all parties for example at community level, in producer associations, at landscape level may increase acceptance and balancing of each other's competing claims.
In developed countries governments, NGOs and the food processing industry may work together in order to make food supply more sustainable.

Appendix 1 - Case Studies

This appendix gives the full description and analysis of the case studies discussed in Chapter 3.

A 1.1 Yan River Basin, Loess Plateau, China

Rudi Hessel (Alterra, part of Wageningen UR)

State

It has been estimated that major floods on the Yellow River could threaten the lives of 150 million people; this threat is caused by a major peculiarity of the Yellow River: its huge sediment content. Because the river is harnessed, this has resulted in sedimentation on the river bed, which has raised the river bed to several metres above the surrounding landscape (Douglas, 1989; Zhang et al., 1990; Zhu et al., 1997), so that breaching of the dikes could result in disaster. Discharging all the sediment delivered to the Yellow River requires substantial river flow, which puts limits on the amount of water that can be used for irrigation and industry.

The Loess Plateau is the source of about 90% of all the sediment that enters the Yellow River (Douglas, 1989; Wan and Wang, 1994). The Plateau is located in northern China, in the middle reaches of the Yellow River, and it consists of several parts, such as table lands dissected by gullies, and a hilly part, which has the highest erosion rates. The total area of the Loess Plateau is about 300,000 km^2 (Muxart et al., 1994; Tan, 1988), with a maximum loess thickness of about 300 metres. The study area is the catchment of the Yan River, with an area of 7678 km^2, which is located in the hilly part of the Loess Plateau. The Loess Plateau has some of the highest erosion rates on earth. Sediment concentrations in runoff on the Loess Plateau of over 1000 g/l have been recorded regularly (e.g. Jiang et al., 1981; Zhang et al., 1990). As mentioned above, soil erosion on the Chinese Loess Plateau is a major problem because it has resulted in a raised bed of the Yellow River. Furthermore, on-site it causes loss of arable land, while off-site it can cause silting up of reservoirs.

Reducing the flooding risk and using the Yellow River water for agriculture and industry requires a large reduction in the sediment content. Major projects, e.g. from the World Bank, have therefore been implemented in the past to reduce erosion on the Loess Plateau, mainly by check-dams and terrace building. According to Jiang et al. (1981) the sediment discharge of the one of the major tributaries of the Yellow River decreased by 28% between 1957 and 1978. However, most of this decrease was due to reservoirs and dams, which have limited capacity and which do not tackle the erosion problem at its source.

Afforestation and terracing should result in more permanent decreases in sediment production, while some grass species might be used to stabilise gullies. Fang et al. (1981) reported that terracing can decrease erosion by as much as 95%. Terrace building had already started several hundred years ago and is now widespread on the Loess Plateau. Terraces are effective against erosion because they have low slope angles, which reduce water velocity and increase infiltration. However, they require a high level of maintenance and are prone to gullying when they are not properly constructed. Afforestation is also very effective in reducing erosion (Zhou et al., 2006), but at the same time it reduces runoff and depletes existing soil moisture reserves (McVicar et al., 2007). Other measures that reduce water velocity and increase infiltration should also be effective in combating erosion, as for example shown for mulching by Zhang et al. (2007). A thorough understanding of the local conditions is necessary to select measures that are suitable, that do not have negative by-effects, and that are acceptable to the local population.

In 1999, the Chinese government formulated new ambitious policies about the Loess Plateau (e.g. McVicar et al., 2007) in order to achieve further reductions in erosion. These 'Grain for Green' policies aim to decrease erosion rates through changes in land use. In particular, they aim at a large decrease in cropland area so that all fields on slopes above a certain slope degree (25 degrees in the short term, 15 degrees in the long term) should be changed from cropland to other uses. The decrease in cropland should be accompanied by an intensification on the remaining cropland and by an increase in woodland, shrubland and orchards (cash trees). This policy was followed by the 'Conversion of farmland to forests' policy, which was adopted in 2002, and became operative in 2003. The Chinese government has the power to enforce such policies. As stated by EU-China RBMP (2004), these policies have been implemented with urgency, but also with severity.

The measures and policies mentioned above range from short-term technical measures like terracing and check-dams to long-term institutional and political measures such as policies to convert cropland to natural land, and to re-green the Loess Plateau.

The Loess Plateau is also home to millions of people, many of which make their living by growing crops on small plots. The main crops are winter wheat, maize, millet, buckwheat, potato and different kinds of beans. There is some irrigation using river water that is diverted to low-lying croplands on the river terraces. However, most crops are grown under rain-fed conditions, making harvest highly dependent on rainfall. Agricultural plots are often located on steep slopes, of up to about 40 degrees. Practicing agriculture under such conditions is sometimes called 'irrational land use' (e.g. Fu and Chen, 2000) from the point of view of soil conservation, as these agricultural practices are seen as one of the main causes for the high erosion rates on the Loess Plateau. However, local farmers often have no alternative, as they need to ensure their livelihoods under difficult circumstances. They are not using the land irrationally, but to the best of their ability, and making optimal use of the natural resources that their environment provides them with.

As a result, there is a conflict of interest between on the one hand the people living downstream, Chinese government and policy makers, who strive to decrease erosion rates, and on the other hand local farmers who need the land to ensure their livelihoods. In Chinese society, the power balance is distinctly uneven, meaning that local farmers have very limited power to protect their interests if policies are adverse for them.

Drivers

Erosion rates on the Loess Plateau are so high because of a combination of bio-physical factors and socio-economic factors. Bio-physical factors are mainly related to the properties of loess and to climate. Loess is very erodible, especially when wetted, because wetting can result in collapse of the soil structure. Rainfall is characterized by heavy storms in summer (mainly July and August). Single storms can produce 10% of yearly precipitation and 40% of erosion (Gong and Jiang, 1979; Zhang et al., 1990).

Erosion rates have not always been so high. Ren and Zhu (1994) showed how different kinds of information (written records, Yellow River delta volumes) indicate that the serious soil erosion on the Loess Plateau started at about 1000 AD. Xu (2001) found that bank breaching of the Yellow River increased in frequency from the 10th century AD. According to him, breaching frequency depends on sediment load, which apparently increased because erosion on the Loess Plateau was increased by destruction of the natural vegetation. On the other hand, Long and Xiong (1981) reported that historic literature from the Eastern Han Dynasty (25-220 AD) already recorded very high sediment contents: 'the silt occupied six tenths of the volume in one barrel of water sampled'. Nevertheless, such observations seem to have been exception rather than rule before about 1000 AD.

This indicates that land use change (and deforestation in particular) as a result of population growth has been a major driver of erosion for the last 1,000 years. Because of this, vegetation cover has decreased, and local relief has increased due to the development of gullies. Population in the Yan catchment is still increasing, and was close to 700,000 in 1999, meaning that about a 100 persons per km^2 need to make a living in this semi-arid area.

The climate in the area shows a trend towards warmer and drier. Compared with the average condition in 1960s, the annual precipitation in the 1970s, 1980s and 1990s in the Yan catchment, has respectively reduced by 10.5%, 11.7% and 14.0% (data from Institute of Soil and Water Conservation). This also decreases the amount of water that is available to grow crops. Current average yearly rainfall is around 400-500 mm, but this is concentrated in a few major storms, and is very variable from year to year.

Another driver of land use change is the expansion of extraction of oil and coal, which results in extending road networks, urbanisation, heavy traffic (oil lorries), and pollution. Because of such developments, the Loess Plateau has become far more accessible, and urban populations are increasing. Farmers from the more accessible villages are increasingly employed in e.g. construction, but are not yet migrating to the cities.

Pressures

The drivers mentioned above put pressure on the environment, as well as on agricultural systems and local populations.

For example, changing climate results in changing sediment loads. Pollution from agriculture and industry are both increasing, as fertilisers and pesticides are increasingly used, and as industry is expanding. Discharge is decreasing as a result of both lower rainfall and land use change. However, erosion remains a major problem as it is concentrated in a few heavy storms per year. Besides, climate change could also directly affect the amount of water that is available in the soil for agriculture, e.g. through decreased rainfall and increased evaporation.

Continuing population growth also puts additional pressure on the environment, and on the agricultural land. This is exacerbated by increased development as well as by current policies that restrict the availability of cropland. These conditions force farmers to grow more crops on a smaller area, under climatic conditions that might become more adverse.

Impacts

Local farmers experience the impacts of climate change when growing crops, and are simultaneously faced by expansion of cities and industry. Yields are never certain as they depend on erratic rainfall, and a series of dry years might well result in famine. Farmers have traditional measures to minimise risk of total crop failure, such as planting crops on both north-facing and south-facing slopes. In years with sufficient rainfall, the south-facing slopes provide the best yield, but in dry years only the north-facing slopes provide yield. Changed access to

land as a result of recently adopted policies might undermine such traditional systems. Therefore, food security of the local population is not ensured.

The environment is impacted by multiple factors, such as increased pollution from industry and agriculture, urbanisation, increased traffic etc. Water extraction from the Yellow River has become so large that the river is nowadays dry during part of the year (e.g. McVicar et al., 2007), increasing sedimentation on the river bed. Therefore, solving the erosion problem is also becoming increasingly urgent.

These impacts are partly interwoven, but they also result in potential conflicts of interest. For example, farmers need their cropland to ensure their livelihoods, but these lands are under pressure from on the one hand expansion of industry, urbanisation and road construction, and on the other hand from increasingly strict regulations that aim to decrease soil erosion. Conservation measures can decrease erosion, but could also result in reduced runoff. The main challenge in this area is to find the right balance between environmental protection, increased development and small-scale agriculture.

Responses
As mentioned before, the Chinese government is committed to combat the problems caused by soil erosion on the Loess Plateau. Efforts to reduce erosion rates are certainly working from a physical point of view. To make the changes in land use economically feasible for the farmers, the Chinese government is paying compensation to farmers in the Grain for Green policy. This compensation is 70 RMB per mu (1/15 of a hectare) per year and will end after eight years, when the newly planted fruit and cash trees are supposed to start providing revenues to the farmers. At the same time, production on the remaining cropland should be increased through intensification. Since an adaptation of the policy (in 2007), farmers not only receive 70 RMB compensation for cropland for five years, but they also receive 400 RMB subsidy per mu to create such high-quality cropland (with maximum two mu per capita). The compensations paid to farmers shows that policies are not being enforced regardless of their effects on local stakeholders.

However, there are still concerns, regarding both the bio-physical effects of measures taken, and the socio-economic effects of these measures.

One of the major bio-physical concerns is that many measures against erosion also conserve water and thus reduce runoff (McVicar et al., 2007). This is, in principle, good for growing crops, but as runoff is decreased, it increases sedimentation problems in the Yellow River and limits the possibilities of using its water for irrigation and industry. Therefore, these measures do not fully achieve the aim for which they were intended. It remains a challenge to develop strategies that at the same time reduce erosion and improve crop yield on the Loess Plateau, while also resulting in less erosion without decreasing runoff.

The most crucial question, however, is what the socio-economic consequences of these measures are, especially for those people who depend on growing crops to ensure their livelihoods. Is the compensation they receive sufficient, and are they able to sustain their livelihoods once compensation ends? Preliminary studies carried out in 2000 (Hoang Fagerström et al., 2003) indicated that this might not be the case. An analysis of household economy in two villages within the Yan Catchment indicated that if cropland is restricted to slopes below 25°, income from farm production would be at the same general level as today, but only if farmers received support from the government for food and seedlings (as planned), and if they would also benefit from cropping intensification. However, if cropland would be restricted to slopes below 15°, income from farming in both villages would be reduced by almost 30% even though it was assumed that the villagers would get support from the government as well as benefits from cropping intensification. In the long term, the situation might be better if income from orchards and cash trees would become available. However, it remains an open question whether this will actually work out as planned, as there might not be sufficient demand for the increased production of fruit that is foreseen. For both slope degrees, farmers with off-farm activities seemed

to manage better than farmers with only farm work both in the short and the long run. Such off-farm opportunities might increase because of increasing development, but are less likely to be available in the more remote villages, which are in fact the villages in which the dependency on agriculture is highest and in which the effects of the new policies will therefore be felt the most.

The Chinese government does consider the interests of local stakeholders, which in a centrally regulated state like China is vital because farmers themselves hardly have power to defend their interests. In such political conditions it is - even more than in Western democracies - the responsibility of the government to formulate policies that are beneficial for the local population too. It is therefore very positive that China is also interested in learning from the European Union's long experience in providing a high level of environmental protection to its citizens, and has been inspired by EU in the elaboration of a number of environmental policies (EU, 2008). There are currently three major EU environment programmes in China, namely Biodiversity, Energy and Environment and Integrated River Basin Management. For instance, EU and China have agreed on a partnership on Climate Change (EU, 2005), while EU is also providing China with assistance in River Basin Management. For example, the EU - China River Basin Management Programme (www.euchinarivers.org) is addressing the Yangtze River, but also the middle reaches of the Yellow River, where the Loess Plateau is located. A key aspect of this Programme is to establish links with the EU Water Framework Directive. China and the Netherlands are also collaborating on issues relevant to this case study. For example, the Dutch ministry of EL&I has three offices in China, and the Dutch ministry VenW is also active in China, and collaborates e.g. with the Yellow River Commission (www.hollandinchina.org). Such collaboration with EU might contribute to increased food security, and ensured livelihoods, for millions of people in China's rural areas in general, and on the Loess Plateau in particular.

