New Challenges in Rural Development

A multi-scale inquiry into emerging issues, posed by the global land rush

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Cover: farmer´s house in Kampot province, Cambodia (above); field of rice seedlings (below)
Cover design, photos and drawings by Arnim Scheidel

In memory of my father, from whom I learned that knowledge and wisdom do not come from titles but from life itself

PREFACE

This doctoral dissertation is the product of three years of research on new debates and challenges in rural development that have appeared – or require further attention – within the context of the emerging global rush for land resources. This dissertation, I believe, is however, also the product of a new way of doing research, which evolved within the context of science concerned with sustainability issues. Being concerned with complex socio-ecological systems, which may change in an unpredictable manner and which require to be studied from a multitude of different perspectives, new scientific paradigms have emerged, moving away from doing 'substantive' research to doing 'procedural' research. This entails in practice moving away from narrowly defined research questions, previously closed research objectives and hypotheses, to moving to a process-oriented research culture, in which particular attention is paid to emerging issues that may come out during the research process.

This paradigm is encouraged and lived within the research culture of the societal metabolism group at ICTA-UAB. Having proudly been part of this group, this dissertation has departed from a general interest to better understand a series of new debates and challenges in rural development. However, the particular structure and focus of the research chapters that make up this dissertation has emerged during the research process. The outcome of this Ph.D. project is a research series on emerging challenges in rural development, presented from a variety of different perspectives. I hereby invite the reader to join me on this intellectual journey, presented in this dissertation.

Chapter I introduces new challenges and debates in rural development that require attention within the context of global land grabbing. The following research chapters take the reader from the fundamental questions of what we may pursue with development efforts and poverty alleviation (Chapter II), to a discussion of emerging global development trajectories and trends (Chapter III), to the fascinating country Cambodia (Chapter IV and V) where the reader may observe, how such visions and trends of development may unfold within rural economies and life itself. Chapter VI presents some concluding remarks on future challenges in rural development.

I hope you enjoy.

Arnim Scheidel

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As specifically discussed in some of the articles of this dissertation, labor time is only maintained thanks to the existence of non-labor activities. Within this context, I owe large part of this dissertation to all the friends and family who accompanied me during that time.

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ABSTRACT

Within the recent years, new challenges in rural development have appeared, triggered by the emergence of a global rush for land resources. This phenomenon, well-known under the term 'land grabbing', has produced controversial debates surrounding the question whether rising global interest in farmland and related large-scale land deals may benefit poor rural communities across countries of the global South, or whether it may drive the marginalization of the global peasantry. This doctoral dissertation presents a compilation of four research articles that address important issues, relevant to better understand debates, drivers, characteristics and impacts regarding the global land rush and its implications for rural development.

In order to understand the controversial debates on potential risks and opportunities of the land rush to *poor* rural communities, it becomes necessary to deal with the question: *what kind of poverty is aimed to be reduced?* Poverty is a complex phenomenon, appearing across multiple dimensions and scales. This matters to the debates, as large-scale land deals may help to alleviate poverty in one dimension, while jeopardizing at the same time other poverty dimensions. The first article thus addresses on an epistemological and theoretical level challenges for development efforts that result from a multidimensional conceptualization of poverty. The second article investigates underlying driving forces of the land rush on a global level, in order to better understand future trajectories and implications for global rural development. Taking a biophysical perspective, the article argues that the land rush is likely not an ephemeral phenomenon, but rather might be persistent. Increasing competition and struggles over access to land might increase in the future, thus provoking new challenges for rural development on a global level. The third article illustrates for the case of Cambodia, how both the land rush and conflicting visions of rural development and poverty reduction may unfold in practice. Based on an empirical investigation at the national level, characteristics, constraints and impacts of large-scale land deals are addressed and a fundamental conflict between governmental interests and local realities of rural development is illustrated. Finally, the last article discusses how small-farmers at the village and household level may be able to deal with declining access to land. This is an issue which likely will require more attention in the future, when the land rush further unfolds. Conclusions on global rural change and the emergence of new ruralities, characterized by new economic activities and institutions, are presented.

In summary, this dissertation combines general theoretical and empirical case study research in Cambodia, in order to discuss from a variety of different perspectives emerging challenges in rural development. While the dissertation points out the complex issues that rural development studies and efforts may face due to the existence of multiple scales and dimensions of rural systems, also some simple lessons and clear conclusions are presented regarding debates, drivers, impacts and future consequences of the global land rush on rural development.

Keywords
Rural development; poverty; land grabbing; rural change; Cambodia; small-farmers; MuSIASEM; societal metabolism

RESUMEN

En los últimos años están surgiendo nuevos retos asociados al desarrollo rural, catalizados por una fiebre mundial por la adquisición de tierras a gran escala. Este fenómeno, conocido como 'acaparamiento de tierras', está generando controversia en cuanto a si el interés creciente en estas adquisiciones podría beneficiar a las comunidades rurales empobrecidas del campesinado mundial, o al contrario, incidirá en su marginalización. Esta tesis doctoral presenta una recopilación de cuatro artículos que abordan aspectos relevantes para entender mejor los debates, impulsores de cambio, características e impactos de la creciente demanda de tierras y sus implicaciones para el desarrollo rural.

Entender los controvertidos debates asociados a los potenciales riesgos y oportunidades del acaparamiento de tierras para las comunidades rurales empobrecidas, nos plantea la siguiente pregunta: ¿qué tipo de pobreza queremos reducir? Como problema que se manifiesta a múltiples escalas y dimensiones, la pobreza es un fenómeno complejo. Será importante tenerlo en cuenta, pues, en estos debates, ya que la adquisición de tierras a gran escala puede aliviar una determinada dimensión de la pobreza, a la vez que estar amenazando otras. Así, el primer artículo aborda los retos epistemológicos y teóricos que surgen al conceptualizar multidimensionalmente la pobreza. En el segundo artículo se investigan los impulsores de cambio del acaparamiento de tierras a nivel global, para poder entender mejor sus implicaciones para el desarrollo rural global y las trayectorias futuras que de él pueden derivarse. Desde una perspectiva biofísica, el artículo argumenta que el acaparamiento de tierras apunta a ser un fenómeno persistente y no efímero: la competición y la lucha por el acceso a la tierra son susceptibles de incrementar en el futuro, provocando nuevos retos para el desarrollo rural a nivel global. El tercer artículo ilustra, para el caso de Camboya, cómo pueden revelarse en la práctica el acaparamiento de tierras y distintas visiones conflictivas sobre el desarrollo rural y la reducción de la pobreza. Basándose en una investigación empírica a nivel nacional, se abordan las características, limitaciones e impactos de las adquisiciones de tierra a gran escala y se ilustra el conflicto fundamental entre los intereses gubernamentales y las realidades locales del desarrollo rural camboyano. Finalmente, el último artículo discute la capacidad del pequeño campesinado para gestionar el decreciente acceso a la tierra a nivel local; una cuestión que seguramente requerirá más atención en el futuro, con la evolución del acaparamiento de tierras. Se presentan así algunas conclusiones sobre el cambio rural global y la emergencia de nuevas ruralidades, caracterizadas por nuevas instituciones y actividades económicas.

En resumen, esta tesis combina investigación teórica y empírica con el fin de discutir bajo diversas perspectivas los nuevos retos emergentes del desarrollo rural. Para ello, se destacan las complejas cuestiones, asociadas a la existencia de múltiples escalas y dimensiones de los sistemas rurales, a las que se enfrentan los esfuerzos en torno al desarrollo rural. Asimismo, se presentan también algunas lecciones y conclusiones sobre los debates, impulsores de cambio, impactos y consecuencias futuras del acaparamiento de tierras sobre el desarrollo rural.

Palabras clave
Desarrollo rural; pobreza; acaparamiento de tierras; cambio rural; Camboya; pequeños agricultores; MuSIASEM; metabolismo social

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MAIN ACRONYMS AND ABBREVIATIONS

MuSIASEM – Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism
ILA – Impredicative Loop Analysis
THA – Total Human Activity
TAL – Total Available Land
TPL – Total Productive Land

SEA – Southeast Asia
KKL - Khcheay Khang Lech (case study village)

FAO – Food and Agriculture Organization of the United Nations
ASEAN - Association of South East Asian Nations
MAFF – Ministry of Agriculture, Forestry and Fisheries, Cambodia
NIS – National Institute of Statistics, Cambodia
RUA – Royal University of Agriculture, Phnom Penh, Cambodia
CEDAC – Cambodian Center for Study and Development in Agriculture
GTZ – Deutsche Gesellschaft für Technische Zusammenarbeit (German Society for Technical Cooperation)
ICTA – Institute of Environmental Science and Technology
UAB – Autonomous University of Barcelona

ELC – Economic Land Concessions
SLC – Social Land Concessions

Hrs – Hours
Ha – Hectare
Kg – Kilogram
Yr – Year
t – Metric tonne

CHAPTER I

INTRODUCTION

1 New challenges in rural development, posed by the global land rush

During the last decade, new challenges and debates in rural development have emerged, triggered by a globally rising demand for land resources, commonly described under the term 'land grabbing' (Borras et al., 2011; GRAIN, 2008; World Bank, 2010; Zoomers, 2010). Land grabbing refers to the current processes of large-scale and long-term land acquisition through governmental and private actors, mainly concentrated in non-industrialized countries of the global South. While land acquisition for agricultural expansion is nothing new in history, the recent growth in demand for land is occurring in a new way and on an unprecedented scale. According to a World Bank report (World Bank, 2010), within one single year (2008-2009), announced land deals have amounted to 45 million ha globally. While a quarter of all these projects involve areas greater than 200,000 ha, single project proposals for palm oil and biodiesel production have been reported to cover up to 2.8 million ha (von Braun and Meinzen-Dick, 2009), reaching the size of small countries such as Belgium. The emergence of this global land rush has been largely understood as being a response to food security threats within the context of the global food and financial crisis in 2008 (GRAIN, 2008; Merian-Research and CRBM, 2010; von Braun and Meinzen-Dick, 2009). The phenomenon has received particular attention from international development institutions, media and non-governmental organizations (NGOs)[1], not at least due to the fact that many investors have been governmental actors or governmentally supported companies from wealthy foreign countries, rich in financial capital, but with growing natural resource needs. Statements such as *"in the worst cases it's fair to say, we are looking at neo-colonialism"* (deputy director of trade and market division at the Food and Agriculture Organization (FAO), reported by Williams (2009)) appeared in international meetings and media.

However, the land grab phenomenon has many faces (Borras and Franco, 2012; Hall, 2011) and research from different perspectives is needed, in order to understand the underlying driving forces, characteristics and impacts of large-scale land deals on the involved countries and the rural poor. Indeed, many rural systems across the globe face currently an unsustainable and unviable economic situation. While many farmers of the industrialized global North depend on large amounts of state subsidies for the agricultural sector in order to survive economically (Harvey, 2004; Offermann et al., 2009; Scheidel and Krausmann, 2011), many farmers of countries of the global South – where state subsidies may be absent – depend on seasonal migration, non-farm work and remittances (Hecht, 2010; Kay, 2008). Moreover, poverty alleviation, being the central normative goal in rural development (Ellis and Biggs, 2001), is said to be largely an issue of rural areas (World Bank, 2007). And last, but not least,

[1] See www.farmlandgrab.org for a vast collection of media and NGO reports.

rural systems play a key role in global food production as well as for the maintenance of a healthy environment (Altieri et al., 2011). Thus, achieving economically viable and socially and ecologically sustainable rural systems has become a key necessity of the 21st century. Within this context, the general question has arisen (cf. Cotula et al, 2009; von Braun and Meinzen-Dick, 2009; World Bank, 2010): *Can the rising global interest in land resources offer new opportunities for the development of poor rural communities in countries of the global South, or may it further drive the marginalization of the global peasantry?*

There is no simple answer to this complex question and a variety of current debates in rural development have emerged regarding the land grab phenomenon. Different visions of rural development and poverty reduction are entering into play and the debate on the challenges and opportunities associated to the global land rush is controversial (see e.g. Borras and Franco, 2010; Borras et al., 2011; Cotula et al., 2009; De Schutter, 2011; Deininger, 2011; Li, 2011; von Braun and Meinzen-Dick, 2009; World Bank, 2010). On the one side, international development institutions as well as governments of involved countries have identified large potential opportunities for rural development and the rural poor. Although acknowledging risks due to lack of regulations for investment procedures, different 'codes of conducts' have been proposed, in order to turn potential threats into mutual benefits (Borras and Franco, 2010; FAO et al., 2010; von Braun and Meinzen-Dick, 2009). In fact, many countries of the global South are perceived to inhabit large reserves of underutilized and idle land resources, but lack investment opportunities to develop rural areas. Many actors from countries of the global North lack access to productive land resources, but have investment capital at their disposal, which could promote infrastructure development, new local employment opportunities and income options for the rural poor (Cotula et al., 2009; World Bank, 2010). Thus, large-scale-land deals could be seen as a potential win-win-win solution, in which all parties would benefit. As, for example, stated by the ministry of agriculture of Southern Sudan: *"This [new policy for large-scale land leases] could be an excellent factor in our own quest for food security"* (reported by Goswami, 2010).

However, the *rhetoric of win-win-win solutions* has often turned in practice into a *reality of win-lose-lose situations*. While some actors may benefit from large-scale land deals, many other actors may be put at a disadvantage. Regarding the impacts of recent large-scale land deals on rural areas, some organizations already have reported massive increases in land conflicts (e.g., Licadho, 2009; Vrieze and Naren, 2012), threats to marginalized groups such as women, pastoralists or indigenous communities (e.g., Kachika, 2011; Leuprecht 2004) and further fear the loss of thousands of rural livelihoods due to declining access to land for the smallholder sector (cf., GRAIN, 2008; Via Campesina, 2010). This however does not come

unexpectedly, if we acknowledge that the potential impacts on rural development and rural systems may be complex and diverse. Win-win-win solutions, despite sounding tempting, unfortunately may be based on reductionist views that do not account for the wide range of potential impacts across multiple scales and dimensions of rural systems. For example, benefits at the national level, such as infrastructure development, rising tax flows and foreign currency incomes due to increased external trade may not necessarily benefit people at the local level, whose livelihood may not depend on tax and trade flows, but rather on agricultural goods produced for household consumption. Moreover, the land rush is not a homogenous process, but rather has many faces itself (Borras and Franco, 2012; Hall, 2011; Zoomers, 2010), which in turn may result in different characteristics of large-scale land deals, with varying impacts on rural development and the rural poor.

In order to get a fuller picture of the new challenges and debates in rural development, triggered by the recent emergence of the global land rush, an enhanced understanding of the underlying debates, driving forces, characteristics, impacts and potential future consequences is necessary. This particularly requires accounting for multidimensional impacts, such as economic, social and ecological impacts, but as well for different implications at different scales of rural systems, such as at the global, national, regional or local scale. An investigation from a variety of different perspectives and different scientific disciplines is required. This doctoral dissertation aims to contribute to these research needs, by presenting four research articles that address a variety of new challenges in rural development, which are relevant to consider within the context of global land grabbing. To do so, the four articles presented in this dissertation bring together perspectives from bioeconomics, ecological economics, development studies and integrated assessment, in order to track the research questions and scales of analysis, presented in the following section.

2 Research questions and scales of analysis

Within the above described context, this doctoral dissertation presents a research series of four articles that address emerging issues in rural development studies regarding (i) the epistemological dimension, (ii) the global scale, (iii) the national scale and the (iv) local scale of analysis. In particular, this dissertation aims to track the following issues and research questions:

The epistemological dimension: In order to address potential opportunities and challenges of the global land rush for the development of rural communities, it is necessary to discuss first:

what is it that should be developed? Poverty alleviation has been always at the center of rural development efforts (Ellis and Biggs, 2001). Yet, the question remains: *What are the different understandings and dimensions of poverty alleviation and their implications for development efforts?* This is not a trivial issue, since a multitude of different concepts and perceived dimensions of poverty exist (Caizhen, 2010; Laderchi et al., 2003; Sumner, 2003). A previous discussion on the different poverty concepts and a theoretical investigation into their implications for (rural) development efforts may help to consider in subsequent research potential impacts of the land rush across various dimensions of rural development and poverty. Chapter II presents such a theoretical investigation into the characteristics and implications of *multidimensional poverty* for development efforts.

The global scale of analysis: The land rush has emerged as a complex global phenomenon, which has been largely attributed to the global food, financial and energy crisis in 2008 (GRAIN, 2008; von Braun and Meinzen-Dick, 2009). However, the question arises: *Is the land rush merely an ephemeral reaction to the recent global economic events, or is it of persistent nature and thus has long term consequences for rural development in the global South?* A general analysis of the nature of the land rush and its underlying driving forces at the global level is required, in order to understand its potential trajectories and future implications for rural development. Such an analysis is presented in Chapter III.

The national scale of analysis: The particular challenges for rural development, posed by large-scale land deals in practice, ultimately depend on the specific country context. *What are the different visions and realities of rural development and poverty reduction in the involved countries? What are the particular drivers, characteristics and impacts of the land rush on the national and local level?* Empirical case study research is needed to answer such questions. Chapter IV presents case study research from Cambodia in order to illustrate the existence of contrasting visions and realities of rural development at the national and local level. Characteristics, impacts and future consequences of large-scale land deals for the national economy of Cambodia, as well as for the smallholder sector are addressed.

The local scale of analysis: Finally, if the land rush further unfolds, large-scale land deals are likely to instigate a drastic reduction of the amount of land available for present and future small-farmers. Thus, in order to understand potential future pathways of smallholder agriculture at the local level, it is necessary to address the question: *How are small-farmers able to deal with declining access to land? What are the new forms of rural life that may emerge as a response to upcoming alterations in the subsistence economy of small-farmers?* Chapter V

presents insights on this issue from case study research at the village and household level in a rice farmer's village in Kampot province, Cambodia.

With these four research articles, the present dissertation aims to contribute to a better understanding of a variety of contemporary challenges in rural development, relevant to consider within the context of the global land rush. The presented research illustrates the complexity involved in addressing these new challenges due to the existence of multiple dimensions and multiple scales and shows that interdisciplinary approaches are required to better understand the issue. However, the presented research also presents some simple lessons and clear conclusions regarding debates, drivers, characteristics and impacts of large-scale land deals, as well as potential future trajectories of rural systems (Chapter VI).

3 Common conceptual frameworks

Being a compilation of four independently readable research papers, the particular concepts and methods employed are introduced in detail in each article. Nevertheless, the four articles share a common epistemological and conceptual approach, of which the underlying basic ideas are briefly introduced and justified in this section.

3.1 A complexity perspective on rural systems and rural development

This dissertation is largely based on the conceptual framework put forward by Giampietro (2003), which considers rural systems complex in the sense that they cannot be reduced to a single description. Rural systems are understood as irreducible systems, for which many legitimate, but non-equivalent descriptions are possible. This in turn implies that study of these systems should consider the co-existence of multiple identities, dimensions and scales of rural systems, as well as multiple perspectives on rural systems taken by a variety of observers.

This understanding of complexity of rural systems can be well illustrated by considering the existence of different bodies of knowledge, derived from the traditional division of scientific disciplines. For example, the economist may describe a smallholder village in terms of all the monetary flows that enter and exit the village, converting household production and consumption into monetary income and expenditure values. The anthropologist may describe the same village in terms of rituals and time use patterns of the villagers. The ecologist may be interested in biodiversity of the farming systems, without

being concerned about how the farmers live, or on how much money they spend. All these descriptions represent different valid identities of the same system – a smallholder village – whose complexity becomes perceivable through different observers, focusing on a variety of different dimensions of the same system under analysis.

Yet, complexity of rural systems further results from the existence of multiple scales of analysis. In the above example, different processes in the smallholder village may be studied at the village or household level. At the household level, the economist may look at household income and consumption; the anthropologist may look at the daily time use profile of household members; and the ecologist may look at the biodiversity of the corresponding rice plots and the household land. However, at the village level, a variety of other issues of potential interest appear. For example, the economist, may be interested in the governmental subsidies received at the village level; the anthropologist may be interested in how time is used for community meetings and other village activities over the year; and the ecologist may be further interested how biodiversity of local rice plots interacts with forests, rivers, roads and other land uses, available only at the village level. Thus, at each level of observation, *new properties emerge* that can be studied only at the respective scale of analysis (Giampietro, 2003).

Thus, complexity arises from the existence of both multiple dimensions and multiple scales of analysis of rural systems. This has fundamental implications for the assessment of rural systems as well as for rural development studies and efforts. Firstly, a multidimensional perspective is required to get a good understanding of the relevant systems dynamics, particularly, for those aspects where the dimensions are strongly interlinked; for example, where time use in terms of labor is linked to income and consumption, as well as to biodiversity due to different cultivation techniques. Secondly, different challenges in rural development may appear at different scales of analysis. In the above example, the sustainability of rural livelihoods at the household level may depend on the different on- and off-farm tasks of the family members as well as on the assets the household has at its disposal. At the village level, the opportunities of rural communities may further depend on the amount of subsidies received for public infrastructure, such as schools or roads as well as for example on the organization and cooperation of the villagers at the community level. Thus, *emerging properties* at different scales of analysis of rural systems may turn into *emerging challenges* in rural development.

The present dissertation deals with the complexity of rural systems and rural development issues, by providing a series of research articles that point out new challenges in

rural development visible from different perspectives and scales of analysis. The four research articles address qualitative and quantitative, as well as theoretical and empirical issues, at the epistemological (Chapter II), global (Chapter III), national (Chapter IV) and local (Chapter V) level of analysis. Chapter II moreover introduces with detail a complexity perspective into the study of poverty alleviation – the central goal in rural development studies – arguing for the need to account for different development visions, poverty dimensions and scales.

Considering rural development issues to be complex, moreover, poses conceptual and methodological challenges. It requires a coherent, but flexible conceptual framework that can be tailored to various scales of analysis, capable of accounting for the interactions between social and ecological systems. To do so, this dissertation employs the flow-fund framework of Nicholas Georgescu-Roegen (1971), the concept of societal metabolism and the MuSIASEM approach (Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism) (Giampietro and Mayumi, 2000a,b; Giampietro et al., 2009). These concepts are briefly introduced in the following section.

3.2 The flow-fund framework of Nicholas Georgescu-Roegen

Georgescu-Roegen (1971) developed the flow-fund framework to analyze economic production processes. 'Fund' elements refer to the transformative agents that are maintained during a given production process, providing the services required for the process to happen. Typical examples of funds are labor, capital and Ricardian land. Although such fund elements are *used* within an economic process, none of these items are *consumed* in the sense of declining stocks. 'Flows' refer to those elements that are transformed by the funds. Thus, flows either enter into the process but do not exit in the same state (i.e., input-flows), or exit from the process in form of products, without having entered in the same state (i.e., output-flows). The example of agricultural production illustrates the use of the framework well (Georgescu-Roegen, 1976 (1965)). Within an agricultural year, nutrients, solar energy, CO_2 and water enter the production systems as input-flows and exit the production system in a qualitative different state; as food or other agricultural commodities. However, this process is only possible thanks to the presence of funds, in particular labor, land and machinery such as a plough, providing transformative services required for the process to happen. These fund elements are generally maintained during the production process.

In order to define a flow-fund relation, the explicit adoption of analytical boundaries regarding the process to be studied becomes necessary (Farrell and Mayumi, 2009). Thus, the

particular elements considered as fund or flows need to be redefined in accordance with the chosen process and analytical scale. In the previous example, the plough has been the fund element, which is maintained during the production process, in order to provide services. However, looking at the production of ploughs themselves, (thus, another production process with different analytical boundaries), the services of other funds such as other machinery is required and the plough itself turns out to be the output-flow. Thus, only, when the temporal and spatial boundaries of the process under study are identified in a pre-analytical step, it becomes possible to identify the elements that are maintained (the funds) and the elements that enter and exit (the flows) the analytical boundaries. This has the advantage that the flow-fund framework can be used to study systems across various scales of analysis.

While the flow-fund framework was initially developed to analyze differences in *production processes* (Georgescu-Roegen, 1976 (1965)), Giampietro, Mayumi and colleagues further extended it to distinguish between two fundamentally different pre-analytical categories in the study of socio-ecological systems. According to Giampietro et al. (2009): *"(A) Fund coordinates represent the set of attributes used by the analyst for defining* ***what the system is*** *in the chosen representation and (B) flow coordinates represent the set of attributes used by the analyst for defining* ***what the system does****, when interacting with its context. In fact, the flows disappear in the duration covered by the representation. They have to be either (i) 'consumed' or 'generated' by the investigated system and (ii) 'made available by' or 'absorbed by' the context of the system." (Giampietro et al., 2009: 314, emphasis added).*

This has been an important conceptual extension of the flow-fund framework, as it draws the attention not only to *production processes*, but also to the *process of maintenance of funds*, and as such to *consumption processes* within a socio-economic system. For example, the fund of (skilled) 'labor' for the production of flows, such as food, is maintained as such, thanks to the *total human activity* within the system, including regeneration and cultural activities, such as sleeping and eating, household work, leisure and education. To maintain in turn these fund elements, they require the consumption of flows, such as food. For the land fund, the focus can be extended from focusing on land in production, to including also a focus on land for ecological regeneration, recreational use and housing. Thus, depending on the analytical boundaries, funds may be understood not only as transformative agents, required for the production of flows, but also as those elements that consume such flows, in order to be purposively maintained within a given system. Summing up, as pointed out by Farrell and Mayumi (2009), the flow-fund framework may be used as a general framework for the *parameterization of processes* across scales, not necessarily restricted to the production process.

All four research articles of this doctoral dissertation adopt the flow-fund framework, however, in various ways. A more 'conventional' use of the framework can be found in Chapter III, concerned with the distinction of energy carrier production based on stocks versus funds, with a particular focus on the use of the land fund. Chapter IV and V use the flow-fund model within the MuSIASEM approach (see Section 3.3). In these chapters, rural systems are analyzed at different scales, by looking at both production and consumption processes. Finally, Chapter II uses the flow-fund model to discuss the different characteristics of flow and fund elements in the process of creating *capabilities*, in order to live a meaningful life (Sen, 1999). This is generally consistent with the view of Nicholas Georgescu-Roegen that *"the true 'product' of the economic process is not a material flux, but a psychic flux—the enjoyment of life by every member of the population"* (Georgescu-Roegen, 1971: 285). In providing a series of applications of the flow-fund model, the present dissertation further aims to contribute to the study and further development of the work of Nicholas Georgescu-Roegen; one of the intellectual founders of *bioeconomics* and *ecological economics*.

3.3 The concept of societal metabolism and the MuSIASEM approach

In order to take a multidimensional perspective on the impacts of rural change on rural development, it is necessary to address aspects of the concerned social system under study (i.e., social, cultural and economic dimensions of rural systems), as well as aspects of the ecological system under study (i.e., land use dynamics, material and energy uses and the environmental dimension of rural systems). For studying the interactions between social and ecological systems, this dissertation employs the concept of *metabolism of societies*. Within the related literature, both the terms 'social metabolism' (e.g., Fischer-Kowalski, 1997; Martinez-Alier, 2009) as well as 'societal metabolism' (e.g., Giampietro and Mayumi, 2000a,b; Giampietro et al., 2011) may be found. On a general level, both refer to the processes of appropriation, transformation and disposal of materials and energy by societies, in order to maintain their existences. On an operational level, the two terms often refer to alternative sets of approaches, concepts and methods, representing a complementary focus on which aspects of society's metabolism are to be analyzed.

Regarding the 'social metabolism' approach, the most common operationalization can be found in the Material and Energy Flow Accounting (MEFA) methods (e.g., EC, 2001; Fischer-Kowalski et al., 2011). MEFA methods provide a standardized protocol of accounting for a variety of biophysical flows, produced, consumed and transformed by a given society. Thus, it can be said that an important focus in the study of 'social metabolism' is on the

involved *flows* of material and energy. Information regarding the issue of how these flows are *metabolized*, in other words, on the particular compartments of a society that produce, trade and consume such flows, is generally addressed on a 'per capita' and 'per unit of total land area' level. Regarding the concept of 'societal metabolism', related operationalizations are usually based on the MuSIASEM approach (Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism) (Giampietro and Mayumi, 2000a,b; Giampietro et al., 2009). In contrast to MEFA methods, the MuSIASEM approach is not a standardized protocol, but rather consists of an expandable set of concepts, methods and tools that are coherently related to each other, in order to be purposely tailored to the study of various dimensions (thus, to conduct an *integrated analysis*) and various scales (thus, to conduct a *multi-scale analysis*) of different processes of societal metabolism. In particular, the MuSIASEM approach puts a central focus on the underlying elements involved in the production and consumption of a given set of flows. These elements are understood, in line with Georgescu-Roegen's work, as the *fund* elements of socio-ecological systems (see Section 3.2). In doing so, the MuSIASEM approach goes beyond using 'per capita' benchmarks and offers the opportunity to conduct a detailed analysis of how certain flows are metabolized (produced, traded and consumed) by different categories of *human activity,* expressed in terms of hours (e.g., total human activity, productive activities, non-productive activities etc.), and *land use,* expressed in terms of hectares of different types of area (e.g., total available land, land in production, land for ecological regeneration and recreational uses and so on).

This dissertation builds on the concept of societal metabolism and the related MuSIASEM approach, in particular on the application of MuSIASEM for the analysis of rural systems (Giampietro, 2003; Giampietro and Mayumi, 2009; Giampietro and Pastore, 1999; Gomiero and Giampietro, 2001; Grünbühel and Schandl, 2005; Mingorría and Gamboa, 2010; Pastore et al., 1999; Pastore et al., 2000; Ramos-Martin and Giampietro, 2005; Serrano and Giampietro, 2009; Siciliano, 2012). These concepts and tools are used in Chapter III, IV and V for the analysis of society – nature interactions and particularly for the analysis of rural systems. The specific methods and tools, taken from the MuSIASEM approach and used in the research chapters, are introduced in detail in the corresponding chapters. Further, Annex I provides detailed practical information on how field research was designed in order to conduct a MuSIASEM analysis at the local level (i.e., village and household level) of rural systems. Ultimately, in providing a series of new applications, the present dissertation also aims to contribute to a better understanding of societal metabolism of rural systems, as well as to the further development of MuSIASEM itself.

4 Dissertation structure and chapter summary

This doctoral dissertation is a compilation of four scientific papers that are presented as research chapters, embedded in a general introduction and a final chapter with main conclusions. A report on related field research activities in Cambodia, including more detailed background information on the case study, is attached as Annex I. Each paper focuses on new challenges in rural development that appear from different perspectives and at different scales of analysis, and which are relevant to consider within the context of the global land rush. The nature of investigation ranges from both qualitative to quantitative, as well as from theoretical to empirical approaches (see below table 1.1) and draws from the fields of ecological economics, bioeconomics, development studies and integrated assessment.

The research chapters are presented in a paper-like format, whose content is equivalent with the published or submitted research articles. At the time of writing, the first two chapters were published, the third was in press and the fourth submitted for consideration for publication in international peer-reviewed, scientific journals. Being a compilation of stand-alone papers, the four research chapters are independently readable. For this reason, a minimum degree of redundancy between the research chapters regarding conceptual framework and background information has been unavoidable. However, I hope that this may also help the reader to keep track on the key concerns and concepts addressed in each chapter, while reading the dissertation as a whole. The following paragraphs give an overview of the dissertation structure, by summarizing the four research chapters and how they are interlinked.

The first article, presented in Chapter II, addresses the epistemological challenge related to the efforts of studying *multidimensional* poverty. Poverty alleviation always has been at the center of rural development thinking (Ellis and Biggs, 2001). However, acknowledging that poverty is multidimensional, poses serious challenges to rural development efforts, as it requires dealing with the questions of what poverty dimensions should be targeted for alleviation and which are the respective development visions in place? The article deals with these questions, by taking a complexity perspective on deprivation. Based on Georgescu-Roegen's distinction between flow and fund elements, the characteristics of different types of poverty reduction are discussed within the light of Amartya Sen's capability approach (Sen, 1999). Further, a distinction between 'weak' and 'strong' poverty reduction is developed, based on the idea that improvements in one poverty dimensions cannot necessarily compensate for the deterioration of other poverty dimensions. Important implications for development efforts are derived from an ecological economics perspective.

Although the paper does not explicitly refer to the global land rush, the presented discussion matters a great deal to the controversial debates surrounding the land rush, as large-scale land deals may help alleviating some dimensions of rural poverty, while jeopardizing others. The article further provides theoretical evidence for the importance of increasing access to 'funds' – such as productive land – for the creation of capabilities. The focus on the importance of access to land for rural livelihoods is maintained throughout the other research chapters and plays a central role in the subsequent discussions. This article has been published in 2013 in the journal *Ecological Economics* (Elsevier).

The second article, presented in Chapter III, addresses the emergence of the land rush at the global scale of analysis. The paper aims to understand, whether the land rush has only been an ephemeral reaction to the global food and financial crisis in 2008 (GRAIN, 2008; von Braun and Meinzen-Dick, 2009), or whether it will be persistent, bearing long-term consequences for rural development. To do so, the paper takes a biophysical perspective and investigates how declining fossil energy stocks and a global transition towards renewable energies ultimately drive the land rush. The article addresses in both qualitative and quantitative terms, how a transition from a global energy system based on fossil stocks to an energy system based on renewables, such as biofuels, is drastically boosting societal demand for land resources. This drives the land rush directly, through the acquisition of land resources for the expansion of energy systems. However, it also drives the land rush indirectly, through rising food security threats, motivated by an increasing competition over farmland uses and changes in crop supply. Given the inevitability of the energy transition, it is argued that the land rush will be a persistent consequence for the 21st century. Hence, competition between different actors over potential land uses may increase in the future and thus may substantially jeopardize poverty alleviation targeted at assuring access to land for small-farmers; an issue discussed on a theoretical level in Chapter II and on an empirical level in Chapter IV and V. This article was published in 2012 in the journal *Global Environmental Change* (Elsevier).

The third article, presented in Chapter IV, focuses on new rural development challenges that appear at the national scale of analysis. It presents a case study on Cambodia, illustrating how both conflicting visions of development and poverty alleviation (as discussed in Chapter II) and the recent global trend of land grabbing (as discussed in Chapter III) may unfold in life practice. The article discusses contrasting pathways of rural development in Cambodia, by analyzing the impacts and constraints of different visions and realities of land use. On the one side, there is the aim of the governmental elites to foster surplus-producing rural areas for overall economic growth, employment creation and ultimately poverty

reduction through overall national development. On the other side, there are the attempts of smallholders to maintain and create livelihoods, based on access to land in order to achieve self-sufficiency. The article argues that, if the Cambodian Government manages turning the land reserved for economic land concessions into viable agribusinesses, added value creation and increased trade and tax flows may be achieved at the national level. However, the article shows also that large-scale land deals do not have the potential to substantially alleviate poverty at the local level, based on new employment opportunities in rural areas. On the contrary, they have high opportunity costs in terms of poverty reduction, based on smallholder land uses and access to land. In relation to Chapter II, this can be understood as an example of 'weak poverty alleviation', in which improvements in one poverty dimension (e.g., increasing state revenues at the national level) may jeopardize other poverty dimensions (e.g., increasing land poverty at the household level). The paper has been accepted for publication in April 2013 in the journal of *Land Use Policy* (Elsevier) and is currently in press.