Conclusion

The importance of the Yellow River for China, and therefore of the control of soil erosion that occurs on the Loess Plateau, is obvious. It is also very clear that the Chinese government is committed to tackle the problem of soil erosion, and of siltation of reservoirs and river beds. Far-reaching programmes have been started in an attempt to solve such problems. However, it remains to be seen in how far these programmes benefit the local stakeholders on the Loess Plateau. Grazing has been prohibited and growing crops on steep slopes has been restricted, thus restricting the livelihood possibilities of the local people and potentially threatening their food security. The idea is that this will be compensated by more intensive agriculture on the remaining croplands, and by establishing more orchards, but how effective this will be is not yet clear. Development on the Loess Plateau has also accelerated as valuable oil and coal reserves are increasingly being exploited, but it remains to be seen if the benefits of such development reach the local farmers too. Therefore, the vital questions is how the local stakeholders were affected by the various policies that have been adopted and are being enforced, and if they are still able to ensure their livelihoods under the pressure of policies to decrease soil erosion.

A 1.2 Food security - Creation of a National Park in Mozambique

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The world is now inhabited by some 6.7 billion people. A decelerating growth is expected until the mid-21st century, after which the world population might stabilize at around 9 billion (UN, 2009). Almost 99% of this population growth will occur in developing countries. Therefore, competing claims on natural resources for food production, urbanization and new non-foods will strongly increase (Koning et al., 2008). Moreover, human settlement and biodiversity conservation will claim part of the land. Food security is defined by access to sufficient and affordable food; it can relate to a single household or to the global population. The first

Millennium Development Goal is food security in seeking to reduce by half the proportion of the world's population experiencing hunger.

Africa is the continent with the highest number of undernourished people. Especially there, a wide variety of driving forces leads to increased pressure on land. These forces range from population growth, poverty - with associated declines in land quality and soil fertility - to national and private sector demands for land for commercial production and nature conservation. Changes in EU policies have a major influence on these sectors and on the income of producers in the southern Africa region. At the same time, strong international environment pressure and national demands for income from tourism results in land use change for nature conservation. Although the different countries in southern Africa are confronted with the same international claims on their natural resources, possible solutions and mechanism for land use change will be different, due to contrasting stakeholders, contrasting national governance and economic policies, different systems of land ownership and local diversity such as in Mozambique, South Africa and Zimbabwe (Koning et al., 2008). The creation of transnational parks in Africa is a possibility to increase income through foreign tourists and to conserve natural resources (ODI, 2006). The Dutch government supports a large number of tourism projects in southern Africa (ODI, 2006). The Prince of the Netherlands founded together with A. Rupert and Nelson Mandela a Peace Park Foundation (PPF) to facilitate the establishment of a trans frontier conservation areas under these the trans-frontier area between South Africa, Mozambique and Zambia.

However, there is a lack of data which analyse the impact of tourism on poor people. Negative effects of tourism are the often forced resettlement of local people to develop tourism infrastructure or national parks. Therefore, local people lose their homes and land and this may strongly affect their food security. Positive effects on local economy can results from the employment of local people in tourism establishments.

In the following case study we analyse the effects of the creation of the trans-frontier Great Limpopo National Park between South Africa, Mozambique and Zambia on food security and livelihood on local communities in Mozambique.

State

In November 2000, the governments of Mozambique, Zambia and South Africa signed an agreement over the establishing of a common trans-frontier conservation area of 99,800 km^2. In 2001, this area was converted into a park named the Great Limpopo Transfrontier Park. 66,000 km^2 of the park area are in Mozambique - named Limpopo National Park, 22,000 km^2 in South Africa and 12,000 km^2 in Zimbabwe. The funding of the Great Limpopo National Park comes from a variety of parties including World Bank, the German Development Bank, WWF Netherlands, the Dutch National Postcode Lottery etc. (www.peaceparks.org). The change from a conservation area to a park means strong changes in land rights and rights for the people living in the park. The Mozambique part of the park is placed under the authority of the Ministry of Tourism.

Lowland plains up to 450 m above sea level characterize the Limpopo National Park. Characteristic vegetation are bush land on sandy soils and Mopane and Acacia forests in the regions between the main rivers. The fertile alluvial soil along the rivers is used for agriculture. 27,000 people are living in the park, 20,000 reside along the eastern and southern borders of the Limpopo National Park, 7,000 people live in eight villages along the Shingwedzi River. People in the park live from crop production and cattle keeping.

From the foundation of the national park on, park managers tried to colonize the park with wild animals such as elephants, giraffes, gnus, zebras etc. from the South-African Kruger-National park. During the civil war in Mozambique these animals were all killed in the area and now wildlife is introduced again.

The actual conflict in the Limpopo National Park takes place between the 27,000 people who see their livelihood threatened by wild animals and the restricted park management. The local communities do not want

to leave the park and want to continue their way of life whereas the park management wants to guarantee a sustainable ecotourism development (www.limpopopn.gov.mz). Under the land laws established in 1997, all land in Mozambique ultimately belongs to the state. Both, communities and individuals con register land and obtain titles for the use and enjoyment of the land (Norfolk, 2004). In case of the communities along the Shingwedzi River the Ministry of Tourism repeatedly disputed the claim of the communities that they belong to the area (Spierenburg et al., 2006). Due to current law, the state can decide unilaterally on conversion of land use if this is deemed to serve public interest (Spierenburg et al., 2006). In this case, NGOs only can assist to moderate the impact of resettlement. Many villagers moved into the area after the end of the civil war and they are not used to live with wild animals.

Due to Neumann (2000), in many development agencies African local communities can be divided into 'good' and 'bad natives' depending how close they are to nature. The closer they are the better they are and the more they have to right to stay and benefit economically from conservation initiatives. The more 'modern' they are the most they are kept away from the conservation areas, developing new poor local communities. This concept is exactly applied upon the people in the Limpopo Park as we analyse in this case study.

Drivers

In Southern Africa most recently a post-national dream of large cross boundary conservation areas has crystallized to serve peace and stability in the region (Hanks, 1999). The creation of these trans-frontier-conservation areas (TFCAs) has the objective to conserve nature, promote regional peace, cooperation and socio-economic development (www.environment.gov.za).

Due to the fact that for the governments poverty reduction and economic growth are top priorities, nature can only be conserved if it pays for itself. This fact and the neo-liberal politics led to growing private sector involvement in trans-frontier nature conservation with the idea that conservation areas can stimulate development through tourism which as well benefits communities living in the conservation areas. Private sector's stimulation of trans-frontier conservation sometimes is seen as conservation into transnational business opportunity (Chapin, 2004; Hutton et al., 2005).

Neoliberal policy agendas which were adopted by southern Africa's government enabled the promotion of the biggest TFCA in Southern Africa, the Limpopo Conservation Area (Milgroom and Spierenburg, 2008). The drivers for the creation of this national park are established organizational networks linking the public domain, private sectors and NGOs. The TFCAs attract substantial international capital (Draper et al., 2004). National and international public-private partnerships are seen to be the main vehicle for this type of economic development (Ramutsindela, 2004). The project of expanding the Kruger National Park over the borders seems to be driven by a combination of 'Super-Africa' nationalism and local and national capital interests. The strongest driving force was the South African Peace Parks Foundation (PPF), founded by Anton Rupert, a wealthy South African tobacco magnate and former president of WWF-South Africa, supported by Nelson Mandela and the Dutch prince. Rupert as well interested the World Bank, the German Development Bank, Dutch WWF, Dutch national postcode lottery and others in securing financing.
However, during the process of formation and planning, there was next to no consultation of local communities (Wolmer, 2003).

Pressures

Whether local communities will actually become equal partners in the TFCAs and will benefit from them is a moot point (Draper et al., 2004). Let´s have a look on this point in our case study.
Although the Ministry of Tourism and the German Development Bank have insisted not to relocate people, in 2005 the Project Implementation Unit of the TFCA in Mozambique announced that the first hundred families will be resettled (Spierenburg et al., 2006). The concept of the park was published in a brochure by PPF and South Africa National Park Service (SAN Parks) in December 2002 such as 'These authorities also undertake to

remove all human barriers within the Park so that animals can roam freely' (SANP/PPF, 2003 cited by Milgroom and Spierenburg, 2008). This does not correspond to the initial statement about the importance of the community participation and benefits (Spierenburg et al., 2008). The suggestions of a consultant to educate residents and integrate them into the conservation process were not realized (Woodburne et al., 2002).

Due to a study carried out for PPF, the banks of the Shingwedzi River hold the greatest tourism potential and are the most attractive to private tourist operators (Spierenburg et al., 2006, 2008). Therefore, the 7,000 villagers living in this area should be resettled. This is not a voluntary resettlement.

However, the other 20,000 people living along the eastern and southern borders as well suffer strong pressure. According to national park legislation, there is strong pressure on food security of the people living in the park due to the following facts:

- Cultivation inside the park is forbidden. Only areas cultivated before the park declaration can be used for farming, however, no further clearance in allowed: that means no shifting cultivation, decreasing soil fertility and decreasing yields.
- Access to emergency pastures in the park in times of drought is illegal: that means emergency for cattle in case of drought.
- Decreasing possibility to work temporally in South Africa due to patrols and fences.
- Damage of crops and cattle through re-introduced predators (Spierenburg, 2008; Spierenburg et al., 2008). That means human - wildlife conflict.

One example may demonstrate the pressure in an excellent way: in October 2001, 30 elephants were released from the Kruger National Park into Mozambican territory to celebrate the accord signed by the governments of Mozambique, Zimbabwe and South Africa to establish the Great Limpopo Transfrontier Conservation Area. This was a symbolic act of celebration of trans-nationalism (Draper et al., 2004; Spierenburg et al., 2006). However, the fear of the 27,000 villagers living inside the Limpopo Park in Mozambique about elephants threatening their livelihood was not addressed at all (Mail and Guardian, 26 April and 3 May 2002). Furthermore, local communities were not informed about the plan to liberate the elephants.

Impact

The food security and livelihood of all people living in the park are strongly threatened by the introduction of the wild predators which destroy their fields and yield and by the restrictions for shifting cultivation. Resettlement is not an alternative for them as they doubt that the land which is offered to them outside the park is fertile and adequate (Milgroom and Spierenburg, 2008). It has been clearly demonstrated that the Limpopo Park is effectively under control of a network of public and private organizations. Local communities are under constant risk of further marginalization despite the conservationist's promises that they will participate on the advantages of the park creation (Spierenburg et al., 2006).

Responses

The Ministry of Tourism's response to the current situation is the resettlement of the 7000 people who are living the along the Shingwedzi River to areas outside the park. Cross-border migration has increased as a form of resistance to resettlement (Spierenburg et al., 2006). Mainly families who have been living during the civil war in South Africa return now as 'conservation refugees'. They see this as the only alternative for themselves. They want to return to South-Africa permanently, i.e. until they are discovered by the South African authorities (Spierenburg et al., 2006).

The 20,000 people living on the park boundary are not threatened by resettlement through authorities, however, they feel that 'we are forced because we are no longer allowed to live our lives as before, we cannot longer cultivate what we want….Yes, we agree to move, but we did not do so freely'. (Village chairman) NGOs

say that they cannot touch the park; people do not have land rights. 'We only can help them to make sure that the resettlement will done in a proper way' (NGO member 2005).

Conclusions
The establishment of the Limpopo National Park may increase in a long term the devises for Mozambique by foreign tourists; however, local communities do not receive any benefit from the park creation. Human-wildlife conflict leads to decreasing food security and livelihood for local communities in the park. Furthermore, forced resettlement takes place in an area which is very interesting for private investors. The initial aim to create a sustainable National Park which permits a coincidence between local communities, tourism and wildlife and where local communities are integrated in the process is not at all realized.
An open question is why no effort or no sufficient communication took place to capacity local people to increase their livelihood working as tourist guides or in other areas of the tourist business.

A 1.3 Competing claims, competing responses - the case of FLEGT/VPA as international trade instrument intending to contribute to sustainable forestry in Ghana

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Introduction
The EU FLEGT (Forest Law Enforcement, Governance and Trade) Action Programme recognizes that the EU, as a significant consumer of tropical timber, shares responsibility with tropical countries to combat illegal logging and its associated trade. The programme proposes the development of Voluntary Partnership Agreements between the EU and individual tropical timber exporting countries such as Ghana to eliminate illegally-produced timber from the partner countries through a timber licensing scheme (Box A1.1). The VPA between Ghana and the EU has been designed over a 5-year period. It was signed between the parties in September 2008 and has been ratified by the Ghana Parliament in June and by the European Parliament in November 2009. A major challenge in implementation is the expected tension between the legality-focus of the programme and a rights-based approach towards combating deforestation and forest degradation. The former approach is largely technocratic and focuses predominantly on the need to counteract illegal logging practices with transparent and accountable legality standards. The latter approach has political connotations and focuses predominantly on the need for a more equitable distribution of forest benefits and public participation in decision making.

The dual focus is further instigated by the multiple objectives of EU regarding forestry in developing countries. On the one hand the EU (and in the Netherlands predominantly LNV) argues that international trade protocols such as CITES and FLEGT/VPA are effective instruments contributing to sustainable natural resources management in producing countries (and reducing the ecological footprint of the consuming countries - while sustaining the supply of timber); on the other hand the EU (and DGIS/Netherlands Embassies) drive a poverty alleviation agenda based on their perception of forests and other natural resources as vital ingredients in the livelihoods of the poor. In Ghana both EU and the Netherlands Embassy generously support the Natural Resources and Environmental Governance (NREG) programme (a sector-wide budget support programme).

One could question the extent to which these two policy angles are compatible? To what extent is the EU endeavour to sustain the tropical timber trade in order to satisfy western consumers compatible with improving governance in the Ghana forestry sector to give the poor an equitable share of the country's natural wealth and turn forestry into a viable economic engine of growth? Or would both angles be conflicting, with a successful implementation of the timber licensing scheme securing formal legality of exports to Europe, and

hence easing the conscience of EU consumers while the opportunity costs are borne by the poor forest-fringe communities in Ghana?

These questions can only be answered by mapping the competing claims of the different stakeholders on the forest resources in Ghana, and analysing the extent to which the FLEGT/VPA mechanism concurs with the different interests. It is only then that, in this case an ex ante assessment can be made of the potential of such international trade instrument to contribute to sustainable forestry in Ghana.

Box A1.1. What is a Voluntary Partnership Agreement (VPA)?

The EU has developed bilateral agreements with timber exporting countries to put in place regulations that avoid the export of illegally produced timber. As bilateral trade agreements are against global trade protocols (WTO) these instruments are called Voluntary Partnership Agreements. The aim of the VPA, claims the European Forestry Institute, is not simply to reduce illegal deforestation but to tackle poverty and encourage development, as (good) forest governance - combining trade and aid - can reduce conflict and exploitation in forest areas and create a better climate for long term investment in sustainable forest management (EFI, 2009). The credibility of each VPA (Ghana was the first country to sign one with the EU in 2008) relies on the development of a Legality Assurance System (LAS), the technicalities of which are detailed in the VPA. The system must be coherent and reliable and based on laws and institutions of the partner country. Its function is to license legally produced timber, and ensure that only this legal timber is exported to the EU. A robust LAS has five key elements (EFI, 2009, comments between brackets are from the author):

- A clear definition of legal timber (more or less a set of regulatory instruments covering the entire production chain from stump to port of exit).
- A mechanism to control the movement of timber (in Ghana called a Wood Tracking System, proposed to be digitized).
- A government endorsed institution to verify that both the law and the control system (1 and 2 above) have been complied with sufficient rigour (after a long negotiation process it was finally accepted in Ghana to institute the Timber Validation Department as part of the Forestry Commission. This aroused much debate as some see the Forestry Commission at the core of bad forestry governance and corruption, and therefore do not expect the necessary rigour in a situation that virtually puts the FC in the seat of the judge reviewing its own case).
- A licensing authority for exports (resulting in the granting of a Certificate of Legal Origin as a condition to be granted an EU FLEGT license) and
- An independent institution to monitor the functioning of the whole system (not identified yet in Ghana, possibly an NGO?).

Methodology used

This case study uses the DPSIR analytical framework to assess the changes in forest conditions in Ghana as a result of the export of timber to the EU, and the policy response of the EU as formulated in the FLEGT initiative and applied in the VPA with Ghana. The DPSIR framework can be summarized as follows:

- The Driving forces are processes and human development (production, consumption, recreation etc.) able to cause pressures.
- The Pressures are the direct stresses, derived from these developments, and affecting the natural environment, i.e. deforestation.
- The State reflects the environmental conditions of natural systems (forest environmental goods and services).

– The Impact measures the effects of changes in the State of the environment.
– The Response is the evaluation of actions oriented to solve environmental problems in terms of management strategies.

In most cases the responses affect the pressure on the system. In the Ghana case these effects are not yet clear as the VPA has only recently been adopted and its outcome is uncertain. It is possible however to paint some scenarios of possible outcomes in terms of the Ghana forest conditions and impact on key stakeholders. These scenarios help testing assumptions of the EU policy and help identify further research on the impact of an international timber trade agreement on local livelihood and forest conditions.

An attempt has been made to identify the competing claims of the key stakeholders on the forest resources in Ghana throughout the application of the DPSIR framework. It is uncertain to what extent the methodology is appropriate in bringing out the interests of stakeholders underpinning their claims, and largely determining their response. The resulting power dynamics (across societal perspectives - social, political, economic, institutional, and across scales) may require additional study in order to be fully understood.

A multitude of factors driving deforestation in Ghana
Ghana's economy has expanded rapidly over the past years with an annual average GDP growth of 6%. Part of this growth is driven by booming urban economies as well as agriculture development. In combination with a growing population of 22.5 million (Marfo, 2009) and a population growth of 2.1% between 2000 and 2005 forests are increasingly converted into arable lands. The natural resources of Ghana are depleting at an alarming rate (Worldbank, 2006). In its 2006 'Country Environmental Analysis' the Bank estimates the costs of environmental degradation at 10% of GDP as result of 'unsustainable management of the country's forests, land resources, wildlife, and fisheries and through health costs related to water supply and sanitation, and indoor and outdoor air pollution'. This has a significant impact on the capacity of the country to sustain its growth, as it substantially reduces the genuine savings rate (a measure of growth sustainability that takes environmental factors into account): the genuine savings rate would be negative, i.e. -4%!

The booming economy (gold, remittances, oil has been found off-shore) has generated a high demand for construction timber. High unemployment rates in rural areas further increase the pressure on the country's natural resources (Appiah et al., 2009). The exploitation of resources for the domestic market is often illegal, therefore uncontrolled and often resulting in degradation.

The demand for tropical timber by international markets is an additional factor driving forest degradation. Timber sales provided around 12% of Ghana's foreign exchange between 1990 and 2000. Between 2002 and 2006 Ghana earned an average of US$ 174 million annually from the export of timber products (Ayine, 2008). The EU accounts for 43% in volume and value of Ghana's timber exports (Beeko, 2009). The second (and growing) market for timber is China and the Far East (currently 25%). For the EU, Ghana is only a small supplier of sawn timber. In 2008 for example only 4% of the EU-25 imports of hardwood sawn lumber from countries in the tropical zone came from Ghana (http://www.globalwood.org/market1/aaw20090401e.htm).

Apart from the abovementioned demographic and economic factors, also policy and governance failures drive deforestation (Hansen, 2009):
– Low forest fees - incentive for the sector to increase logging, disincentive for efficient production, disincentive for forest communities to engage in management.
– Inappropriate benefit sharing - provides a very low share of the economic value of a tree to farmers and forest communities resulting in a disincentive to conserving and an incentive to engaging in illegal harvesting (through illegal chainsaw operations).
– Discretionary allocation of timber rights - skewed towards larger (export-oriented) firms, exclusion of small-scale chainsaw operations (outlawed since 1998) resulting in 'double pressure' on the resource.

– Low level of law enforcement - outdated and conflicting legislation, non-compliance with current rules and corruption resulting in 'non-controlled' over-exploitation.

These governance factors ('policy failures') have emerged and persisted not out of ignorance or low capacity (alone), but because the political elite in Ghana has used the forest resource as a mean to serve other purposes than forest conservation, including personal and party-political purposes (Hansen, 2009). In a recent study on the possibilities for dealing with illegal chainsaw lumbering that is partly responsible for the forest degradation in Ghana the authors conclude that the enforcement of the ban on chainsaw lumbering cannot be realised without addressing three key sector governance problems: corruption by Forestry Commission staff, corruption by the police and the political will on the part of Government (Marfo et al., 2009).

The pressure on forests in Ghana is mounting

Natural forests in Ghana are dwindling rapidly with current logging intensity at four times the sustainable rate (Forest Watch Ghana, 2006); the natural forests outside national parks are in danger of disappearing. The off-reserve forests (201,000 km^2) are largely gone, the forest reserves (26,000 km^2) are not optimally managed (World Bank, 2006). Efforts towards forest management certification have not yielded much result. To date Ghana does not have certified forests (Beeko, 2009).

The pressure on forests in Ghana is largely caused by illegal activities. While figures are not consistent they all indicate that more than 50% of the total annual harvest is sourced illegally (Hansen and Treue, 2008; Marfo et al., 2009). Hansen and Treue (2008) mention an illegal logging rate in Ghana of 70% (of the total 3.7 million cubic metres). The estimate includes a 24% illegal felling by the timber industry assuming that this timber is channelled into the export. There is general consensus that the domestic market in Ghana is largely (80 - 100%) supplied with illegally acquired timber (1.7 million cubic metres of timber according Hansen and Treue (2008); 0.45-1.3 million cubic metres of lumber according Marfo et al. (2009)).

Forests do not only provide timber. Among 431 households in three forest districts in Ghana, 38% of the total household income was derived from NTFPs (Appiah et al., 2009).

Furthermore, forests provide environmental services that are increasingly recognised and valued globally. Forests provide watershed protection services of increasing importance for growing population areas; forests provide shelterbelts against northerly dry-season winds; forest harbour 'globally significant biodiversity' for which the global community is willing to pay the opportunity and management costs (e.g., through the GEF); and forests sequester carbon (opportunity to sell carbon credits). The latest global climate-regulating initiative, REDD holds prospect for payments to refrain from deforestation.

The claims on forests come from different stakeholder groups of which the following are key actors for the purpose of this case study:

– ***Government of Ghana (GoG)*** represents the national public interest and has to address all management perspectives of the forestry sector. Keen to secure maximum benefits GoG is perceived to be opportunistic in tapping forest area potential. There is a national interest in mining in forested areas, in large scale agro-forestry (biofuels), in biodiversity conservation to comply with global environmental commitments, etc. There is the political motivation to satisfy the domestic market with cheap timber as well as to keep the oversized and inefficient national timber industry in business. Lack of political will, lack of willingness to enforce the law, and political patronage mechanisms more often than not result in opportunistic decision-making driven by the agenda of the political elite rather than by sustainable forestry considerations.
– ***Forestry Commission of Ghana (FC)*** is a mandated by the Ghana Constitution to protect, manage and develop the nation's forest and wildlife resources. As such it is the executive agency of the Ministry of Lands, Forestry and Mines. It is important to note that the FC by its statutes is expected to operate in a

cost-recovery manner. It has a vested interest in generating income from forests. So far the FC has been unable to become self-financing and the Ministry (and international donors) have supplemented annual budgets. The timber sector in Ghana is characterised by poor levels of governance. Legislation, regulations and codes of practice, put in place to control harvesting and to protect the forest resource have been either inadequate or not properly enforced. FC retains a number of potentially conflicting functions (e.g. law enforcement, monitoring, forest management, and revenue collection). The result so far has been degrading forest resources, increased illegality and corruption, and less than optimal revenues for the State and society. The incapability of the FC to manage forests in a viable and sustainable manner has prompted the call for major reforms of the sector. One of the main barriers to reform is the presence of strong, long-standing alliances within the forest sector, involving producers, politicians and the forest authority who wish to maintain the status quo (Ayine 2008; Verifor website 2009; and case study; Ghana: saving the country's forests, 2007 published at www.illegal-logging.info).

- *EU* is not only an important trade partner of Ghana but is also perceived as a political ally. Substantial aid packages flow from EU and EU countries to Ghana, and international relations are cordial. In terms of the timber trade Ghana is one of the countries targeted in the EU Forest Law Enforcement, Governance and Trade (FLEGT) programme to stem illegal trade in tropical timber. One instrument of FLEGT is the Voluntary Partnership Agreement (VPA) which has as main objective to promote trade and to secure the legal origin of wood products entering the European market. The EU needs timber, has an economic interest in sustaining its supply and has a political interest to demonstrate legality of origin and sustainable management of forest resources to convince EU consumers that their ecological footprint in the forests of Ghana is reduced.
- *Civil society in the forestry sector in Ghana* has been increasingly vocal in calling for transparency and accountability within the sector. The civil society organisations (150 NGOs and CBOs, Mayers et al., 2008), some of them rooted in international organisations such as Tropenbos Ghana, WWF Ghana, and IUCN Ghana are lobbying for reform of the sector. All tree tenure and user rights are vested in the State and this State monopoly does not give incentives to farmers and other stakeholders to carefully manage the forest. Trees in Ghana are perceived as a free-for-all resource benefitting all, leaving the costs to none, meaning the State and later generations. The agenda (or the claim) of civil society on the forests in Ghana is predominantly biodiversity conservation-focused and pro-poor.
- *Farmers and forest-fringe communities* are the key users of forested areas. About 14% or three million of Ghana's people are in forest fringe communities, and about 35% of their livelihood is derived from forest resources. With a GDP per capita of US$ 430, the annual income of fringe communities from forest resources could be in the order of US$ 450 million (Mayers et al., 2008). Where it concerns the use of trees this is largely illegal. Figures on illegal use vary widely, According Mayers et al. (2008) about 350,000 people are engaged (most in casual labour relations) in the illegal chainsaw business with an expected annual turn-over of US$ 58 million. According Marfo et al. (2009) the illegal chainsaw business gives jobs directly and indirectly to 86.000 people with revenues for the farmers/communities in the range of 7 US$ million while 2.7 - 3.9 US$ million is retained by the chainsaw operators. The employment numbers are significant given Ghana's unemployment rate of more than 20% in rural areas. The growing domestic demand for lumber acts as an incentive to support these jobs (Marfo et al., 2009). One reason for its extensive operation is that chainsaw milling has undoubtedly distributed benefits to the poor (Verifor, 2006).
- *Traditional authority* in Ghana has a complex relationship with its forests. Having constitutionally 'handed-over' the management responsibility over forests to the State the traditional leadership does not play a major role in management. However, as original landowners the chiefs are recognised by the State as legitimate recipients of forest revenue. In those circumstances where timber concessions pay royalties to the 'community' in the form of Social Responsibility Agreements (SRAs), the chiefs get the biggest share, on behalf of their community. Question 1: how many times is payment of SRAs enforced? Question 2: how much of the revenue paid to the chief (Mayers et al., 2008, estimates US$ 1.7 million per annum) actually benefits the community at large? It is generally perceived that chiefs and sub-chiefs are actively engaged in

illegal lumbering activities as payments by chainsaw operators are direct (without administrative delay) and higher than formal payments.