The fourth and last article, presented in Chapter V, focuses on new challenges in rural development that are appearing at the local scale of analysis. Within the context of land grabbing and rural change in Cambodia (as discussed in Chapter IV), the paper analyzes at the household and village level, how small-farmers are able to deal with declining access to land; an issue that may be of increasing global importance for rural development (see Chapter III). Based on case study research in a small-farmers village in Kampot province, Cambodia, the paper shows, how access to productive 'funds' is crucial for lasting poverty alleviation (an issue discussed on a theoretical level in Chapter II). It further addresses how 'land poverty' is unavoidably driving the emergence of new ruralities, in terms of new economic activities and institutional arrangements. It is illustrated in quantitative terms, how land shortage is leading to declining surplus production and problems of liquidity in both monetary and non-monetary flows. The emergences of new forms of rural livelihoods are discussed, which may be seen as responses to the new threats that declining land availability poses to the subsistence economy of small-farmers. This paper has been submitted for consideration for publication in the journal *Environment, Development and Sustainability* (Springer). The paper is submitted as part of a forthcoming special issue, entitled *"Pathways of rural change: An integrated analysis of the metabolic pattern of emerging ruralities"* (see Annex II).

Chapter VI draws general conclusions, based on the four research chapters previously presented. Contributions of this doctoral dissertation to different scientific disciplines are presented, as well as a summary of the lessons learned regarding the new debates in rural development that have emerged within the context of global land grabbing. Future areas of

research are outlined regarding the field of multidimensional poverty analysis, as well as regarding the issue of global rural change and the emergence of new ruralities.

Finally, Annex I provides a report containing a summary of the field research design and field research activities, on which basis Chapter V was elaborated. Moreover, detailed background information on Cambodia and the case study village in Kampot province is provided. Last, but not least, the report discusses aspects of the methodological challenge that someone – particularly Ph.D. candidates – may face when conducting field work for rural system analysis at the local level, within the context of the MuSIASEM approach. This report has been published in 2013 as *Technical Report on Environmental Sciences*; a working paper series, published by the Institute of Environmental Science and Technology (ICTA), Autonomous University of Barcelona, Spain. Annex II provides an overview of all other academic achievements obtained during the Ph.D. project. Annex III presents my Curriculum Vitae.

Table 1. 1: An overview of the dissertation structure and their research chapters

Research chapter	**Article title**	**Focal scale/ dimension**	**Emerging issues in rural development**	**Nature of investigation**	**Scope of research**	**Academic outlet**	**Current status (April 2013)**
II	*Flows, funds and the complexity of deprivation: Using concepts from ecological economics for the study of poverty*	Epistemological	*What are the different understandings and dimensions of poverty alleviation and their implications for development efforts?*	Theoretical	General	Journal of: *Ecological Economics (Elsevier)*	Published (2013)
III	*Energy transitions and the global land rush: Ultimate drivers and persistent consequences*	Global	*What are the underlying drivers of the global land rush, its potential trajectories and its implications for global rural development?*	Theoretical/ Empirical	General	Journal of: *Global Environmental Change (Elsevier)*	Published (2012)
IV	*Self-sufficiency or surplus: Conflicting local and national development goals in Cambodia*	National	*What are the impacts of large-scale land deals at the country level and how are they related to different visions and realities of rural development?*	Empirical	Case study	Journal of: *Land Use Policy (Elsevier)*	In press (accepted for print in April 2013)
V	*Land poverty and emerging ruralities in Cambodia: Insights from Kampot province*	Local	*How are small-farmers able to deal with declining access to land? What are the new forms of rural life that may emerge as a response?*	Empirical	Case study	Journal of: *Environment, Development and Sustainability (Springer)*	Submitted - under revision (accepted as part of a special issue)
Annex I	*From MuSIASEM theory to praxis: Report and reflections from field research in Kampot province, Cambodia*	Methodological	*How to design field work for conducting a MuSIASEM analysis at the local level of rural systems?*	Report	Methods	*Technical Reports on Environmental Sciences (ICTA Working paper)*	Published (2013)

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CHAPTER II

THE EPISTEMOLOGICAL CHALLENGE

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Methodological and Ideological Options

Flows, funds and the complexity of deprivation: Using concepts from ecological economics for the study of poverty

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Capability approach

ABSTRACT

Poverty has been increasingly conceptualized as being multidimensional, involving deprivation in many dimensions of life. This paper discusses issues and implications of multidimensional poverty by adopting concepts commonly used in ecological economics. In particular, poverty is approached as an irreducible, complex phenomenon for which many legitimate, but non-equivalent descriptions exist. Issues of social and technical incommensurability are illustrated for different meanings and measurement types of poverty. Georgescu-Roegen's flow–fund framework is interpreted, informed by the capability approach of Amartya Sen. The paper argues that a predominant focus on flows as a proxy to analyze poverty represents rather a short-term perspective on access to satisfiers to fulfill particular needs. Contrary to that, focusing on valued funds may provide useful information for the analysis of capabilities that persons and societies might pursue in the long term. Furthermore, it is argued that strong poverty alleviation needs to adopt analytical tools that can deal with non-trade-off cases: improvements in one poverty dimension cannot always compensate for the deterioration of other poverties. This implies to rethink the usefulness of aggregate multidimensional poverty indices, as well as the predominant use of income measures.

1. Introduction

During the last century, the understanding of poverty has experienced profound changes. While decades ago, poverty was mainly conceptualized from a conventional economics perspective, based on income measures such as dollars-a-day, currently a variety of different approaches to poverty exist (Laderchi et al., 2003) as well as multidimensional poverty concepts, such as offered by the capability approach of Amartya Sen (1999b). Multidimensional poverty concepts acknowledge that poverty does not only involve deprivation in the economic dimension, but rather that poverty consists of deprivations in a variety of dimensions, such as health, education, living a meaningful live and others. This shift in the conceptualization of poverty has been related with a subsequent involvement of a variety of scientific disciplines for the study of poverty.[1]

Within ecological economics, poverty has been mainly studied in relation to the environmental dimension and resource use issues (e.g., Goodland and Daly, 1993; Martinez-Alier, 2002; Moseley, 2001; Narain et al., 2008), but some contributions also explicitly address the multidimensional aspects of poverty. Examples are Cohen and Sullivan's (2010) toolkit for the evaluation of the multiple dimension of poverty in relation to water use, or Max-Neef et al. (1989) theory of fundamental human needs, which underlines the necessity to deal with different 'poverties', rather than just with poverty.

In this paper, I aim to further integrate on a conceptual level the notion of multidimensional poverty – as largely discussed within development studies – into an ecological economics framework. To do so, I particularly aim to bridge different concepts from both development studies and ecological economics in order to connect both fields of study as well as to address further implications for research and policy. To do so, the paper discusses some poverty concepts from development studies with the following four theoretical frameworks commonly used in ecological economics:

First, the paper uses a complexity perspective (Giampietro, 2003) to approach the notion of multidimensionality. Poverty is conceptualized as complex phenomenon for which various legitimate but non-equivalent descriptions are possible. Such an approach shifts the emphasis from the need to find a universally agreed definition of poverty to rather finding an adequate definition regarding a certain social group and context.

Second, the paper addresses issues of incommensurability (Martinez-Alier et al., 1998) of different poverty concepts. Incommensurability means that there is no common measure. The paper argues

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[1] It is necessary to mention that while the shift from a one-dimensional monetary poverty concept to a multidimensional approach has been successfully made in theory and the study of poverty; monetary income measures still dominate development practice. See Sumner (2007) for a discussion on this issue.

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Flows, funds and the complexity of deprivation: Using concepts from ecological economics for the study of poverty

Abstract

Poverty has been increasingly conceptualized as being multidimensional, involving deprivation in many dimensions of life. This chapter discusses issues and implications of multidimensional poverty by adopting concepts commonly used in ecological economics. In particular, poverty is approached as an irreducible, complex phenomenon for which many legitimate, but non-equivalent descriptions exist. Issues of social and technical incommensurability are illustrated for different meanings and measurement types of poverty. Georgescu-Roegen's flow/fund framework is interpreted, informed by the capability approach of Amartya Sen. The paper argues that a predominant focus on flows as a proxy to analyze poverty represents rather a short-term perspective on access to satisfiers to fulfill particular needs. Contrary to that, focusing on valued funds may provide useful information for the analysis of capabilities that persons and societies might pursue in the long term. Furthermore, it is argued that strong poverty alleviation needs to adopt analytical tools that can deal with non-trade-off cases: improvements in one poverty dimension cannot always compensate for the deterioration of other poverties. This implies to rethink the usefulness of aggregate multidimensional poverty indices, as well as the predominant use of income measures.

Keywords

Multidimensional poverty; complexity; incommensurability; flow-fund framework; capability approach;

JEL Classifications

I 32; R11; R14; Q18

1 Introduction

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Within ecological economics, poverty has been mainly studied in relation to the environmental dimension and resource use issues (e.g., Goodland and Daly, 1993; Martinez-Alier, 2002; Moseley, 2001; Narain et al., 2008), but some contributions also explicitly address the multidimensional aspects of poverty. Examples are Cohen and Sullivan's (2010) toolkit for the evaluation of the multiple dimension of poverty in relation to water use, or Max-Neef's (1989) theory of fundamental human needs, which underlines the necessity to deal with different 'poverties', rather than just with poverty.

In this paper, I aim to further integrate on a conceptual level the notion of multidimensional poverty – as largely discussed within development studies – into an ecological economics framework. To do so, I particularly aim to bridge different concepts from both development studies and ecological economics in order to connect both fields of study as well as to address further implications for research and policy. To do so, the paper discusses some poverty concepts from development studies with the following four theoretical frameworks commonly used in ecological economics:

First, the paper uses a complexity perspective (Giampietro, 2003) to approach the notion of multidimensionality. Poverty is conceptualized as complex phenomenon for which various legitimate but non-equivalent descriptions are possible. Such an approach shifts the emphasis from the need to find a universally agreed definition of poverty to rather finding an adequate definition regarding a certain social group and context.

[2] It is necessary to mention that while the shift from a one-dimensional monetary poverty concept to a multidimensional approach has been successfully made in theory and the study of poverty; monetary income measures still dominate development practice. See Sumner (2007) for a discussion on this issue.

Second, the paper addresses issues of incommensurability (Martinez-Alier et al., 1998) of different poverty concepts. Incommensurability means that there is no common measure. The paper argues that the study of poverty has to deal with incommensurability of different meanings as well as of different types of measurements of poverty.

Third, the different implications of analyzing poverty in terms of access to flows versus access to assets that allow for the production of flows (Carter and Barrett, 2006) are discussed in relation to the flow-fund framework of Georgescu-Roegen (1971). The paper then provides a further interpretation of the flow-fund framework in the light of Sen's (1999b) capability approach and arguments are presented for why the analysis of capabilities needs to focus on funds rather than on flows.

Finally, some reflections on how to integrate the many dimensions and measures of poverty within assessment approaches are presented. In an analogy to the debate of weak and strong sustainability (Daly, 1990), aspects of weak and strong poverty alleviation are discussed. The paper argues that 'strong poverty alleviation' efforts need to adopt analytical tools that can deal with non-trade-off cases: improvements in one poverty dimension cannot always compensate for the deterioration of other poverties. For example, an increase in living standards, such as buying a new TV, cannot necessarily compensate for the deteriorations in health, such as the loss of a child. Furthermore, an increase in income cannot necessarily substitute for the deterioration of the underlying factors that allow producing income as well as the creation of capabilities in the long-term.

The paper is organized as follows: Section 2 introduces the conceptual approach to poverty taken in this paper and distinguishes between meaning and measurement of poverty. Section 3 then reviews different meanings of poverty, while Section 4 discusses the characteristics of different types of poverty measures. Section 5 discusses issues of weak and strong poverty alleviation, and Section 6 concludes with some general implications for the study of poverty.

2 Complexity and incommensurability: Conceptual tools to approach the many notions of poverty

The conceptualization of poverty has seen substantial shifts within the last century and currently various different definitions exist rather than a universally agreed upon concept. Studies that compare different poverty concepts show that the response to the question of 'who is poor' differs substantially in relation to the various poverty concepts associated with

the question of 'poor in what' (Caizhen, 2010; Havemann and Wolff, 2005; Laderchi et al., 2003; Rojas, 2008). Thus, the co-existence of different concepts evidently matters to the study of poverty. In order to deal from an epistemological point of view with such conflicting poverty definitions*, the main assumption and approach of this article, is, that poverty needs to be considered as a complex phenomenon.* A phenomenon is complex when it cannot be reduced to a single description, but rather various legitimate, but non-equivalent definitions are possible (Giampietro, 2003).

Somebody can be understood as poor if he/she has passed a certain threshold of deprivation. Thus, in order to analyze poverty, two elements are indispensable: a particular understanding of deprivation and a formal procedure to indicate if somebody is deprived. This includes setting a threshold, the poverty line, for classifying the poor and the non-poor. Different poverty concepts hence can be discussed by looking at these two different but closely related parts: (i) the meaning, and (ii) the measurement of poverty (Sumner, 2007).

Acknowledging that poverty is complex and multidimensional, however, implies that the study of poverty needs to deal with multiple meanings and measurements that are not necessarily comparable, nor commensurable. *Incommensurability* means that there is no common measure (Martinez-Alier et al., 1998). Munda (2004) further distinguishes between social and technical incommensurability. We encounter *social incommensurability* when, within a society, a multiplicity of legitimate values exists towards a certain issue. As illustrated presently, this is the case for the existence of different meanings of poverty. *Technical incommensurability* refers to the existence of multiple formal descriptions of a phenomenon that cannot be represented on the same measurement scale. For example, income in monetary units is not commensurable with life expectancy values. This requires particular attention when trying to integrate different types of poverty measurements that aim to represent different poverty dimensions. Based on this complexity perspective to poverty and the distinction between meaning and measurement types, the following sections will illustrate issues of incommensurability and discuss some implications for research and policy.

3 Defining the meaning of poverty: Understanding deprivation as a complex phenomenon

Defining the meaning of poverty has always been a challenging task. Some poverty concepts are reviewed in this section with the objective to point out the plurality of legitimate perceptions towards poverty. Figure 2.1 illustrates a selection of historical and current

concepts, which are outlined below in the indicated subsections (3.1 – 3.5). The drawn eyes symbolize the different perspectives on deprivation under which the meaning of poverty has been defined.

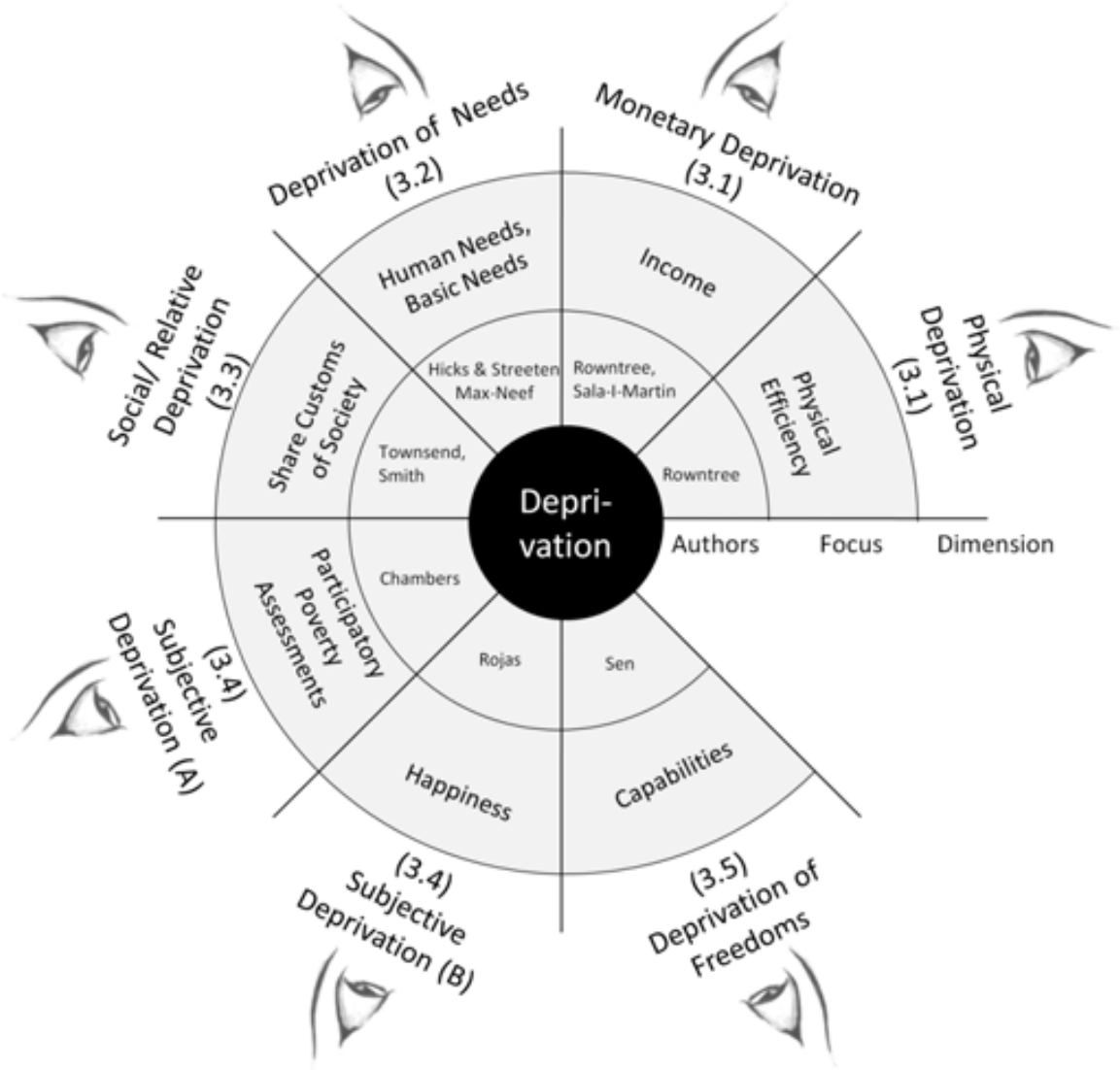

Figure 2. 1: Defining the meaning of poverty – a selection of different perspectives on deprivation. Source: Own elaboration, based on Rowntree (2000 (1901)), Sala-I-Martin (2006), Hicks and Streeten (1979), Max-Neef (1989), Townsend (1979), Smith (2007 (1776)), Chambers (1994, 1995), Rojas (2008), Sen (1999b).

3.1 Physical and monetary deprivation

Seebohm Rowntree's (2000 (1901)) work on poverty in York, was among the most influential for modern poverty studies. He defined families as being primary poor when their *"total earnings are insufficient to obtain the minimum necessaries for the maintenance of merely physical efficiency"* (Rowntree, 2000 (1901): 86). The poverty line was set as subsistence

standard in relation to physical needs. For calculation, Rowntree translated estimations of children' and adults nutritional needs into food quantities and related cash equivalence, and added, in relation to the household size, small sums for basic goods necessary to achieve physical well-being such as clothes and fuel. While the meaning of poverty in Rowntree's understanding reflects a *physical deprivation* perspective focused on the working class, poverty measurement was done in monetary terms. The choice of a monetary indicator hence was a means for articulating a semantically defined poverty analysis (i.e., poverty as physical inefficiency) in a cash economy, in which access to food and other basic needs was achieved through money. However, if monetary income itself is what matters, monetary assessments become an end rather than a means. In fact, the dominant discussions around economic growth and GDP in development discourses seem to have constituted *monetary deprivation* as a meaning of poverty on its own.

3.2 Deprivation of needs

Rowntree's understanding of poverty as physical deprivation can be seen as an early precursor to the more comprehensive poverty concepts that focus on the *deprivation of needs.* On a theoretical level, needs, in contrasts to wants, have been defined as universal goals of humans beings (Doyal and Gough, 1984), which are finite, few and classifiable (Max-Neef et al., 1989). Basic needs concepts in practice (Hicks and Streeten, 1979) usually have put attention on the goals of nutrition, health, shelter, and education, and poverty based on a deprivation of basic needs perspective expresses itself in their insufficient satisfaction. While this covers mainly physical needs (plus education), Max-Neef's (1989) theory of fundamental human needs further includes non-physical needs, i.e., subsistence, protection, affection, understanding, participation, idleness, creation, identity and freedom. He further draws the distinction between needs and their satisfiers, arguing that needs (e.g., physical health) are the same for all cultures, while the satisfiers (e.g., type of food) are those that change over place and time. In emphasizing the necessity to analyze the fulfillment of different needs independently, Max-Neef accounts for the incommensurability of different poverty dimension. The analysis of poverty under a deprivation of fundamental human needs perspective, thus, turns into an analysis of various 'poverties'.

3.3 Social and relative deprivation

The above-described concepts claim to have an absolute nature. They assume that independently definable needs exist, which are valid over time and space, whereas not meeting these needs translates into absolute poverty. Relative poverty approaches differ from this and emphasize the relational character of deprivation. As already pointed out by Adam Smith: *"By necessaries I understand, not only the commodities which are indispensibly necessary for the support of life, but whatever the custom of the country renders it indecent for creditable people, even of the lowest order, to be without."* (Smith, 2007 (1776): 556). Written in 1776, Smith's example for illustration was the need to own a white linen shirt. Though it was not a necessity for staying alive, it was an important trait for not being classified by society as extremely poor. This understanding of poverty of being unable to share the customs of a society can be described as *social deprivation*, which was further developed, mainly in Townsend's (1979) concept of *relative deprivation.* Townsend defined a group of people as poor: *"when they lack the resources to obtain the types of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or approved, in the society to which they belong"* (Townsend, 1979: 33). Related indicators commonly rely on monetary proxies, however an important characteristic is that relative poverty lines are employed, set as percentages of the analyzed population group.

3.4 Participatory poverty assessments and subjective deprivation

Both absolute and relative poverty concepts claim to be objective reflections on poverty (Doyal and Gough, 1984; Townsend, 1979). Participatory Poverty Assessments (PPAs) and subjective well-being approaches differ to that by emphasizing the subjective nature of poverty. PPAs, developed in the 1990s, are based on the idea that the meaning of poverty (as well as related measurements) has to be defined by the analyzed groups themselves in order to understand what constitutes poverty within a specific reality (Chambers, 1994, 1995; Norton et al., 2001). Thus, they can be described as aiming to capture subjective poverty experiences, hence a perception of *subjective deprivation*. Another subjective approach is the concept of experienced poverty (Rojas, 2008). It is based on a life-satisfaction and happiness conception of well-being, in which somebody is poor if he/she is unsatisfied with his/her life. In such a subjective well-being approach, poverty can be understood as a type of socio-psychological deprivation, in which only the subjects of analysis themselves have the authority to evaluate their well-being.

3.5 Deprivation of freedoms

Amartya Sen introduced a new line of thinking into the discourse, by conceptualizing poverty *"as the deprivation of basic capabilities rather than merely as lowness of income"* (Sen, 1999b: 87). Capabilities refer to a person's real opportunities to achieve a set of 'functionings', which are understood as *"things a person may value doing or being"* (Sen, 1999b: 75). Examples for functionings in terms of 'beings' are being well nourished, being educated or being part of a society. Functionings in terms of 'doings' refer to activities, such as for example eating adequate food, studying, or participating in social life. To enhance capabilities, hence, means to increase the freedoms to live a valued and meaningful life. Poverty then in turn refers to a condition of *deprivation of freedoms.*

In order to formalize poverty in terms of deprived freedoms into measurable categories, several authors attempted to define basic capabilities (Alkire, 2002; Nussbaum, 2000). Among these are living a full life without a premature end, favorable health conditions, access to education, being able to have emotions to others, and control over political and material environment (Nussbaum, 2000: 78ff). While basic capabilities offer thus a broad and multidimensional framework for the study of poverty, they have the advantage to directly focus on ends rather than on means of development (Sen, 1999a). Moreover, a capability approach to poverty is to a great extent semantically open in that sense that the specific functionings that are considered as relevant need to be defined within each particular context.

3.6 Section summary

This section has illustrated a variety of poverty meanings that, although addressing the same phenomenon of poverty, differ fundamentally. Evidently, there is some common ground, such as that physical efficiency is part of fulfilling basic needs, which in turn is a precondition of capabilities and freedoms, of relative well-being and in most cases of happiness. However, under certain circumstances, poverty meanings can result even to be contradictory. The ascetic, being deprived relatively, may experience happiness and life-satisfaction through physical inefficiency. Slaves in the Southern United States were unsatisfied with their live and ran away due to deprived freedoms although in terms of life expectancy and commodity baskets (and hence in terms of basic needs fulfillment), they were better off than free agricultural workers (Fogel and Engerman, 1974, cited in Sen, 1999b: 28).

As shown in this section, the differences between the meanings of poverty become further evident in relation to their focus on (i) physical needs vs. non-physical needs, (ii)

absolute vs. relative conceptualizations, (iii) objective vs. subjective poverty evaluation, and (iv) means vs. ends of development. Within the light of the many possible and legitimate notions of deprivation that have been articulated by development experts as well as by the poor themselves, poverty becomes well understandable as an irreducible, complex phenomenon that requires a multidimensional approach to deal with.

Given the differences in perspectives and social values attached to the phenomenon, the study of poverty has to deal with social incommensurability. In particular, in situations, in which science aims to inform development policies, it becomes necessary to expose the involved values for a participatory negotiation of preferences of what type of poverty is aimed to be reduced. Hence, rather than trying to find a universally agreed definition of poverty, it becomes relevant to find the adequate perception of poverty within a certain social group and context. Asking consequently 'poor in what?' and 'who is legitimate to simplify the complexity of poverty?' may be useful reflective questions for such an effort.

4 Poverty measurements: Which types of proxies are useful to analyze different poverty dimensions?

The analysis of a specific meaning of poverty requires a formal representation of the phenomenon; in other words a measurement procedure. Evidently, also a plurality of different measurement procedures exists that adopt different types of proxies to represent poverty. In order to discuss some characteristics and implications of different measurement types, this section draws on two distinctions of how poverty has been represented. First, in monetary terms vs. non-monetary terms (Sumner, 2007) and second, in consumption terms (i.e., income, expenditure and non-monetary consumption) vs. access to the underlying factors (i.e., assets) that enable production, income and consumption (Bebbington, 1999; Carter and Barrett, 2006).

The first distinction between *monetary- vs. non-monetary* types of poverty measures is straightforward. Monetary indicators represent poverty using monetary proxies, such as expenditure, dollars-a-day, or absolute and relative income. Non-monetary indicators represent poverty using all other types of proxies. This distinction is an important reflection of the shift from conceptualizing poverty only in economic terms (as it was done predominantly until the 1990s) to the current multidimensional approaches that involves a variety of disciplines (Sumner, 2007). I will come back to this distinction in more detail in Section 4.3 and 5. The second distinction between production, income and consumption

categories vs. underlying factors that enable production, income and consumption has been expressed as the distinction between *flow variables vs. productive assets stocks,* such as physical, natural, financial, social and human assets, that enable producing flow variables (Bebbington, 1999; Carter and Barrett, 2006). Within an ecological economics approach to poverty, this second distinction can be related to Georgescu-Roegen's distinction of flows vs. funds[3].

4.1 The flow-fund framework of Georgescu-Roegen

Georgescu-Roegen (1971) proposed the flow-fund framework to analyze the economic process. With fund elements, he referred to the *transformative agents that are maintained* during a given process, such as labor power, capital and Ricardian land. Hence, funds provide the services required for a process to happen, but since they are merely *used*, rather than *consumed*, they enter and exit the process in the same form. Flows, in relation to funds, refer to those *elements that are transformed* by the funds. Thus, flows either enter into the process but do not exit in the same state (i.e., any input-flows for economic production), or exit from the process in form of products, without having entered in the same state (i.e., any output-flows such as goods and commodities). In order to define a flow-fund relation, the explicit adoption of analytical boundaries becomes necessary. Only once the system boundaries are defined, it becomes possible to identify the elements that are maintained, and the elements that enter and exit the system.

While the flow-fund framework was mainly used to describe the economic production process, Giampietro and Mayumi (Giampietro et al., 2009; Giampietro et al., 2011) applied it further to describe consumption and distribution processes in terms of flows necessary to maintain the identity of a socio-economic system in terms of funds. For example, instead of focusing only on labor time as fund, Giampietro and Mayumi refer to total human activity, including regeneration and cultural activities such as sleeping, household work, leisure and education. In relation to the land fund, they focus not only on land in production, but also on land not in production but needed for ecological regeneration or recreational uses. Thus, depending on the analytical boundaries, funds are not only productive assets that produce flows for consumption and commodities for trade, but also those elements that consume such flows in order to be purposively maintained within the economy, be it a household or nation.

[3] It should be noted that there are also some analytical differences between the flow/asset stock and the flow/fund framework, which are related to the differences of stocks and funds. For a discussion see Georgescu-Roegen, 1971: 211ff)

Regarding the study of poverty, the flow-fund framework can provide a useful analytical basis to discuss a variety of different aspects of poverty. Firstly, it may provide different perspectives on the scale of analysis that is adopted. Funds and flows required to alleviate poverty within a household differ from those required at the national level. For example, a household may require control over the fund land in terms of productive land, such as for agricultural uses. Yet, a national economy also requires having unproductive land for ecological regeneration, environmental health and cultural recreation (Giampietro, 2003). While the technological capacity of a household may be influenced by the fact if the household owns tools such as a plough (thus, the fund at this level of analysis), the technological capacity of a nation may depend on if the nation has the funds to produce such tools (thus, the flows at this level of analysis). Currently, poverty is mainly evaluated at the household level and aggregated poverty headcounts do not account for the requirements at higher societal scales. Multi-scale poverty analysis that accounts for the emerging properties of each scale has yet to come, but the flow-fund framework may be a useful tool for such an analysis as it requires rethinking the flow and fund elements necessary for poverty alleviation at different levels of analysis.

Secondly, a focus on attributes of flows addresses fundamentally different dimensions of poverty than a focus on attributes of funds. Following Carter and Barret (2006), a focus on access to funds can help to identify whether a household is structurally poor because it does not hold any productive assets that allow for the production of income over a certain poverty line, or merely temporarily poor, because it holds productive assets, but income production failed only temporary. Yet, it is important to see that funds are not only crucial for the production of commodities and related income. As stated by Georgescu-Roegen, *"the true 'product' of the economic process is not a material flux, but a psychic flux – the enjoyment of life by every member of the population"* (Georgescu-Roegen, 1971: 285). As argued in the next subsection funds have an important role for the creation of capabilities.

4.2 Flows, funds, and the capability approach

In order to evaluate poverty, Sen has particularly pointed out the need to focus on ends rather than on means, because of various reasons (Sen, 1999a, b). Firstly, the specific set of functionings in terms of meaningful 'beings' and 'doings' may differ largely between individual persons and cultures. Hence, a context-dependent definition of what is desirable to be maintained or achieved (in terms of ends) is needed first. Only then, it becomes possible to focus on the particular means necessary to achieve these ends. Secondly, the transformation

of certain means such as commodities into capabilities strongly varies depending on the individual and environmental context. For example, heterogeneity of personal status (e.g., illness, age, or gender), environmental diversities (e.g., temperature ranges and heating), social context (e.g., crime rates, public education), and distribution within the household are important factors of influence (Sen, 1999b: 70). For these reasons, Sen has argued to focus directly on ends in terms of capabilities rather than on underlying means, such as commodities (Sen, 1999a).

However, someone could argue that functionings, such as being literate, do not entirely focus on ends, since a person may want to have them to do other specific things, such as reading a newspaper, or understanding a contract (Robeyns, 2011). Regarding this issue, Sen distinguishes between *direct reasons* to value functionings, such as increasing the personal well-being through being literate, healthy and well nourished, and *indirect reasons*, such as being able to increase economic production or allow for other activities thanks to the services that functionings provide (Sen, 1997). The important issue here is that functionings, valued for either direct or indirect reasons, increase the general capabilities of a person or group of people.

Regarding this discussion of means and ends of development, the point I aim to make presently is, that the assessment of capabilities as direct and indirect ends, needs to integrate a focus on funds rather than on flows as proxies for analysis. The reasons of why a focus on flows is not adequate to address capabilities directly follow from the above arguments from Sen. Flows represent important satisfiers, such as food, clean water, clothes or other goods and commodities. As argued by Sen, the way they are converted into particular functionings depends largely on transformation factors that follow from the varying individual and environmental context. Yet, moreover it can be argued, that a focus on flows represents rather a short-term perspective, since no information is given on the issue of how the flows are generated. In other words, such a focus does not address the basis upon which funds are involved in the production of these flows. For example, the focus on food intake in terms of kcal/cap in order to evaluate if a child is well nourished does not inform about the source and sustainability of this food flow and therefore does not address the possible causes of why this food flow may be absent. Thus, the usefulness of flows as proxy to assess poverty is largely restricted to a short-term perspective on particular satisfiers.

The analysis of capabilities requires a different focus to that on flows, capable of capturing the indirect and direct reasons to value functionings. A focus on funds can provide a useful basis for such an analysis. Firstly, funds – in comparison to flows – do not represent

satisfiers to fulfill particular needs of persons and societies, but rather refer to a set of constantly available resources that provide transformative services for the people who access them. As commonly discussed in ecological economics when addressing poverty, such funds are the ecological systems in which persons, household and societies are embedded. Other funds consist of healthy labor power, technology and knowledge that produce the capacity to do certain things. In a broader view, also existing social institutions may be considered as funds (Farrell and Mayumi, 2009), allowing for the creation of identity, participation and decision-making within a society. Funds in the economic process have thus a crucial role not only in producing commodities but also in increasing a society's ability to carry out entirely new series of actions. As Georgescu-Roegen stated: *"the essence of development consists of the organizational and flexible power to produce new processes rather than commodities."* (Georgescu-Roegen, 1971; 275). Thus, building and preserving valued funds may significantly increase the general capabilities of a person, household or society. This notion of funds as transformative agents that provide important services and the ability to create new processes for those who access them relates to what Sen (1997) termed the indirect reasons for valuing functionings.

With regard to the direct reasons, it is important to understand funds not only as transformative agents that provide services, but moreover, as important element of the identity of a person or society[4]. As mentioned previously, a healthy body, patterns of labor use, leisure and general time use, land uses, technology and knowledge, and social institutions are to some extent direct reflections and outcomes of what persons and societies have considered valuable to achieve and maintain. Functionings in terms of valued 'beings' may refer directly to some characteristics of funds, such as for example being healthy (referring to the population fund), being member of a certain guild (referring to the labor fund invested into a professional activity), or being part of a society (referring to the fund of social institutions). Functionings in terms of valued 'doings' may further point to the services that are created by the funds, such as living a healthy life, engaging in professional work and well as in leisure and cultural activities, or participating in social life. Deciding on which type of funds to build and to preserve, hence, means to decide on which type of life a person, household or society might want to pursue.

[4] For some discussion on this dual function of resources as means and providing meaning see Sen's (1997) essay on human capital and human capability as well as Bebbington (1999).

4.3 A typology of poverty measures

Based on the two distinctions of poverty measures focusing on monetary vs. non-monetary attributes and poverty measures focusing on attributes of flows vs. attributes of funds, we can identify a general typology of poverty measures that consists of four different types: Measurement procedures that generally focus on attributes of (I) monetary flows, (II) non-monetary flows, (III) non-monetary funds, and (IV) monetary funds (figure 2.2). Recall from Section 2, that different poverty measures are ultimately used to discuss different poverty meanings. As summarized below with particular attention to the difference of type I and type III, the inherent characteristics of the different types of poverty measures restrict their potential use to represent different meanings of poverty within different contexts.

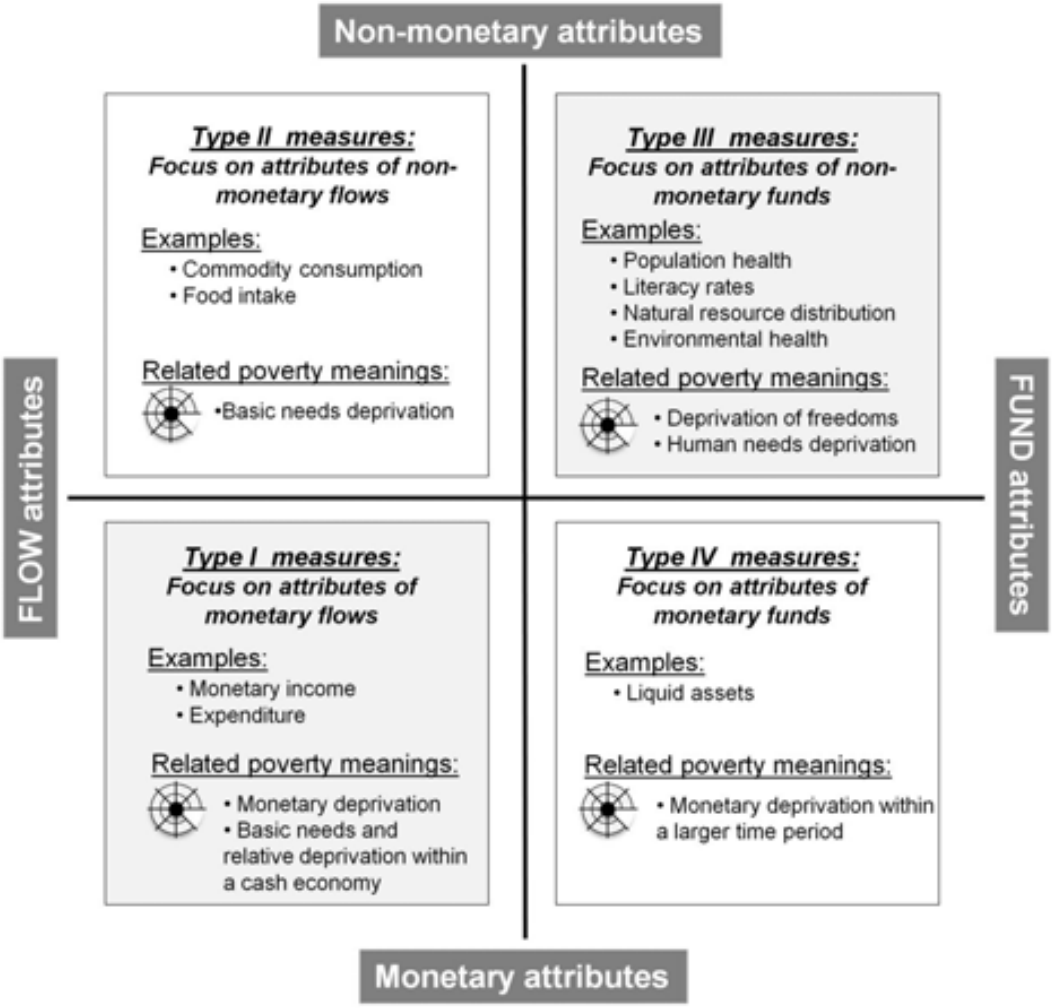

Figure 2. 2: A typology of poverty measures. Note: 'related poverty meanings' refer to those poverty concepts outlined in Section 3 and figure 2.1. Source: Own elaboration.

Type I refers to those poverty measures that focus on attributes of monetary flows as proxy to represent poverty. They comprise different monetary income as well as expenditure measures. Poverty lines can be set as absolute flow rates, such as for example a fixed amount of dollars-a-day, or as relative flow rates, such as a percentage of average per capita incomes. In practice, indicators related to type I are used to represent a large variety of poverty meanings, ranging from physical deprivation (Rowntree, 2000 (1901)), over monetary deprivation (e.g., Sala-I-Martin, 2006) and basic needs deprivation (via cost-of-basic-needs methods (Wodon, 1997)) to relative deprivation (via relative income standards (EC, 2010; Townsend, 1979)). Moreover, the dollar-a-day measure indicates target 1A of the Millennium Development Goals of halving extreme poverty by 2015. Thus, we can see that while the evolution of the meaning of poverty successfully integrated non-economic dimensions, poverty measurement is still dominated by monetary measures (Sumner, 2007).

Putting this type of poverty measures into its historic and intellectual origins may help to understand this bias. The focus on monetary flows as a way to formalize poverty goes back to Rowntree (2000 (1901)). Rowntree justified his monetary assessment of poverty as physical inefficiency because money entitled to food in the society (urban York) he discussed. Hence, his perspective was grounded in the context of a cash economy in which a majority of goods and services were traded for money. It can be argued that this approach thus represents a stereotypical Northern-urban perspective to study poverty. Yet, the adoption of poverty measures focused on monetary flows to study poverty in the very different Southern-rural conditions is an example of how concepts lose sense when the context changes (Allen and Giampietro, 2006). Many stereotypical Southern-rural livelihoods are only partly integrated in the cash economy (e.g., Samal et al., 2003) and hence, much more based on access to non-monetary funds (see type III), such as productive land or own labor power (Grünbühel and Schandl, 2005). Hence, the appropriateness of using monetary flows as proxy for a global poverty indicator, as it is done with the predominant focus on the dollar-a-day indicator, needs to be seriously questioned. It is not that monetary income does not matter for well-being, but rather that it does not adequately measure well-being across drastically varying contexts.

Type II represents those indicators focusing on attributes of non-monetary flows, such as the production and consumption of non-monetary goods. A well-known example is food consumption per capita, for which poverty lines are usually set at a minimum level of dietary energy consumption. Such indicators provide relevant information over access to satisfiers and can be meaningfully related to a physical needs perspective, particularly in contexts in which monetary flows cannot be claimed anymore to be a representative proxy. However, as

discussed previously, a focus on flows only represent access to particular means needed to achieve valued ends, but do not provide any information about how, and for how long these flows are provided, or not.

Type III comprises those poverty measures focusing on attributes of non-monetary funds. Examples are those focusing on the characteristics of the fund population, labor power and knowledge, such as through health indicators or literacy rates. Such indicators have been interpreted within a perspective of human needs deprivation (i.e., education and healthcare) and, in comparison to type II measures, have the advantage to focus directly on long-term outcomes rather than on satisfiers. Moreover, as argued in Section 4.2, a focus on funds may provide important information on the capability space of a social group under analysis. Therefore they are useful proxies to be interpreted within a deprivation of freedoms perspective on poverty. The discussions within ecological economics on poverty in relation to natural resources and the social struggles that the poor face to access them (Martinez-Alier, 2002), are direct reflections of the importance of non-monetary funds for the (rural) poor.

Finally, type IV comprises those few approaches that focus on attributes of monetary funds. An example is Havemann and Wolff's (2005) liquid assets poverty, which is defined as having less monetary assets than necessary for meeting the basic needs for three months[5]. This measurement procedure represents a type of monetary deprivation that Havemann and Wolff termed economic hardship. While in fact such a measure does not say much about the actual basic needs fulfillment of a person, it may provide new information on the economic position of a household or person within a larger time period.

5 Weak and strong poverty alleviation

The previous sections have illustrated the plurality of poverty meanings and the potentials and limitations of different measurement types to represent them. Any approach that aims to deal with the multidimensionality of poverty will need to reflect on how to integrate the various dimensions in a meaningful way. Some final considerations regarding this issue are presented in this last section.

A common approach to deal with the multidimensionality of poverty is the use of aggregated indices. Well-known examples are the Human Poverty Index (HPI) (UNDP, 2010)

[5] If liquid assets would only be used as safety net for times of unemployment and lack of income, hence to substitute income flows, this indicator would actually be a stock- rather than a fund-indicator. However, financial assets also serve as funds as they create services such as credit-worthiness and liquidity for which reason they are included into this type.

and the recently developed Multidimensional Poverty Index (MPI) (Alkire and Santos, 2010). The MPI constructs a single index out of three dimensions of deprivation – health, education and living standards – which are represented through a variety of indicators, such as child enrollment, child mortality, type of floor, ownership of durable goods, and so on. Evidently, these indicators are technically incommensurable; i.e., the numbers of children enrolled in school is by no means comparable with the type of floor a household may have. However, this problem is formally overcome, by aggregating a weighted deprivation value of each indicator. In order to illustrate this for the MPI, let us consider a household with the following characteristics in the year 2010 (table 2.1): (i) it has a malnourished child; (ii) it owns only one radio, but no TV, bike or other durable goods; (iii) the sanitation facility is shared with another household, and (iv) it has a dirt floor. According to the MPI, this household faces multidimensional poverty, because the aggregated deprivation value exceeds the poverty line.

Table 2. 1: An example of compensability between different poverty dimensions in the Multidimensional Poverty Index. Values are taken from Alkire and Santos, (2010). Note: HH = household.

Household in 2010 Deprivations (Weighted Deprivation Value)	***Household in 2011*** Deprivations (Weighted Deprivation Value)
The family's **child is malnourished (1,67)**	The **child has died (1,67)**
The HH **owns one radio (0,55)**	Now, the HH **owns a radio and a TV (0)**
Sanitation facility is shared with another HH (0,55)	Sanitation facility is still shared with another HH (0,55)
The HH has a dirt floor (0,55)	The HH still has a dirt floor (0,55)
Multidimensional poor: **Yes** (aggregated deprivation = 3,32, and poverty line = 3)	Multidimensional poor: **No** (aggregated deprivation = 2,77, and poverty line = 3)

Now, imagine the same household one year later. During this year, the household could buy a TV, but the child that before was malnourished has died. According to the MPI, the household is not anymore multidimensional poor: The new TV, (thus, an improvement in the means of living standards), could formally compensate for the loss of the child, (thus for the deterioration of the health situation as an end). Hence, such an analytical approach to multidimensional poverty allows that improvements in one poverty dimension can substitute for improvements of other poverty dimensions. Moreover, it allows that means can substitute for ends. Yet, is the household better off?

In an analogy to the distinction of weak and strong sustainability (Daly, 1990), it can be argued that such analytical tools only allow for 'weak poverty alleviation'. Recall, that the paradigm of weak sustainability is based on the assumption of substitutability of different types of capital; implying that maintaining the total stock of capital in monetary terms is

enough for sustainability. Strong sustainability assumes that different types of capital cannot be substituted but rather are complementary and as such have to be maintained independently for sustainability. Regarding poverty, certainly most approaches acknowledge complementarity of the different poverty dimensions. Yet, this has to be reflected also in the formal language of their analytical tools they adopt. Otherwise, it leads to weak poverty alleviation in that sense that improvements in one dimension of well-being can compensate for other deteriorations and thus only the aggregated amount of incommensurable poverties would be alleviated.

This is implicitly also the case for the predominant use of monetary flow measures (previous section, type I) such as the dollar-a-day indicator. While they provide relevant information about monetary poverty, their predominant use simplifies the complexity of deprivation to one aspect, without informing about the performance of other dimensions. Yet, this may jeopardize lasting poverty reduction. Flows, such as rural incomes from agricultural yields, may be drastically boosted through intensification methods, however at the cost of the underlying funds that produce them, such as through decreasing soil fertility and the loss of local biodiversity (Giampietro, 1997). Hence, an excessive focus on increasing the availability of flows may trigger policies liquidating funds in favor of flows, which is unfortunately a short-term solution working against sustainable poverty alleviation. Building and preserving funds is a key necessity in order to enable and maintain, although at a limited rate, the sustainable production of flows[6].

For these reasons, 'strong poverty alleviation' efforts need to adopt analytical tools that can deal with non-trade-off cases: improvements in one poverty dimension cannot always compensate for the deterioration of other dimensions and an increase in flows to relieve deprived consumption cannot always substitute for the loss of funds that in turn enable the production of flows and the creation of capabilities in the long-term. On an epistemological level, this requires to acknowledge the existence of non-equivalent and incommensurable types of poverties. On a practical level, this implies to step back from single, aggregate indices and to adopt rather a set of multiple indicators that inform independently about the different dimension of poverty.

[6] A sustainable production of flows in terms of preserving the funds, relates to John Hicks' understanding of people's income as *"an indication of the amount which they can consume without impoverishing themselves"* (Hicks, 1946: 172), which in fact is at the basis of the sustainability concept (Daly, 1990).

6 Conclusions

This paper has highlighted the plurality of poverty concepts, both in terms of meanings and measurement types. Understanding poverty as an irreducible, complex phenomenon for which various legitimate descriptions are possible may help to deal with the many definitions on an epistemological level. It further enables integrating new characteristics of deprivation into an understanding of poverty that life might bring up in the future; may they be articulated by development professionals or by the poor themselves.

Yet, acknowledging that poverty is complex and multidimensional also poses new challenges for research and related policies: it becomes necessary to deal with social and technical incommensurability of different meanings and measurement types of poverty. Acknowledging the many meanings requires not simply referring to 'poverty' but being explicit about the questions of 'poor in what?' and the involved values and preferences. Rather than trying to find a universally objective meaning of poverty, a complexity approach to poverty emphasizes the need to find the adequate perception of poverty regarding a certain social group and context.

With regard to poverty measurement, the paper presented some considerations on how to account for the many dimensions of poverty. Common approaches are multidimensional poverty indices such as the MPI. Yet, they might represent only weak poverty alleviation, as they may allow that improvements in one poverty dimension (e.g., having a new TV) can compensate for other poverties (e.g., the loss of a child), which is not necessarily the goal of development. Hence, in order to achieve strong poverty alleviation, analytical tools will be needed to deal with situations in which improvements in one dimension cannot substitute for the deteriorations of other poverty dimensions. In this light, we also have to critically revise the predominant use of monetary flow measures, such as dollars-a-day. While such measures may inform about deprivation in income and consumption, they may trigger policies that boost the production of flows in the short-term at the costs of the underlying funds that enable the production of flows as well as the creation of capabilities in the long-term.

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CHAPTER III

THE GLOBAL CHALLENGE

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Energy transitions and the global land rush: Ultimate drivers and persistent consequences

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ABSTRACT

While the recent emergence of a global land rush has initiated large debates and conflicts over the use and access to land, further investigation into the underlying drivers is required to enhance the understanding of the potential trajectories of the land grab phenomenon. This paper takes a biophysical perspective and explores how declining fossil stocks and a global transition towards renewable energies ultimately drive the land rush. The paper addresses, in qualitative terms, how societal needs for land change with different patterns of societal energy metabolism. The potential spatial expansions of renewables are illustrated in quantitative terms, based on the power density concept and energy provision forecasts for the year 2020. The transition from an energy system based on fossils stocks, with high power densities, to one based on renewables, with low power densities, drastically boosts societal demand for land. This drives the land rush directly through land acquisitions for the expansion of energy systems. The energy transition also drives the land rush indirectly, in particular through food security threats motivated by the growing competition over farmland uses and changes in crop supply. Although currently fossil stocks are still relatively abundant, future declines are expected to trigger the demand for land to even greater extents. Given the inevitability of the energy transition, we believe that the land rush will have persistence, bearing long-term consequences for land use and struggles over access to land.

1. Introduction

Within the last years, a global rush for land has emerged, prominently represented by the term "land grabbing" (Borras et al., 2011; Cotula et al., 2009; von Braun and Meinzen-Dick, 2009; Zoomers, 2010). Land grabbing refers to the current processes of large-scale and long-term land acquisitions through private and governmental actors and is associated with vast and rapid changes in land use patterns and land use rights (Borras et al., 2010; Deininger, 2011; De Schutter, 2011; GRAIN, 2008). Land acquisition for agricultural expansion is nothing new in history, yet the recent growth in demand for land is occurring on an unprecedented scale. Before 2008, for instance, average annual agricultural land expansion was less than 4 million ha. Currently, the announced land deals within one single year (2008–2009) have amounted to 45 million ha globally. While the median acreage of land in these projects is no less than about 40,000 ha, a quarter of all projects involve areas greater than 200,000 ha (World Bank, 2010). In fact, single project proposals for palm oil and biodiesel production have been reported to cover up to 2.8 million ha (von Braun and Meinzen-Dick, 2009), reaching the size of small countries such as Belgium.

The debate on the impacts of these large-scale land deals is controversial. International development professionals – although acknowledging significant risks for local rural livelihoods and the environment – have identified large economic opportunities for the countries involved and the rural poor (Cotula et al., 2009; Deininger, 2011; Vermeulen and Cotula, 2010; von Braun and Meinzen-Dick, 2009; World Bank, 2010). Responsible Agricultural Investment (RAI) principles (FAO et al., 2010) have been put forward in order to turn challenges into benefits. Others, however, have seriously questioned these principles regarding their pro-poor effects from a human rights and employment perspective (Borras and Franco, 2010; De Schutter, 2011; Li, 2011). Meanwhile, grassroots organizations have reported a significant increase in the number of conflicts related to land grabbing (e.g., Licadho, 2009) and fear future marginalization of the global peasantry (GRAIN, 2008; Via Campesina, 2011).

An analysis of the underlying dynamics of the land rush may help to achieve a better understanding of its potential future development. In this paper, we aim to address drivers of the emerging land rush by putting it into the broader context of the global energy state of affairs. Previous works (e.g., Borras et al.,

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Energy transitions and the global land rush: Ultimate drivers and persistent consequences

Abstract

While the recent emergence of a global land rush has initiated large debates and conflicts over the use and access to land, further investigation into the underlying drivers is required to enhance the understanding of the potential trajectories of the land grab phenomenon. This chapter takes a biophysical perspective and explores how declining fossil stocks and a global transition towards renewable energies ultimately drive the land rush. The paper addresses, in qualitative terms, how societal needs for land change with different patterns of societal energy metabolism. The potential spatial expansions of renewables are illustrated in quantitative terms, based on the power density concept and energy provision forecasts for the year 2020. The transition from an energy system based on fossils stocks, with high power densities, to one based on renewables, with low power densities, drastically boosts societal demand for land. This drives the land rush directly through land acquisitions for the expansion of energy systems. The energy transition also drives the land rush indirectly, in particular through food security threats motivated by the growing competition over farmland uses and changes in crop supply. Although currently fossil stocks are still relatively abundant, future declines are expected to trigger the demand for land to even greater extents. Given the inevitability of the energy transition, we believe that the land rush will have persistence, bearing long-term consequences for land use and struggles over access to land.

Keywords

land rush; land grabbing; peak oil; energy transition; energetic metabolism of societies

1 Introduction

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The debate on the impacts of these large-scale land deals is controversial. International development professionals – although acknowledging significant risks for local rural livelihoods and the environment – have identified large economic opportunities for the countries involved and the rural poor (Cotula et al., 2009; Deininger, 2011; Vermeulen and Cotula, 2010; von Braun and Meinzen-Dick, 2009; World Bank, 2010). Responsible Agricultural Investment (RAI) principles (FAO et al., 2010) have been put forward in order to turn challenges into benefits. Others, however, have seriously questioned these principles regarding their pro-poor effects from a human rights and employment perspective (Borras and Franco, 2010; De Schutter, 2011; Li, 2011). Meanwhile, grassroots organizations have reported a significant increase in the number of conflicts related to land grabbing (e.g., Licadho, 2009) and fear future marginalization of the global peasantry (GRAIN, 2008; Via Campesina, 2011).

An analysis of the underlying dynamics of the land rush may help to achieve a better understanding of its potential future development. In this paper, we aim to address drivers of the emerging land rush by putting it into the broader context of the global energy state of affairs. Previous works (e.g., Borras et al., 2010; World Bank, 2010) have focused on biofuels production as a major cause of the land grab phenomenon and important contributions to this issue have come from a social and political science perspective (see Journal of Peasant Studies, Special Issue vol. 37 no 4). However, to our knowledge, there is a lack of investigation that

systematically brings in a biophysical perspective on the land rush. In order to address this issue, this article discusses the following questions: (i) How do societal needs for land change with peaking fossil stocks? (ii) How is an anticipated energy transition (from fossils towards renewable energies) expected to drive future processes of land grabbing? (iii) What are the particular implications for future land use trends and struggles over access to land that can be derived from this energetic perspective?

Given the complexity of the land rush phenomenon, there are many factors to be considered as potential drivers (such as growth oriented policies, national political interests, population growth, lifestyle changes and increased resource consumption). However, within the scope of this article, we limit our contribution to the analysis of how declining fossil stocks and a global transition towards renewable energies ultimately drive the land rush. We argue, from a biophysical perspective, that the energy transition inevitably drives societal land needs, and further motivates cases of land grabbing. We see this relation directly through land acquisition for the expansion of societal energy systems (though, not limited to the production of biofuels), driven by energy security needs. In addition, we identify an indirect relation through land acquisition for food security and emerging agro-businesses, both motivated by rising agricultural commodity prices that are associated to the competition of "fuels for food" and disturbances in the fossil-energy-dependent global food system. Rather than seeing these trends as a mere ephemeral reaction to the 2007-08 food price crisis (cf. von Braun and Meinzen-Dick, 2009), we believe that they will be persistent, bearing significant consequences for global development.

Before addressing the aforementioned key questions, Section 2 briefly reviews the different notions of the term 'land grabbing' and describes the conceptualization that we adopt in this paper. Thereafter, Section 3 addresses, in qualitative terms, how expected shifts in global energy provision relate to changes in societal areal requirements. Section 4 illustrates this issue in quantitative terms with calculations of area requirements for non-fossil energy sources, based on energy forecasts for the year 2020. Section 5 identifies direct and indirect links between an anticipated energy transition and the land grab phenomenon, while Section 6 discusses their particular implications for global development. Closing remarks follow in Section 7.

2 Notions of 'land grabbing'

'Land grabbing' is a broad term, entailing various interpretations. Hence, before approaching the issue, the phenomenon itself requires a pre-analytical clarification regarding the questions of "what exactly is it that is acquired, and for which purpose?"

The term land grabbing has been widely used to describe large-scale and long-term farmland acquisition through the appropriation of land property rights (i.e., land purchase) and/or land use rights (i.e., land lease) (Borras and Franco, 2010; Cotula et al., 2009). Aside from biofuels production, the causes of such farmland deals have been ascribed to food security threats (GRAIN, 2008) and the rediscovery of the agricultural sector through investment in key commodities (such as plantation forestry, soy bean or maize cultivation (World Bank, 2010)) and financial speculation on agro-businesses (Merian-Research and CRBM, 2010). However, Zoomers (2010) has argued that an exclusive focus on farmland acquisition offers a narrow perspective on the complex land rush. Zoomers has pointed out, how a variety of other processes add significantly to the land grab phenomenon, for instance the expansion of protected areas and eco-tourism, land purchases by migrants in their country of origin, residential migration, large scale tourist projects and the establishment of large scale infrastructures. Thus, a broader analytical framework is needed in order to account for the full extent of the land grab phenomenon.

The above-mentioned scholars generally refer to land grabbing as a cross-border process that usually involves *foreign* actors. Others, however, have highlighted that incidents of *domestic* land grabbing also require attention, in which the agents are domestic companies or national governments (von Braun and Meinzen-Dick, 2009; Siciliano, 2011). In fact, recently reported land transfers have been dominated by domestic actors (Deininger, 2011).

In line with Siciliano (2011) and Deininger (2011), we distinguish in this article between foreign and domestic land grabs. Moreover, following the suggestion of Zoomers (2010), we do not restrict our interpretation of land grabbing to farmland acquisition, but rather refer to any type of long-term and large-scale land acquisition, regardless of its purpose. We particularly consider the expansion of societal energy systems as a further land grab motive and do not only account for biofuels, but also for the large-scale expansion of other energy sources such as the construction of dams, wind farms and solar installations.

3 Energetic metabolism of society: flows, stocks and funds

In this section, we start our analysis by addressing the question of how societal land needs change with peaking fossil energy stocks and associated alterations in 'societal energy metabolism'.

The concept of 'societal metabolism' characterizes the processes of appropriation, transformation and disposal of materials and energy by societies in order to sustain their existence (for an overview of the evolution of the concept, see Martinez-Alier, 1987). 'Energetic metabolism of societies' refers particularly to the dynamic energy budget needed, transformed and consumed in a society to perform different functional and structural activities (Giampietro and Mayumi, 2000; Giampietro and Ramos-Martin, 2005; Giampietro et al., 2011, Ramos-Martin, et al., 2007). Hence, there is a need of balancing the flow of energy required by society, and the flow of energy supplied to society. The energy flow required by a society is clearly determined by its socio-economic identity, i.e., population structure, the material standard of living and the diversity of activities performed inside and outside of the economic sectors. The supply side is determined by society's biophysical and technological identity, i.e. the mix of accessible primary energy sources, available technology, conversion and transformation factors and the mix of specific energy carriers required for various end-uses.

Looking through the lens of thermodynamics, society, at large makes use of low entropy (high order) energy for self-organization and releases high entropy waste (Ulanowicz 1986, 1995; Odum 1971, 1996). Hence, the energetic metabolism of societies characterizes the appropriation process of low entropic resources and their subsequent transformation by society into high entropic materials in order to perform socio-economic activities. In order to carry out different functional and structural activities, energy is provided to society via the production and consumption of energy carriers (i.e., fuels, heat and electricity), that come from different primary energy sources (i.e., fossil, nuclear and renewable sources). Based on Georgescu-Roegen's (1971) classification of the production process, we distinguish in this article between two different types of energy carrier production: production based on *funds* and production based on *stocks.*

The fund-flow framework derives from the definition that the *fund* variable act as an agent that transforms input flows into qualitatively different output flows at a given rate, while preserving their identity across this production scheme. Although these fund elements are *used within the process*, none of these items are *consumed* in the sense of declining stocks. Classical examples of funds are Ricardian land, capital and labor. In this article, we consider

land (or land area) as the most basic fund variable, and we consider fossil sources as a fundamental stock. Through this distinction, it then becomes possible to characterize historic and future patterns of energetic metabolism of societies in terms of their territorial requirements. To do so we look at the energy provision sources of the preindustrial, industrial and the expected 21st century society model (see Figure 3.1) and discuss its implications for areal needs.

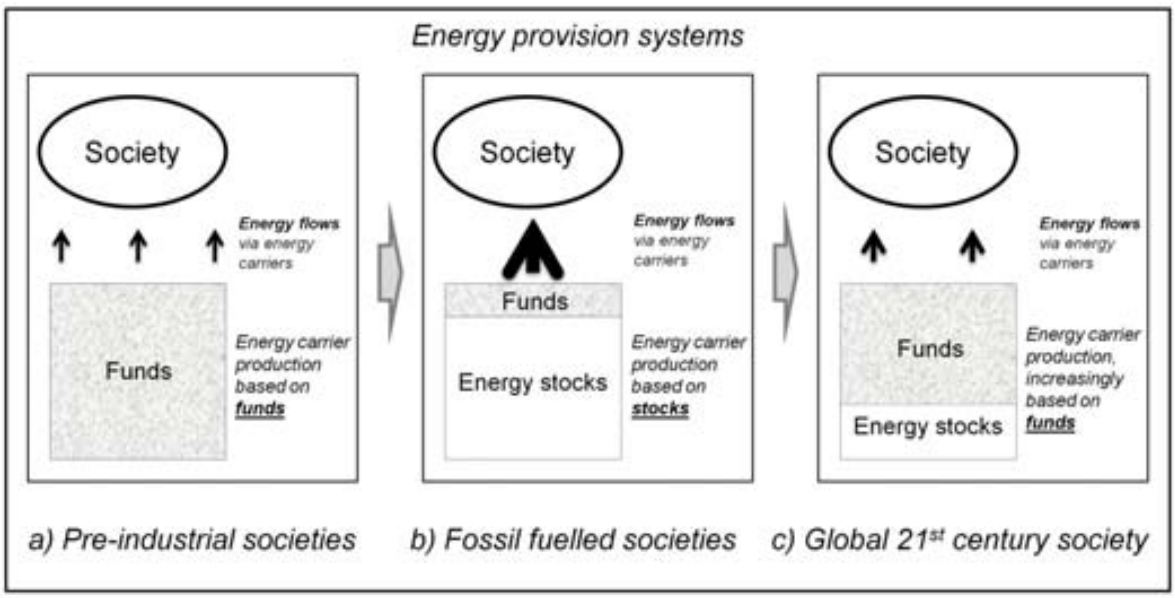

Figure 3. 1: Schematic illustration of stock- and fund-based energy provision systems. Source: Own elaboration. (Note: Big arrows indicate centralized energy flows to society, small arrows indicate decentralized flows.)

Pre-industrial societies (see Figure 3.1a) depended primarily on the direct use of solar radiation through photosynthetic conversion to produce food and fuel-wood that could be used as a direct flow of energy from the environment; mainly to satisfy endosomatic needs and sources for heating and cooking (Smil, 2008). Energy provision took place on a decentralized and local scheme, on conditions of the quantity and quality of *available productive land* for biomass production. Surplus biomass gave room for the maintenance of draft animals, which in turn helped increase land productivity and further areal expansion (Smil, 2008). Therefore, it could be said that pre-industrial societies had a fund-based energy provision system, depending highly on utilizing the land fund. The size of a society's territory and thus its access and control over abundant resources was a crucial constraint factor, limiting the overall energetic metabolism of pre-industrial populations (Sieferle et al., 2006).

This changed drastically with the processes of industrialization and society's growing use of fossil inputs, namely as *stock variables,* found in concentrated form and having a very high energetic yield. Contrary to the previous decentralized energy system of pre-industrial societies, the provision of energy carriers within industrial societies became less 'land' dependent, yet more centralized, and it was based on the extraction of a few primary energy sources attained through specific spatial locations and distribution channels (Grubler, 2008). We therefore can call most forms of energy provision for the global society of the 20th century a 'stock-based' system (see Figure 3.1b). In comparison with pre-industrial societies, where land acted as a fundamental constraint for energetic expansion, sustenance and maintenance of the energetic metabolism of industrialized societies has decoupled from the size of its territory.

Nevertheless, the industrial revolution came only as a temporary emancipation from land (Mayumi, 1991), in which modern societies had the opportunity to exploit concentrated, point resources of fossil stocks that had taken millions of years to create. Nowadays, the post-industrial era is facing immense stress from biophysical pressures through the peak oil phenomenon (Campbell and Laherrère, 1998; Kerr, 2011) and the peaking of coal stocks, with China as a dominant actor driving the demand (Heinberg and Fridley 2010). Energy Return on Energy Investment (EROI) values – defined as the net amount of energy supplied by a process after having accounted for the energy used in the process itself – are declining for the production of fossil energy carriers (Hall et al., 2009) as well as in the agricultural sector (Martinez-Alier, 2011). These motives and additional attempts for reducing carbon emissions bring upon us a required shift from the use of fossil energies as well as from the advantages they have provided for societies.

A new state, in which the mix of primary energy sources is increasingly based on alternatives rather than on fossil stocks, thus becomes vital in order to achieve this critical, yet essential, transition. The main obstacle for the realization of such a shift arises from the diminution of high energy yields of the *stock-flow system*, and the return to a lower energy yield *fund-flow system* of the 21st century society model (Figure 3.1c). This brings about extremely large areal requirements, as illustrated in quantitative terms in the next section.

4 Areal requirements of alternative energy options

4.1 The issue of power density

The power density concept, used extensively by Smil (2003, 2008) is a powerful indicator that shows the amount of watts that can be generated from a certain area. It is defined as the energy flux per horizontal area of land (or water surface), expressed in W/m^2. With such an indicator, the different 'fund-based' energy sources can be compared in terms of their energy yield potentials and the associated areal requirements that are necessary to achieve a given energy flux.

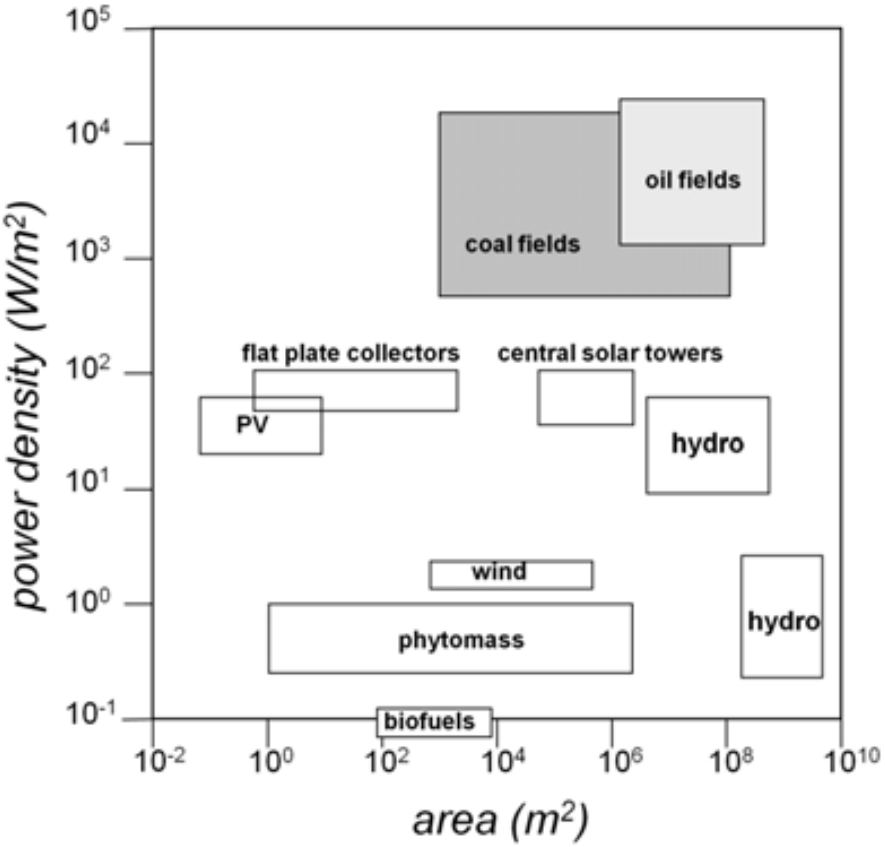

Figure 3. 2: Power density and areal requirement of different energy sources. Source: adapted from Smil 2003, 2008. (Note that the power density output of hydro sources may vary substantially according to the scale and extent of the installation).