– *The timber industry* in Ghana has an over-capacity and claims an increasing volume of timber. While the major exporting sawmills (six companies account for nearly 50% of exports) realise the need for regulating instruments such as the VPA, and can afford its costs, the smaller (local) mills are in a different position. The possible loss of capital and employment when 'sustainable' forestry management is achieved makes this segment generally opting for maintaining the status-quo hereby showing little regard for future generations. The unwillingness to change is further compounded by the comfortable position the industry has manoeuvred itself into due to its political and financial influence in society (Ayine, 2008). It requires political will and mitigating measures of GoG to overcome the resistance of the industry to change (Beeko, 2009).

State of the forests in Ghana in 2009

Ghana's forest cover has dwindled from 8.2 million hectares to less than 1.5 million hectares between 1900 and 1990. Between 1990 and 2005 the rate of deforestation accelerated to a historical high with large forest reserves losing their entire forest cover. The current logging intensity is four times the sustainable rate (Forest Watch Ghana, 2006). At this rate commercial species could be logged-out in as little as five years. Deforestation is already having a noticeable impact on water supplies, soil fertility and climate pointing to a looming environmental disaster (Forest Watch Ghana, November 2007).

Perceived impact of deforestation on the key stakeholders in the sector

No attempt has been made to fully analyse the impact of deforestation on all affected stakeholders (including those at global level) as this would go beyond the scope of this case study. Instead the impact on the selected key stakeholders was reviewed to a certain extent with the objective to illustrate that impacts are not the same for all stakeholders, and are not always negative as may be expected (Table A1.3.1).

The analysis is meant to explain the different, not always concurring responses of stakeholders on changes in the state of their environment, in this case Ghana's forests, as highlighted in the next paragraph.

Competing claims, competing responses

The most discussed response to deforestation in Ghana currently is the VPA process that Ghana and EU embarked upon five years ago and which culminated in the Ghana Parliament ratifying the Agreement in June 2009. The VPA initiative is not the only response in the forestry sector, there are actually quite a number of stakeholder consultation and policy development initiatives implemented in the sector (and not always coordinated let alone complementary): the Reducing Emissions from Deforestation and forest Degradation (REDD) initiative; debate on the UNFF Non-Legally Binding Instrument (NLBI); the NREG-related KASA civil society project; the Global Witness Forest Transparency Reporting; Pro-poor REDD (IUCN/Danida); WWF Forest Certification support; GIRAF Civil society Project (EU); National (and district) Forest Forum (FAO supported); and the Growing Forests Partnership[2].

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Table A1.3.1
Perceived impact of deforestation on the key stakeholders in the sector.

Key stakeholder	Perceived negative impact	Perceived positive impact
Government of Ghana	– High future costs of replacing or rebuilding lost environmental goods and services (not yet featuring prominently on the political agenda of today) – Foregone carbon payments and biodiversity value – Political damage due to loss of employment opportunities in the industry	– Opportunities to further tap international donor funding to address deforestation and assumingly related poverty conditions
Forestry Commission	– Loss of status and credibility – Confronted with an increasing demand for sector reform endangering its monopolistic position in the sector – Further loss of institutional income (was not that high anyway as an estimated half of the potential income was channelled away privately)	– Opportunity to tap funding for large-scale plantation programmes – Opportunity to tap funding for alternative livelihood programmes
EU	– Decreased supply of tropical timber to the EU market (not dramatic as Ghana market is small) – Loss of credibility due to its devastating ecological footprint	
Civil society		– Opportunity to tap international donor funding for forest lobbying and advocacy programmes
Farmers and forest-fringe communities	– Loss of potential benefit from timber production in the long term (hardly any benefits from formal logging at the moment) – Loss of NTFPs; loss of 35% of income	– Increased access to farming land or farming opportunities (taungya system - agro-forestry practice in Ghana) – Consolidated (for the short term at least) employment and income opportunities from illegal logging activities – Opportunities to benefit from deforestation-related alternative livelihood programmes
Traditional leadership	– Loss of (relatively small) income from formal logging	– Potentially enhanced influence on and benefits from non-forested lands
Timber industry (large scale)	– Decreased supply of timber – Increased cost of timber supplies (possibly from outside Ghana such as Liberia and Sierra Leone)	– Cleaning-up (downsizing) of the industry is in the interest of the large scale internationally-oriented companies
Timber industry (small scale)	– Decreased and therefore assumingly more expensive supply puts many industries out of business	– Opportunities for receiving state subsidies

[3] List compiled by Terry Green in June 2009, personal communication.

The VPA however currently features most prominently on the agenda of the stakeholders even though their affiliation with the objectives and operationalisation of the mechanism differs from one to the other, depending on the underlying political, economic and institutional interests:

- EU responded to rampant illegal logging with the introduction of a trade instrument (the FLEGT/VPA) with the intention to ban import of illegally produced timber and in this way contribute to more sustainable forest management in Ghana. The preparation of the VPA was based on extensive participation of the main stakeholders from the Ghanaian forest and timber sector. With this preparation an important step was made to generate ownership amongst parties to accept 'the legal framework aimed at ensuring that all imports into the Community from Ghana of timber products covered by this agreement have been legally produced and in doing so to promote the trade in timber products (the VPA objective as identified in article 1 of the VPA[4]). It was also recognised that further forest policy reforms are needed, especially in respect to social safeguards (article 17 of the VPA): 'the Parties agree to develop a **better understanding** of the livelihoods of potentially affected indigenous and local communities as well as the timber industry, including those engaged in illegal logging' and will '**monitor the impacts of this Agreement on those communities** and other actors ….., while taking **reasonable steps to mitigate** any adverse impacts'. As illustrated by these articles, the VPA focuses primarily on legality issues. Social change issues such as forest rights and benefits are added to this agenda but play a subsidiary role. The FLEGT/VPA process so far is based on three key assumptions that need vigorous testing (Brown, 2009): 1). It is assumed that by addressing the symptom of illegal timber production it will be possible to contribute towards remedying the cause (poor governance) of unsustainable timber production; 2) It is assumed that a timber trade agreement can be used as a vehicle for wider political reforms related to forestry; and 3) It is assumed that legality reforms can deliver 'co-benefits' such as good governance, equity in access to resources and biodiversity conservation.
- Government of Ghana and most notably the Ministry of Lands, Forestry and Mines (MLFM) responded positively to the initiative of EU (in the notable absence of effective nationally driven initiatives to stem deforestation). What may have helped in decision-making was the conditionality of signing the VPA for sector wide budget support by a consortium of donors to MLFM which amounted to 27 US$ million over the 2008 -2010 period, giving a slightly different connotation to the words Voluntary Partnership Agreement.
- The Forestry Commission (FC) of Ghana is forced to respond to deforestation and illegal timber production out of institutional interests (not out of staff's private interests). With a current illegal production of 70% the Commission is missing out on institutional income that is required to sustain itself as per statutes. With international donors increasingly calling for performance-based support the days that the FC can rely on blank cheques from the Ministry to fill the budget gaps, are numbered. The introduction of the VPA as technical instrument to ensure that all timber is legally produced and all dues are paid to the Commission seems a logical step for the institution to take. The private interests of staff, management and the FC Board however are perceived to be different. It is exactly because of poor governance, limited enforcement of regulations and corruption amongst powerful factions in the sector that has led to the current crisis in forestry, not because of lack of technical instruments. The FC therefore responded by following a very technocratic approach (Illegal or Incompatible? Research programme, 2009), diligently steering clear from elaborating sector reforms and managing to retain its monopoly position in the sector (by high-jacking the VPA verification role). It should be further noted that donors pushed an agenda of reorganisation of the FC during the VPA design phases advocating privatisation of much of its functions. Especially the Forestry Services Division (FSD) is anticipated to lose 50% of its staff (of 2500) due to

[4] The full text of the Ghana-EU VPA as signed in September 2008 and ratified by the Parliament of Ghana in June 2009 can be read on the illegal or incompatible project website: *http://www.vpa-livelihoods.org/homepage.aspx*.

proposed outsourcing (Birikorang et al., 2007). It is not difficult to perceive a failing roll-out of the VPA as being welcomed by the FC. Opportunities for alternative institutional income looms as the FC has recently been tasked by the new Minister of Lands and Natural resources (website of FC, 2009) to concentrate on plantation development as cornerstone of its tenure: 'The rapid depletion of Ghana's forest resource base, with its inherent adverse climatic consequences on socio-economic development, has made robust plantation development, more imperative now than ever'.

- Civil society response to the deforestation in Ghana is a call for sector reform. Civil society in the sector has four concrete objectives: a) fair access to forest resources as between different stakeholders and in particular for improved access for forest dependent-communities; b) fair distribution of benefits from forest exploitation as between different stakeholders and in particular forest-dependent communities; c) greater democratic stakeholder participation in forest policy-making particularly for forest-dependant communities; d) greater civil society mobilization around forest and natural resource uses[6]. Civil society in this regard is very wary of the monopolist position of the Forestry Commission and has been active via the IIED supported Forest Governance Learning Group, Forest Watch Ghana (a consortium of 26 forestry-related NGOs and CBOs), and Civic Response to lobby for inclusion of a commitment to reform in the VPA. Though the lobby was successful, the open-endedness of the committed reform in the Agreement (Section 5 of Annex 2) calls for caution.
- Farmers and forest-fringe communities are uncertain of the impact of the VPA on their livelihoods and currently respond with ongoing deforestation. They are not the only ones being unaware of the impact of the VPA on their livelihoods, also those who have signed the Agreement do not know but they at least are committed 'to develop a better understanding of the livelihoods of the potentially affected local communities…' under the heading of 'social safeguards' (article 17). It is not sure that the VPA will positively impact on farmers and communities. In the short term it will probably not, especially not when pro-poor reforms are lagging behind. Both FLEGT and the VPA are not pro-poor agendas and it has been a matter of political choice to emphasise a legality focus to address illegal logging rather than a full-fledged forestry reform emphasis. The effect of the former may be a neglect of farmers and forest-fringe communities that have more benefit from illegal forest use (income and employment) than from legal forest use (fewer opportunities for income and employment); and more benefit from deforestation (more opportunities for farming) than from sustainably managed forests (currently meaning: no rights of access to the resource).
- Traditional leadership seems to respond to deforestation and the VPA initiative along similar lines as 'the community' even though the chiefs have more to gain from 'legal timber' (enforcement of SRAs as per LAS means more formal income). The traditional leadership is perceived as not overly engaged in the VPA design process and this may be explained by the fragile relationship between 'the chiefs' and the Forestry Commission concerning control over forest land.
- The timber industry sees a major restructuring looming with or without a VPA and currently responds to the deforestation with a call for government subsidies to sustain employment and opening up of the Ghana market for free import of round wood from the region (e.g. Liberia)[7]. During the VPA design process there was no pro-active engagement of the timber industry hinting at certain satisfaction with the status quo rather than an eagerness to contribute to efforts towards sustainable forest management.

Concluding observations on the anticipated impact of the VPA on forest condition and rural livelihoods

Mayers et al. (2008) painted three scenarios for the Ghana forestry sector without a VPA, with a VPA and with reform, summarising gains and losses by 2020:

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6 (www.illegal-logging.info/item_single.php?item=news&item_id=1943&approach_id=26).