Figure 3.2 shows power density ranges for the most prominent fossil and alternative energy sources on a global scale. While the specific power density values vary with geographic zones, installation scale and technology, figure 3.2 provides a general picture, indicating the

minimum and maximum reachable power densities for each type of energy source. The vast differences across types of energy sources enable us to make some relevant observations.

As it can be seen, the power density yields of current fossil energy sources (including thermal power plants, oil and coalfields) are two orders of magnitude greater than possible substitutes such as hydro or solar sources, and three orders of magnitude greater than biomass and wind sources. Such a comparison shows that a transition to a new mix of primary energy sources, based on alternative energies rather than on fossils, will largely reduce energy yield outputs. Therefore, if the level of energetic metabolism of societies is to be maintained as such (assuming a no-growth scenario), areal coverage for alternative energy sources will have to increase in large magnitudes, in accordance with their respective power densities. Accounting for these large differences in energy yields, even a partial substitution of fossil fuels with renewable energy sources will instigate vast land use changes for the expansion of energy systems. The following subsections illustrate via quantitative assessments, the potential global areal expansion associated with such a transition.

4.2 Alternative energies

The options for alternatives are numerous, each presenting certain trade-offs for energy provision. Within the option space, the most prominent sources are hydro, wind, solar photovoltaic (PV) and concentrated solar power (CSP). Many references forecast varying rates of likely expansions of installed capacity for each source, greatly depending on the variation across conservative and supportive policies towards renewables. Table 3.1 summarizes different forecasts of expected global capacity in 2020 for various energy sources. The associated areal requirements are calculated based on the respective power density value of each energy source.

Table 3. 1: Power density, expected global capacity, areal requirement and constraint factors for alternative energy sources. Source: own elaboration based on different data sources (see footnotes).

Energy source	***Power density (W/m²)[a]*** *(low – high)*	***Expected global capacity for 2020 (GW)*** *(low – high)*	***Associated areal requirements (Million ha)*** *(low – high)*	***Constraint factors***
Wind	0.5 – 1.5	230.65 – 1072.93[b]	~11.5 – 160.9	Area, wind speed
Solar PV	4 - 9	30	~12.0 – 27.0	Area, labor, solar intensity, water, precious materials (i.e. gallium arsenide or indium selenide for high efficiency cells),
Solar CSP (or solar thermal)	4 - 10	21.54[c] – 122.25[d]	~8.6 -122.3	Land, solar Intensity
Hydroelectric	~1[e]	1239[f]	~123.9	Catchment area, rainfall
Biomass	0.5 (from 0 – 0.6)	106 -245[g]	~5.3– 12.7	Farmland, labor, water, fertilizers

[a] Smil (2008).
[b] Data ranges have been gathered from the Global Wind Energy Outlook 2006, of the Global Wind Energy Council (GWEC, 2006). Lower estimates are for the most conservative "Reference" scenario ("Reference" energy demand projection is
based on the (International Energy Agency) IEA's World Energy Outlook 2004) to the higher most ambitious scenario in which all policy options are assumed to be in favour of renewable energy. The IEA World Energy Outlook of 2008 estimates a capacity of 383 GW in 2020 for wind power (IEA, 2008).
[c] Brakmann et al., (2003) on Solar Thermal Power 2020. In the IEA World Energy Outlook 2008 Solar has been categorized as a single entity and has an expected installed capacity of 72GW (IEA, 2008).
[d] Energy News, July 19, 2010 "Solar Thermal Power Market Forecast to 2020 – Utilities to Drive Future Developments in the Concentrated Solar Power (CSP) Market". Available online: http://marketpublishers.com/lists/7720/news.html
[e] As Smil puts it: "Power densities of hydro generation are thus broadly comparable to those of wind-driven generation, both having mostly magnitude of 10^0 W/m² and exceptional ratings in the lower range of 10^1 W/m². Relatively large reservoirs, smaller stations have power densities less than 1 W/m²; for stations with installed capacities of 0.5–1 GW the densities go up to about 1.5 W/m²; the average power density forthe world's largest dams (>1 GW) is over 3 W/m²" (Smil, 2010, p. 114).
[f] As stated in World Energy Outlook 2008, reference scenario 2020 (IEA, 2008).
[g] Lower range data are taken from IEA World Energy Outlook (IEA, 2008), reference scenario for World. Higher range data are taken from Energy Watch Group, Renewable Energy Outlook 2030 (Peter and Lehmann, 2008).

4.2.1 Wind

Wind farms (both onshore and offshore) have gained immense momentum in the last years, to the degree that it is argued to be the fastest growing market in comparison to any of the other renewables (GWEC, 2006). However, varying wind speed, land and spacing requirements make this renewable technology area-intensive and irregular for electricity production (MacKay, 2009). Onshore windmills usually occupy 0.05 mills per square kilometer on average, whilst clustering of plants in wind-parks can increase up to 9 mills/km^2 on average (Peter and Lehmann, 2008). With a power density averaging between 0.5 – 1.5 W/m^2 and a very wide range of installed capacity forecasts, the areal requirements are large. Based on contemporary forecasts, higher estimates would require an area coverage for wind power installations that reaches up to around 161 million ha. This corresponds to an area six times bigger than that of Great Britain.

4.2.2 Solar PV

Photovoltaic (PV) panels converting sunlight into electricity currently have a typical efficiency of about 10% and a maximum of about 20% (MacKay, 2009). Despite their requirement of solar intensity, PV installations have utmost dependence on other flow and fund factors. Fund variables are labor (for maintenance) and land (which competes with other land uses such as agriculture), and flow variables are water (for maintaining a speckles PV surface for full capacity functioning) and other precious materials such as gallium arsenide or indium selenide for high efficiency cells. Although their power density values are higher than that of wind, the aforementioned basic requirements and its economic feasibility limits the installation capacity for the potentialities of possible PV options. The highest estimate in terms of areal expansion for Solar PV for the year 2020 lays around 27 million ha, which corresponds to the size of New Zealand.

4.2.3 Solar CSP

The main market for concentrated solar power (CSP) lies within the hands of the United States and Spain who have increased their installed capacity by more than 70% in the last 5 years (REN21, 2010). Among the several important factors for CSP asides from solar radiation (forming the basic prerequisite for this alternative) is the heliostat configuration (the mirrors laid out in the field reflecting sunlight to the receiver of the main tower). Investigations have shown that a radial staggered layout is the most favored for greater amounts of energy

collection (Al-Rabghi and Elsayed, 1991). This, in return, results in high areal requirements, competing with other area uses. The highest estimates for the expansion of CSP technology would require an area-coverage of 122 million ha, which equals the size of South Africa.

4.2.4 Hydropower

Hydropower is currently the most dominant renewable resource for electricity production worldwide and in 2008, it accounted for 15% of all the electricity generated (REN 21, 2010). The main biophysical factors constraining hydroelectricity production are rainfall and the catchment area. It is calculated that the power density of hydropower is similar to that of wind, varying with the size of the installed dam (e.g., it is projected that the power density of the Three Gorges station reaches up to 30 W/m^2 - the total area of the reservoir is 104,500 ha) (Smil, 2008, 2010). The highest estimates of areal requirements for installed hydropower in 2020 would, similar to CPS, reach up the size of South Africa.

4.2.5 Biomass

Biomass as alternative energy source to fossils remains as a controversial category. As a traditional source for heating, it has been the predominant fuel in prehistoric times. Currently, around 2.7 billion people still rely extensively upon traditional forms of biomass (IEA/OECD, 2011). However, biomass for the production of large-scale biofuels has proved to be a fallacy given its very low EROI yields, and it usually entails the destruction of vast tropical areas (Giampietro and Mayumi, 2009). Power generation of biomass at best estimate remains around 0.5 W/m^2 and raises the debate of producing "food for fuels". The highest forecasts of biofuels production for 2020 imply an area-coverage up to 13 million ha, which corresponds to half of the size of Great Britain.

4.2.6 Nuclear energy

Although nuclear energy production depends on point resources, based on a finite stock of uranium (and thus limiting the further production of plutonium), it is important to consider its areal requirements for the disposal of nuclear waste. Evidently, there is a political and institutional requirement to handle this delicate issue. As witnessed in the past, search for disposal sites for nuclear waste have resulted in its externalization to third parties through

(illegal) attempts of dumping (Perera, 1985). It has been noted that on a global level, nuclear facilities produce around 200,000 m^3 of low- and intermediate-level radioactive waste, and about 10,000 m^3 of high-level waste, including used fuel designated as waste per year (World Nuclear Association, 2009). For the disposal of such waste, an areal requirement is imperative; however, this is something that is usually not accounted for. Moreover, there is a dubious issue regarding the safe distance in terms of area-coverage to beware of the disposed wastes.

4.2.7 Implications for future energy provision

For such energetic transitions to take place, there is a primary requirement for the basic modern energy infrastructure to change, adapting to collect fuels at low power density, covering extensive areas rather than the accustomed, nodular extraction of fuels with very high power densities (Smil, 2010). To complicate issues further, it is also crucial to bear in mind that not all the categories of primary energy sources are equally capable of producing all sorts of carriers (i.e., fuel, heat and electricity) that are at request by society. Depending on the characteristics of the alternative energy sources of concern, they might produce only some (or one) of the necessary carriers. For example, solar PV, wind and hydro are only capable of producing electricity. Although electricity is currently considered as the most valuable, versatile and flexible carrier for societies, it still has limitations (e.g., flying a jumbo jet) (Giampietro et al, 2010; Smil, 2003). Therefore, it is imperative to achieve a critical mix of all primary energy sources to obtain all the required carriers requested by society.

Due to all the uncertainty factors and the variation in potential yields and requirements, energy provision forecasts always remain speculative. Moreover, it is difficult to say to what extent a multifunctional land use (e.g., wind parks together with agriculture, solar panels on the roofs of buildings) can offset areal demand for particular energy provision systems. However, this section has illustrated in quantitative terms that for both optimistic and conservative forecasts, the foreseen areal requirements are substantial. Moreover, the forecasted capacity installment for 2020 for any of the alternative energies serves only as a partial substitution to fossil resources. Under more dramatic circumstances, the areal expansion of energy systems can be expected to increase exponentially in order to recover for the energy provision due to a more complete switch to renewables.

5 The energy transition and the global land rush

Fossil energy sources are becoming increasingly scarce and an anticipated global energy transition is expected to drive overall societal needs for area in a substantial manner. Yet, the question remains of how this links to the land rush phenomenon. Figure 3.3 illustrates our interpretation of this issue over three scales of causalities: ultimate drivers, intermediate causes, and proximate causes (cf. Geist and Lambin, 2002).

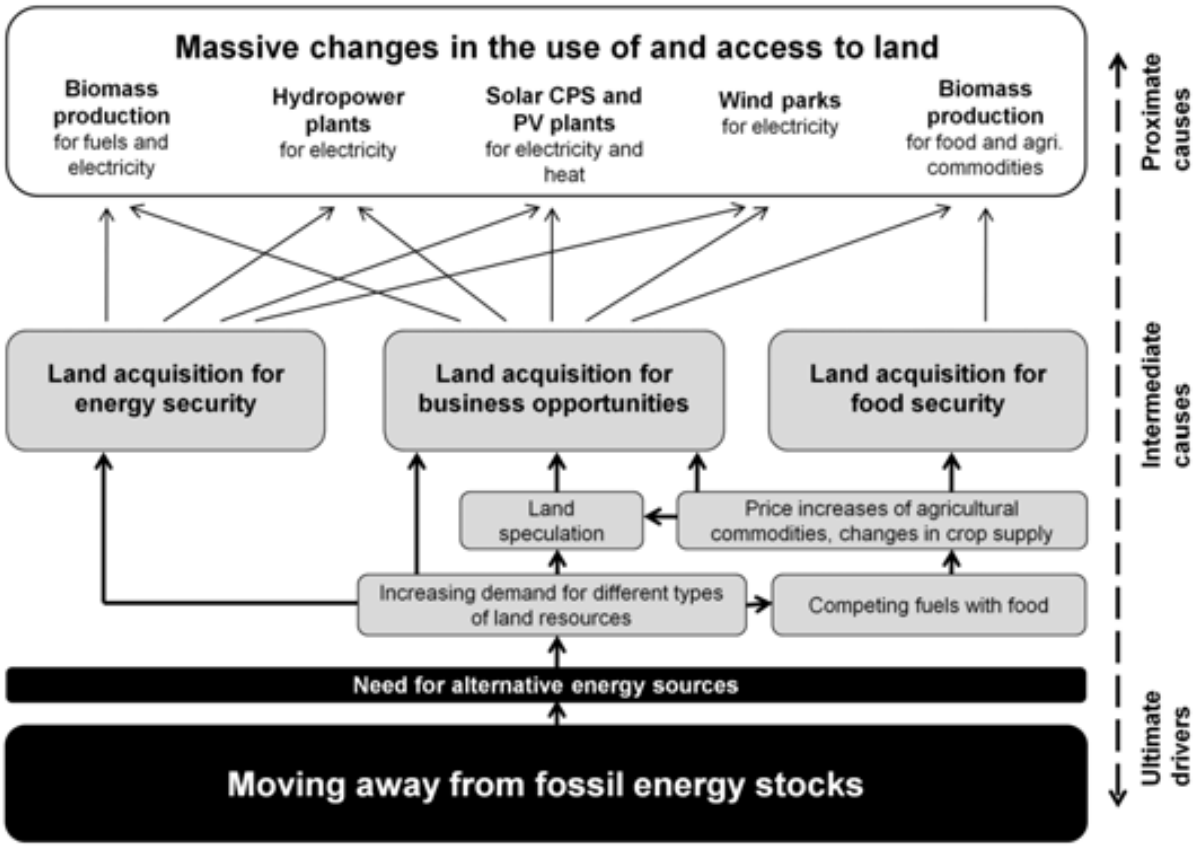

Figure 3. 3: The global energy transition as ultimate driver of the land rush. Source: own elaboration. (Note that the categories are qualitative and thus not weighted).

The vertical axis of figure 3.3 indicates these levels of causalities. *Ultimate drivers* refer to fundamental socio-ecological processes that appear on a global level over a large time scale. These, in turn, drive the *intermediate* and thereby the *proximate causes* of land grabs, reflected in immediate and local actions of land acquisition. While there might be other ultimate drivers, bounded by the aims of this article, figure 3.3 only explores the energy transition as an ultimate driver to the land rush.

As previously argued, declining fossil stocks and diminishing EROI values are driving the demand for alternative energy sources (with comparatively low power density levels) that require vast and different types of area for energy provision systems. This, on the one hand, can be argued to drive directly land acquisitions for the expansion of energy systems, fuelled by energy security threats and the emergence of business opportunities in the renewables sector. Although, until now the land grab debate has mainly focused on farmland acquisition (e.g., for biofuels production), further attention needs to be paid on expansion of other alternative energy provision systems. Moreover, these alternatives may bring about other significant livelihood implications. Forced evictions owing to the construction of large dams are a well-known issue and may represent prominent motives for domestic land grabs. The construction of China's Three Gorges dam required the resettlement of no less than an estimated number of 1 million of people (Jackson and Sleight, 2000). Further, it can be argued that indirect foreign land grabs may exist in cases where dams are co-owned by Multinational Corporations and serve to satisfy energy needs of neighboring countries. The recently inaugurated *Nam Theun 2* dam project, located in Lao PDR, is such an example. Ninety-five per cent of the electricity generated by the dam, which is co-owned by the Lao government, two European and one Thai company (Morning-Star, 2010), is exported to Thailand. However, the reservoir's 45,300 ha (Hydroworld, 2010) are located in Lao PDR and required the displacement of about 6,200 indigenous people from the land (Ong, 2007). To give an example of the expansion of solar power plants and wind farms, another private but governmentally backed up energetic project is the Desertec Industrial Initiative (www.desertec.org). It aims at covering 15-20% of European energy needs by 2050 through the construction of large-scale solar-thermal power plants and wind farms in North Africa and the Middle East. To reach this goal, an area about 250,000 ha for energy production plus some additional 360,000 ha for high voltage power lines would be necessary, according to founding member Siemens (Siemens, 2009). As well in this case, the vast area expansion of energy systems can be related to satisfy foreign energy needs.

On the other hand, the growing demand for alternative energies (i.e., energy from biomass), indirectly provokes food security threats while also creating business opportunities in the agricultural commodity sector. Biofuels production has been driving competition over the use of (i) farmland (through plantation of energy crops) and (ii) agricultural commodities that are suitable as both food and fuels (e.g., oil seeds and grains). In fact, the increased demand over these crops caused by biofuels production has been identified as a significant (Rosegrant, 2008), if not the most important (Mitchell, 2008) component of the recent food price crisis. Financial speculation in the agricultural sector also adds on to the issue (De Schutter, 2011). Finally, food security threats are further driven by the heavy dependence of

industrial agriculture on fossil energy consumption (Arizpe et al., 2011). Expected impacts on crop supply due to rising oil prices (OECD/FAO, 2010) present a further motive for land acquisition for food production. These developments, in combination with a growing global population and changing lifestyles, pressure the global food system through rising food demand (Godfray, 2010).

In the broader context of current and future energy state of affairs, these well-known motives for land acquisition – (i) energy security, (ii) business opportunities and (iii) food security (see figure 3.3) – should be perceived as *intermediate causes,* which are ultimately driven by moving away from fossil energy sources. They link the global energy transition to the current land rush by motivating local cases of foreign and domestic land grabs for various purposes (see figure 3.3: proximate causes). As observed in the current land grab experiences, vast changes in land use patterns and access to land can be expected in the near future.

6 Persistent consequences for global development

In this section, we now turn to discussing the particular implications for land use trends that can be derived from our biophysical perspective.

Initially, it should be clearly acknowledged that the outcomes of such a transition are to be persistent. The depletion of fossil stocks, at current rates, result irreversible and are ultimately expected to bring about biophysical constrains to development. This highlights, that, the metabolic patterns of societies (depending on their capability of appropriating low-entropy and high-quality energy resources from their environment) are to be affected in due course (Giampietro, et al., 2011). The persistence of the transition is likely to lead to permanent alterations of societal organization and resource use patterns. Nowadays, fossil stocks are still relatively abundant and the situation of the current land rush only reveals to be "the tip of the iceberg". In the near future, the spatial and natural constraints within national territories can be expected to push for a further land rush in order to satisfy the needs for alternative energy provision. Therefore, massive land use changes associated to the vast expansion of energy provision systems can be anticipated.

Second, although the transition to renewables will bring a substantial expansion of energy systems, it can only serve as a partial substitution to fossil fuels. As discussed in Section 4, power densities of renewables are of magnitudes lower than power densities of fossil energy sources. Hence, in order to adapt to new forms of energy provision, the energy transition also entails societal re-arrangements of energetic metabolic patterns. Consequently,

this might have implications on lowering energy needs for staying in the margin within future limiting conditions. As Gillon (2010) argues, contemporary attempts to negotiate biofuels – the alternative energy source with the lowest power density – as an 'environmental fix' to the problem of oil dependence merely overshadow the far-reaching socio-economic and ecological consequences of fossil energy dependency.

Third, the biophysical requirements for alternative energy provision provoke both private and public actors to move their operations to those countries that fulfill these prerequisites. In doing so, the associated socio-ecological consequences are unavoidably shifted to these areas. In the case of farmland grabs for biomass production, areas with high biomass productivity and high potential economic output (in terms of $/ha) are concentrated in the South, particularly in Sub-Saharan Africa and tropical/sub-tropical regions (World Bank, 2010). According to Dauvergne and Neville (2010), some of these countries, and in particular Brazil, India and Indonesia, had the possibility to previously develop institutional capacities for managing the challenges associated to large-scale agricultural production. They entered the biofuels market before the recent land rush, with a large domestic share that was able to buffer fluctuations of international crop markets. However, many of their Southern counterparts that entered the market more recently could not previously position themselves in the international arena. As such, they face problems of weak land governance and lack the capacity to protect smallholders with insecure land rights.

Lastly, it should be noted that the energy transition is only one of the ultimate drivers inducing the land grab phenomenon. It is likely that the global rush for land will be triggered to even greater extents due to other global processes such as population growth and changing lifestyles, further driving increases in overall societal resource needs. Overall, we argue that these motives are causing a persistent increase in the scarcity of land that can be expected to contribute significantly to future conflicts and struggles over access to land (cf. Homer Dixon, 1999).

7 Conclusions

In this paper, we have highlighted the rising importance of land as required to sustain the current and future energetic metabolism of societies. Approaching biophysical constraints (i.e., peaking fossil stocks), in combination with changing global dynamics (i.e., lifestyle changes) and demographic trends (i.e., population growth), are ultimately driving a transition to area-intensive forms of energy provision. While this provokes a land rush directly through

the expansion of energy provision systems, we also have argued that there is a close relation between the energy transition and land acquisitions motivated by food security threats. Given the inevitability of the energy transition, we believe that the recent increase in demand for land will rather be a persistent consequence for the 21st century.

Many governments have promoted 'green' alternative energy sources, as observed with biofuels policies, disregarding the associated changes in use and access to land. As seen in this article, however, each potential option for future energy provision yields trade-offs and/or constraints in terms of its prerequisite for land requirement for the ultimate goal of energy delivery. Multiple criteria need to be considered (such as power density, areal requirements, constraint factors, likelihood to create land disputes, competition with food production, associated social and environmental impacts, etc.) in order to shed light on the option space and, therefore, on future pathways of energy provision. Nevertheless, it is evident that land is becoming scarce and, consequently, future struggles over access to land can be expected to increase on a global scale.

There might be some ways to tackle this dilemma; however, alternative pathways are not easy to take. Natural gas and nuclear energy sources might postpone the shift from a global energy system based on *stocks* (i.e., nuclear energy and fossils) to one based on *funds* (i.e., renewables). Yet, the feasibility and the desirability of such options are open for discussion. As in the case of nuclear, waste production, operation risk, and fragility to external events (as seen with the most recent case of the Fukushima Power Plant crisis in Japan in March 2011) should not be overseen. From the perspective of the consumption side, global societal energy metabolism could also be scaled down to decrease areal requirements for energy provision and potential conflicts regarding access to land. However, this would also imply a radical change in lifestyles and the way industrialized societies function nowadays.

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CHAPTER IV

THE NATIONAL CHALLENGE

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Self-sufficiency or surplus: Conflicting local and national rural development goals in Cambodia

Abstract

Cambodia is currently experiencing profound processes of rural change, driven by an emerging trend of large-scale land deals. This chapter discusses potential future pathways by analyzing two contrasting visions and realities of land use: the aim of the governmental elites to foster surplus-producing rural areas for overall economic growth, employment creation and ultimately poverty reduction, and the attempts of smallholders to maintain and create livelihoods based on largely self-sufficient rural systems. Based on the MuSIASEM approach, the rural economy of Cambodia and different rural system types are analyzed by looking at their metabolic pattern in terms of land use, human activity, and produced and consumed flows. The analysis shows that the pathways of self-sufficiency and surplus production are largely not compatible in the long term. Cambodia's rural labor force is expected to increase enormously over the next decades, while available land for the smallholder sector has become scarce due to the granting of Economic Land Concessions (ELC). Consequently, acceleration in rural-urban migration may be expected, accompanied by a transition from self-employed smallholders to employment-dependent laborers. If the ELC system achieves to turn the reserved land into viable agribusinesses, it might enable added value creation; however, it does not bring substantial amounts of employment opportunities to rural areas. On the contrary, ELC have high opportunity costs in terms of rural livelihoods based on smallholder land uses and thus drive the marginalization of Cambodian smallholders.

Keywords

Cambodia; Land grabbing; Economic land concessions; Poverty reduction; Rural development

JEL codes

Q15; Q57; R11; R14; J22

1 Introduction

"The government talks about poverty reduction, but what they are really trying to do is to get rid of the poor. They destroy us by taking our forested land, 70% of the population has to disappear, so that 30% can live on" (Villager, affected by an Economic Land Concession in Cambodia (Licadho, 2009)).

Within the recent years, Cambodia has experienced profound processes of rural change, associated to the large granting of land concessions for economic purposes. While rural smallholders have been striving to achieve and maintain livelihoods based on largely self-sufficient smallholder agriculture (cf. Leuprecht, 2004), the governmental elite is seeking the establishment of large-scale industrialized agriculture capable of providing surplus flows for overall economic growth, employment creation and ultimately poverty reduction (RGC, 2004, 2008). This paper discusses impacts, constraints and potential future consequences of these contrasting land use paths in Cambodia.

A variety of studies has discussed the recent changes in the rural sector of Southeast Asia (SEA) and Cambodia. Hall et al. (2011) identified and discussed four powers of exclusion that have shaped land use and land users in SEA. Borras and Franco (2011) analyzed the political dynamics of land grabbing in SEA with a particular focus on the role of the European Union. Furthermore, a number of reports from development organizations (Leuprecht, 2004; OHCHR, 2007) and NGOs (e.g., Licadho, 2009), critically discussed the negative impacts of Cambodia´s land management strategy on human rights and human development in rural areas. While these studies have addressed important aspects of the political and social dimension of rural change in Cambodia and Southeast Asia, there is further need for a quantitative assessment of the current processes of rural change in order to discuss potential future pathways of land use and rural livelihoods in Cambodia.

Within this context, this article analyzes, based on the MuSIASEM approach (Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism) applied to rural systems (Giampietro, 2003), patterns of land use and human activity of the rural economy of Cambodia and of different rural system types. The constraints, impacts and potential future consequences of the governmental Economic Land Concession (ELC) system are addressed and the incompatibility of different development visions and realities, such as expressed by a villager in the introductory statement, are discussed. Although the geographic focus of this paper is Cambodia, we further contribute to the more general debates on agricultural and rural development that have recently emerged with the global land grab (see Chapter III and Borras et al., 2011; Scheidel and Sorman, 2012; von Braun and Meinzen-Dick, 2009; Zoomers,

2010). Hence, we address currently debated issues in land use and rural development studies, i.e., the potential contribution of large-scale land deals to rural employment (Li, 2011; Vermeulen and Cotula, 2010); the perception that the global South inhabits large reserves of 'idle' agricultural land (Borras and Franco, 2010, 2011; Cotula et al., 2009); the role of domestic actors in the land grab phenomenon (Deininger, 2011; Hall, 2011; Siciliano, 2012); and the opportunity costs of large-scale agribusiness in terms of poverty reduction and livelihood opportunities based on smallholder land use (De Schutter, 2011).

The paper proceeds as follows: Section 2 provides background information on Cambodia, its development policy and the ELC system. Section 3 introduces the methods and data, on which basis Section 4 analyzes potential challenges and constraints for ELC in terms of land use, demography and human activity. Section 5 discussed rural employment issues related to ELC, and highlights the opportunity costs in terms of livelihood opportunities from smallholder land uses. Finally, Section 6 illustrates the fundamental differences between self-sufficient and surplus-producing rural systems and the paper concludes in Section 7 on the existence of conflicting development visions and realities as drivers of rural change.

2 Background – Land users and land use governance in Cambodia

During the last 50 years, Cambodia experienced an eventful history that drastically affected rural and urban populations as well as their way to make use of their central natural resource: land. Ruled under six different regimes and constitutions that were accompanied by war, civil war and the devastating Khmer Rouge rule, Cambodia's population saw growth and decline, massive dislocation between cities and rural areas and constantly changing rules under which they were allowed to use the land (figure 4.1). It took until 1993 to establish the current Kingdom of Cambodia as a constitutional monarchy with a democratically elected government, which has pursued the development of the country based on a market oriented economy (Chandler, 2008; Leuprecht, 2004).

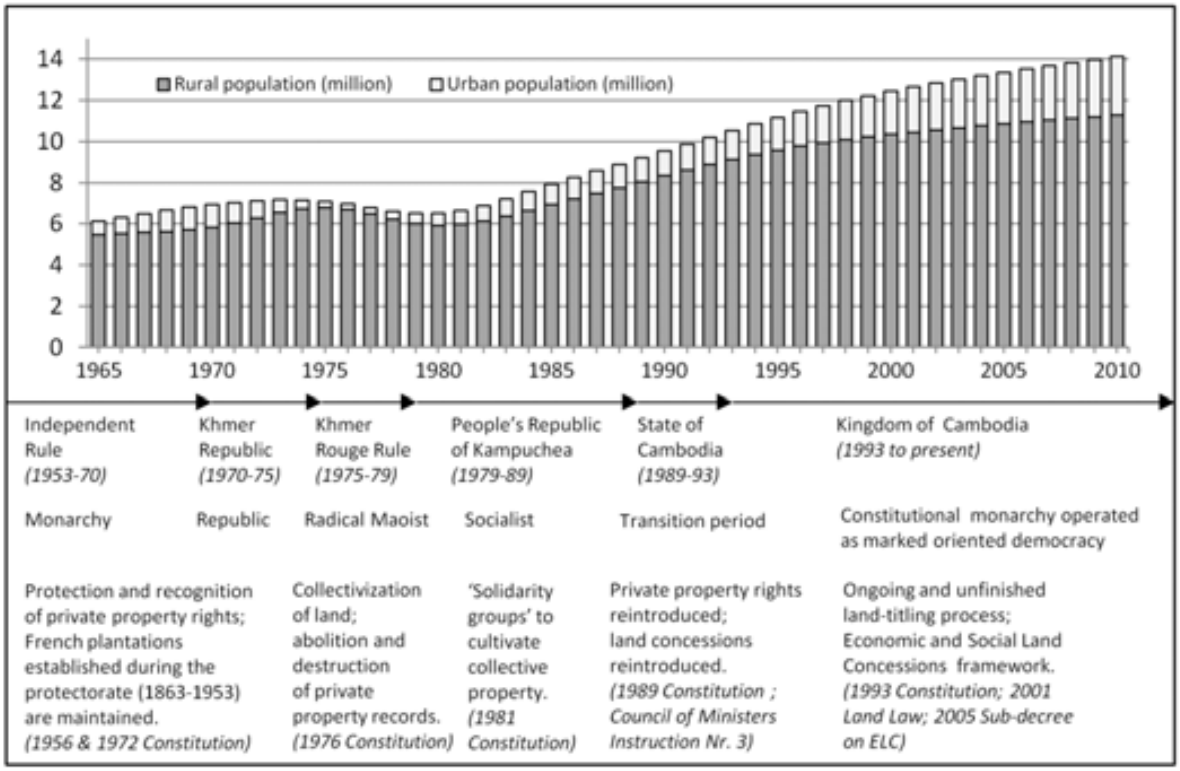

Figure 4. 1: Population dynamics, key historic periods and land use governance in Cambodia since 1965. Source: adapted from Chandler (2008), FAO (2011), Russel (1997) and Thiel (2010).

Nowadays, Cambodia has slowly recovered from its recent history, however faces current socio-economic challenges. Despite of rapid economic growth of almost 10% Gross Domestic Product (GDP) growth during 1998-2008 and 7.1% in 2011, the per-capita GDP remains low at 897 current US $ (2011) and poverty headcount ratios in terms of income over 2 dollars-a-day (PPP) were at 56% in 2007 (World Bank, 2010a). Rural communities further identified via participatory poverty assessments a variety of other major concerns. Among them are food insecurity, lacking assets to pay health costs, limited access to education, poor physical infrastructure and particularly increased vulnerability due to lacking access to land and community natural resources, driven by growing demographic pressure and increasing competition over natural resources from outside actors (ADB, 2001; Ballard et al., 2007). Although population growth has slowed down from an annual rate of 4.8% in 1984 to 1.2% in 2011 (World Bank, 2010a), the total population more than doubled since 1980, with a growing urban share (figure 4.1), leading to increasing resource needs exerted on the country from both the rural and the urban population. Total external debt outstanding was in 2010 with 27.6% of GDP relatively low and remained constant over the last years in relative terms (IMF, 2012), however, more than doubled in absolute terms since the establishment of the

Kingdom of Cambodia in 1993 (World Bank, 2010a), requiring an economy capable of generating surplus flows for external trade.

Cambodia has largely a rural economy, with 80% of the population living in rural areas and around 75% of the active labor force working in agriculture, forestry, hunting and fishing. Despite of this large share, the agricultural GDP accounted in 2007 only for 26.7% of the total GDP (constant 2000 prices), of which the service sector was the largest contributor (38.3%), followed by industry with 28% (NIS, 2008b). In consideration of a potentially higher contribution of the rural sector to economic growth and poverty reduction, the *Rectangular Strategy for Growth, Employment, Equity and Efficiency in Cambodia* of the Royal Government of Cambodia (RGC) has set agriculture as a center stone of its overall development policy:

> *"Indeed it is necessary to enhance and broaden the base for economic growth by opening and utilizing the* ***potentials in other sectors, especially in the high-potential agricultural and agro-industrial sectors****, so that the nation will obtain larger positive windfall gains in the* ***improvement of the livelihoods of the rural people****. The agriculture policy of the Royal Government is to* ***improve agricultural productivity and diversification, thereby enabling the agriculture sector to serve as the dynamic driving force for economic growth and poverty reduction****"* (RGC, 2004: 13, emphasis added).

In order to promote such agricultural development, Cambodia was, and still is, in the need of a proper land administration system that informs well about land use, land users and land use rights (Thiel, 2010). Land use governance has experienced fundamental changes in Cambodia, ranging from private property rights and concession systems during the French protectorate (1863-1953) and the subsequent regimes, over a complete collectivization under the Khmer Rouge regime (1975-1979), to the reintroduction of private property and land concessions in 1989 under the State of Cambodia (figure 4.1). After this, smallholders were encouraged to apply for formal land titles to agricultural and residential land, but the land administration was unable to deal with more than 4 million applications lodged, resulting that less than 10% of them were processed at the end of 1995 (Russel, 1997). The current land-titling process results in 250,000-300,000 new land titles annually; however, at least 12 million parcels remain still unregistered (Thiel, 2010). In addition to the land-titling system for smallholders, a system of Social Land Concessions (SLC) was established (Land Law 2001), aimed at providing land for landless, land poor people and other disadvantaged groups for subsistence and family farming (RGC, 2003) (table 4.1).

Table 4. 1: Social and Economic Land Concessions: A land management for sufficiency and surplus production. Source: adapted from Thiel, 2010.

	Social Land Concessions (SLC)	***Economic Land Concessions (ELC)***
Socio-economic purpose	Sufficiency oriented	Surplus oriented
Duration	No time restriction	Restricted to max. 99 years
Area	Max. 1,250 m2 for residential and max. 2 ha for agricultural use	Max. 10,000 ha for agricultural and industrial use
Property and use rights	Can be transformed into private property	Cannot be transformed into private property

However, for the development of agriculture as engine for economic growth, a land concession system was needed that allowed for the generation of large surplus flows for the economy; both in terms of commodities produced and tax fees. Since 1989, concessional land larger than 5 hectares could be granted to private companies for crop production "to support the national economy" (Russel, 1997). Despite of the fundamental lack of information regarding land use and land registration, agricultural concessions were generously awarded, leading to increasing land conflicts and a shortage of arable land at the end of the 1990s (Leuprecht, 2004). The 1992 Land Law failed to regulate land concession and although the new constitution of the Kingdom of Cambodia was promulgated in 1993, it took almost ten years to establish the new 2001 Land Law that would regulate concessional land. Finally, in 2005, the RGC (2005) issued the current sub-decree on Economic Land Concession (ELC) with the final objective to determine the procedures and criteria of revising concessions prior to the 2001 Land Law and granting new ELC. According to the sub-decree, among the main purposes of ELC is the promotion of agro-industries, large projects investments, the creation of employment in rural areas and fiscal revenues[7]. And according to *"Invest in Cambodia"*, a governmentally supported investors magazine: *"For investors looking to grow and process crops, Cambodia is an ideal location with plenty of land available for agricultural concessions"*[8]. The following sections of this article will provide and assessment of the constraints, impacts and potential future consequences of this land use policy.

[7] Concession rental fees range from 0-10$/ha/yr, depending on the quality and location of concession land (MAFF, 2011)

[8] http://www.investincambodia.com/agriculture.htm (accessed on 04.04.2011). These words were also used by other governmental bodies to promote ELC; e.g., http://www.cambodianembassy.org.uk/ (accessed on 01.03.2012).

3 Methodological framework and data

In order to assess constraints and impacts of the ELC system, it is necessary to get an understanding of the current rural economy of Cambodia (Section 4) as well as to analyze the performance of the proposed concessions systems, i.e., industrialized large-scale plantations, in comparison to common current rural systems, i.e., smallholder agriculture (Section 5 and 6). To do so, this paper uses core concepts from the MuSIASEM approach (Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism) applied to rural systems analysis (Giampietro, 2003; Gomiero and Giampietro, 2001; Serrano and Giampietro, 2009; Siciliano, 2012). In particular, we draw on the concepts of 'societal metabolism', 'rural system types' and 'impredicative loop analysis'.

The societal metabolism approach looks at socio-ecological systems by analyzing the processes of material and energy transformation required to sustain a given identity and to perform structural and functional activities (Giampietro et al., 2009; Giampietro et al., 2011). In order to formalize the socio-metabolic process in terms of *what the system is* and *what the system does*, we employ the concepts of 'funds' and 'flows', developed by Georgescu-Roegen (1971). 'Funds' refer to those elements of the system that are maintained and unchanged during a production process (hence, the identity of the system), while providing crucial services for the process to happen. 'Flows', refer to those elements that enter but do not exit the production process (i.e., input-flows), or exit, but do not enter the production process in the same state (i.e., output-flows). Flows hence are transformed by the funds during the socio-metabolic process. Following the MuSIASEM approach, we consider land use and human activity among the most crucial funds of rural systems and look at flows of commodity production and consumption, and their monetary value. Thus, we look at patterns of land use and land cover to represent the biophysical identity of rural systems and analyze patterns of human activity (i.e., time allocated to sleeping, eating, on-farm and off-farm work, education and leisure) to represent the socio-cultural identity of rural systems. Sustainability and lasting rural poverty alleviation ultimately is about maintaining the integrity of the funds and their transformative services, in order to sustain a desired socio-ecological system (see Chapter II and Scheidel, 2013). For land in production, this means maintaining the productive properties and for land not in production, it means maintaining critical ecosystem functions that serve as ecological overhead. For human activity, it means to guarantee survival (i.e., maintaining the physiological overhead in terms of sleeping, eating, personal care, care of elderly and children) as well as maintaining a valued socio-cultural identity (i.e., the social overhead: patterns of leisure, education, social institutions) (Giampietro, 2003). For the assessment of the current situation of rural Cambodia in Section 4, we thus account for both productive and

non-productive activities of the population, as well as for productive and non-productive land uses.

In order to be able to compare the performance of a rural system operated under concessions to those operated by smallholders (Section 5 and 6), the complexity and diversity of rural life needs to be simplified in accordance with the purpose of analysis. We use the concept of rural system types in order to deal with rural complexity (Giampietro, 2003). With 'type', we refer to a general set of expected relations of funds and flows of rural systems, which provides relevant information to understand the particular 'instances' (i.e., realizations) of such types in real life. A simple example illustrates the type concept well: the transport types 'bicycle' and 'car' have millions of different realizations each, but the realizations share enough commonalities that allow discussing general aspects, i.e., what you can do with cars, and what you can do with bicycles. Based on the purpose of this paper, we define a simple typology that consists of two rural systems types: a) the average Cambodian smallholder village, which represents a general pattern of the current rural Cambodia; and b) industrialized, large-scale agribusiness as pursued to be developed with the ELC system. The performance of both systems in terms of production and reproduction patterns will be compared using an impredicative loop analysis (ILA) (see Giampietro, 2003 for a detailed description). Briefly, an ILA is a methodological tool to provide a representation of the linkages between selected fund and flow elements. We use an ILA in Section 6 to analyze the relations between the land in production, the flows produced, the required labor, and the total amount of human activity (labor plus dependent part) that is associated to and sustained by each rural system type. The smallholder system type will be used to discuss the general performance of the current rural reality, while the ELC system type is used to discuss the urban and governmental vision of development of rural systems.

All data employed in the paper come from various secondary sources. Statistical data are generally taken from the Cambodian National Institute of Statistics (NIS) and include the Cambodia Socio-Economic Survey 2009 (NIS, 2010), the General Population Census (NIS, 2008a), the Statistical Yearbook of Cambodia (NIS, 2008b) and the Time Use Survey (NIS, 2007). Currently, no national agricultural census is available that informs coherently about land holdings, land uses and production data; hence they need to be integrated from various sources. While we take ELC data from the Ministry of Agriculture, Forestry and Fisheries (MAFF, 2011), we use the Cambodian Agrarian Structure Study (ACI, 2005) as source for average industrial production data and average smallholder production data. The average smallholder village type is calculated based on average statistical data on demography, human activity, land use and production for rural villages in Cambodia. Finally, although the data

come from secondary sources, the presented research is inspired by a three months research stay in Cambodia during 2011, which included visits and interviews to various development organizations, NGOs, farmers' associations, governmental workers and farmers (see Chapter V and Annex I).

4 The rural economy of Cambodia: land use, demography and human activity

This section presents land use, demography and human activity in Cambodia in order to understand the current situation of rural Cambodia in terms of land availability and demographic pressure, as well as to identify constraints, impacts and future consequences of the ELC system. Figure 4.2 puts SEA in a global context, by comparing the region with other world regions in terms of used land potential and inhabitants per hectare of land with rain-fed cultivation potential as a measure of demographic pressure on agricultural land. The axes cross at world average.

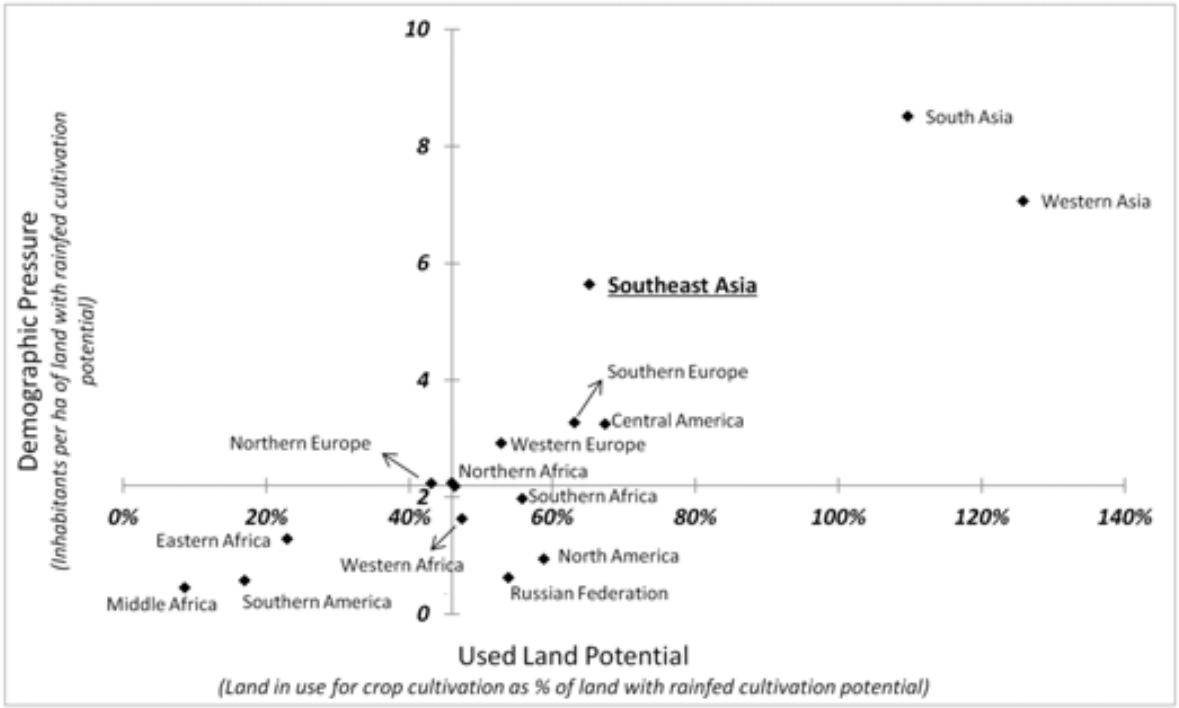

Figure 4. 2: Demographic pressure on cultivable land and used land potential across world regions in the year 2008. Source: own calculation, based on data from FAO (2011) and Fischer et al. (2002). Note: the axes cross at world average.

It can be seen, that SEA is among the world regions with the highest demographic pressure on cultivable land resources and has a large share of its cultivable land potential already used. Thus, on a regional level, SEA faces significant constraints of agricultural expansion. At the national level in terms of inhabitants per total land area, Cambodia's population density has grown rapidly from 36 hab/km^2 in 1980 to 80 hab/km^2 in 2010; and nowadays remains at a medium level between neighboring Lao PDR (27 hab/km^2), and Thailand (135 hab/km^2) and Vietnam (280 hab/km^2) (2010 values, from World Bank, 2010a). A closer look on land use, population dynamics and human activity will help to assess if, and under which conditions, Cambodia has *"plenty of land available for agricultural concessions"*, as mentioned by official propaganda (Royal Embassy of Cambodia, 2011).

4.1 Land use in Cambodia

The calculation of a non-overlapping land use account for Cambodia is not straightforward, because statistical sources are not always up to date or may provide contradictory information. Moreover, land use categories that are theoretically exclusive overlap in practice; in particular, large parts of ELC and mining concessions reach into protected areas (ODC, 2012; Vrieze and Naren, 2012). Figure 4.3 presents a rough approximation to land use in Cambodia, based on official data integrated from various sources. Data on protected areas, shrub land and agricultural area under production are taken from NIS (2008b). Data on the built environment are adapted from ACI (2005). Data on the share of smallholder land for household consumption and cash crop production were estimated based on the proportion of agricultural output absorbed by household consumption, using a 65% share (Mund and Ngo, 2005)[9]. ELC data are taken from MAFF (2011) and forest concessions data from the Forestry Administration Cambodia (FA, 2012). Mining concessions are not presented in the figure because they largely overlap with other categories such as forests, protected areas and ELC (ODC, 2012) and no official data on the total expansion was found. Reports however indicate that mining concessions amount up to no less than 1.9 million ha (Vrieze and Naren, 2012).

[9] While Mund and Ngo estimated a subsistence share of 60-65% of total agricultural output, other estimates for subsistence rice consumption range from 50% to 77%; see e.g. Meyer et al., (2009).

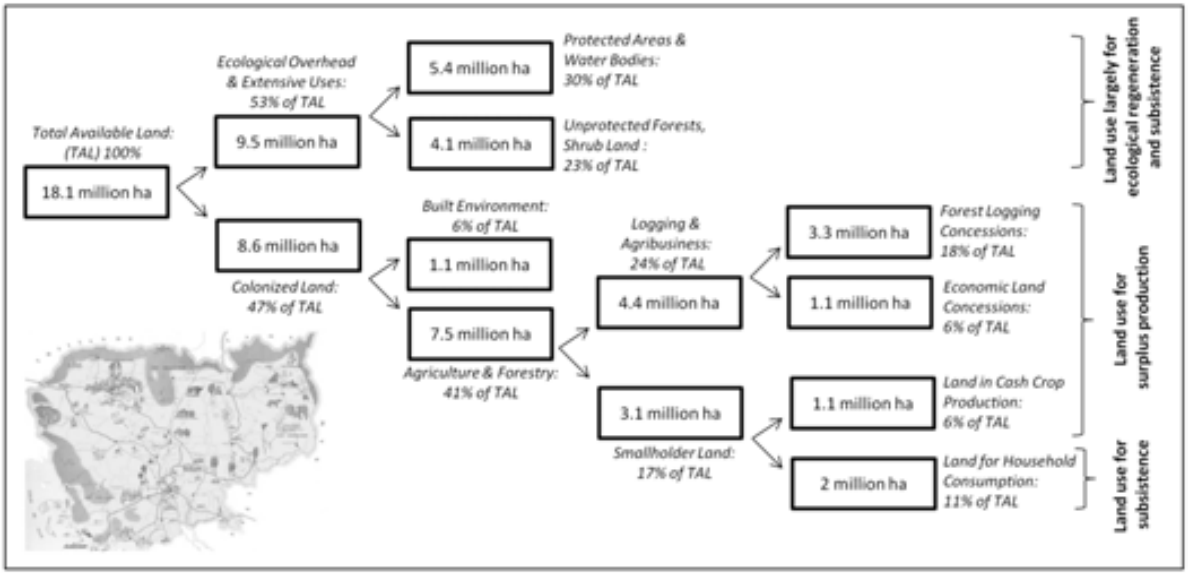

Figure 4. 3: An approximation to land use in Cambodia. Source: own elaboration, see text.

Figure 4.3 shows that Total Available Land (TAL) in Cambodia amounts to 18.1 million ha. Protected areas, wildlife sanctuary and water bodies (including the Tonle Sap Lake) cover 30% of TAL and provide important ecosystem functions, thus serving as a crucial 'ecological overhead'. Large parts of protected areas are moreover located in mountainous regions, making them badly suited for large-scale agriculture. Shrub land and unprotected forests not under logging concessions (23%) involve largely extensive uses that range from regeneration over community-forests to production not under concessions (FA, 2010). The remaining colonized land areas consists of the built environment (6%), and agriculture and forestry (41%). Within the last category, the total smallholder land, serving as a crucial livelihood asset for about 10.7 million rural people (NIS, 2008a), merely accounts for 17%, resulting in an average land use of less than 0.3 ha/cap. In comparison to the smallholder sector, 110 companies were awarded ELC and logging concession land, accounting for 24% of TAL (FA, 2012; MAFF, 2011).

In the last decade, the Cambodian Government was effective in granting ELC. Official data indicate a total concession area of 1.15 million ha in 2009, of which 956,690 ha have been validated and contracted with 85 companies (MAFF, 2011)[10]. Note that this is a rather conservative number, since MAFF data do not include concessions below 1000ha. In fact, other calculations indicate a total of 2 million ha of ELC land (Vrieze and Naren, 2012), which is substantially higher. Based on the MAFF data, the majority of the projects are dedicated to forestry (46%); followed by rubber (19%), oil palm (9%) and other crops such as sugarcane,

[10] Note that 9 companies, accounting for 587,000 ha concession land, have contracted land above the legal limit of 10,000ha and MAFF is currently trying to negotiate the reduction of concession land.

Jatropha and grains. Companies with Cambodian head offices dominate the sector, representing 61% of all concession land and 41% of all companies. This confirms that domestic actors play an important role in the recent land grab phenomenon (Deininger, 2011; Hall, 2011). Chinese companies are the second most important actors, accounting for 22% of total land size. The remaining 17% of concession land is divided between Vietnamese, American, Thai and other Asian companies (own calculations, based on MAFF, 2011).

On an aggregated level (figure 4.3), we can see that the current amount of concession land could only be granted due to the small land holdings of the rural population. Land for further ELC could currently only come from unprotected forests and shrub land, protected areas, or from (unregistered) smallholder land. However, total forest cover was already in 2008 with 10.5 million ha (NIS, 2008b) more than 2% below the Cambodian target of maintaining 60% (FA, 2010) and both ELC and mining concessions have already penetrated large parts of protected areas as well as unprotected forests (ODC, 2012). In addition to the quantity of available land, also certain qualities, such as productivity, suitability for large-scale agriculture and access to markets which usually characterize lowlands, matter and may drive investors' operations into areas already cultivated by smallholders (Cotula et al., 2009). In fact, the granting of ELC has widely affected Cambodian smallholders because of substantial problems regarding the allocation of concession land (Licadho, 2009). Due to the unfinished land-titling process, information on smallholder land is largely missing, resulting in problems of weak land governance (Thiel, 2010). It was estimated that since 2003, no less than 400,000 people have been affected by land disputes and forced evictions in only 12 out of 23 provinces (Vrieze and Naren, 2012).

Regarding the current land grab debate, the perception of vast available reserves of 'idle' or 'underutilized' land in the global South gained prominence among governments trying to attract investors as well as among investors seeking for opportunities and partly has its roots in technical land mapping based on satellite imagery (Borras and Franco 2010, 2011; Cotula et al., 2009). However, it is not clear to which extend such 'idle' land accounts for the above mentioned qualities; to which degree it has been undervalued because production is not marketed (von Braun and Meinzen-Dick, 2009); if fallow land is included (Cotula et al., 2009); and to which degree land use fragmentation due to peasant settlements would interfere with large-scale concessions. As seen above, the large granting of ELC in Cambodia was only possible due to small land holdings of the rural population; through increasing land conflicts due an overlap of concessions and smallholder land; and through the penetration of concessions into (protected) ecosystems. All this supports that the perception of *"plenty of*

land for agricultural concessions" needs to be reconsidered by the Cambodian government as well as within the land grab debate.

4.2 Demography and human activity in Cambodia

The long-term consequences of the rapidly declining land availability for the smallholder sector can be well understood by looking at demographics and human activity in Cambodia. Figure 4.4 shows the demographic structure and patterns of human activity for the Cambodian population. While the population pyramid on the left of figure 4.4 shows the population decomposed in economically active and inactive persons, the pyramid on the right represents hours of human activity in terms of monetary income generating work, other productive work and non-productive work, calculated on the basis of NIS data (NIS, 2007, 2008a). Income generating activities were calculated by summing up work as employed, own business work, and the share of agricultural work invested in crops sold on the market. This share was calculated based on the proportion of agricultural output for household consumption (65%) and agricultural output for selling (35%) (Mund and Ngo, 2005). Other productive activities include agriculture work for household consumption (tending rice, tending other crops, tending animals, hunting, fishing), household work (fetching water, collecting firewood, construction, weaving, sewing, textile care, handicraft (not textile) and housework (buying, cooking, washing, cleaning, care of children and elderly). Non-productive activities include all other activities, in particular education, sleeping, eating and drinking, personal care, travels and leisure time.

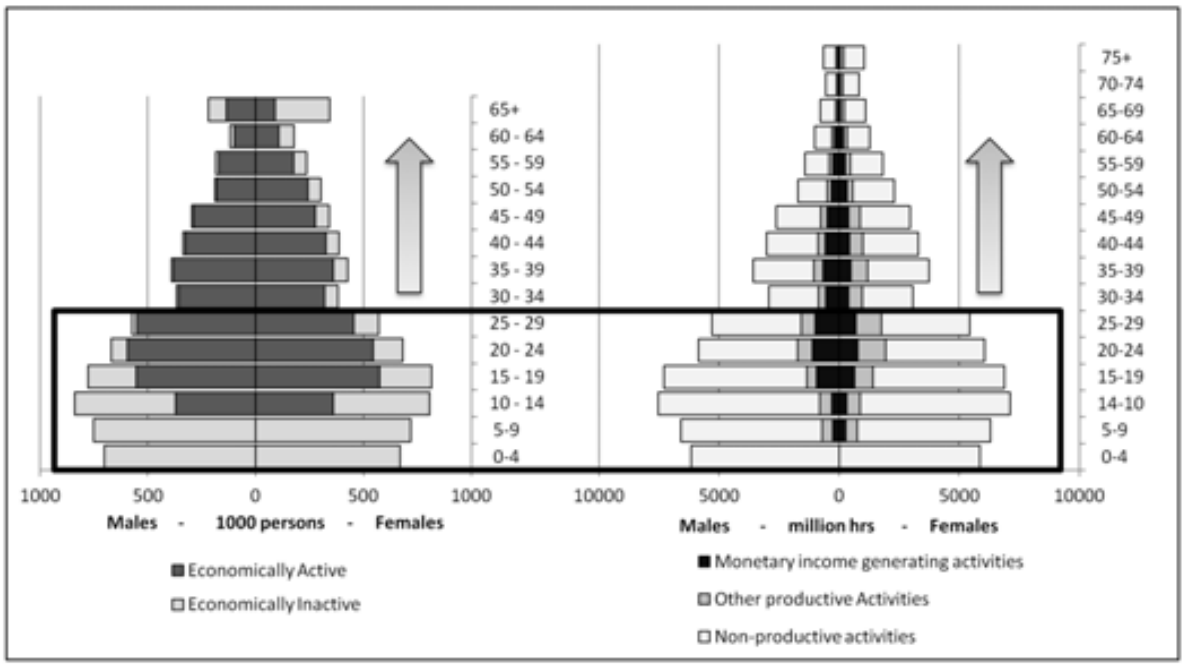

Figure 4. 4: Population structure of Cambodia (2008), decomposed for economically active/inactive persons (left pyramid) and human activity in terms of hours of monetary income generating activities, other productive and non-productive activities (right pyramid). Source: own calculation, based on NIS (2007, 2008a, b). Note: persons below 4 years, for which no time use data were available, were accounted as spending all their time on personal care (sleeping, eating, drinking, and personal hygiene).

What becomes visible from both population pyramids is that Cambodia has an extremely young population. This relates back to the devastating rule of the Khmer Rouge regime during the 1970s, in which an estimated number of 2.2 – 2.8 million people lost their life (Heuveline, 1998). While the associated socio-demographic impacts are far-reaching (De Walque, 2006), particularly the cohorts aged above 30 years - that is born before the genocide - are vastly diminished. However, the cohorts below 30 years are rapidly growing, implying that an extremely high number of young people enter each year the labor force. According to NIS (2010), during 2004-2009 around 1.3 million persons entered the labor force, of which 1 million were located in rural areas. This corresponds to an overall increase in the labor force of 20% on the national level, and 22% in rural areas. Although such a rapid growing labor force has led to a low dependency ratio of merely 55 dependents per 100 workers (World Bank, 2010a) and a large share (60%) of economically active population (figure 4.4, left pyramid), it represents a severe challenge for Cambodia to provide sufficient livelihoods opportunities.

The official unemployment rate of merely 0.7%, with 1.8% in Phnom Penh, 2.2% in other urban areas and 0.35% in rural areas (NIS, 2010) would suggest that Cambodia is doing well in terms of employed people (defined as all persons that worked at least one hour during the survey-reference-period of seven days, including unpaid family workers (NIS, 2010)).

However, a deeper analysis is required to reveal employment quality (i.e., underemployment) and employment source (i.e., self-employed subsistence work versus employment from other sectors). Regarding underemployment, many workers, especially from rural areas, are seeking additional employments in spite of long working hours, reflecting the low and seasonal earnings from agriculture (Morris, 2007). Regarding the employment source, an analysis of human activity, as proposed by the MuSIASEM approach, helps to get a more detailed understanding about the sources of livelihood opportunities in Cambodia. While the pyramid on the left of figure 4.4 shows a graphical representation of human activity in terms of monetary income generating, other productive and non-productive activities, figure 4.5 provides an aggregated approximation to human activity in the economy of Cambodia.

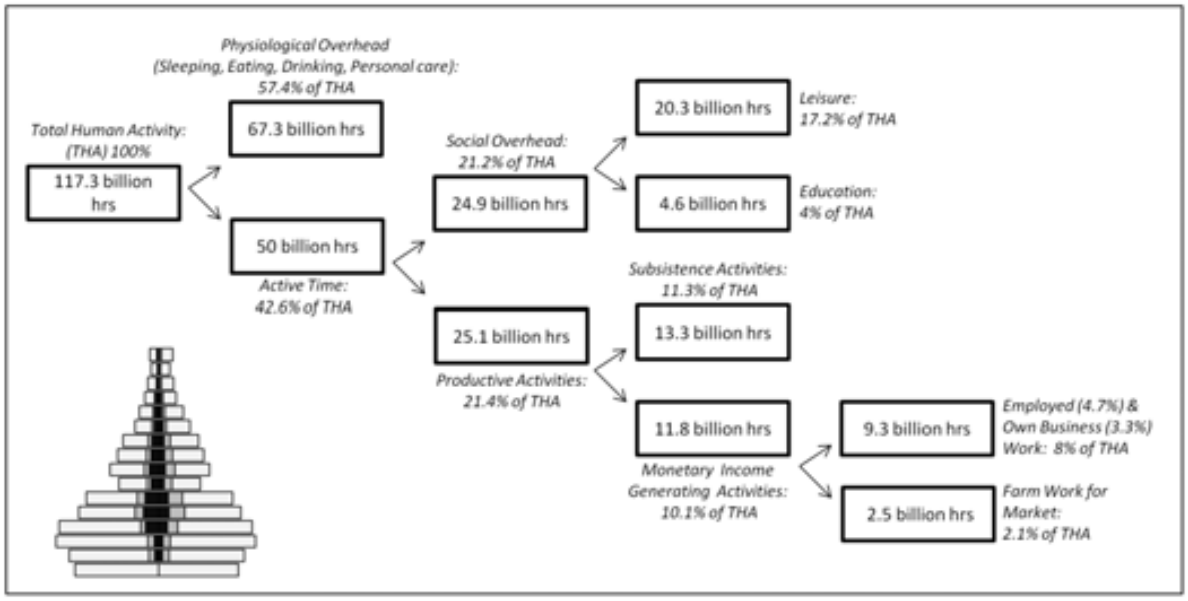

Figure 4. 5: Human activity in Cambodia. Source: own calculation, based on NIS (2008, 2007).

Cambodia's Total Human Activity (THA) is composed of a total time budget of 117.3 billion hrs (population*24hrs*365days), of which a generous share of 57% is dedicated as physiological overhead in terms of sleeping, eating and personal care. From the remaining potentially active time, around 21% of THA is dedicated to productive activities, which are further split into subsistence activities (11.3% of THA), employed work (4.7% of THA), own business work (3.3%) and farm work for the market (2.1% of THA) (figure 5). A land-time-budget-analysis from neighboring Lao PDR (Grünbühel and Schandl, 2005) shows a similar pattern, however with a larger share of subsistence activities (25% of THA). Such a pattern of human activity can be understood as a pattern of a largely agrarian, non-industrialized economy, in which a large share of productive activity is dedicated to the agricultural sector,

in particular to subsistence activities. On an aggregated national level, such as presented in figure 4.5, subsistence activities together with farm work for the market account for 63% of all productive activities (in terms of hours of work). This implies that livelihood activities outside the agricultural sector, including urban areas such as Phnom Penh, account only for 37% of total livelihood activities in Cambodia. If we account only for rural areas, subsistence activities together with farm work for the market, make up 68% of all livelihood activities (calculations based on NIS 2007, 2008a).

In summary, what we can see is that two thirds of the livelihood activities come from subsistence activities and 'self-employed' farm work for the market. These livelihood activities are however based on very small land holdings (see Section 4.1) that generally do not allow for large incomes or for sharing with the next generation. Hence, in order to provide livelihood opportunities for the growing rural population, people that enter the labor force will need either land for subsistence, or jobs outside the 'self-employed' smallholder sector. Yet, while the rural labor force is growing rapidly, land availability has declined drastically due to ELCs. This is putting enormous pressure on the subsistence economy and forcing young Cambodians to seek livelihood opportunities outside the smallholder sector. Thus, it can be expected that within the next decades, Cambodia´s rural sector will experience a fundamental change from an economy based on a 'self-employed' peasantry, towards an economy based on employment-dependent laborers, suggesting acceleration in rural-urban migration. Such a transition happened in many industrialized countries; however, there is a crucial difference in the underlying driving forces. In many industrialized countries of the global North, *land was left without farmers* due to the availability of other livelihood opportunities in other sectors. In Cambodia, *farmers are left without land* and thus are forced to seek jobs in other sectors.

5 The employment potential of Economic Land Concessions (ELC)

We turn now to discuss if the ELC system can provide the promised and needed employment in rural areas. According to article 3 of the ELC sub-decree, among the main purposes for which ELC can be granted is: *"To increase employment in rural areas within a framework of intensification and diversification of livelihood opportunities and within a framework of natural resource management based on appropriate ecological system" (sic, RGC, 2005).*

The majority of the ELC projects have not yet entered in a productive state and only some started with preparative activities such as land clearing, while even less started to

actually plant crops (MAFF, 2011). Thus, rather than to assess the *actual employment* provided, it makes more sense to provide a discussion on the *employment potential* of the ELC system for rural areas as well as to point out potential problems that will need to be addressed by Cambodian policy makers. It is important to note that along the life-cycle of the obtained products from both smallholder and ELC systems also further jobs are associated in urban areas, such as through the processing, trade and retail sector. Since the ELC policy focuses on employment in rural areas, we limit our quantitative assessment to the job opportunities in rural areas that are directly related to the proposed agribusinesses.

Table 4. 2: Job potential of Economic Land Concessions in Cambodia – a rough assessment.

Main purpose:	***Forestry***	***Rubber***	***Oil palm***	***Sugar cane***	***Jatropha***	***Grains***	***Other*****	***Total***
Total ELC area (1000ha)	525	196	107	56	8	38	220	1,150
Jobs/ 1000ha	20	420	350	153*	420	10	400	---
Potential jobs	~11,000	~83,000	~38,000	~9,000	~4,000	~400	~90,000	**~235,400**

*Source: own elaboration, based on data from MAFF (2011). Note: For projects that have stated various cultivation purposes, the first purpose has been used for categorization. Values on potential jobs are generally rounded upwards, assuming labor-intensive investments. *Rain-fed, 1/3 mechanized.**The category "Other" summarizes all other ELC projects for which either no information was given regarding the purpose, or no jobs estimates are available from the World Bank. In order to estimate the job potential we assume labor-intensive investments of 400 jobs/1000ha.*

To do so, we use general estimates on jobs/ha for different industrial crops from the recent World Bank (2010b) report 'Rising global interest in farmland' in order to come up with a rough assessment of the employment potential of ELC (table 4.2). Table 4.2 indicates that although forestry accounts for most ELC projects in terms of area, it has quite a low job potential. ELC projects for rubber plantations are the second largest group in terms of areal expansion and, being labor-intensive, have the highest job potential of 420 jobs/1000 ha. This is consistent with data from private rubber plantations in Kampong Chan province, that suggest 400/jobs/ha during the most labor-intensive production phase (year 6-29 of production; calculations based on ACI (2005), considering 300 workdays/year as one 'job'). The total potential jobs estimated for all registered ELC projects amount to around 235,000 for 1.1 million ha of concession land.

While around 235,000 new jobs in rural areas sound promising, the picture changes rapidly if this number is put into context. First of all, this number is in fact lower than the amount of people (400,000) that have been reported to be negatively affected by land conflicts and forced evictions due to the granting of ELCs (Vrieze and Naren, 2012). Secondly, in rural Cambodia yearly 220,000 persons enter the labor force (average of 2004-2009, NIS, 2010). Based on the optimistic assumption that all ELC projects would materialize soon and would further be managed during the 70 years of contract time, they would have the potential to provide enough long-term jobs (50 years of work, from age 15 to 65) for the labor force cohort of one year. However, the persons that enter the labor force during the following 49 years would not have any benefits in terms of direct employment in ELC agribusinesses; but rather will encounter the countryside with little land available for their own smallholder enterprise.

Hence, the ELC system bears the severe risk of triggering rural-urban migration motivated by a vast number of job-seekers from rural areas. Whether the indirectly created jobs in urban areas such as in the retail and trade sector can absorb the rapidly growing rural labor force, remains questionable; however, it becomes clear that the potential of ELCs for direct employment creation in rural areas, as pursued by the 2005 ELC sub-decree, is limited. Moreover, this pathway of rural change, based on a vision of surplus providing rural systems fostered by the urban elites, has large opportunity costs in terms of alternative land uses (cf. De Schutter, 2011) for rural poverty reduction and self-sufficiency. On the basis of 2 ha/household (a value which is above the Cambodian average of 1.7 ha (ACI, 2005) and which represents twice as much land for about half of all Cambodian households (NIS, 2010)), the opportunity costs in terms of livelihoods based on smallholder farming amount to 575,000 households, corresponding to no less than 2.7 million Cambodians.

6 Self-sufficiency or surplus: conflicting local and national rural development goals

What could be seen so far is that the ELC system, in terms of livelihood opportunities, does currently not serve as ‘dynamic driving force of poverty reduction’ but rather bears the risk to act as major driver of rural change, manifesting itself in a shift from a self-employed smallholder sector towards employment-dependent laborers. Weak land governance, land speculation, corruption and other factors certainly play an important role regarding the issue of why large-scale land deals do not necessarily benefit ‘the poor’ (cf. Leuprecht, 2004). However, we aim to add another argument to the debate: there is a fundamental conflict

between the urban elite's vision of rural development and poverty reduction based on industrialized land use, and the visions and realities of rural communities themselves, who see their livelihoods fundamentally dependent on access to land for smallholder agriculture (Ballard et al., 2007).