7 Taxes on imported roundwood have recently been removed.

	Gains	Losses
Without a legitimate timber regime attempted	– Short term profit for some existing industry – Short term benefits for some from chainsaw lumbering – Short-term employment benefits in forest industry	– 'Hard landing' as sector dwindles fast, corruption rife – Resource crash, deforestation and degraded ecosystem services: foregone carbon payments; soil erosion and water quality problems; and loss of biodiversity – Marginalised communities, rampant illegality, conflict and local governance problems
With an effective Legitimate timber regime	– Softer landing' for a downsized sector – Improved formal sector resource management – Increased accountability stimulates positive engagement	– Lower revenues, continued social / environmental risk – Some species loss and forest degradation – Communities still disenfranchised and some social dislocation – Substantial numbers of companies dissolved with employment losses
With sector reform	– Stabilized productive forest sector, healthy revenues – Responsible management on and off reserve with maintenance of ecosystem services resulting in carbon storage, watershed and biodiversity protection – Rights, responsibilities and capacity in the best places for good management and local benefit – Larger share of 'timber economic rent' to resource owners	– Smaller forest sector – Still lower levels of forest goods and services (may regenerate / expand beyond 2020) – Lower (but sustainable) employment levels – Despite gains - it is too little and too late for some communities

Mapping the competing claims on forests in Ghana and analysing the underlying interests of stakeholders as attempted in this case study gives an indication to what extent any of these scenarios can become reality. The responses to the degrading state of the forests in Ghana differ by stakeholder grouping with at extreme ends civil society 'as spokespersons' of disenfranchised communities and to an extent the EU calling for a full-fledged reform while the Forestry Commission and the industry prefer to retain the status quo. The power dynamics in the sector will therefore largely determine which scenario becomes reality. Whatever the outcome of the VPA implementation process there are very likely to be winners and losers and it is questionable that the introduction of the VPA as trade instrument alone will do the trick. In line with this observation one can ask the following policy-related questions:

1. The EU FLEGT/VPA is a response to illegal logging and stresses legality issues more than rights issues. In essence it is not a pro-poor programme even though livelihood considerations have been added as points of attention. The impact of this trade instrument on the livelihoods of forest-dependent communities in Ghana is still under study. The impact will largely depend on the identification and implementation of further forestry reforms covering pro-poor forest rights and fair forest benefit-sharing mechanisms. The need to consider further forestry reforms over the next five years has been identified in the Ghana VPA but the nature and outcome of such reforms are still very difficult to predict. What measures are in place to have all stakeholders engaged in this debate?
2. The competing claims on the declining forest resources in Ghana and underlying power dynamics in the contested sector makes win-win situations very unlikely. What capacity and mechanisms can be put in

place to monitor the implications of ongoing changes on all stakeholders and most notably the less privileged, and, if relevant, what appropriate safety nets to compensate the losers need to be designed?
3. The EU/FLEGT process of policy consultations and debates is not the only international programme for improving governance in the forest sector. There are several related (international) policy development processes based on international standard setting ongoing, e.g. the REDD discussion, forest certification debates, etc. Moreover, in Ghana different donors have encouraged the formation of various national forest policy platforms. What are the opportunities and challenges of integrating the various policy processes?

The Ghana case shows that the introduction of an internationally driven regulatory instrument, in this case the FLEGT/VPA, may be adopted bilaterally but not necessarily concur with the economic and institutional interests of all key societal groups. A thorough analysis of the diversified competing claims and competing responses makes effectively achieving the underlying objectives more likely and assessing the need for the necessary safeguards for disenfranchised groups more timely.

A 1.4 Competing claims in the Central Rift Valley of Ethiopia

Olga van de Valk and André de Jager (LEI, part of Wageningen UR)

Introduction

The Central Rift Valley (CRV) of Ethiopia, about 150 kilometre south-west of Addis Ababa, is situated in the administrative regions (provinces) of Oromia and the South Nations Nationalities and Peoples Region (SNNP). It forms part of the Great African Rift Valley and covers about one million hectares. The total population of the CRV is approximately 1.5 million with an average population density of 1.5 persons per ha.

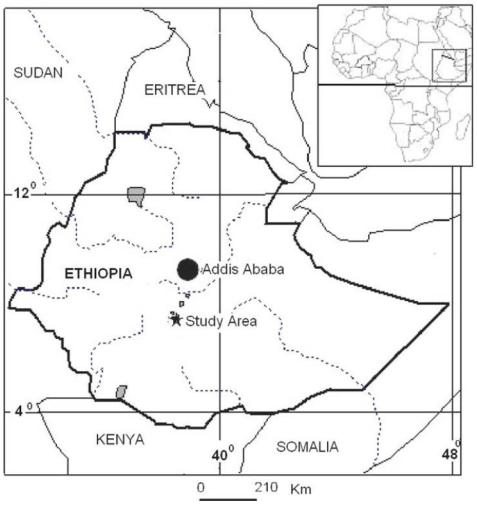

Figure A1.4.1
Study area in Ethiopia.

The Central Rift Valley is composed of a chain of lakes, streams and wetlands with unique hydrological and ecological characteristics. It is a closed basin, which means that relatively small interventions in land and water resources can have extensive repercussion for the survival and the quality of the basin. Currently, there is a clear decrease of water resources with a decreasing size of the lakes and deterioration of wetlands around them. This is mainly due to the abstraction of water by agricultural production systems having changed in time and place.

A deficient management of the natural resources, may lead to affecting sustainability, potentially threatening the livelihood of the population and current and future economic activities.

Climatologic characteristics of the CRV

The area encompasses three lakes, Ziway, Langano and Abyata. The Abyata lake forms part of the Abyata-Shala National Park; one of Ethiopia's National Parks. Both Abyata and Shala lakes are saline. The national park is well-known for its large number of wetland birds (over 400 recorded species), and a major flyway for Palearctic and African migrants. It supports one of the largest African populations of *Pelecanus onocrotalus*. Depending on the fish population, the pelicans and other fish-eating birds leave and return to the lakes.

The Bulbula River is the main tributary river to Lake Abyata, discharging fresh water from Lake Ziway. The level and discharge of the Bulbula River determine the riverine forests, the alkalinity of the lake and the fish populations. Lake Ziway and its tributaries make up to 70% of the total water catchment.

Lake Shala has a relatively steep shoreline and is much deeper and more alkaline. Due to the high alkalinity and subsequent low production of biomass of organisms, the lake cannot support large population of animal higher in the food chain. On its east shore, the hot springs of Lake Shala are attractive to tourists. Around Lake Langano a new resort have been set up for foreign tourists. National tourists, however, cannot afford the prices.

The area is characterized by warm, wet summers (with most rain falling from July to September) and cold dry and windy winters. The distribution of the rain within the year is very erratic, with large differences in precipitation during the dry season. This is an indication a high level of uncertainty in the yields of rain-fed agriculture, as it is very susceptible to water shortages.

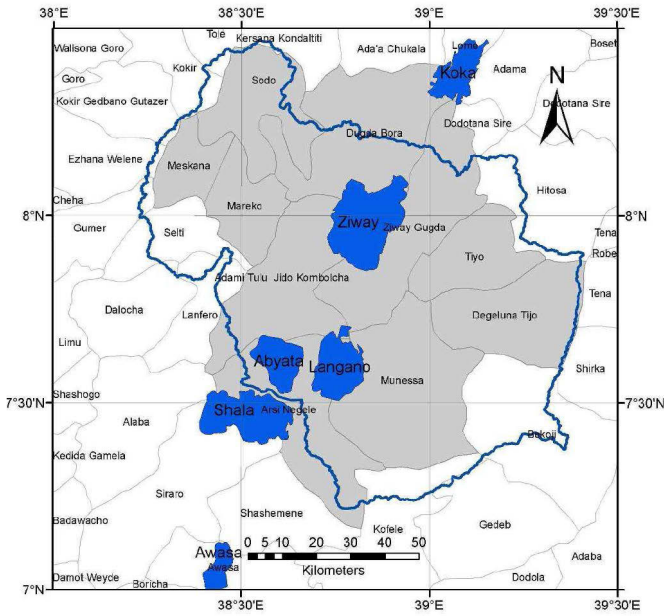

Figure A1.4.2
Central Rift Valley Water basin.

Population growth and irrigated horticulture driving regional change
The CRV faces many challenges including poverty, causing the local population to deplete their surrounding environment in order to survive; and a rapidly increasing population that needs to be fed. Increasing urbanization, expected to quadruple in fifteen years; makes it necessary to improve agricultural productivity to maintain regional food security. With a growing local economy, claims for water, land and labour for rural and urban development will increase.

Some claims are relatively new, like the agricultural development taking place from 1990 when the Government of Ethiopia adopted the Agricultural Development Led Industrialization Policy. The creation of favourable investment conditions, has led to expansion of irrigated horticulture and floriculture for export in the area. Fiscal incentives including a five-year tax holiday, custom duty exemptions, loss carry forward and remittance of funds. Lands can be accessed on a leasehold basis. The Development Bank of Ethiopia (DBE)

provides soft loans to the sector. The bank extends credits up to 70% of the total investment with as collateral the project itself.

Other claims have a long history, such as the claim on woody biomass for the production generation of charcoal benefiting local population but causing deforestation. Grazing of livestock has led to the shortage of good feed and overgrazing of common pastures. The claim for land between arable and nomadic pastoralists is also old, having led to a disappearing percentage of pastoralists in the region. Urbanization is a recent phenomenon keeping pace with the development of local towns near Lake Ziway as economic hubs (with floriculture as important driver). The claim for labour is directly related to the issue of agricultural productivity and consequent efficient use of resources for economic development. A related issue is whether the use of labour for intensive commercial horticulture is not in conflict with local food production.

Increased pressure on forests because of erratic rains and food insecurity
Due to the rapid population growth (2.5 to 3%) and lack of proper land management, natural (wood) land is converting into agricultural land at a fast rate. A study of the adjacent Awassa water shed to the south on dry land mixed farming, gives an indication on deforestation dynamics in the area. The study revealed that from 1973–2006, the area of cropland doubled at the expense of woodland and wooded-grassland. Major deforestation and forest degradation took place from 1973 - 1986; with woodland cover declining from 40% to 9%. The severe drought of 1984 contributed to this (Garedew et al., 2009).

Because of erratic rainfall, in drought years farmers fail to produce crops and lose livestock. Many are driven to woodland resources to raise income through the sale of wood fuel. Study by ICRA and EARO (2002) estimated that 40% of households were food insecure for around nine months each year. Other factors for cropland expansion are the rapidly increasing population pressure and the declining crop productivity. With increasing population density, farmers cannot compensate for low productivity by cropping more lands. The size of cropland per household is diminishing because the limits of usable land have been reached (Garedew et al., 2009).

Three basic livelihood strategies; animal husbandry, rain-fed and irrigated agriculture
Animal husbandry is an important livelihood strategy in the conventional mixed farming system in the CRV. Animals serve as traction power, as saving buffer in periods of insufficient food, while they also provide socio-economic status to the owner. The livestock population in the area is estimated at 857,000 heads, leading to overgrazing and invasion of water buffer zones.

Two types of farming systems can be distinguished in the area: rain-fed and irrigated agriculture. The small mixed rain-fed production system is the predominant farming system in the CRV. Main crops (in order of importance) are wheat, maize, barley and teff, combined with husbandry. This segment represents the poor farmers, whose farming system is characterized by very low yield, with as result a lack of food security and dependency on food relief. The system's performance varies in relation to altitude and soil type, but in general relies heavily on the availability of rain.

The irrigated farming systems can be divided into three subcategories:
1. Closed horticultural and floricultural production systems. These refer to greenhouses with drip-irrigation. Only one closed system is operational in the CRV. Sher-Ethiopia in the first phase is aiming for 360 ha of greenhouses, of which 210 ha were in production in 2008. It furthermore purchased 300 adjacent ha from a state farm for future expansion. For the future, an area of 1,000 ha of greenhouses will be developed. The amount of waste (drainage) water from these systems that flows directly into lake Ziway is small, but it's quality may impact the water basin system because of the nutrients and pesticides it contains.
2. Open field vegetable and fruit production on state and private farms. One irrigated state farm is still operational, with an irrigated area of 680 ha in 2006. It's size is expected to decrease, to be converted

into (privately owned) closed production systems. Main crops are beans, tomatoes, onions and maize for seed. The Ethio-Flora private farm in the Ziway area produces maize, green beans, papaya and banana on 70 has. of irrigated land.

3. Open field smallholder vegetable and fruit production. Individual production systems are very small, around 0.5 ha; and predominate in the area, both in number and irrigated area. Small holders are often organized in Peasant (water) Associations and they run the irrigation schemes collaboratively. Predominant irrigation method is furrow irrigation. Main crops are tomatoes and onions. The irrigated production is completed with rain-fed cropping and livestock. The total irrigated area, mainly around lake Ziway, is estimated at between 7,500 and 10,000 ha and increased particularly after 1999.

Changes in the irrigated and intensively cultivated lands are expected to have most impact on water resources in the catchment. It is estimated that water use efficiency (due to evapotranspiration) in open irrigation systems (furrow irrigation) is approximately 30%; versus 50 to 65% in the closed irrigation systems (roses).

Regional industry

Since 1990, a soda-ash factory is operational along the shore of Lake Abyata. The experimental factory is designed for the production of 20,000 tons of soda-ash per year, but actual production has not exceeded 10,000 tons per year. Water usage has been calculated at 0.9 million m^3 (Legesse and Ayenew, 2006) for average sodium bicarbonate concentration, while Bastiaanssen with remote sensing techniques arrived at a water usage of 1.4 million m^3.

The town of Ziway has grown rapidly in the last, multiplying with almost factor 6 (545%). This growth has accelerated in recent years; it is safe to assume that the Sher-Ethiopia lease greenhouse complex and related growing demand for employees in the floriculture has a fair share in the population growth.

Population growth of Ziway				
	May 1984	Oct 1994	Jul 2005	May 2007*
Ziway	6,585	20,056	35,931	43,610

* According to CSA Ethiopia estimate for 2007 census.

The major competing claims concern water, land and labour

The claims for water have been analysed extensively in the study by Jansen et al. (2007). There is less information to be found on claims for land and labour. As land is state-owned, the land market is a rental market and directly related to labour market. Both are imperfect, depending on many factors, such as the availability of family labour and presence of alternative income sources (Van den Berg and Ruben, 2006). Nevertheless, some general conclusions on labour and land claims related to productivity will be made.