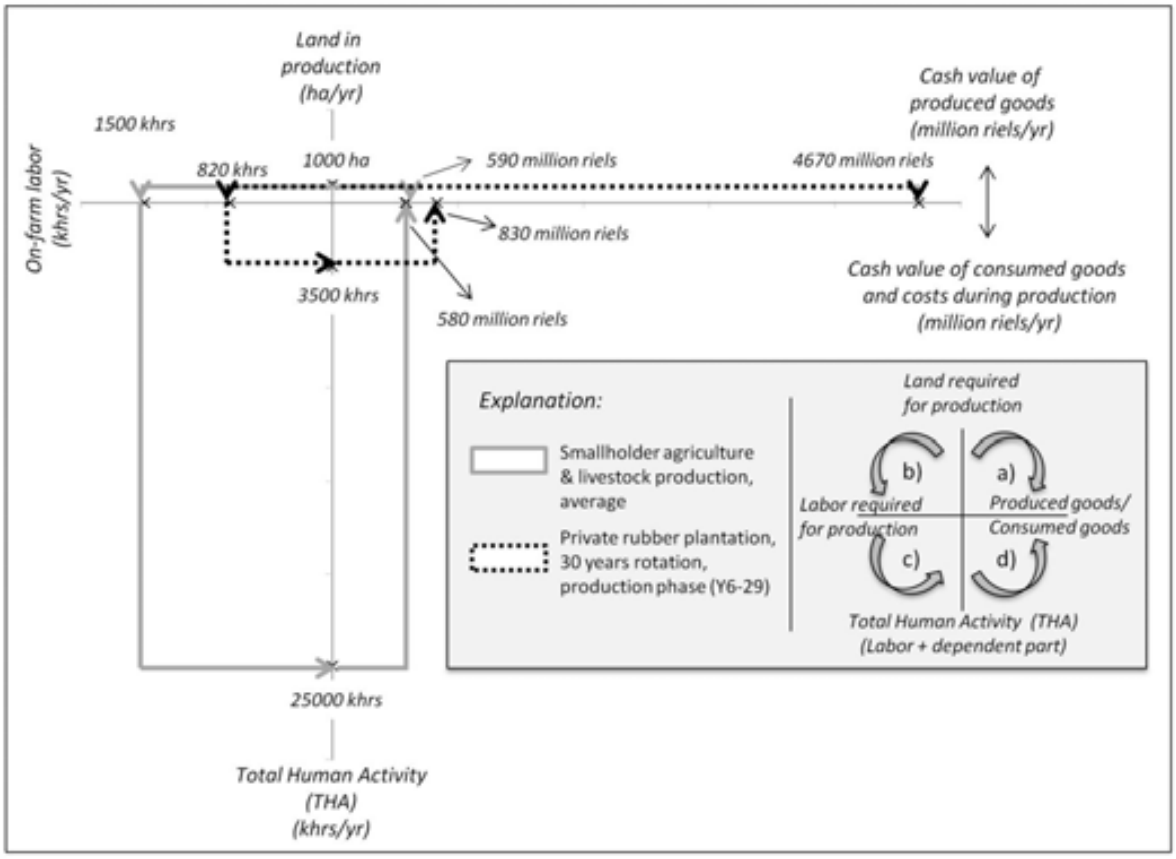

Figure 4. 6: Impredicative Loop Analysis (ILA) of two rural system types in Cambodia. Note: the 'cash value of produced goods' of both systems refers to the value of gross agricultural and livestock production. The 'cash value of consumed goods and production costs' in the average smallholder system refers to the cash value of total agricultural output absorbed through household consumption using a 65% share (Mund and Ngo, 2005) plus the total production costs. Source: own calculations, based on various sources. All data on rubber production are taken from ACI (2005) and refer to a 30 years rotation model in Kampong Chan, assuming a workload of 8hrs/workday. Total human activity associated to the rubber production system was calculated based on average household size (NIS, 2008b) in terms of hours, of which the depend part was calculated based on the labor required to arrive at an income allowing for average household consumption in rural Cambodia (NIS, 2010). Data on average smallholder agriculture and livestock production come from ACI (2005) and NIS (2007). Total human activity of the smallholder system is calculated based on the ratio of time allocated to agriculture & livestock activities to all other activities of the average rural household (NIS, 2007). Note: all cash values have been rounded and deflated (2005 constant prices).

Figure 4.6 shows an impredicative loop analysis (ILA) of two rural systems: the average smallholder system of agriculture and livestock production (i.e., the average Cambodian village) versus a model of private rubber plantation with 30 years rotation during production phase (year 6 to 29). We use the average smallholder system to represent a rural

system type that largely reflects the current rural reality in Cambodia and take the private rubber plantation as an example of the urban elite's vision of agricultural and rural development within the ELC scheme. The ILA illustrates the following relations for the two rural system types (see figure 4.6: explanation): a) the cash value of the goods produced for a fixed amount of land in production (1000 ha); b) the amount of labor hours required for the cultivation of the land; c) the total human activity associated with the workers (labor hours plus dependent part such as family); and d) the value of goods consumed within the production system. Again, the compared two systems are 'types' based on average values. Hence, realizations of such types differ in practice, according to the particular socio-ecological context (see for example Chapter V). Nevertheless, the differences between the compared systems are large enough to discuss some general trends of contrasting land uses regarding value added (as an important feature for the urban elite's) and rural livelihood opportunities based on having access to land (as an important feature for the rural population).

What can be seen clearly from figure 4.6 is that the two systems have different identities and functions regarding their socio-metabolic patterns of production and reproduction. Looking at the smallholder system (full grey lines in figure 4.6), we can see that the main function consists of its own reproduction. Most of the flows, produced at a limited rate, are fed back to maintain the funds of the system, i.e., patterns of land use and human activity. Although often operated at low yields, smallholder agriculture has the potential to maintain land productivity and biodiverse agro-ecosystems in the long-term (Altieri et al., 2011). As these systems operate largely outside the market economy (e.g., labor exchange, production for household consumption), total income is generally underestimated in official statistics (NIS, 2010), fostering the perception of 'poor' rural areas, when using income as proxy for poverty evaluation (see Chapter II and Scheidel, 2013). However, this rural system type can provide livelihood opportunities for a comparatively large population (see figure 4.6: THA), thus resulting in a high carrying capacity in terms of persons/hectare. Regarding the function of such a rural system from a governmental perspective, little surplus is left for trade and the remaining Cambodian society in urban areas. However, although the surplus flows are limited, they consist mostly of food (i.e., rice), thus bearing benefits for the Cambodian society in terms of food security. The large-scale private rubber plantation system, as a relevant and job-intensive example of the ELC land use scheme, clearly has a different function, oriented to economic surplus production (figure 4.6, dashed lines). The funds that produce the flows are largely modified and decreased; industrial land use, such as rubber plantations, has generally severe environmental impacts in the long-term (Ziegler et al., 2009) and the identity of the associated social system changes to employment-dependent laborers. A smaller fraction of labor is required that sustains with the generated incomes a disproportionally smaller

amount of total human activity. Hence, the carrying capacity of such rural systems is reduced in order to produce surplus flows that, rather than self-consumed, are passed on to other sectors.

Currently, most ELC projects have not yet materialized (MAFF, 2011) and the question remains open whether the potential future benefits and tax revenues that may be obtained will be re-invested in Cambodia and particularly in rural areas. Justified by the governmental discourse of poverty reduction based on overall economic growth, ELCs however have currently led to the exclusion of other potential land users and thus to large opportunity costs in terms of livelihood opportunities for smallholders. Thus, to understand current processes of rural change in Cambodia, the existence of fundamentally conflicting local and national realities and visions of land use, rural development and poverty reduction need to be considered (see Chapter II; Scheidel, 2013). Such different visions of rural development might have less conflict potential under conditions of low demographic pressure, which however do not apply to Cambodia, an even less in the future in which productive land resources may become scarce globally (see Chapter III; Scheidel and Sorman, 2012). Under the conditions of land scarcity, such conflicting visions of rural development are not compatible in the long-term, driving the local population into a situation in which *"their land is needed but their labor not"* (Li, 2011: 286). Theoretically, this can be understood as a drastic trade-off between different visions, scales and dimensions of rural development and poverty reduction (see Chapter II; Scheidel, 2013). In development practice however, it may unfortunately imply – as stated by the villager (introduction) – *"to get rid of the poor"*.

7 Conclusions

Cambodia, on its path of development is experiencing profound processes of rural change and future pathways are challenging as they are facing drastically changing relations between land use and human activity. While the rural labor force is growing at a rapid pace, land availability for the subsistence economy has declined drastically due to the large promotion of land concessions, leaving farmers without land. Consequently, rural-urban migration can be expected to accelerate tremendously, provoking a transition from a self-employed smallholder sector to employment-dependent laborers. If, in the future, the ELC system achieves to materialize the projects for which large amounts of land have been reserved, the interest of governmental elites on surplus production for national economic growth may be served. However, the opportunity costs of alternative land uses in terms of smallholder

livelihoods based on subsistence and self-sufficiency are enormous and need to be considered by Cambodian policy makers.

Within this context, we have argued that acknowledging the existence of different visions, scales and dimensions of rural development and poverty reduction is crucial to understand the current conflicting processes of rural change in Cambodia. Development and poverty reduction efforts at the national level, focused on the production of surplus flows for overall economic growth, does not necessarily benefit development at the local level, based on smallholder production that provides only limited amount of surplus flows, but sustains the involved funds such as land and labor and may provide a large amount of livelihood opportunities. The existence of such conflicting development visions and poverty dimensions matters, as in the case of Cambodia, the governmental development policy bears the risk to foster 'getting rid of the poor' rather than 'getting rid of poverty'. Considering rural development and poverty reduction as a complex challenge that involves various dimensions and scales of development (see Chapter II; Scheidel, 2013), thus ultimately requires dealing with the questions of rural development and poverty reduction for whom and for how long.

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CHAPTER V

THE LOCAL CHALLENGE

This chapter has been submitted as: Scheidel, A., Farrell, N.K., Ramos-Martin, J., Giampietro, M., Mayumi, K.: Land poverty and emerging ruralities in Cambodia: Insights from Kampot province. Submitted to the journal *Environment, Development and Sustainability*, as part of the special issue *"Pathways of rural change: An integrated assessment of the metabolic patterns of emerging ruralities",* February, 2013.

Land poverty and emerging ruralities in Cambodia: Insights from Kampot province

Abstract

Rural change in Cambodia manifests itself in a rapidly declining availability of land for the smallholder sector. In this chapter we illustrate with a case study how this relates to the emergence of new ruralities at the local level through a subsequent re-organization of the peasant economy. Based on an integrated assessment of the metabolic pattern of a smallholder village in Kampot province, we illustrate in quantitative terms how land shortage is leading to declining surplus generation and problems of liquidity in monetary and non-monetary flows. At the household level, livelihood diversification based on the involvement of other productive resources becomes necessary and thus, pluriactivity, including migration to work in the new industries, is becoming a key feature of new ruralities. At the village level, smallholders may respond to these new challenges through institutional innovation, in particular through the establishment of a community banking system and a rice paddy bank to provide money and rice credits to overcome transitory shortages and to cover investment costs for additional productive resources. Thus, in this case, we observe the emergence of new patterns of livelihood in rural areas that combine properties of traditional peasant agriculture with new economic activities and institutions.

Keywords

Cambodia; rural change; land poverty; land grabbing; emerging ruralities; societal metabolism

JEL codes

Q12; Q14; Q18; Q57

1 Introduction

In Cambodia, availability of productive land is a central livelihood condition for the majority of the population (ADB, 2001). However, the emergence of a global rush for land resources during the last years (see Chapter III and Borras et al., 2011; Scheidel and Sorman, 2012; Zoomers, 2010) has also affected Cambodia and claims for land have drastically increased from both the rural and the urban population. While a rapid growth of the rural labor force has driven the need for smallholder land, land availability has drastically declined due to the large granting of Economic Land Concessions (ELC) to foreign and domestic agribusinesses, governed by the urban elites to foster trade and tax flows (see Chapter IV and Leuprecht, 2004; Scheidel et al., in press). Since a large share of the population is affected by this trend in Cambodia but also in other countries of the global South, it becomes of crucial importance to understand how declining access to land affects small-farmers and which measures they may take to overcome challenges related to land shortage.

Within this context, the aim of this paper is to analyze how processes of rural change in terms of decreasing land availability may affect smallholders. To do so, we discuss in quantitative terms with a case study from Kampot province, Cambodia, how shortages in access to land are related to problems of liquidity in monetary and non-monetary flows and how land poverty violates the viability of subsistence agriculture and produces farm income gaps. While the latter is well known in Cambodia (ADB, 2001; Ballard et al., 2007), we aim to advance the understanding of the importance of access to land for rural livelihoods by presenting a quantitative analysis capable of accounting for the particular situation of individual types of households. Therefore, we develop an 'impredicative' subsistence land poverty line that depends on household size, consumption level and rice growing technology, and use the resulting analysis to discuss how land shortages are related to livelihood diversification. Further, we illustrate how smallholders may deal with the new challenges through innovation in community institutions, in terms of the introduction of a community banking system to manage both monetary and rice surpluses and deficits. Finally, we argue that both livelihood diversification and institutional innovation are resulting in the emergence of new ruralities through a subsequent re-organization of the peasant economy.

The term 'new rurality' has been largely used in a Latin American context (Kay, 2008). It generally refers to the changes in rural life due to an increasing engagement in multiple activities (i.e., 'pluriactivity') of small-farmers and the growing importance of rural-urban linkages (Kay, 2008; Hecht, 2010). Although the concept of new rurality has received less attention in a Southeast Asian (SEA) context, similar processes can be found related to rural

change. Kelly (2011) for example addressed the growing importance of migration for smallholders in SEA. Hall et al. (2011) have identified a variety of exclusion processes that have shaped new land relations. Elsewhere we discussed general drivers and impacts of rural change in Cambodia due to increasing demographic pressure in combination with 'land-grabs' through the ELC system (see Chapter IV; Scheidel et al., in press). While all these studies provide an overall picture of the various processes involved, the present paper rather aims to generate in-depth knowledge by focusing on a single village and household case studies. Thus, the results presented here are not necessarily representative, on a country-wide basis. Instead, they provide a theoretically informed reflection on the challenges that many rural people face nowadays in Cambodia and elsewhere, as they develop new ruralities. In relation to the theme of this special issue, we particularly put declining access to land at the center of the explanation of rural change and emerging ruralities.

The paper is structured as follows: Section 2 provides background information on rural change in Cambodia. Section 3 presents the methodological framework and the data sources. Section 4 shows the results from the village and household case study, while Section 5 discusses individual and collective responses to declining land availability. Section 6 concludes with reflections on the importance of access to land and its relation to the emergence of new ruralities.

2 Background: Rural change in Cambodia

Within the last 50 years, Cambodia experienced radical regime changes that drastically affected rural populations and their ways of making use of their land resources. During the colonial French protectorate (1863-1953), farmers continued to cultivate land based on the traditional "acquisition by the plow" principle, despite property rights and land concessions being first introduced. The radical Khmer Rouge Rule (1975-1979) abolished all forms of private property and uprooted urban and rural populations to force them to collectively cultivate the land. Solidarity farming groups followed under the subsequent Vietnamese occupation and the socialist People's Republic of Kampuchea (1979-1989) and finally in 1989 private property and land concessions were reintroduced under the transitional regime of the State of Cambodia (1989-1993). Since the establishment of the Kingdom of Cambodia in 1993 as a constitutional monarchy, Cambodia has pursued a transition towards a market economy, with particular attention to developing the rural sector (Chandler, 2008; RGC, 2004). At present, Cambodia remains a largely agrarian country with 80% of the population living in rural areas and around 75% of the active labor force still working in agriculture, forestry,

hunting and fishing (NIS, 2008b). However, the country is entering deep processes of rural change associated with rapidly declining land availability for smallholders.

On the one hand, the demand for resources from the countryside has substantially increased within the rural population itself, due to demographic changes: an endogenous driver of rural change. Recent discussions on globally increasing urbanization rates (which is a relative measure, gauged in terms of percentage) have mainly brought attention to the fact that, for the first time in human history, the global urban population exceeds the global rural population (UN, 2012). However, in terms of absolute population growth, pressure on rural land nonetheless continues to grow among many rural populations. Being home to around 11 million rural people, Cambodia has never before, in its entire history, been inhabited by so many farmers as today (figure 5.1a). Cambodia's population is a special case, due to a demographic legacy of the devastating Khmer Rouge rule, under which an estimated number of 2.2 – 2.8 million people died earlier than was to be expected (Heuveline, 1998). As a consequence, at present, cohorts above 30 years of age are vastly diminished and the cohorts below 30 years are rapidly growing (figure 5.1b). In fact, no less than 1.3 million persons entered the labor force during 2004-2009, 1 million of which were located in rural areas (NIS, 2010). This constitutes an overall increase in the rural labor force of 22%, whose central activity is farming, which has drastically increased the overall endogenous demand for land, as this is the major rural livelihood asset in Cambodia.

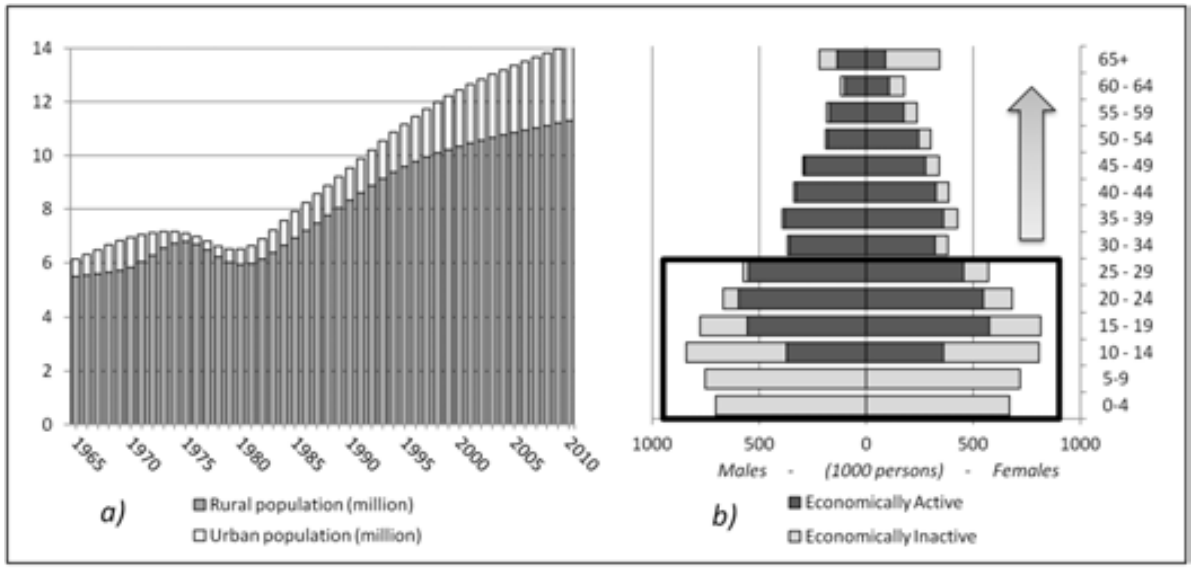

Figure 5. 1: Demography in Cambodia: a) Population growth since 1965; b) Population structure of Cambodia (2008), decomposed for economically active/inactive persons. Source: own elaboration, based on FAO (2011) and NIS (2008a).

At the same time, demand from the urban population for land resources has also drastically increased since the 1990s, adding an exogenous driver of rural land use change.

Urban growth in Cambodia has led to a total urban population of around 3 million people (figure 5.1a) which is also a unique number in Cambodia's history. While small-farmers in Cambodia do not pay taxes, the Royal Government of Cambodia established the Economic Land Concession (ELC) system in order to make use of their land resources for overall economic growth by fostering tax revenues and trade flows from industrialized agriculture (RGC, 2004; 2005). ELCs can be granted to foreign and domestic companies for the development of agro-industries and contracts are usually made for 70 years (MAFF, 2011). Data from the Ministry of Agriculture, Fisheries and Forestry (MAFF) indicate a total concession area of 1.15 million ha in 2009, of which around 957,000 ha have been validated with 85 companies (MAFF, 2011). This is a rather conservative number, since MAFF data do not include concessions below 1000 ha. Other calculations indicate a total of 2 million ha of ELC land (Vrieze and Naren, 2012), which is a substantial amount of land for a few companies. To put this number into context, the smallholder sector, consisting of no less than 10.7 million Cambodians, accounts merely for 3.1 million ha of land (NIS, 2008b).

Summing up, we can see that both rural and urban populations are increasingly claiming land resources, leading to decreasing land availability for smallholders. Insufficient access to land is a fundamental concern for the rural population and affects large parts of rural communities (ADB, 2001; Ballard et al., 2007). The following case study from Kampot province illustrates how decreasing land availability affects both smallholder livelihood and potential to respond to deal with declining land availability.

3 Methodological framework and data

3.1 Methodological framework

Following the approach of the special issue, the paper conducts an 'integrated assessment of the societal metabolism' of rural systems. Generally, the concept of societal metabolism refers to the transformation processes of materials and energy in order to sustain a given identity of a socio-ecological system and to perform a given set of structural and functional activities (Giampietro et al., 2011). An integrated assessment of societal metabolism focuses simultaneously on the performance of various dimensions (e.g., economic, ecological, social) and scales (e.g., village and household scale) of societal metabolism. In order to formalize the concept of societal metabolism, we adopt the flow-fund framework for the parameterization of processes, as developed by Georgescu-Roegen (1971). 'Funds' refer to those elements of the system *that are maintained constant*, for all intents and purposes, during the processes under analysis, typically economic factors such as Ricardian land, capital and human activity (e.g.

labor force). These elements provide important transformative services for a process to happen. 'Flows' refer to those elements *that are transformed* by the funds and may either enter or leave the process under analysis, such as agricultural goods, energy and materials, or added value.

In this paper, we consider available land and human activity to be among the most crucial funds of rural systems and analyze produced and consumed flows in terms of biophysical and monetary flows. Within non-industrialized rural systems, land and human activity become crucial proxies for any analysis, as they represent important livelihood resources (i.e., land and labor) as well as important livelihood constraints (i.e. limited availability of land, limited availability of labor) (Giampietro, 2003; Grünbühel and Schandl, 2005; Pastore et al., 1999). Moreover, they also reflect relevant parts of the rural identity: Time use patterns (i.e., time for sleeping, eating, labor, leisure and socio-cultural activities) ultimately form part of the identity of social systems and land use patterns (i.e., vegetation types and habitats, recreational landscapes, infrastructure) are ultimately reflections of the *Gestalt* of the biophysical systems.

The following integrated assessment thus quantifies land use, human activity, produced and consumed agricultural commodities, energy flows and monetary flows for the case study village *Khcheay Khang Lech* (Kampot province, Cambodia) as well as for four households that were purposively selected based on their distinct land endowments. Variables are presented both in extensive terms (i.e., absolute quantities of funds and flows) and intensive terms (i.e., fund/fund and flow/fund ratios). For the discussion of the village metabolism we adopt the representation scheme developed by Serrano and Giampietro (2009) that consists of an exhaustive visualization of the monetary and non-monetary flows that are metabolized (i.e., produced and consumed) using the funds of human activity and land (see figure 5.2). For the household analysis we conduct an Impredicative Loop Analysis (ILA) (Giampietro, 2003) in order to illustrate the quantitative relations between various funds (i.e. available land and household size) and flow elements (i.e. farm income, expenditure, paddy rice consumption and production) in both extensive and intensive terms. The conducted ILAs (figure 5.3-5.6) are explained in detail in Section 4.2.

3.2 Data sources

Field data were gathered during March and May 2011 with a field team consisting of a research coordinator (the author), one assistant and translator and three local enumerators.

Research activities included participant observation of household activities; 19 semi-structured interviews with key informants (village chiefs, village group members, NGO members, agricultural experts); and a random household survey (number of sample households = 92 / total number of households in the surveyed village = 195) on demography, land use, livelihood activities, income and expenditure, time use and institutional activities. The survey design, data processing methods and detailed background information are reported elsewhere (see Annex I; Scheidel, 2013b). Six samples were dropped, resulting in a total random sample of 86 households out of 195. This is a representative sample with a confidence level of 95% and a margin of error of 8%, assuming a normal distribution of selected characteristics across the surveyed population. Additional data sources included the village statistics from 2008 and the village report book maintained by the village community committee. Further, the full accounts of the savings group over the last three years were kindly provided by the secretary of the village community committee. Cambodian Riels were converted to dollars based on the exchange rate of 1 $ = 4100 Riels (see Annex I; Scheidel, 2013b).

4 Results: Emerging ruralities in Kampot province

4.1 Liquidity problems and institutional innovation at the village level

Khcheay Khang Lech (hereafter KKL) is a smallholder village located in Damnak Sokram Commune of Dang Tong district in the coastal province Kampot. Non-industrialized wet season rice dominates the subsistence oriented agricultural practices of the village and open access resources such as natural forests are scarce. The whole commune, consisting of 5 villages with a total of 3954 inhabitants, has only 2 ha of forest land. Public infrastructure is generally not very developed in the region (NCDD, 2009) and in KKL, no single household accesses wired electricity. The only larger dirt road was constructed in 2002 with support from the German aid organization GTZ (Gesellschaft für Technische Zusammenarbeit)[11]. Figure 5.2 shows a detailed representation of the societal metabolism of KKL, for which we discuss below the allocation of the funds human activity (doughnut-chart on the left of figure 5.2) and land use (box-chart on the right of figure 5.2), and how they metabolize (i.e. produce and consume) the associated flows. Black arrows indicate monetary flows, grey arrows indicate biophysical flows and white arrows indicate allocation of productive activities.

[11] GTZ is now called GIZ (Gesellschaft für Internationale Zusammenarbeit)

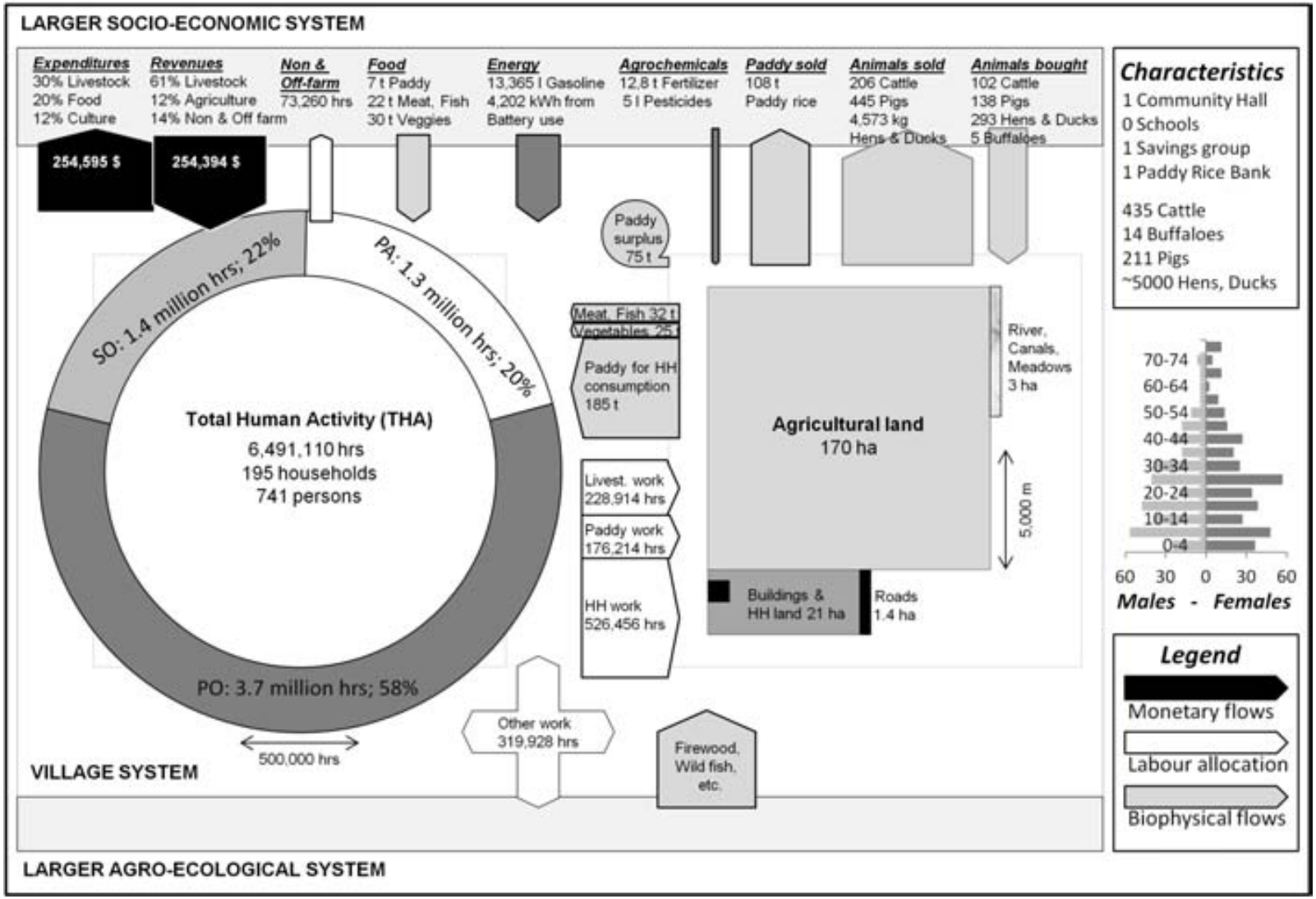

Figure 5. 2: The societal metabolism of the case study village in 2010/2011. Note: PO= Physiological Overhead; SO=Social Overhead; PA=Productive Activities. Source: own elaboration, based on survey data.

Regarding human activity in KKL, we can see a time use allocation common for agrarian communities (cf. NIS, 2007; Grünbühel and Schandl, 2005). Villagers have a generous share of Total Human Activity (THA) dedicated to the physiological overhead (i.e. sleeping, eating, personal hygiene: 58%) and the social overhead (leisure: 18%; education: 4%). All productive activities (household work, on- and off-farm work, other work) account for 20% of THA, whereas most of the time is allocated within the village itself, thus showing at the aggregated level a high degree of 'self-employment'. Looking at the population pyramid of KKL (figure 5.2, right side), we can observe the same pattern of a young and growing labor force as at the national level (figure 5.1b). While already nowadays average agricultural land holdings of 0.9 ha/household in KKL are substantially lower than the national average of 1.7ha (ACI, 2005), land scarcity might increase in the future when the younger inhabitants of KKL start to have their own households.

Figure 5.2 further shows that the current *production of flows* associated with the limited availability of the land fund just meets the *consumption of flows* processed by the human activity fund, with only a very small amount of surplus production. Total village expenditure (254,600$) and revenues (254,400$) more or less cover each other; however, here there is no income surplus at all. Livestock production (61%) is most important for income generation, followed by non- and off-farm work (14%). Paddy production, based on small land holdings is most important for meeting own food needs, yet a share is also required for income generation, as well as to store for food security reasons. Finally, the values in figure 5.2 are aggregated and what appears to be a small surplus at the village level may be a deficit for some families at the household level. For example, while the village seems to be food secure, single households with land shortage or with failed paddy production may face a transitory food deficit. Likewise, expenditures on livestock can produce transitory income gaps that however can be paid back in the future when selling grown livestock. Hence, the lack of surplus production translates into problems of liquidity both in terms of monetary and non-monetary flows.

KKL seem to have tackled the problems of liquidity through institutional innovation, in particular through the establishment of a strong village community, supported by an international network of aid organizations. GTZ supported (materially and ideologically) the construction of a community hall providing the physical space for institutional activities and further assisted villagers in the development of a paddy rice bank with defined rules to provide rice credits with interest rates paid in rice. In the year 2010, the bank had a stock of 28 tons of paddy rice, of which 7 tons were provided as credits to villagers. Based on average paddy rice consumption of 223 kg/cap/yr in Cambodia (ACI, 2005), 28 tons of paddy rice

stock correspond to the annual paddy rice needs of around 126 persons, equaling 17% of KKL's population. Received rice dividends from rice credits were used to support community work such as renewing the dam and repairing the road as well as for compensation for the working hours of the paddy bank committee.

Moreover, CEDAC (a large Cambodian agricultural NGO), supported by international funds from ACT (Asian Community Trust), actively promoted the establishment of a community savings group to fosters household saving, pooling capital and the provision of micro-credits to villagers. At the time of field research, the group consisted of 168 villagers. In order to facilitate access to community based micro-credits, the interest rate, fixed at 2.5% per month in 2011, was purposefully lower than the rates of professional microfinance institutes. Further, a poorest group was established as a sub-group of the savings group, with a lower interest rate of 2%/month. Data from the 2010 banking year show that the savings group, consisting at that time of 83 villagers, had a pooled capital of roughly 34,850 $ at the end of the year. Credits provided to villagers during 2010 amounted to 18,736 $ and produced a total dividend of 6,071 $ from interest payments, resulting in average shareholder revenues of around 73$ per member. Individual revenues however differed largely from the average value due to an unequal distribution of the capital savings across members. In fact, the top quintile accounted for no less than 86.8%, while the lowest quintile accounted for only 0.12% of the total savings capital. Nevertheless, it is important to see that if the credits were provided by external and more expensive micro-finance institutes, this money would have left the village and benefited other (urban) areas. Thus, the establishment of a community banking system successfully increased access to credits that may help to overcome transitory shortages as well as to enable investment in new productive capital apart from land.

Both the savings group and the rice paddy bank are part of the village community named *'Rathanak Samaky Rung Roeung',* meaning *'sharing and helping each other in order to be prosperous'.* The group was established as a democratic grassroots group with a president, cashier and secretary and elections every three years. KKL is thus an illustrative example of an emerging rurality that has combined the properties of traditional subsistence peasantry with modern institutional banking arrangements, in order to overcome problems of liquidity in terms of both monetary and non-monetary flows.

4.2 Land poverty and livelihood diversification at the household level

We now turn to the household level in order to explore how individual household types in KKL manage to make a living based on small landholdings.

Participative poverty assessments from Cambodia have generally shown that insufficient own rice production for household consumption due to lacking access to land is perceived as a central element of rural poverty in Cambodia (ADB, 2001; Ballard et al., 2007). However, assessing the degree of subsistence land poverty of a household is not straightforward, since a land poverty line defined as a fixed amount of land can neither account for specific paddy rice needs, due to varying household size and consumption rate, nor for specific yields due to varying productivity. Therefore, we define an 'impredicative' land poverty line, understood as the amount of land necessary to cover subsistence needs in terms of paddy rice production for paddy rice household consumption[12]. Such an impredicative land poverty line can be well expressed as the maximum population in terms of hours of human activity that can be sustained by a given area under production without additional purchase of rice; hence as a *subsistence density threshold* in terms of hrs/unit of area. Based on this ratio, the minimum amount of land required for subsistence can be calculated in relation to the total household size. We distinguish two kinds of subsistence densities, explained below: an *actual subsistence density threshold* and *a fixed subsistence density threshold.*

The *actual subsistence density threshold* refers to the maximum amount of hours of human activity that can be sustained by a certain land area, based on *actual paddy rice yields* and *actual paddy rice consumption rate* of the given household. This subsistence density threshold expressed as hrs/ha thus accounts for the specific household's paddy rice consumption and rice growing technology (i.e., yields). It thus indicates the impredicative subsistence land poverty line effective for that household. The difference between this production level and the actual production of the household is the production gap that must be filled with purchased rice. In addition to the *actual subsistence density threshold*, we also calculate a *fixed subsistence density threshold* to be used as a benchmark value, based on average paddy rice consumption of 223 kg/cap/yr in Cambodia (ACI, 2005) and a fixed yield of 2 tons/ha that corresponds to the village average, thus representing a likely achievable yield (average paddy yield in Cambodia is at 2.5 tons/ha (NIS, 2008b)). The *fixed subsistence density threshold (*hrs/ha) is thus the same for all households; however absolute land requirement (ha) still depends on total household size. This benchmark allows us to compare the land endowment across different household sizes.

[12] Paddy rice, of course, is only one component of Cambodian diet, and thus it is necessary to state that other components such as vegetable and meat are also important for subsistence. Nevertheless, rice is the most crucial component and in fact, the Khmer word for 'eating' means 'eating rice'.

The following analysis focuses on four purposively selected households with progressively decreasing land endowment. In particular, we conduct an Impredicative Loop Analysis (ILA) for each household, in order to analyze the quantitative relations between (i) the household size in terms of THA, (ii) its dependent share of hours in relation to food and income production (thus, all activities that do not produce food or income itself; i.e., physiological and social overhead plus household work), (iii) the total cash expenditure, (iv) total monetary income from on-farm production, and (v) total productive land (TPL) available to produce food for the household and agricultural goods for farm income generation (figure 5.3-5.6). The *actual* and *fixed subsistence density threshold*s are indicated at the interface between THA und TPL and are compared with the household density. The household expenditure is compared with farm income generated from the available land, in order to identify the farm income gap that needs to be closed by other income sources apart from farming.

4.2.1 A peasant's family: A land-based livelihood

Our first analysis focuses on a rather 'common' peasant household of KKL whose livelihood is fully based on typical peasant activities. Figure 5.3 shows the ILA for the household: the extensive values THA (Total Human Activity in the household – hrs/yr), TPL (Total Productive Land used by the household – ha/yr), dependent hours (number of non-productive hours – hrs/yr) and monetary flows in terms of farm income and household expenditure can be found on the four main axes (a, b, c, d) of the figure. The intensive values are the ratios of the extensive values and consist of household density (THA/TPL – hrs/ha), dependent share (dependent hours/THA - %), household expenditure rate (household expenditure/dependent hours - $/hr) and farm income generation rate (farm income/TPL - $/ha). The subsistence density thresholds and related land requirements are indicated at the interface of THA/TPL with dashed lines, expressed in hrs/ha.

The four-person household with a THA of 35,040 hrs has a paddy land endowment of 1.68 ha. This represents an average value for Cambodia, in which average household size amounts to 4.7 persons/household (NIS, 2008a) and average land holdings are of about 1.7 ha/household (ACI, 2005). The household density amounts to 20,820 hrs/ha, which is well below the *actual* and *fixed subsistence density threshold* of 78,560 and 60,900 hrs/ha respectively, which translate into a subsistence land poverty line of 0.45 and 0.58 ha, respectively. Hence, the household can maintain food security through a large surplus and further produce paddy for the market. Total annual farm income amounts to 764$, generated

through selling 1.5 tons of paddy as well as vegetables and livestock products, resulting in an average annual return of 450$/ha of productive land. Monetary income is further increased by 244$ through collecting and selling firewood from (remote) forests, which however is not presented in figure 5.3 as this income is not generated by the land owned by the household.

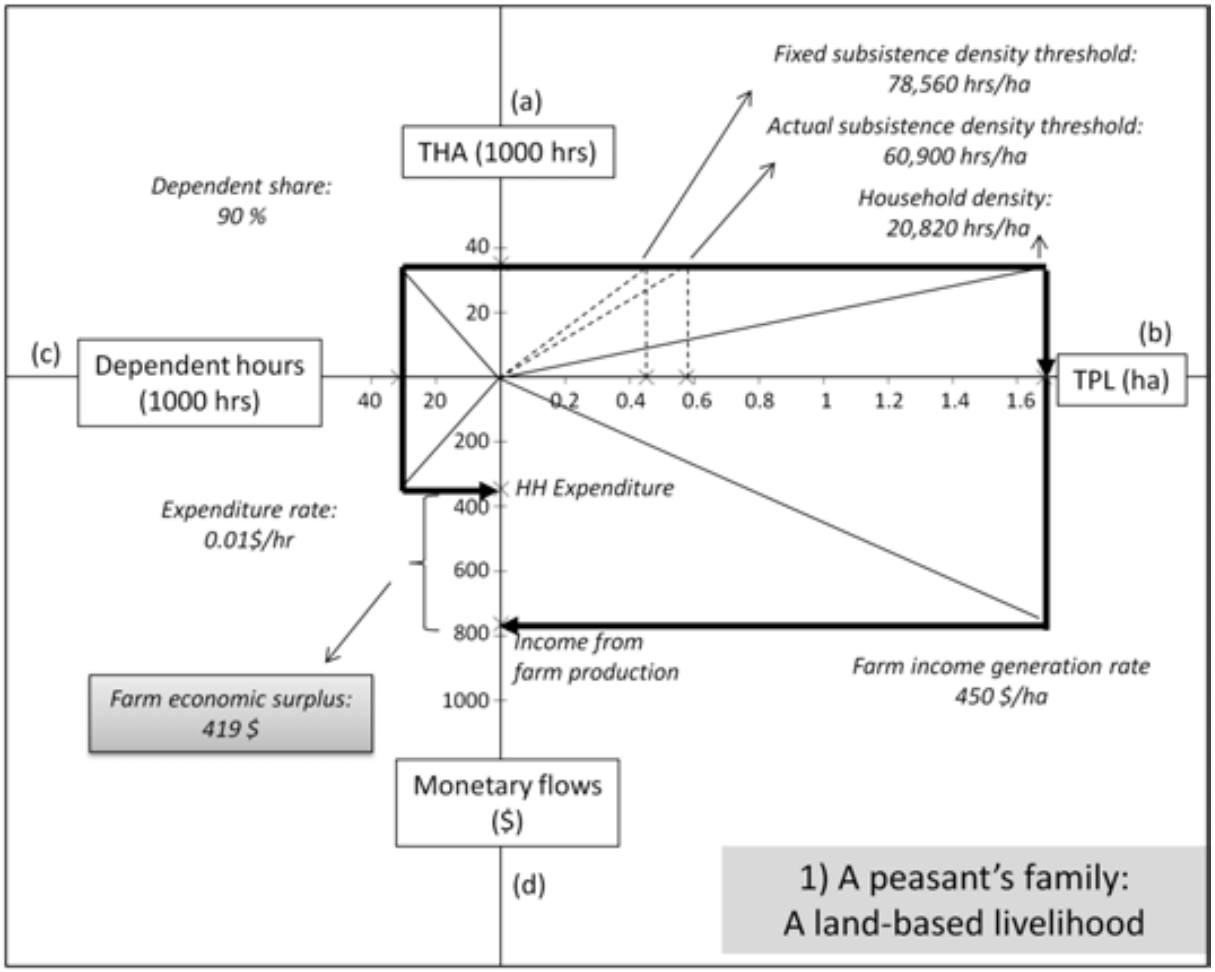

Figure 5. 3: Impredicative Loop Analysis of a peasant's household. Source: own elaboration, based on survey data. Note: THA = Total Human Activity, TPL = Total Productive Land.

In comparison to the household expenditure of 345$, the monetary farm income generated from the available land (excluding firewood from remote forests) produces a monetary surplus of 419$. This surplus however depends not only on the amount of farm income generated through available land, but also on the consumption rate and related household expenditure. A monetary expenditure of less than a dollar-a-day per household could be interpreted as a shocking low level of consumption. Yet, such a household operates, in large part, outside the cash economy and only a small amount of meat and vegetables is bought from the market, while all other food is self-produced. In fact, food consumption in rural Cambodia accounts on average for no less than 52% of the total household

expenditure/consumption value (NIS, 2010), thus being self-sufficient can drastically reduce expenditure. Having the own farm as the center of livelihood also keeps other costs low, as the household does not need a motorbike or gasoline to maintain its general livelihood activities. Thus, the above illustrated household can generally be seen as an example of a peasant household whose livelihood is based on having, although not much, enough land for self-sufficiency.

4.2.2 A taxi-driver's family: Additional capital investment

The next example shows a rural household whose 'land budget' is drastically reduced. As above, it is a four-person household (THA = 35,040 hrs), but owns only 0.48 ha of productive land (figure 5.4). This amount of land endowment is also a reflection of common rural life in Cambodia: more than half of all households have less than 1 ha of land (NIS, 2010).

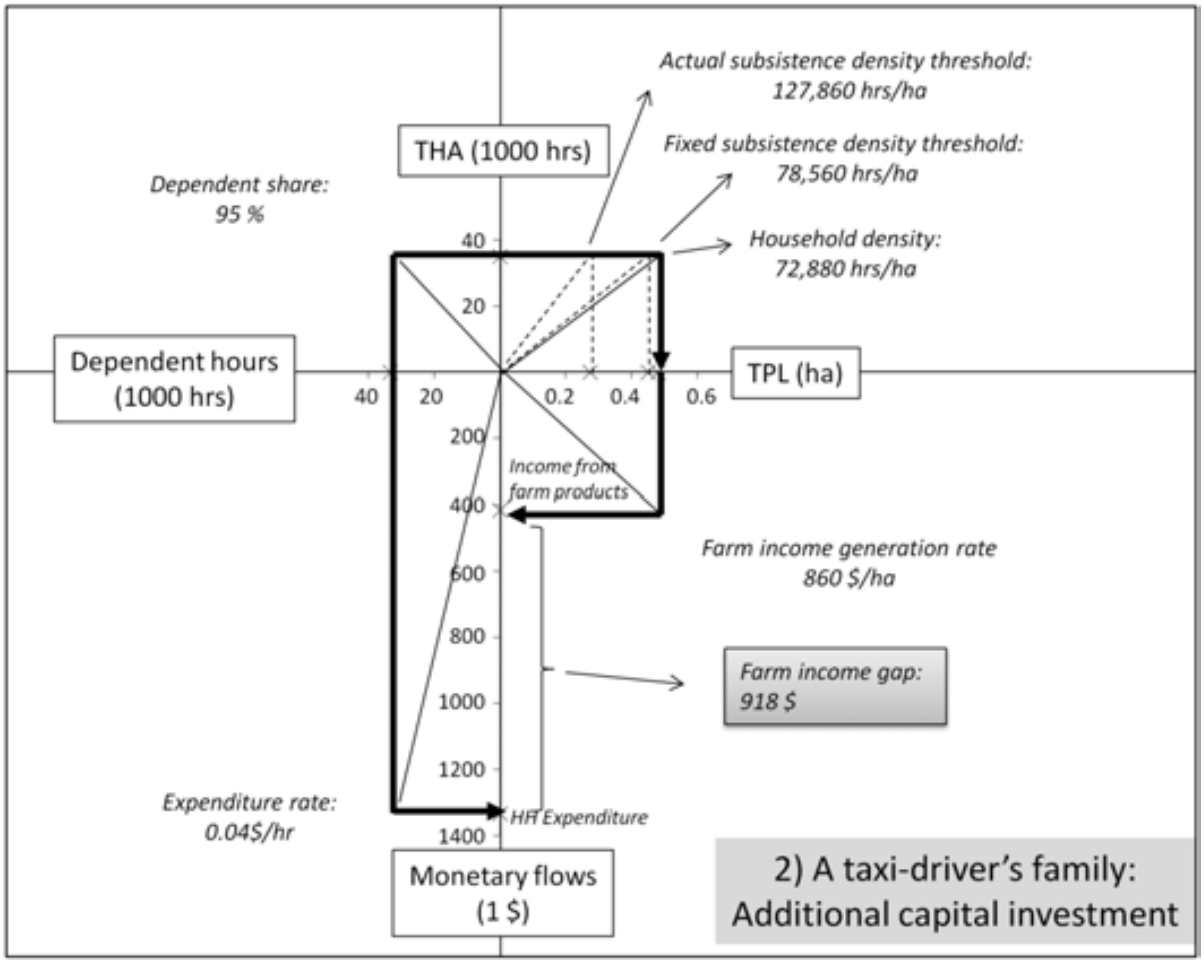

Figure 5. 4: Impredicative Loop Analysis of a taxi-driver's family. Source: own elaboration, based on survey data. Note: THA = Total Human Activity, TPL = Total Productive Land.

Due to the small landholding, the household density of 72,880 hrs/ha is very close to the *fixed subsistence density threshold*. While this household may produce just the paddy needed for self-consumption, it cannot produce much surplus and did not sell any paddy to the market. Farm income results exclusively from livestock production, yielding a higher average annual return of 860$/ha. However, it generates in absolute terms only 415$. Moreover, this household needs to spend substantially more money on food from the market (322$/yr more than the previous example) because production for self-consumption is limited. Thus, higher expenditure and lower farm income leave the household with a farm income gap of 918$, which needs to be closed by additional labor investment into non-farm activities, which in the case of this household is taxi-driving, thus entering the service economy. With a net return of 0.6 $/hr, taxi-driving is three times better paid than the basic off-farm work in KKL (working on farms of others during transplanting, harvest, etc.), yet it also requires initial capital investment for the motor-taxi as well as a high levels of fossil energy consumption of 1.3 liter gasoline/hr of work and thus increases fossil energy dependency.

4.2.3 A land-poor household: Forced pluriactivity

Figure 5.5 represents a subsistence land-poor household. With 0.38 ha, total productive land is small not only in absolute terms, but particularly in relation to the household size of nine persons (THA=78,840hrs).

The household density of 204,980 hrs/ha far surpassed the *actual subsistence density threshold* of maximum 35,940 hrs/ha, which would require a minimum amount of subsistence land of 2.19 ha (figure 5.5: dashed lines). In addition, the *actual subsistence density threshold* of this household is particularly low due to the low yields of 0.78 tons/ha. Technological improvements to close the yield gap, in order to arrive at the village average, would improve the household situation in terms of food supply. However, household density is still well above the *fixed subsistence density threshold,* which would require at least 0.62 additional hectares to cover subsistence paddy production. The farm income obtained from the available land is generated mainly from livestock products and does not reach more than 174$, which is definitely too small to cover the expenditure of the nine-person household.

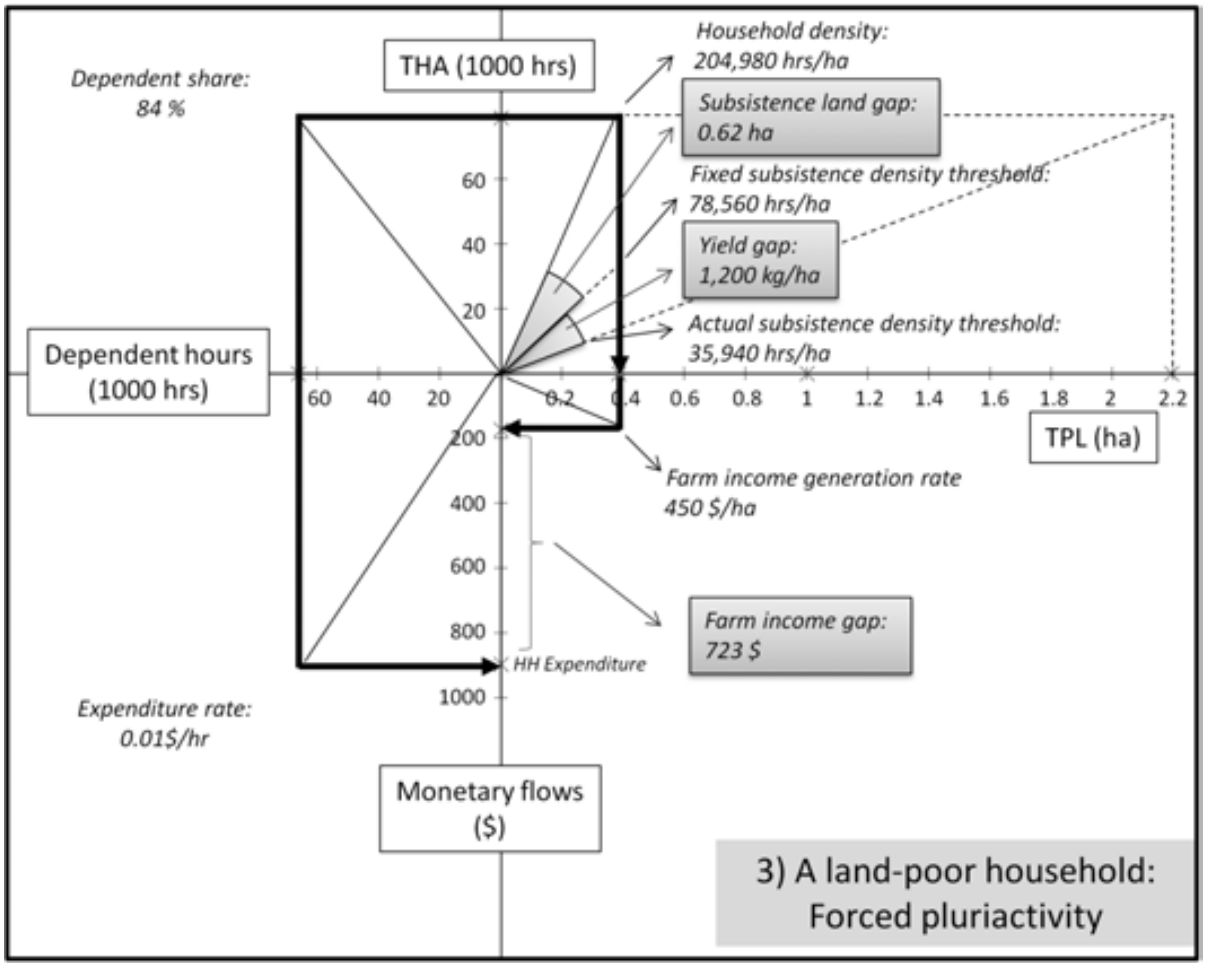

Figure 5. 5: Impredicative Loop Analysis of a land-poor household. Source: Source: own elaboration, based on survey data. Note: THA = Total Human Activity, TPL = Total Productive Land.

Thus, such drastically reduced access to land not only makes farming-based livelihoods economically unviable, but also undermines subsistence security. For such types of households, pluriactivity becomes a crucial necessity, not only for closing the farm income gap, but for survival. Where land endowment falls short and other productive capital (such as a motor-taxi) is not available, only labor power is left to create a livelihood, which might in turn explain the large household size. Apart from having a significantly lower share of dependent hours (84%), also the absolute number of available working hours is very high due to the large household size. Between May 2010 and April 2011, five household members were involved with a total of 3,925 hrs in seven different off- and non-farm jobs, including seasonal migration to work in the garment industries and the construction sector, receiving a total average return of 0.19 $/hr. The generated income of 774$ is enough to close the farm income gap, yet it does not allow for any surplus accumulation and the household has to live with vulnerability all the time.

4.2.4 And old widow: Land and labor-poor

Finally, we close our analysis of land poverty at the household level by looking at how an aging rural household with an extremely reduced land budget manages to survive. Figure 5.6 shows an ILA for the household of an old widow.

The household owns only 0.24 ha of productive land, however as a single person household with a THA of 8760 hrs/yr, the household density of 36,440 hrs/ha is still lower than the *fixed* and actual *subsistence density thresholds*. Thus the household could be self-sufficient in paddy production and consumption, however, the little amount of land makes it impossible to generate any substantial surplus, particularly as the household faces an additional shortage in funds: its own labor power. The dependent share of hours amounts to no less than 96% in relative terms, which can hardly be maintained by the remaining 4% (= 365 hrs/yr) of food and income generating activities.

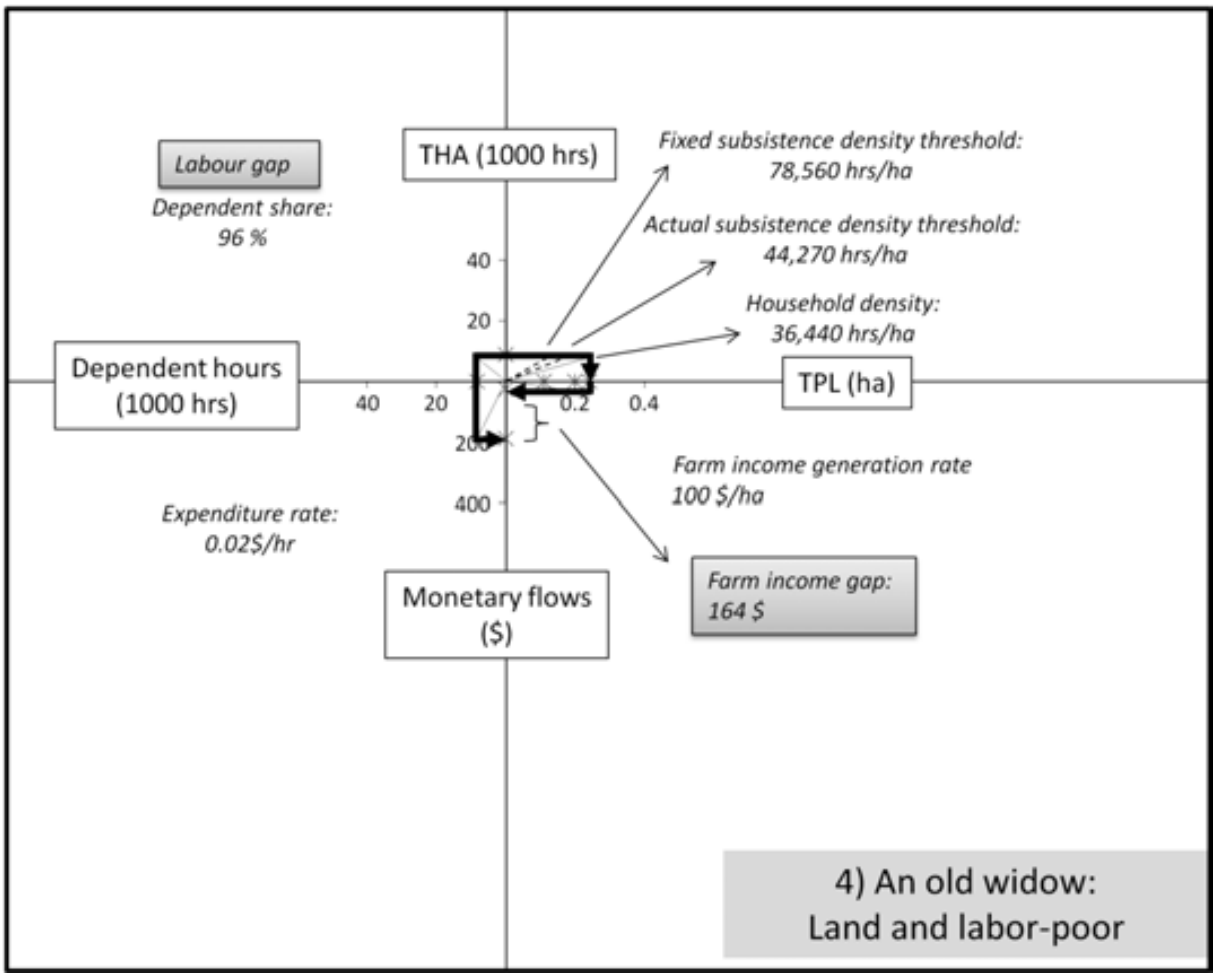

Figure 5. 6: Impredicative Loop Analysis of an old widow's household. Source: own elaboration, based on survey data. Note: THA = Total Human Activity, TPL = Total Productive Land.

Thus, the household faces a labor gap that challenges self-sufficiency in paddy rice production, as well as a labor and land gap in order to close the farm income gap. Relatives assisted with around 150 hrs of labor for paddy rice production (twice as much labor as provided by the widow herself) and with around one million Riels (244 $) to close the farm income gap. In such a case, livelihood diversification is obviously no solution due to the lack of labor power and traditional kinship institutions that assure assistance in labor and consumption goods become crucial. These in turn however depend also on the proximity of family households and their capacity to generate sufficient surplus, which, as seen above, might be challenged in the future with decreasing access to land.

5 Discussion: Individual and collective response to deal with declining access to land

Section 4 has shown four different stories that all share a common feature: how reduced access to land affects small-farmers in terms of food sovereignty and economic viability of the farm enterprise. Lacking access to land, as seen above, does not only decrease food sovereignty and farm income generation, but may increase at the same time expenditures, due to growing dependency on food from the market. Land-poor households thus face not only a lack of access to flows such as food and income in the short-term, but particularly face a lack of productive funds to create stable livelihoods over the long-term (see Chapter II; Scheidel, 2013a). The particular responses to the challenges of land poverty differ across the presented cases and may be manifold, yet, they share a common pattern: the emergence of new ruralities due to livelihood diversification, based on a subsequent involvement of additional productive funds to compensate for insufficient access to land[13].

At the household level, important additional productive funds are additional labor investments into on-farm and non-farm work, but may also come from the acquisition of new productive funds such as the motor-taxi in the above example or the rice or microfinance credits mentioned earlier. Pluriactivity and work in the new industries such as garment factories or the construction sector is thus becoming a key feature of these emerging ruralities, which however also requires sufficient employment opportunities. While ELCs were promoted to create rural employment, we have shown elsewhere that they cannot provide sufficient rural jobs and rather have large opportunity costs in terms of livelihoods based on smallholder land uses (see Chapter IV; Scheidel et al., in press). As illustrated in

[13] Peasant revolts and/or illegal land possession may be other important measure taken by smallholders to overcome land shortage, which is however not discussed here.

Section 4.2.1, farmers with sufficient, although not much, land will never become rich, however, they have at least a secure livelihood, as they are in the possession of means of production. ELCs thus introduce the risk of removing people from a secure livelihood system and putting them into a situation of "living with worry all the time" (Ballard et al., 2007), due to insufficient access to land in the absence of other livelihood opportunities.

The above shown ILAs have represented the self-reproduction potential of individual households. This, however, does not happen in a vacuum. The viability of these various household types also depends on the capacity of the community to support their continued existence. This capacity depends, in part, upon the institutions that the community has at its disposal. For the case of KKL, we have seen the introduction of a community banking system and a rice paddy bank. In order to cover acquisition costs of new productive funds, such as livestock or a motor-taxi, increased access to credits has become increasingly important (Ballard et al., 2007) and could be achieved in KKL thanks to the community banking system. Moreover, the paddy rice bank was not only able to reduce food insecurity at the community level, but also produced rice dividends, used to support community work (repairing the road, dam construction), and has thereby helped to increase the productive capacity at the village level. Thus institutional innovation, in terms of the introduction of new institutional arrangements in KKL can generally be seen as a collective response intended to increase the productive capital available at the village level, in order to compensate for declining land availability.

6 Conclusions

This paper has illustrated how current processes of rural change in Cambodia – manifested in decreasing land availability for the smallholder sector – may affect small-farmers, leading to the emergence of new ruralities based on livelihood diversification and institutional innovation. While the importance of access to land is a well-known issue in Cambodia (Ballard et al., 2007; ADB, 2001), this paper has aimed to increase the understanding of how land poverty is affecting rural livelihoods when the amount of available land falls below critical thresholds. It further discussed individual and collective responses to deal with decreasing land availability, declining farm surplus production and problems of liquidity in monetary and non-monetary flows at the village level.

Subsistence fears – which James Scott (1976) argued to be at the bottom of peasant's *resistance to innovation* in pre-colonial times – have turned nowadays for many smallholders

into acute survival threats, due to lacking access to land, resulting in a *requirement for innovation* in peasant life in order to survive. In this context, livelihood diversification and pluriactivity, including (seasonal) migration, farm to service sector activities, and being producers and wage laborers at the same time, is likely becoming an increasingly important feature of modern rural households in Cambodia. Institutional innovation, such as the establishment of a formal grassroots village community, a village banking system and a rice paddy bank, may further offer a collective response that facilitates access to productive capital.

Meanwhile, as the peasant economy is adapting to declining access to land, linkages to urban areas are increasing, not only through seasonal work in the new industries, but also through increased capital and information flows from a growing network of global and local aid organizations. Thus, many new ruralities of Cambodia may be understood to be emerging at the interface between the local and the global, the rural and the urban, and particularly, as 'hybrids' that combine properties of traditional peasant agriculture with new economic activities and institutions.

Acknowledgments

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CHAPTER VI

CONCLUDING REMARKS

This dissertation is the result of three years of research on new challenges in rural development, motivated by the personal interest and public need to better understand the debates and impacts of the recent global land rush on rural livelihoods. It is also the result of three years of research revolving around the epistemological and methodological question of how to coherently conceptualize and study the many dimensions of poverty and rural systems. As such I hope that the papers constituting this dissertation could make contributions to a variety of disciplines, as well as to a better understanding of some aspects of the land rush phenomenon. The general contributions, conclusions and potential future research lines are summarized in the following.

1 General contributions and conclusions

1.1 Summary of conceptual and methodological contributions to different disciplines

Dealing with a cross-disciplinary issue, this dissertation has touched upon concepts and concerns from a variety of different disciplines. As such, I believe that this dissertation may offer some contributions to different fields of inquiry, by having integrated various bodies of knowledge[14].

Regarding the field of development studies, the dissertation has offered a complexity perspective on poverty, which may be helpful to frame, on an epistemological level, the many challenges that development efforts may face in theory and practice when dealing with multiple dimensions and scales (Chapter II). As such, attention has been drawn to the issue that poverty is generally defined at the individual or household level, but not at higher scales, such as at the country level, which would require accounting for emerging properties. For such an effort, it would be necessary to go beyond aggregating poverty headcounts from the local level, which is a scaling-up method that does not account for the emerging challenges that a country may face at the national level. At the household level, the work of this dissertation could advance the development of an 'impredicative' land poverty line, for which the poverty threshold is not arbitrarily set – as would be the case for setting a fixed amount of land as a poverty line – but rather depends on household configuration, available land and productivity. Finally, the distinction between weak and strong poverty alleviation, elaborated in Chapter II, may provide some conceptual basis for reflection, when discussing the sustainability of poverty alleviation efforts. For example, I have shown in Chapter IV at the national level, that an increase in employment opportunities due to land concessions does not

[14] At this point, I would like to gratefully acknowledge the inputs from and discussions with my supervisors and co-authors, which have been a great support in doing interdisciplinary work.

necessarily benefit smallholders, because it may entail drastic increases in countrywide land poverty. At the household level (Chapter V), we could see that increases in income do not necessarily mean that the household is better off, if at the same time expenditures rise for food due to reduced household production because of declining access to land. These are examples of weak poverty alleviation, in which poverty alleviation in one dimension cannot necessarily compensate for deteriorations in other poverty dimensions.

Regarding the field of bioeconomics and ecological economics, the dissertation could bridge the ideas of multidimensional poverty, mainly stemming from development studies, with concepts commonly used in ecological economics (Chapter II). In doing so, I hope to have contributed to the integration of knowledge across two fields of inquiry that are both concerned with future pathways of societies. Regarding the nexus between society and energy – a central concern within bioeconomics and ecological economics – the dissertation has illustrated the enormous challenge in terms of growing land requirements that the upcoming global energy transition may provoke (Chapter III). Society's 'temporary emancipation from land' (Mayumi, 1991) thanks to fossil energy stocks may soon come to an end and immediate attention is required to identify and negotiate future trajectories of society's energy metabolism (Giampietro et al., 2011). In relation to the concept of societal metabolism, this dissertation further has shown a variety of applications of the concept at the national and local level, which has been proven to be useful to further understand society-nature interactions (Chapter IV and V). Particularly, the dissertation could advance the understanding of how certain flows are metabolized (i.e., produced and consumed) by different compartments of non-industrialized rural systems and as such could make some conclusions on the performance of reproduction and production patterns of current peasant societies. All these contributions to bioeconomics and ecological economics were conceptually based on the flow-fund framework put forward by Nicholas Georgescu-Roegen (1971). While his work has been fundamental for the establishment of ecological economics, it has been argued that the framework has not yet received the attention it may deserve in economics (Vitucci Marzetti, 2010). Within this context, this dissertation could provide a series of new applications of the framework, which hopefully may produce some discussions and reflections of its potentials and limitations for further application.

Finally, regarding the field of integrated assessment, this dissertation has shown a variety of new applications of the MuSIASEM approach, focused on the fields of rural development studies and poverty analysis. Multidimensional poverty assessments have become popular in the recent years and new methodological tools (e.g., Alkire and Santos, 2010; Cohen, in press; Cohen and Sullivan, 2010) allow assessing the many dimensions of

poverty. However, they usually do not account for the (quantitative) linkages between the dimensions. As such, these methodological tools may be useful for the *evaluation* of multidimensional poverty at a particular point in time, however, are less appropriate for the *analysis* of multidimensional poverty, since no information is provided on how the different dimensions are interlinked and affect each other. The examples provided at the national and household level in Cambodia (Chapter IV and V) have shown how an impredicative loop analysis (ILA) – a central tool of the MuSIASEM approach – can account for linkages between different rural poverty dimensions such as land availability, demographics, food security or income. While this dissertation thus could set a primer for quantitative multidimensional poverty *analysis*, I am aware that much work still remains to be done in this field in order to account for the linkages of many other poverty dimensions not addressed in the presented work.

1.2 Summary of contributions and conclusions to the new challenges in rural development, posed by the global land rush

With regard to the recent land grab phenomenon, this dissertation has made a variety of contributions that may help to better understand (i) drivers, (ii) debates, (iii) characteristics and (iv) potential impacts of large-scale land deals.

Regarding the question of the underlying driving forces (Zoomers, 2010), I have argued that the land grab is not merely an ephemeral reaction to the global food and financial crisis in 2008 (GRAIN, 2008; von Braun and Meinzen-Dick, 2009), but rather part of a larger societal transformation in terms of fundamentally changing patterns of societal energy metabolism. This in turn, is producing a series of intermediate and proximate causes of land grabbing that are far ranging. Moreover, the case study on Cambodia has illustrated how further demographic changes play a crucial role in driving competition over farm land uses. Thus demographic changes may be further considered as ultimate driver of the land grab phenomenon. As such, growing competition over land uses may be a persistent consequence for the 21st century and rural areas may increasingly become places of contested and unprecedented change.

In relation to the controversial debates regarding potential opportunities and challenges of large-scale land deals for rural development and poverty reduction (Borras and Franco, 2010; Borras et al., 2011; Cotula et al., 2009), the dissertation has illustrated that the co-existence of different values and visions of rural development and poverty reduction may be at the bottom of the controversy. As shown on a theoretical level (Chapter II) as well as

empirically for the case of Cambodia (Chapter IV), there is a fundamental conflict between a 'Northern-urban' perspective on poverty alleviation, based on a focus on employment and income creation, and a 'Southern-rural perspective' on poverty alleviation, based on self-employment and having access to land and other productive resources (cf. Chambers, 1995). Both perspectives may be legitimate and adequate within different contexts; however, one discourse should not be abused to rule out the other, such as happened in the case of Cambodia (see also Springer, 2012). To avoid this, we ultimately have to step back from pursuing to find the *right* and universally valid definition of poverty alleviation and rural development, but rather try identifying the *relevant* dimensions within a certain social group and context. Otherwise, as stated by a Cambodian villager affected by a land concession (Licadho, 2009), rural development efforts may bear the risk of fostering *"getting rid of the poor"* rather than *"getting rid of poverty"*, which would be an unfortunate example of 'weak poverty alleviation'.