Water claims

The fact that the CRV is a closed system, means that there is no inflow or outflow of surface water; and all water resources in the area originate from rainfall (Jansen et al., 2007). Rainfall may replenish groundwater levels, evaporate directly or through crops (evapotranspiration) or run off and be collected in rivers and lakes. If changes in land use occur, this will lead to changes in evapotranspiration. For example if open irrigation generates an increase of evapotranspiration, elsewhere in the CRV this process would need to be counterbalanced. At the same time open field irrigation is the most important mode of water abstraction from streams and lakes in the CRV (Table A1.2).

Table A1.2

Depicts the total water abstraction by the various stakeholders in the Central Rift Valley[1].

Water user	Remarks	Annual water use (millions of m^3)	Approx. % of total
Domestic	Population of 1,5 million with average water usage	7	4% (3%)
Livestock	0.8 million livestock population, average use	8	5% (4%)
Closed irrigation[2]	100 ha; 20,000 m^3 ha^{-1} $year^{-1}$	2	1% (1%)
Open field irrigation	7500 - 10,000 ha; 20,000 m^3 ha^{-1} $year^{-1}$	150 - 200	89% (92%)
Soda ash factory		1	1% (0%)

1 Small holders with rain-fed production systems do not appear in the table, as this system has little influence on water balance in the ecological system (no abstraction, but use of precipitation).

2 In case of area increase to 1,000 ha, annual consumption will increase to 15-20 million of m^3 representing 8 to 11% of total usage by stakeholders.

On the supply side, a 10 years period shows a decreasing trend of the volume of rainfall by approximately 15%, though no conclusions can be drawn on long term trends. Rainfall has become more erratic, which influences particularly rain-fed agriculture (and consequent food security). While rain-fed and natural vegetation act as a 'buffer' for rainfall variability, irrigated agriculture does not, as it's water usage is not directly related to rainfall. That is, in dry years more water is consumed, and more evapotranspiration takes place. Over a period of 37 years, maximum daily temperature has increased with about 1.5 °C.

Besides water abstraction, urban growth (Ziway) puts pressure on natural (water) resources where sufficient facilities for waste management is lacking.

Land claims depend on household characteristics which determine labour intensity

Claims for land are regulated by national legislation, which allows small farmers access to state-owned land trough peasant associations (Dessie and Christiansson, 2008; Teklu, 2004). These Peasant Associations function as a state organ for exercising state control over rural land (distribution), indicating political functions of the PAs other than market development for its members (Crewett et al., 2008). Peasant Associations suffer from high overhead and low level of marketing efficiency (Van der Valk and Sopov, 2009; Van der Valk and Tessema, 2010).

Periodical social disruption caused by radical political transformations in 1974 (from Haile Sellasie to military rule) and in 1991 (present Ethiopian People's Revolutionary Democratic Front rule) created a vacuum in which unregulated land usurpation took place. Each change in regime has implied changes in land-tenure systems under differing political principles, causing obstruction of long-term planning; land tenure insecurity, usurpation of land, small holders being forced off their land (Dessie and Christiansson, 2008). Following the 1975 proclamation, major redistribution of land was implemented to provide land to the tiller in accordance to need, expressed mainly in terms of household size. This has led to fragmentation of land (Teklu and Lemi, 2004).

In Ziway, a survey (Debello, 2007) showed that more than half of all households participate in the rental market for land, and almost all households hire labour for producing cash crops.

Table A1.3
Household participation in farmland rental market in Ziway

	Number of sample households renting farmland						
	in for		out for		autarkic in land for		
	cash	food	cash	food	cash	food	
Ziway	25 32%	28 36%	12 15%	3 4%	41 53%	47 60%	78 100%

Table A1.4
Labour market participation status of the sample households

	Hired labour				Work off or non-farm jobs	
	For food crops		For cash crops			
	count	%	count	%	count	%
Ziway	67	85.9	76	97.4	34	43.5

On the demand side of these markets are largely land-constrained farmers whose main objective is to increase the area of operated land. The better-off farmers, who have labour, oxen, seed, and cash, are more into renting land since they rarely hire out their labour. But those who are short in land, oxen and cash, especially the young and newly formed households, either exchange their labour for land or hire out their labour (Teklu and Lemi, 2004).

A higher labour/land ratio at household and community level brings about a rise in labour intensity in crop production, as does ownership of draft animals. Also the presence of alternative income sources affect labour use in crop production. Households with mixed farming systems of small ruminants (goats, sheep) maintain land use systems with lower labour intensity. Labour intensity and agricultural productivity are significantly higher on irrigated fields, which lowers the ability and need to participate in public employment programs (Van Den Berg and Ruben, 2006).

Productivity (defined as net income received per unit of land) to a high extend depends on the prices received for the output (Jansen et al., 2007), which particularly for vegetables may vary considerably, pointing at imperfect markets and the need to develop value chains (Van der Valk and Sopov, 2009). The disclosure of markets is important for land claims as volume of trade correlates positively with increases in land inequality (Teklu and Lemi, 2004).

In the claim for land by large scale and export oriented versus small scale production systems); productivity for irrigation and land is higher for the first. As said, the economic productivity of land and labour depends to a high degree on the yields and market price obtained, as well as costs made, on which a large variation can be noted in the case of small scale agriculture (for domestic markets).
The lesser productivity of informally-contracted lands resulted rather from the inferior quality of inputs (and land fertility) and social context constraint (the obligation to borrowers to contribute labour to family farm) rather than a lack of incentive to allocate inputs to mixed crop-livestock farming. Resource poverty may also be the main reason for failure to invest in perennials (Holden and Yohannes, 2002)

Large scale horticulture brings positive effect in terms of employment and poverty with a smaller number of people receiving higher benefits and secondary labour conditions; versus a wider reach of smaller benefits involving more communities in the case of small scale agriculture (Humphrey et al., 2004) The impact of large scale agriculture on poverty depends on the corporate social responsibility strategies as implemented by the employing companies but is positive. First steps have been set with the development of the code of conduct by the Ethiopian Horticulture Exporters Association EHPEA (Geevers, 2008)

Melese and Helmsing (2010) point at the fact that spill-over effects of export oriented production system for the creation of local entrepreneurial activities remains limited.

Summarizing, in reference to local land markets and productivity of land cultivation systems, both labour and land markets are defined by social characteristics and economic capacity of the households. Productivity is higher on irrigated plots, which are more intensively cultivated, thus require more labour. A very cautious conclusion would be that while claims for irrigated lands puts more pressure on water availability, while those households that cultivate rain-fed plots leasing put more pressure on available natural resources.
Whether intensifying production systems leads to a shortage of regional labour, will be discussed in the following paragraphs.

Labour claims are defined by the influx of outside labour and social practices
The economic hub created by the horticulture companies attracts people looking for a job from other areas, as far as Gondar in the northern part of Ethiopia (Geevers, 2008). At national level, the urban unemployment rate was 20% in 2004-2005 (Geevers, 2008).

Geevers (2008) noted an overcapacity of labour in Ziway, with daily at least fifty people standing at the gates of the greenhouses hoping to find a job that day. This may change when expansion of the greenhouse area will double to labour demand from 8,000 to 15,000. There is competition among the greenhouse employers for experienced and trained workers. Sometimes people do not show up when work needs to be done on the family farm.

Summarizing, we conclude that export-oriented horticulture generates most pressure on natural resources in an indirect way, that is through urbanization, because the economic hub attracts people looking for better remunerated jobs.

Lakes are disappearing in the Central Rift Valley
From satellite images can be seen that between 1973 and 2006 the size of lake Ziway and Lake Langano have not been subject to significant changes in size. Nevertheless, since 2002 the level of lake Ziway has decreased by approximately 0.5m. Further decrease in the level of the lake, caused by increased evapotranspiration of irrigated crops, added to increased inflow of chemical residues from intensive agriculture may cause Lake Ziway to become a terminal (saline) lake, even as soon as in five to ten years.

The discharge into the river Bulbula has decreased from more than 200 million m^3 average per year to less than 50 million m^3. This corresponds with the development of 7,500 to 10,000 of newly irrigated areas.
In 2006 Lake Abyata had reduced its size to 60% of its size in the '80 and '90 of last century. Since 1973, the lake size has shrunk from 194 km^2 to 95 km^2 in 2006.

The Abyata-Shala National Park suffers from the lack of financial resources and management capacity. Larger animals are eliminated from the park. The Acacia savannah, previously dominant in the park, has been replaced by fields of sorghum and maize, despite low fertility of the soil. The park suffers from severe encroachment of settlers, deforestation, cultivation and grazing. The riverine vegetation has been reduced as

a result of the reduced inflow form the Bulbula River. Grass lands along the shores are heavily overgrazed. As a consequence, the Park is losing its attractiveness for tourists.

Over a period of 37 years, the maximum daily temperature has increased with 1.5%, causing increased evapotranspiration of 3 to 4%. In the same order this is causing increased water stress to the rain-fed agriculture.

Further study is needed on the impact of changes towards more intensive irrigated production systems on soil fertility and reduced quality of water resources in the basin.

Regulation is in place, but lack of coordination and sense of urgency
Presently, the main institutional players in the water sector are the Ministry of Water Resources (MOWR: established in 1995), Regional Water Bureaus (RWBs), Woreda Water Desks (WWD), Woreda Administrations, Water Resources Development Fund and NGOs. There is little inter-sectoral coordination between the Ministry of Economic affairs, Ministry of Water Resources, Ministry of Agriculture and the environmental Agency.
The Oromiya environmental protection Bureau (OEPB) mentions that there are no policies in place to address issues of water scarcity, in the sense that there is no control on water quantities for irrigation. This means little or no coordination between water users including irrigation schemes, resulting into increased conflicts over water use as development proceeds. Water management will become the mandate of the New River Basin Organisations which are to be established in all Ethiopian basins.

In April 2006, the Ethiopian Country Water Partnership (ECWP) initiated the Central Rift Valley Working Group. This group integrates organization professionally involved in the CRV and consists of civil organization; representatives of ministries and water-related institutions, the tourist sector and academia. The Working Group has no official mandate or authority in the Central Rift Valley, but functions as a multi-stakeholder that enables policy dialogue on the complex and interrelated issues in the CRV.

On December 1 to 4, 2008, in Ziway a multi-stakeholder participatory workshop was held to develop a joint land use plan.

The solutions proposed by the stakeholders present were the establishment of buffer zones; creating community awareness; dissemination of studies regarding irrigation development and planning; a plan for monitoring pollutants; and capacity building in combination with the development of market chains. Participants were not able to define follow-up activities to tackle the issue of erosion and degraded lands due to overpopulation of animals in the area; probably because livestock fulfils so many functions and is intrinsic part of predominant mixing farming systems. Neither was attention given to the need for effective waste management with further urbanization.

The workshop organizers observed difficulties in breaking away from mainstream and general solution pathways. Responsibilities for follow-up activities were defined in general terms; to organizations rather than individuals. They were also assigned to organizations not participating in the workshop. (Hengsdijk et al., 2008; Hengsdijk, 2009).

Conclusions
Most impact on land degradation is originated by the low productivity of mixed farming combined with population pressure. Irrigated agriculture, especially open field vegetable and fruit production, creates most (negative) impact on water resource balance in the region. The economic performance of irrigated small scale agriculture can be improved upon. As a consequence, focus should be on the improvement of environmental and economic performance of current irrigation systems rather than expanding these. In view of expected

negative impacts of intensification of agriculture; the feasibility of new technologies and agricultural practices needs further study.

First steps towards environmental policies and institutional actions have been undertaken. The low expectations of participants in the multi-stakeholders workshop that follow-up activities to realize the developed land use plan for the West shore of Lake Ziway; indicates a low sense of urgency. Lack of priority for the natural resource management in CRV can also be deducted from absence of national policy makers who could function as a push and pull factor towards local authorities. It was also commented that proper institutions for joint actions are lacking.

The Government of Ethiopia clearly takes a leading role in creating local economic growth and employment opportunities. These efforts can be strengthened by improving access to domestic markets for small scale horticulture and the creation of incentives for domestic value chains. Efficient marketing institutions aiming at decreasing seasonality of product prices and development of added value in market chains are still lacking. Because of multiple functions, including political agency for national policies, Peasant Associations can improve on marketing efficiency and effectiveness.

Emphasis on the monitoring and improvement of the performance of rain-fed agriculture as alternative source of income is necessary in relation to the poverty levels of the population and impacts on further land degradation.

From the stakeholders workshop in Ziway it was concluded that there is a lack of information on the current situation of the CRV; while information to calculate alternatives and come up with innovative solutions is either lacking or not disseminated to stakeholders. Proper institution building and strengthening may bridge this gap. Also outside stakeholders, like the Ryoal Embassy of the Netherlands have played a role here.

Finally, the role of knowledge is emphasized. First, as previously argued. knowledge creation and dissemination will give more awareness of the competing claims, particularly the urgency to mitigate impacts of current economic activities on the CRV. Knowledge and skills for (joint) marketing and design of supply chains in public and private sector will lead to proper (marketing) institutions to reach economic efficiency.

Appendix 2 - Models for assessing competing claims on natural resources

A 2.1 Available tools and models

Available tools and models to assess effects of policy scenarios on claims on natural resources and competition between these claims strongly vary in their spatial extent, scope and level of detail. The examples of global and regional assessment studies in 4.1 combine integrated assessment models with a number of sectoral models to assess specific environmental impacts (e.g. on N balance and biodiversity). Below we provide an overview of models and approaches to study competing claims, with a focus on those tools and models that are available within Wageningen UR and the Netherlands Environmental Assessment Agency (PBL).

A 2.1.1 Integrated Assessment models

IMAGE-LEITAP
The IMAGE-LEITAP modelling framework of PBL and LEI, Wageningen UR is used in various global assessment studies.

LEITAP is a general equilibrium model of the world economy model describing the economic processes on country or regional level. LEITAP is a modified version of the global general equilibrium Global Trade Analysis Project (GTAP) model (Nowicki et al., 2007). Based on expected GDP growth, demographic developments and policy changes, LEITAP estimates commodity production, prices and trade for each region of the world. Trade barriers, agricultural policies and technological development are taken into account. The Integrated Model to Assess the Global Environment (IMAGE; Bouwman et al., 2006) is a dynamic integrated assessment framework to model global land use and environmental change. LEITAP and IMAGE are linked through the land supply model, sectoral production growth rate and agricultural intensification

The land market in GTAP is represented in LEITAP by a land supply curve, which specifies the relation between land supply and a rental rate in each region. The underlying assumption is that the most suitable land is first taken into production, in which suitability is defined by a weighting over population density, distance to water or existing agricultural land and a random factor. Land, which is barely suitable for agriculture in terms of production, has been left out of the land supply curve. In regions with ample of idle land suitable for agriculture, marginal costs of taking extra land into production are low, in contrast to regions where almost all available land has been taken into production already. A curve depicting the ratio between marginal and average productivity describes the heterogeneity of land. The land supply curve and the productivity curve in LEITAP are consistent with the allocation procedure within IMAGE.

IMAGE uses the agricultural production growth to define food production per region. The degree of intensification is modelled endogenously by LEITAP and taken over by IMAGE, while the technology improvement is assumed exogenously using information from FAO's study 'World Agriculture towards 2015/2030'. Finally, the growth of energy sectors in LEITAP has been used to adjust the GHG emissions from industry within IMAGE.

The framework of IMAGE is shown in Figure A-2.1, below. The IMAGE model produces estimates of regional energy use together with land use patterns and GHG emissions. The LEITAP model is linked to IMAGE by replacing the part of IMAGE that provides information on Agricultural Economy and Trade.

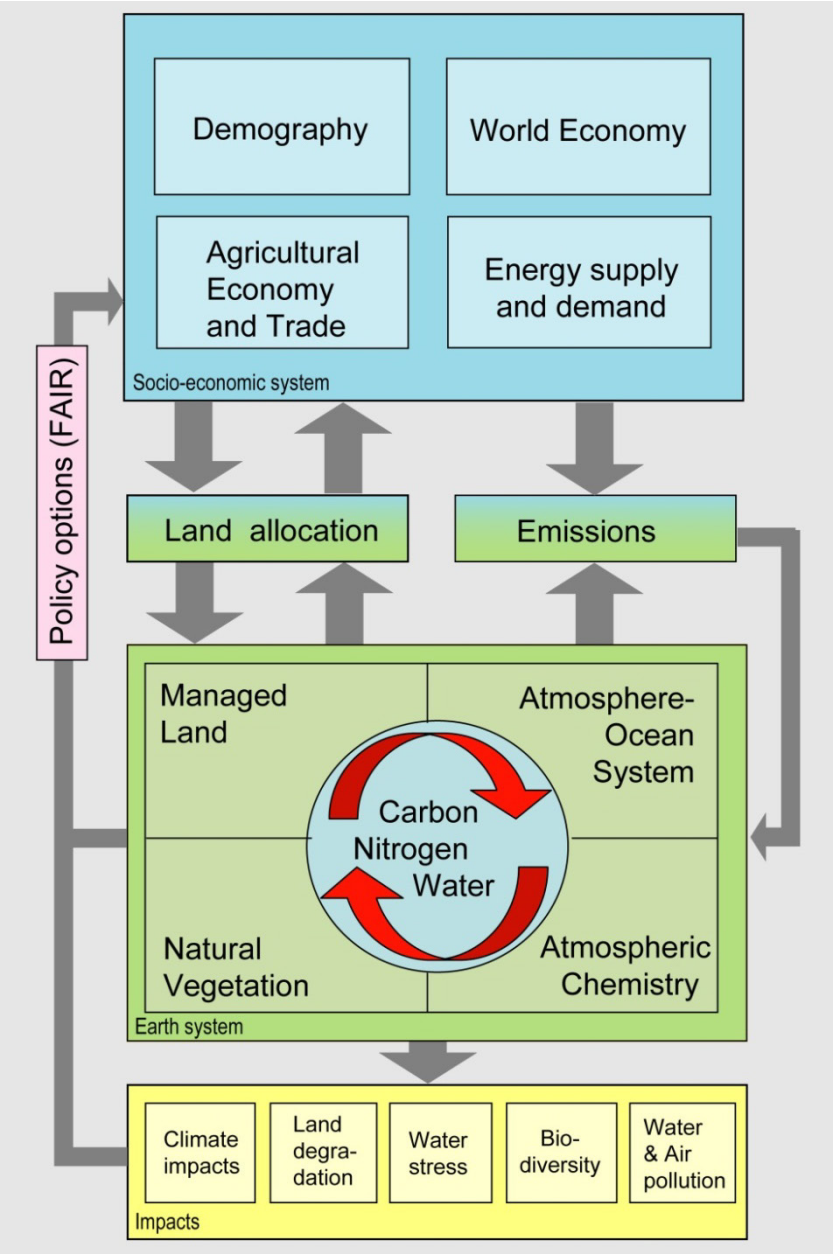

Figure A-2.1
IMAGE 2.4 Framework (Source: Bouwman et al., 2006).

A 2.1.2 Regional land-use policy models

EURURALIS
The EURURALIS project (www.eururalis.eu) is dealing with the future of rural Europe and especially focuses on the way this future is influenced by global developments and strategic EU policies. The future of rural Europe is closely linked to issues like:
- the enlargement of the EU internal market
- on-going liberalization of global trade
- reform of the European Common Agricultural Policy (CAP)
- climate change
- stimulation of bio-energy
- urbanization and infrastructural developments

The cause-effect relationship of both future development scenarios and policy instruments is implemented by a series of linked models. These models are LEITAP/IMAGE, CAPRI (both economic models) and CLUE (a land use allocation model) through which agricultural commodity parameters are linked with regional/territorial aspects. The global economy-wide dimension is covered by the economic model, LEITAP. CAPRI provides more agricultural detail for the EU-25 countries and distributes this impact to the regional (NUTS2) level. Dyna-CLUE provides a detailed analysis of land cover change, thereby giving a spatial representation of the economic modeling outcomes. The latter two models are briefly introduced below.

CAPRI is a EU-27 partial equilibrium model for the agricultural sector at NUTS2 level. An important feature of CAPRI is that agricultural activities are split into an extensive (low input, low yield) and an intensive type (high input, high yield). The main function of CAPRI (Britz et al., 2008) is to assess detailed agricultural policies and the regional impact of post 2013 CAP reform measures (NUTS2 level). Within CAPRI, Rural Development measure groupings valuable areas (e.g. LFA, Natura 2000) and ecosystem services (e.g. Agri-environment (AE)) are assumed to have a direct impact on agricultural land use. The remaining measures are assumed to work indirectly by influencing factor productivity and costs. This is accomplished by linking the costs and production technology of CAPRI to the simulated results of LEITAP, where those other measures are explicitly implemented.

CLUE land use allocation model
The Dyna-CLUE model (Verburg and Overmars, 2009) disaggregates the outcomes of LEITAP - CAPRI to a temporal resolution of two years and a spatial resolution of 1 km^2. Dyna-CLUE models a range of land use types, including forests, nature and urban land use, while LEITAP - CAPRI mainly address agricultural land use. Dyna-CLUE models the changes and conversions between these land use types between 2000 and 2020 for EU-27. The Dyna-CLUE model takes information on the amount of agricultural land used by the different sectors at the national level, provided by the economic models, and allocates this over the land area according to location suitability, spatial policies (LFA, Natura 2000) and rules for natural succession. With regard to location suitability, environmental (biophysical) characteristics (e.g. soiltype, climate, distance to roads), which determine the allocation of land use, are explicitly accounted for. In the economic model chain these factors are not taken into account. Dyna-CLUE enables a comprehensive analysis of land use dynamics, as all relevant land use types, trends and policies are included in the model, simulating developments in nature conservation, peri-urban development, forestry, recreation, and agriculture.

The Dyna-CLUE model downscales in land use simulated to a local use pattern and visualizes the impacts of CAP changes on local land use. It is possible to identify critical regions (hot spots) impacted by the effects of changes in total agricultural area and possible land abandonment. Moreover, the spatially explicit results allow an assessment of the changes within geographically delineated areas, where some measures are targeted, including LFA and Natura 2000 areas.

The Dyna-CLUE model simulates the impacts of a number of valuable areas and ecosystem services measures part of the CAP.

A 2.1.3 Sectoral models

GLOBIO - Global biodiversity model
The GLOBIO3 model (Alkemade et al., 2009; Bouwman et al., 2006; Ten Brink et al., 2007) identifies the cause-effect relationships that link environmental drivers to biodiversity impact. These relationships were derived from an extensive meta-analysis of available literature. The model describes remaining biodiversity under a certain pressure in terms of remaining mean species abundance of original species (MSA), relative to their abundance in pristine or primary vegetation and environmental conditions.

The GLOBIO3 model is linked to the IMAGE integrated assessment model providing spatially explicit input for magnitude of a number of anthropogenic pressures. At regional scales the model is linked to the CLUE land allocation model to be able to include land use changes at high resolution. The pressures that are considered in the GLOBIO model, and for which cause-effect relations have been derived, include:
- Land use change and forestry (i.e. agricultural expansion or abandonment)
- Infrastructure and settlement
- Fragmentation
- N deposition
- Climate change

For the global application of the GLOBIO3 model, land cover and land use types are grouped into the generic land use intensity classes on a spectrum starting from primary vegetation with minimal disturbance indicated by MSA value of 1 to built-up area where over 80% are artificially built at the other end with MSA of 0.05. A MSA value of 1 means that the biodiversity of that land use type is equal to the biodiversity of the original primary vegetation and has a 100% intact biodiversity. In a degraded forest, the biodiversity is much less. Global modelling has identified that MSA of the secondary forests all over the world is 0.5. The remaining biodiversity in human influenced land types through land use is determined by the intensity of use.

It is important to note that the MSA value is not dependent on the number of species alone, but also includes declining abundances (number of individuals) of a representative number of species in an ecosystem. An undisturbed desert with few species has the same MSA value as a pristine rainforest with lots of species. A remarkable finding and concept in the GLOBIO3 methodology is that the disturbances of original ecosystems have more or less a similar ratio of disturbances all over the globe. Light use of an undisturbed boreal forest with fewer species has a similar effect as a light use of untouched primary rainforest. Therefore the remaining MSA for light exploitation of primary forest is similar for both boreal and rainforest primary systems.

CO2fix
The CO2fix model (Masera et al., 2003; Schelhaas et al., 2004) can be used to assess carbon sequestration potential of forest management, agro-forestry and afforestation and of the potential carbon emission of land-use change (i.e. deforestation, forest conversion to other land-uses like such as agriculture). It was originally designed for even aged mono-species stands, but has also been used for a wide variety of forest types from all over the world, including tropical plantations and selective logging systems. The model simulates stocks and fluxes of carbon in trees, soil, and -in case of a managed forest- the wood products, as well as the financial costs and revenues and the carbon credits that can be earned under different accounting systems. The model is able to assess potential revenues from round wood production, as well as carbon trading. Stocks, fluxes, costs, revenues and carbon credits are simulated at the hectare scale with time steps of one year. The results have for example been used in the second IPCC assessment report, for example. A beta

version of a landscape scale model is available to assess the consequences of land-use change on carbon dynamics. This model combines landscape level land-use projections from the CLUE land use model (e.g. Verburg et al., 2007) with the CO2fix projections on the one ha scale.

As illustrated in, the model exists of six modules: 1) biomass module, 2) soil module, 3) products module, 4) bio-energy module, 5) financial module, and 6) carbon accounting module (Figure A-2.2).

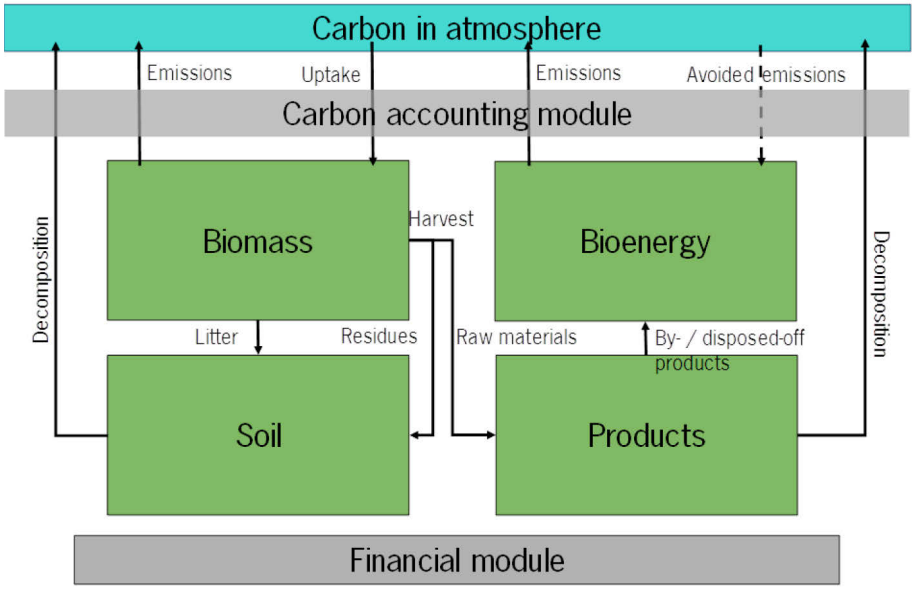

Figure A-2.2
The modules of CO2FIX V 3.1 (source: Schelhaas et al., 2004).

The biomass module converts volumetric net annual increment data of the tree stand with the help of additional parameters to annual carbon stocks in the biomass compartment. Biomass turnover and harvest parameters drive the fluxes into the soil and the products compartment. In the soil module, decomposition of litter and harvest residues is simulated using basic climate and litter quality information. The fate of the harvested carbon is determined in the wood products module, using parameters like processing efficiency, product longevity and recycling. In the bio-energy module, discarded products or by-products from the product module can be used to generate bio-energy, using varying technologies. The carbon accounting module keeps track of all fluxes to and from the atmosphere and determines the effects of the chosen scenarios, using different carbon accounting approaches. The financial module uses costs and revenues of management interventions to determine the financial profitably of the different scenarios.

A 2.1.4 Tools for sustainability impact assessment

LUPIS
The 6th EU framework project LUPIS developed an analytical framework to assess impacts of land-use policies (e.g. Reidsma et al., 2011; Verburg et al., 2009). Using a combination of different economic, sectoral and land use models and/or results from case-studies development of social, economic and environmental indicators are evaluated for different policy scenarios. Responses of the selected indicators are evaluated in an integrated multi criteria analysis, which gives insight into sustainable development in a particular case study.

The framework is based on the interaction between the three dimensions (social, economic and environmental) through land-use. External drivers, like market change, demographic change and climate change affect land-use and therefore the performance of the dimensions. Special reference is also given to institutional issues, referring to the ability of institutions to employ policies and regulations effectively and efficiently. The institutional aspects are therefore crucial in the practical world, but difficult to quantify. While numerical models (and data) exist to project changes in the three 'classical' dimensions, this is not the case for the institutional domain. The EU 6th framework project SEAMLESS project developed a tool for the institutional capacity in Europe to deploy policy options (Schleyer et al., 2006). Such a tool however is not available for less developed countries and therefore the institutional capacity to carry out effective policies will only be described in qualitative terms within the framework.

Evaluation with Land Use Functions

The land use function (LUF) approach connects the dimensions of sustainable development, as described in the previous section, with land-use. This approach is originally developed in the SENSOR project (e.g. Pérez-Soba et al., 2008) and adopted in climate change projects (Verburg et al., 2009).

The LUF approach aims at pointing out regional differentiations of land use-relevant goods and services on human society within rural areas that are primarily affected by land use changes. Thus land-use is redefined in terms of functions. Each dimension (social, economic, environmental) is represented by 3 functions that have a land-based origin. In total nine LUFs are developed for all dimensions of sustainable development, which were defined as follows (i.e. Reidsma et al., 2008):

Social functions

1. Provision of work : refers to the employment provision for all, according to activities in relation with natural resources; quality of jobs, lack of job security, localisation of jobs (constraints / commuting).
2. Human health & recreation (spiritual & physical): refers to access to health and recreational services and factors that influence services quality.
3. Food security: refers to food self-sufficiency.

Economic functions

1. Residential and non-land industry and services: refers to the space where residential, social and productive human activity takes place in a concentrated mode. The utilisation of the space is mainly irreversible due to the high concentrations of the buildings.
2. Land based production: refers to human productive activities that determine changes which are mainly reversible (agriculture, forestry, natural energy sources, land based industry -mining).
3. Infrastructure: refers to the space used for infrastructures that determine changes which are irreversible.

Environmental functions

1. Provision of abiotic resources: refers to the capacity of the land to provide sufficient quantity and quality of air, water and soil.
2. Support & Provision of biotic resources: refers to factors affecting the capacity of the land to provide biodiversity, from the genetic diversity of organisms to a diversity of habitat in the landscape that are in suitable ecological condition.
3. Maintenance of ecosystem processes: refers to the capacity and factors affecting to vital processes such as water purification, nutrient cycling, etc.).

The Land Use Functions are arbitrary descriptions of land-use. To make them useful response variables or indicators are measured. Indicators therefore represent aspects of Land Use Functions. A balanced set of indicators can be linked to the nine LUFs. The selection of indicators to include is based on four criteria: (1) facility of analysis, i.e. their relevance with respect to the problems and the drivers; (2) facility for decision

making, i.e. the balance between different stakeholders such as policy makers, researchers and farmers; (3) ability to reflect the transformations of the environment, and (4) the effect of practices, validity at several scales of analysis (Reidsma et al., 2008).

Each Land Use Function is represented by one to a number of indicators. When a number of indicators represent a single Land Use Function two different methods of aggregation can take place. In the first method policy-makers explicitly weigh the importance of indicators within a LUF. For example, a social LUF like provision of work might comprise indicators like educational level, employment rate and immigration rate. A policy-maker might, for example, conclude that for a specific policy option the development of the educational level is the most important. In such case a stronger weight of this indicator can be given to the performance of the LUF provision of work.

In a second method the weighing of indicators is more analytic. Pérez-Soba et al. (2008) defined a relative score of an indicator to the LUF. Thus a small change in the value of an indicator strongly or moderately changes the value of a LUF. In Pérez-Soba et al. (2008) the relative contribution of an indicator varies between -2 and +2. Thus the values of a - n vary between -2 and +2.

The LUPIS approach deviates from this structure, since there is a lot of subjective interpretation in assigning the relative contribution of indicators. Therefore, LUPIS simply assumes that each indicator in a LUF contributes equally to that LUF. Thus when a LUF has four indicators, each indicator contributes ¼ to the final value of the LUF.

Note that the LUF value itself is arbitrary and relative, but the values allow a comparison among different LUFs. To compare the effects of climate change on the relative performance of the LUFs and eventually on the performance of the three dimensions of SD, all data will be put in a Multi Criteria Analysis (MCA).

A 2.2 Claims included in the models

Food, biofuels and timber in global models
There are a large number of (agro-economic) models that are used to make projections of global agricultural consumption, trade, production and land use (e.g. GTAP, IMPACT, MiniCAM [model of energy, agriculture and climate system]). Some of them have also included a global timber market model (GTM) to account for the demand for wood products, for some this additional demand is handed as second priority to food (e.g. in IMAGE), for others it is part of the land competition (GTAP-GTM). Likewise, some of the models have included biofuels as a second priority after food (e.g. IMAGE, MESSAGE), while others have included biofuels in competition to food production (GTAP). Some models have already included valuing the carbon in land and REDD options (e.g. MiniCAM, MESSAGE) to account for the carbon storage function of forests, which may be valued under the Post-Kyoto protocol. However, only a few global models have explicitly included the claim for ecosystem goods and services (e.g. biodiversity in GLOBIO).

Other claims
Only a few of the competing claims on land have been included in global models as an explicitly competing factor. Competition between the claims is mainly addressed in the socio-economic models that are used in the integrated modelling framework and thus is based on market factors. For many claims, especially supporting, regulating and cultural ecosystem goods and services, a market can hardly be established, and putting a price on it via other methods (e.g. willingness to pay etc.) is uncertain, or even arbitrary. Therefore many of these claims will have to be dealt with in a different way, i.e. by guaranteeing a successful claim via setting boundary conditions (e.g. protected areas, or legislation to implement certain management).

A 2.3 Model uncertainty and use of scenarios

In projections of future developments and trends uncertainty plays an important role. Many parameters that are used in the global and regional models contain a high level of uncertainty. Especially economic development, the level of technological development and consumer preferences are highly uncertain. Moreover, in global assessment models the relevant systems (i.e. energy, agriculture, climate and ecosystems) are determined by complex interactions and feedbacks of many factors (Bouwman et al., 2006; Van Vuuren and Faber, 2009).

To explore different uncertain developments and consequences of trends, tools for scenario analyses have been developed (Alcamo, 2001; Bakkes et al., 2008). A set of scenarios aims to describe divergent futures that encompass a significant portion of the underlying uncertainties in the main driving forces. These drivers cover a wide range of key characteristics such as demographic change, economic development, and technological change. For this reason, their plausibility or feasibility should not be considered solely on the basis of an extrapolation of current economic, technological, and social trends. In scenarios analysis reference futures (the baseline) and policy scenarios should be separated. Reference futures are usually used as 'benchmark' scenarios with dynamics, but the major policy interventions that are being tested. Subsequent comparison with policy scenarios then enables the assessment of the (relative) effect certain policies will have.

Recent scenario assessments, however, are more and more based on only one reference baseline for comparison. This trend mainly stems from demand from decision makers to simplify the uncertainty associated with such scenario studies. Also experiences gained from previous scenario studies indicate evaluating changes or impacts are relative to the baseline scenario strongly reduce sensitivity to uncertain processes.

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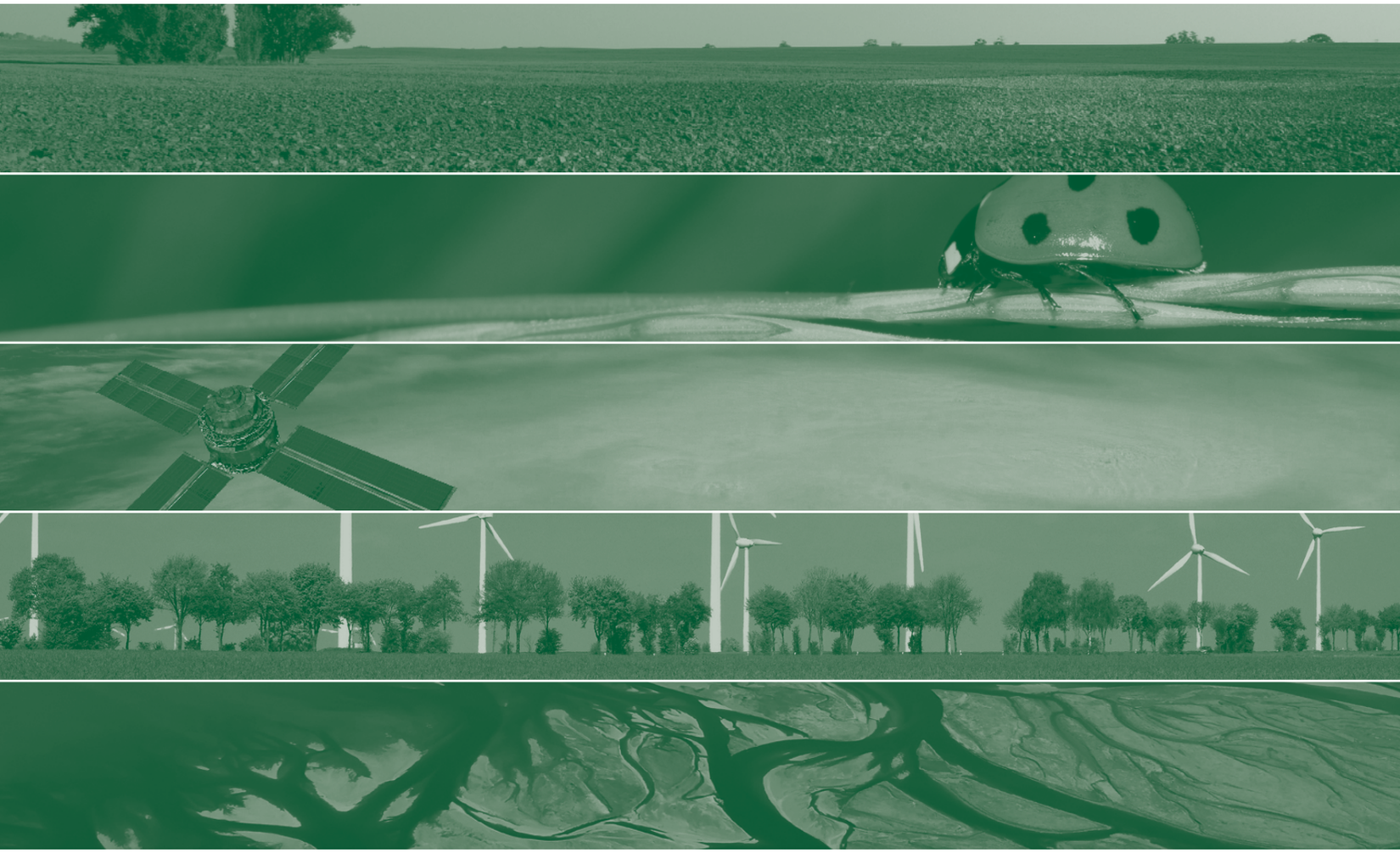

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