This dissertation has further discussed a variety of characteristics of large-scale land deals that received – or further require – attention in the attempts to better understand the phenomenon. First, regarding the purpose of land deals and the targeted type of land areas, Zoomers (2010) has shown that a variety of processes other than farmland grabs play an important role. This dissertation has further provided evidence that land grabs for energy provision, targeted at land for the expansion of energy provision systems may increase in the future. While land grabs for agricultural energy crops are a well-known issue (see e.g., Borras et al., 2010), land acquisition, for example, for the construction of large scale-dams, is a further dimension of the phenomenon, with likely growing future importance when fossil energy carriers may get scarce. Second, regarding the question of who are the actors of the land rush, the phenomenon received large attention due to the fact that land deals involved foreign investors and governments (GRAIN, 2008; von Braun and Meinzen-Dick, 2009). However, insights from the situation in Cambodia (Chapter IV) confirmed that domestic actors play a central role in the land rush (Borras and Franco, 2012; Deininger, 2011; Hall, 2011; Siciliano, 2011). Third, regarding the perception that many countries of the global South have large reserves of idle and underutilized agricultural land available, the case of Cambodia (Chapter IV) shows that this perception – although propagated by government members – may be fundamentally flawed (cf. Borras and Franco, 2011, 2012; Cotula et al., 2009). Living on a physically limited planet, land will always be a limited resource and as such, deciding on land uses can be argued to be a *zero-sum game*. Increasing one type of land use, such as industrialized large-scale agriculture, will always result in the decline of other types of land use, such as areas of environmental regeneration, multifunctional land uses and present and future small-farmer land. Rather than propagating a *win-win-win rhetoric*, it becomes crucial

to be aware of the *win-lose-lose realities* large-scale land deals may cause and to consider the associated trade-offs for rural development.

Finally, regarding the impacts of large-scale land deals in practice, the case study on Cambodia (Chapter IV) has shown that their employment potential – a central issue in the debates surrounding land grabbing (Cotula et al., 2009; Li, 2011; World Bank, 2010) – is limited. Any number of potentially created jobs may sound promising, but is meaningless as long as there are no reference values for comparison. For the case of Cambodia, this dissertation has shown that although land concessions may have the potential to create 'large amounts' of new jobs in rural areas, the number may be relatively small when contextualizing new employment opportunities within the dynamics of labor force growth and allocation. Moreover, new jobs from land concessions are only one side of the coin. On the other side are the vast opportunity costs of alternative land uses, such as small-scale agriculture and related poverty alleviation based on subsistence agriculture (De Schutter, 2011). As shown for the case of Cambodia, these opportunity costs are however enormous. As a consequence, farmers are increasingly forced to establish livelihoods based on declining access to land. Moreover, a growing number of present and future rural dwellers are left with no land at all and need to seek for jobs in the other sectors or remain land-less and/or unemployed.

As discussed already fifty years ago by Georgescu-Roegen (1976 (1965)), small-farmers will never become 'rich'; however, they operate at least within a stable livelihood system, given that they have sufficient access to land. However, nowadays, in the name of rural development and poverty reduction (Chapter IV), large-scale land deals may remove these people from a proven livelihood system and force them to enter other economic sectors. Many industrialized countries experienced similar transitions, in which large parts of the rural labor force left the agricultural sector and entered the new industries. The prospects for work in the new industries were different 40 years ago, when the global economy was expanding, not at least thanks to the availability of cheap fossil energy (cf. Giampietro et al., 2011). During that time, for example in large parts of Europe, *land was left without farmers* thanks to the availability of 'better' livelihood opportunities outside the rural sector (Rey Benayas et al., 2007). Nowadays, in many countries of the global South, *farmers are left without land*, and thus are forced to seek new employment opportunities in industries part of a globalized economy, which during the last decade has not performed particularly well. Those farmers who maintain a living based on agricultural livelihoods face increasing vulnerability and a fundamental requirement of innovation, diversification and adaptation in their livelihood system, in order to cope with declining access to land. Thus, new ruralities are emerging, whose future is yet uncertain. This however, should not only be a concern for the

affected farmers themselves, but also for other rural and urban populations. As claimed by Via Campesina (2008), the small-farmers are those who currently feed the majority of the world.

2 Outlook for future research

I would like to close this dissertation with a brief summary of future areas of research that have been opened up by the underlying work.

2.1 Future research regarding multidimensional poverty analysis in rural areas

Regarding multidimensional poverty analysis, I see four particular areas to be further developed. First, the implications of multidimensional poverty and the theoretical distinction between weak and strong poverty alleviation, as developed in Chapter II, require more 'real life' examples, in order to better serve as point of reflection for rural development efforts. A few examples have been provided in the present work; however I believe, development efforts may produce a series of other trade-offs between different poverty dimensions that easily may be overseen in the normative debates on the urgent need of global poverty reduction. *What are the different trade-offs of poverty reduction efforts that may appear in development practice? Where can further empirical cases of weak and strong poverty alleviation be identified and what are their implications in real life?*

Second, it would be interesting to know, how the use of an impredicative land poverty line, as developed in Chapter V, may change the evaluation of land poverty at the country level. Chapter V has used the impredicative land poverty line as analytical tool for poverty *analysis*. However, it would be possible to make an *evaluation* of land poverty at the country level, by comparing the number of households classified as subsistence land poor in the standard way (thus, using a fixed threshold in terms of fixed amount of hectares) with the number of households classified as subsistence land poor using an impredicative land poverty line (thus, using a subsistence density threshold, based on household configuration and land endowment). Would there be big differences in the results? *Would an impredicative threshold enable a better identification of the regions with subsistence land poverty, or is a fixed land poverty line a sufficient proxy?*

Third, as illustrated in Chapter V, institutional arrangements and cooperation at the local level may successfully help to increase the productive capacities of a household or community. Thus, the institutional dimension plays an important role for certain poverty

alleviation efforts. While community institutions are usually discussed within the light of the potential benefits they may bring (such as seen in Chapter V), it is important to further understand the 'costs' involved in cooperation and maintenance of community institutions, in order to assess their feasibility. As stated by Elinor Ostrom *"'getting the institutions right' is a difficult, time-consuming, conflict-invoking process"* (Ostrom, 1990: 14). Within this context, the MuSIASEM approach may be useful to conduct a 'quantitative institutional analysis' by quantifying the involved human activity, in terms of hours necessary to keep institutions running.

Fourth, as mentioned already above, multidimensional poverty analysis, capable of accounting for the *linkages* of different dimensions, requires further methodological development and a minimum degree of standardization of the different dimensions to be analyzed, including critical performance thresholds. The MuSIASEM approach may serve as a useful methodological base for such an effort.

2.2 Future research regarding global rural change and emerging ruralities

Finally, the global land rush may be just one face of a larger transformation of the relationship between society and land use, triggered by the coincidence of a few historic events. For the first time in human history, the urban population has outpaced the rural population on a global level (UN, 2012). Our planet, at present, inhabits more urban than rural dwellers, meaning that demand for resources from the countryside, such as food, fiber or feedstuff, has drastically increased from urban industrialized areas. However, also the global rural population continued to grow over the last decades and in fact, the number of persons those livelihood depends on agricultural activities, has reached a record number in human history (FAO, 2011). Thus, requirement for resources extracted from the countryside has drastically increased from both the urban and rural population. While until the present years, the discovery of vast reserves of fossil energy stocks could alleviate pressure on land resources (see Chapter III and Mayumi, 1991; Sieferle et al., 2006), cheap fossil energy is getting increasingly scarce due to the coincidence of the above described unique population dynamics with the peak oil phenomenon (Campbell and Laherrère, 1998; Heinberg and Fridley, 2010; Kerr, 2011). As such, the global society is faced with the need for a drastic reconfiguration of the relationship between socio-economic systems and their use of land resources. Thus, in the future, rural areas may become increasingly contested spaces and may show rapid and unprecedented changes. Due to the global dimension of the current key historic events, it is

adequate to describe the potentially upcoming transformation as a phenomenon of *global rural change.*

How may the processes of global rural change affect regional trends and dynamics in both countries of the global South and North? What will be the features of the new ruralities that may emerge as a response to these global processes? What are the different strategies and pathways that rural system types adopt to cope with the changing socio-ecological environment?[15] Since rural systems provide the basis for millions of livelihoods, for global food supply and further are at the interface between the economy and the environment, it will be of utmost importance to increase the understanding of the potential future pathways of emerging ruralities within the context of global rural change.

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[15] At this point I would like to acknowledge, that these question are further addressed in a forthcoming special issue, entitled *"Pathways of rural change: An integrated assessment of the metabolic pattern of emerging ruralities"*. This special issue is edited by Gonzalo Gamboa, Federica Ravera, Jampel Dell'Angelo and myself, on behalf of the rural systems analysis group at ICTA-UAB (www.ruralsystems.org) and has been accepted by the journal *Environment, Development and Sustainability (Springer).* It presents results from the rural system analysis group members, from research on rural change and emerging ruralities in three continents across the globe.

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ANNEX I

THE METHODOLOGICAL CHALLENGE

Report on Environmental Sciences

From MuSIASEM theory to practice: Report and reflections from field research in Kampot province, Cambodia

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From MuSIASEM theory to practice: Report and reflections from field research in Kampot province, Cambodia

Summary

This document contains a report and summary of the field research activities in a rural community of rice farmers in Kampot province, Cambodia in 2011, which I conducted within the context of my Ph.D. research at ICTA-UAB (Institute of Environmental Science and Technology, Autonomous University of Barcelona, Spain). The purpose of the field research was to gather data for a MuSIASEM analysis (Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism) at the village and household level, in order to analyze the multidimensional challenges that small-farmers may face nowadays within the context of global rural change and declining access to land.

While the literature on MuSIASEM offers a great variety of theoretical explanations and practical applications, there is little information available for students regarding the practical steps required for doing a MuSIASEM analysis at the local level. Within this context, this report offers not only a documentation of the field research design and data collection methods, but further provides a general overview on some organizational and preparative aspects, including some personal reflections, that one may face when preparing and conducting field research for MuSIASEM analysis.

In summary, this document thus serves three objectives: (i) to assure methodological transparency for the future work, based on the collected data during field research, (ii) to share my personal experience on the preparative and practical steps required for field research and data collection for a MuSIASEM analysis at the local level, and (iii) to make available for the further interested reader some more detailed background information on the case study village.

Keywords

Integrated assessment; Field research; MuSIASEM; Cambodia; Small-farmers

1 Introduction

This document contains a report of the field research activities in a rural community of rice farmers in Kampot province, Cambodia, which I conducted in 2011 within the context of my Ph.D. research at ICTA-UAB. The purpose of the field research was to gather data for a MuSIASEM analysis (Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism) at the village and household level, in order to analyze the multidimensional challenges that small-farmers may face nowadays within the context of global rural change and declining access to land.

While the literature on MuSIASEM offers a great variety of theoretical explanations and practical applications, there is little information available on the practical steps required for doing a MuSIASEM analysis at the local level. Within this context, this report offers not only a documentation of the field research design and data collection methods, but also provides a general overview on some organizational and preparative aspects, including some personal reflections, that one may face when preparing and conducting field research for MuSIASEM analysis.

The objectives of this document as well as the potential audiences to which it is direct are thus threefold: (i) methodological transparency regarding future research, based on the collected data during field research in Cambodia, (ii) to share experience regarding practical issues that need to be considered when doing field research for MuSIASEM, and (iii) to make available more background information on the case study village for the further interested reader.

1.1 Objectives of the report

The first objective is to provide detailed information on the field research design and data collection methods employed during the field research, in order to be transparent about the involved assumptions, methods, and potentials and limitations associated with the gathered data. The focus here is hence less on theoretical aspects of the MuSIASEM approach, on which basis the data were later analyzed. Theoretical aspects are widely explained and discussed in the peer-reviewed literature (Giampietro, 2003; Giampietro and Mayumi, 2000a, b, 2009; Giampietro et al., 2009; Giampietro et al., 2011; Gomiero and Giampietro, 2001; Ramos-Martin et al., 2007; Serrano and Giampietro, 2009). The present document focuses on how field research was prepared and designed, and how data were collected and processed. With this, I aim to increase methodological transparency, in order to enhance the quality of the follow-up

research and analyses based on the collected field data. This document thus serves as a reference document for forthcoming papers, based on the collected data. The audience, to which this objective is directed, is the scientific community as well as potential future users of the related database who should know the potentials and limitations of the data.

The second objective is concerned with the documentation of organizational and practical methodological steps that were required to conduct the field work. I believe that many Ph.D. students, particularly those, whose case studies are not organized within the framework of a broader project, face not only the theoretical challenge of conducting a sound data collection and data analysis. They also may be faced with the challenge of setting up and managing a case study from scratch, including finding local contacts and hiring a field research team, within the constraints of funding, timing, and language. The literature on MuSIASEM offers a great variety of methods and tools for data analysis; however it does not offer much material about practical and methodological aspects regarding data collection in the field. Setting up a case study from scratch within various constraints has been my personal experience during my Ph.D., from which I could learn many practical issues in addition to the scientific work. The rural systems analysis group (www.ruralsystems.org) at ICTA-UAB has been a very helpful forum for discussing related concerns, thanks to the ability to share experience and reflections among the members. Within this light, I believe that this document may offer some useful practical insights that I have gained from my experience of setting up a case study in rural Cambodia. The audiences to which I direct this objective are thus Master students and pre-doctoral students at the beginning of their Ph.D. The aim is to share my experience, in order to provide reflections and ideas and to facilitate some discussion on how case study research for MuSIASEM analysis may be improved in the future.

Finally, the third objective of this report is to make available some more background information on the case study village. This information is largely qualitative, and partly based on observations, formal and informal interviews and discussions with the villagers and the field research team and personal reflections. This part does not necessarily cover all observed aspects, but it provides much more background information than presented in the related research publications, which – due to formal restrictions of length – can cover only general aspects in the case study description. Thus, the reader may get a deeper understanding of the case study village. Finally, although this type of information is not explicitly presented in the quantitative numbers from the survey data and the related research articles, this information was crucial for me to better understand the very different reality into which I was allowed to enter during field research. Thus, this information ultimately has been important to give meaning and context to the quantitative numbers of the survey.

1.2 Structure of the report

The document consists of seven sections and two attached documents. Section 2 provides background information on the context of the field research as well as on Cambodia. Section 3 shares my personal experience on setting up a case study from scratch, within limited funds, time and local contacts. Section 4 provides a brief introduction to the MuSIASEM approach applied to rural systems and documents the field research design; including case study selection, data gathering methods and sampling. Section 5 reports on the field research activities conducted with the local research team, while Section 6 summarizes how data were processed later on. Section 7 provides more background information and personal reflections on the case study village, based on my observations, as well as on formal and informal interviews and talks with the villagers during the field research. The last two sections attach the final research questionnaire and the explanatory document in which some basic concepts of the questionnaire are defined.

2 Purpose of the case study research in Cambodia

2.1 Research context: Ph.D. research at ICTA-UAB

The case study reported in this document is a part of my Ph.D. research in *Integrated Assessment and Ecological Economics* at ICTA-UAB, in which I am enrolled since November 2009. My Ph.D. research is generally concerned with the challenges of rural development in countries of the global South that arise from a multi-dimensional as well as from a multi-scale perspective within the context of global land grabbing. Regarding the first, I am interested the analysis of trade-offs between social, economic, and ecological dimensions of rural development. Regarding the latter, I am interested to understand the different challenges that emerge at different scales, such as at the global, national and local scale. My dissertation consists thus of a research series of four articles, of which each article focuses on a different scale of rural development, on which emerging multidimensional challenges need to be addressed: (i) the epistemological dimension, (ii) the global scale, (iii) the national scale, and (iv) the local scale (village and household level).

In the first article, I focus on the epistemological dimension and thus investigate theoretical implications related to the study of multidimensional poverty and related development issues, within an ecological economics perspective (Scheidel, 2013). In the second article, I investigate the emerging challenges for smallholder agriculture and rural development at the global scale, within the context of land grabbing (Scheidel and Sorman,

2012). The remaining two article focus on rural development issues in Cambodia as a case study. The third article addresses conflicting national and local rural development visions and realities in Cambodia and discusses how the promotion of large-scale agriculture at the national level is driving the marginalization of the peasantry due to declining access to land at the local level (Scheidel et al., in press). The forth and last paper of my Ph.D. research series focuses on a village and household case study at the local level and investigates how smallholders are able to create livelihoods based on limited access to land (Scheidel et al., submitted). The present document reports on how this case study was set up and how field research was designed and conducted.

2.2 Country background: Rural change in Cambodia

Why choosing Cambodia as a case study country? Cambodia is a fascinating and an interesting country with many aspects to study regarding the tremendous challenges of rural development, which some countries of the global South face nowadays[16].

Figure A. 1: Location of Cambodia (green) within the ASEAN countries (dark grey). Source: www.wikipedia.org

[16] From a personal perspective, it was further curiosity that brought me to Southeast Asia. Southeast Asia is an absolutely fascinating and exciting region and in my opinion, there is no better way to get to know a region, their culture and their natural reserves, than getting involved in some kind of project, rather than mere tourism. Doing research is obviously perfect, if somebody wants to know more about something.

2.2.1 A brief overview of the recent history of Cambodia

During the last 50 years, Cambodia experienced a dramatic history with radical regime changes that drastically affected the rural and urban population and their way to make use of their most fundamental natural resource: land. Figure A.2 presents an overview of the key periods of recent Cambodian history, population dynamics and land governance regimes. The following historical overview is based on the work of Chandler (2008), Russel (1997), Hall et al., (2011) and Thiel (2010), which may be consulted for more details.

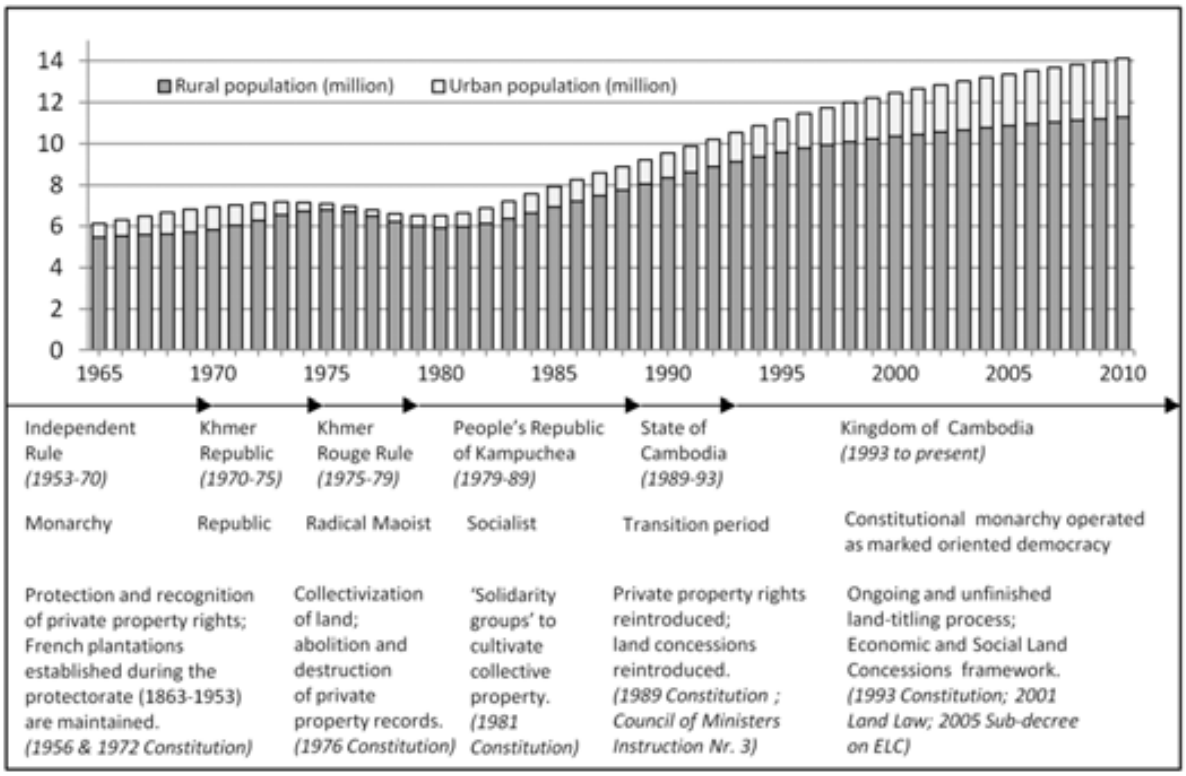


Figure A. 2: Key historic periods, population dynamics and land governance regimes in Cambodia since 1965. Source: own elaboration, based on Chandler (2008), Thiel (2010) Russel (1997) and FAO (2011).

In pre-colonial times (prior to 1863), land was formally property of the King, but open to use for everybody and relatively abundant in relation to the small population size. Land was possessed, based on the *'acquisition by the plough*' principle. During the French protectorate (1863-1953), property rights and land concessions were first introduced, mainly to assure security for French investors. During that time, the first rubber plantations, operated by French companies were established. Small-farmers were reluctant to register their land, partly to avoid paying taxes.

During the independent rule under *Norodom Sihanouk* (1953-1970) as well as under the Khmer Republic (1970-1975), also known as the *Lon Nol* period, the French colonial land law continued to be at the basis of the Cambodian land governance regime, and property rights and concessions continued to be recognized. The increasing civil conflicts, as well as US bombings on the Cambodian countryside in the context of the Vietnam War, led to a drastic dislocation of rural populations and a growing number of refugees from the countryside that migrated to Phnom Penh around 1970.

With the rise of *Pol Pot* and the Khmer Rouge Rule (1975-1979), devastating measures were taken in order to establish the radical Maoist, agrarian-based 'Democratic Kampuchea'. A large part of the Phnom Penh population was evacuated to the countryside and forced to collectively cultivate the land. Rural populations were uprooted and displaced. Private property rights and records were abolished and destroyed and replaced by a radical collectivization of land. Between one and three million people lost their lives due to the devastating Khmer Rouge Rule.

The Khmer Rouge rule ended with the Vietnamese occupation and the following 'People's Republic of Kampuchea (1979-1989). Led under *Heng Sarim,* among others, the radical collectivization of land ended, although small-scale collective farming was continued in small solidarity groups, called *'krom samakhi*'. Residential land was allocated based on occupation and individual peasant agriculture re-emerged in large parts.

In 1989, during the transitional regime of the State of Cambodia (SOC) (1989-1993), property rights were formally reintroduced and land concessions that would *"benefit the national economy"* were reintroduced. Smallholders were encouraged to apply for formal land titles to agricultural and residential land, but the land administration was unable to deal with more than 4 million applications lodged, resulting that less than 10% of them were processed at the end of 1995 (Russel, 1997). The current land-titling process results in 250,000-300,000 new land titles annually; however, at least 12 million parcels remain still unregistered (Thiel, 2010).

2.2.2 Current rural development issues in Cambodia

Since the establishment of the Kingdom of Cambodia in 1993 as a constitutional monarchy, Cambodia has pursued a transition towards a market economy, with particular attention to developing the rural sector. Cambodia has reached some degree of economic and political stability, but maintains to be a dominantly agrarian country in which around 80% of the

population lives in rural areas and 75% of the active labor force is making a living based agriculture, fishery hunting and/or forestry (NIS, 2008b). The rural sector is mainly based on non-industrialized smallholder agriculture and farmers access on average only 1.7 ha of land (ACI, 2005). However, rural Cambodia is changing at a fast pace, instigated by both endogenous and exogenous drivers of rural change.

On the one hand, Cambodia is experiencing demographic changes and increasing endogenous pressure on natural resources. The total population has roughly doubled since the beginning of the 1980s. Being home to around 11 million rural people, Cambodia never before in its entire history has inhabited so many farmers than nowadays. On the other side, also the urban population has grown rapidly to 3 million people, which represents another unique number in Cambodia's history (see figure A.2). Thus, the demand on natural resources from the countryside is also increasing from urban industrialized areas. Finally, the emergence of a global rush for land resources in the event of a global energetic, financial and food crisis (Borras et al., 2011; Braun and Meinzen-Dick, 2010; GRAIN, 2008; Scheidel and Sorman, 2012; Zoomers, 2010) has also affected Cambodia (Licadho, 2009). Hence, domestic as well as outside actors are increasingly claiming land resources.

Cambodia's governmental elite has identified in this new demand for land a unique opportunity to foster investment into agriculture, the creation of rural jobs and tax and trade revenues, based on large-scale industrial agriculture, managed through an Economic Land Concession (ELC) system (RGC, 2004, 2005, 2008). ELCs can be granted to foreign and domestic companies for the development of agro-industries and ELC contracts are usually made for 70 years. The rental fees range from 0 to 10$ per hectare, depending on quality and location of the land (MAFF, 2011). The demand for ELCs has been huge. Data from the Ministry of Agriculture, Fisheries and Forestry (MAFF) indicate a total concession area of 1.15 million ha in 2009, of which 956,690 ha have been validated with 85 companies (MAFF, 2011). This is a rather conservative number, since MAFF data do not include concessions below 1000ha. Other calculations indicate a total of 2 million ha of ELC land (Vrieze and Naren, 2012), which is a substantial amount of land for a few companies. To put this number into context, the smallholder sector, consisting of no less than 10.7 million Cambodians, accounts merely for 3.1 million ha of land (NIS, 2008b).

For the smallholder sector, ELCs are a critical issue and threat to their livelihood (Leuprecht, 2004) for various reasons. First of all, Cambodia is missing a systematic land management system that informs well about property and land use rights, as well as about land users (Thiel, 2010). In fact, at the time of writing this report, not even a comprehensive

agricultural census has been conducted since the establishment of the Kingdom of Cambodia in 1993. Apart from the lack of land management information at the national level, many smallholders do not have formal land titles for their plots. Private property rights were abolished and records were destroyed during the Khmer Rouge regime. While private property and land titles were reintroduced in 1998 under the transitional State of Cambodia, the government was unable to handle the huge amount of lodged applications and nowadays it is estimated that at least 12 million parcels still remain unregistered (Russel, 1997; Thiel, 2010).

In spite of this lack of information, the Royal Cambodian Government (RGC) largely awarded land concessions to foreign and domestic agribusiness (MAFF, 2011). This has resulted in problems of weak land governance that manifest themselves in increasing land conflicts due to the overlap of concession land with smallholder land (Leuprecht, 2004; Licadho, 2009; Vrieze and Naren, 2012). For many small-farmers, decreasing access to land due to both demographic changes and increasing competition with outside actors is among the most crucial concerns to their livelihood and insufficient access to land is perceived by Cambodian smallholders among the most central elements of rural poverty (ADB, 2001; Ballard et al., 2007).

Within this context, it becomes of crucial importance to understand how small-farmers are able to deal with declining access to land and how this affects the many dimensions of rural poverty. However, in order to generate a better understanding, it is necessary to account for the different situations in which households encounter themselves, as well as the different alternatives they might choose to make a living. For example, an old widow that posses land but lacks labor power faces very different challenges than a young and large household that has its own labor power available, but does not possess sufficient land. Further, availability of new economic activities, institutional arrangements regarding the management of productive resource and new agricultural techniques further influence the livelihood opportunities of a household or a village.

Particularly in the recent years, there has been a strong presence of NGOs and aid organization in rural Cambodia that intervened with small-farmers and fostered new livelihood strategies. One example is the Cambodian NGO CEDAC (Cambodia Center for the Study and Development in Agriculture, www.cedac.org.kh) that strongly promoted the establishment of community savings groups, ecological livestock rising and multi-purpose farms, as well as the System of Rice Intensification (SRI). SRI was developed by poor farmers in Madagascar as a set of low external input rice cultivation techniques that help to save seeds,

fertilizer and water, while having the potential to substantially increasing yields based on the use of traditional rice varieties (Stoop et al., 2002; Uphoff, 1999). SRI found very positive response in Cambodia, with an increasing number of farmers who have adopted the techniques (Anthofer, 2004). Apart from farm diversification, farmers have increasingly engaged in non-farm activities that range from setting up own small businesses, such as motor-taxi driving, battery-recharge stations or petty trades, over wage laboring in the service sector (collaborations with NGO, public positions, such as police men teacher, administrative posts) or the new industries, in particular construction and garment factories.

Summing up, the impacts of declining land availability on rural livelihoods as well as the possibilities and viabilities of livelihood diversification depend on many aspects and dimensions. These are on the one side the individual conditions of the household itself (i.e., land endowment, household size and structure, available capital and labor etc.) as well as the possibilities at hand for livelihood diversification (alternative agricultural techniques such as SRI, non-farm work opportunities, community development such as community savings group or paddy rice banks). Cambodia, being in the middle of processes of rural change, is offering interesting cases to be studied, that may help to better understand the current multidimensional challenges of rural development in Cambodia, as well as generally in countries of the global South, within the context of global land grabbing and declining access to land for smallholders.

2.3 Research objectives of the case study

Before describing the objectives of the case study research, a brief comment on the research culture of the integrated assessment research group at ICTA-UAB (www.societalmetabolism.org), seems to be appropriate. Being concerned with the study of complex living systems that may change in an unpredictable way, the research group has largely moved away from doing conventional research in terms of previously defined research questions, hypotheses and research objectives that are pursued from the beginning until the end of the research. To be able to be responsive to the emerging questions and issues that may come out during the research process, research in the integrated assessment group is encouraged to be process oriented[17]. Within this context, also the objectives of the case study

[17] For example, students at the beginning of their Ph.D. are usually asked to define reachable research questions and objectives, which are then to be pursued during the whole Ph.D. However, it is particularly at the beginning of a Ph.D., when students know the least about the topic. Many questions asked at the beginning may seem stupid, obsolete or irrelevant after a year or two of investigation. This also happened in

were defined only on a general level. However, they were maintained largely open in order to be able to adapt them to the conditions and issues that would be encountered in the field.

Having this said, the general objectives of the case study were:

1. To conduct an in-depth analysis and comparison of household types within a non-industrialized smallholder village in Cambodia, in order to better understand the multidimensional challenges that small-farmer may face nowadays within the context of declining access to land and global rural change. The analysis should focus on both the village and the household level. The analysis should further be able to account for the different livelihood strategies a household may choose (such as SRI or non-SRI farming, non-farm work in the new industries, etc.), as well as for the different social, economic and ecological conditions of the household in which it is embedded.
2. To compare this case study on smallholder agriculture in Cambodia with other case studies available from the rural system analysis group (China, Tibet, Italy, Spain, Guatemala and Nicaragua), in order to identify common challenges related to rural change across the globe.

In order to meet these objectives, I set up a case study research, in which I focused, as described below in detail, on a non-industrialized wet-season rice-farmers village that was supposed to inhabit SRI as well as non-SRI farmers. Surprisingly, once being there, SRI seemed to be less important in the village than other things, such as the establishment of a strong and modern grassroots village community, including a community savings group and a paddy rice bank. Thus, while the documents prepared for the organization of the case study, including the criteria for selecting the village and the final research questionnaire, included a focus on SRI farming, SRI is playing a minor role in the subsequent analysis.

3 Organization of the case study

The steps and difficulties that arise from the organization of case study research largely depend on the research context. Conducting case study research within the framework of a broader project with funds and local partners may produce fewer troubles to students than independent Ph.D. projects, in which the doctoral candidate may be funded, but not necessarily travel costs and a local research team. Further, local contacts are often not

my case and thanks to the encouragement of my supervisors, I was able to be responsive to the emerging issues and could constantly adapt to what I was learning.

available and need to be established from outside. Thus, a variety of challenges related to funding, local contacts, timing, language barriers and ultimately lack of experience, arise. There is some literature available on doing case study research in rural communities, covering some organizational issues (e.g. Angelsen et al., 2011; Singh et al., 2010). The following sub-sections share my personal experience and considerations in setting up a case study and further reports on the involved institutions.

3.1 Timing

The timing of the research activities are crucial to consider before planning the case study. Particularly, research in agrarian communities should be timed with the agricultural activities and related seasons. When the researcher enters the community during labor peaks, such as rice transplantation in the wet season or harvest time, he or she will have the opportunity to observe many activities; however, farmers will likely not have time for interviews and so on. On the other side, when visiting a farming village during leisure periods, such as the dry season in Cambodia is, he or she won't be able to observe all the important activities; however, farmers may have plenty of time for interviews as well as for informal, but usually very informative, talks. Further, if local students are involved in the research team as translators or enumerators, the timing of field research should not overlap with periods of exams, etc. in order to assure availability of the field staff. Summing up, timing of research activities needs to be considered already at the beginning of organizing case study research.

Various visits during different seasons would be beneficial in most cases, however, might not always be possible, and – depending on the research objectives – might not always be necessary. In my case, I visited the study village various times over a period of three months between March and May 2011, thus, within the same season (dry season). In order to be able to conduct the detailed household survey, the dry season was the only possible time frame, since only during this period sufficient time for interviews was available from the farmers. Additional visits during other seasons would surely have benefited my understanding of the village dynamics; however, I believe that the time spent in the village was sufficient to assure a minimum of quality of the subsequent analysis.

3.2 Funding

As mentioned previously, independent Ph.D. projects might consist of a fellowship to pay the Ph.D. candidate's salary, but may not always include travel costs or field expenditures. While I was convinced that I was going to win a travel grant for doing my field research, which I had started already to organize, I finally was unlucky and did not have any grant available to cover field expenses. Part of the story was that one evaluation criterion was the amount of published papers of the local research partner. Being a project-focused organization in a developing region, my local host was perfect for setting up case study research, however did not have any peer-reviewed papers published, but mostly project reports and policy briefs. One year later, I applied for 'office research' (i.e., doing the analysis of the collected data in front of my computer) in a research group at a Japanese University that had many publications. I won the grant, although I did not need any money for covering expenses in the field.

There are three reasons why I share this story. First, I learned to be strategic with fund applications; it is important to look at various criteria when choosing a host partner. One aspect is the adequacy for doing field research; another is the possibility to get research funds. Someone might also go for two hosts; one for the funds and the other for setting up the case study. Second, it might be worth considering the opportunity costs of not carrying out the field research. In my case, I started already with the organization but then did not have any funds available. However, stopping what I have started would have meant loosing already established contacts and at least one or two months of preparation work. Thus, I decided to cover expenses with my normal salary. The biggest post was the travel expenditure, but once in Southeast Asia (a region with comparatively low living costs) I could live cheap and further share my European salary to pay the research team in the field. However, I also want to state that I faced financial constraints in setting up the case study, which also limited the possibilities in terms of amount of regions and villages I could survey. I preferred thus to limit the survey to only one village, but collect in-depth information on various dimensions of the village and their households.

3.3 Local contacts

Good local contacts are obviously crucial for doing case study research and should be established at various levels. Someone might need institutional and intellectual support from local universities and/or research and policy institutions, as well as contacts for hiring a field team and ultimately for establishing a relationship to a village and their inhabitants. Thus,

various 'entry points' (Singh et al., 2010) need to be established. They should be carefully selected, as they further influence the relationships the researcher may be able to build in the region. Thus, when setting up a case study, someone may consider what local contacts can offer them, but definitely should also consider what in turn can be offered to the local contacts.

3.3.1 Institutional and intellectual support

Being affiliated to a local research unit in the case study country, such as a university, a policy institute or a development organization brings many advantages. The university in your home country might not be known in your case study country. In turn, a local host can offer institutional support and may have many further local contacts at their disposal, which is important when trying to set up interviews with other actors or institutions. A local host further can offer intellectual support through competent staff and a local library that may contain many reports on local issues that are not available from outside. Depending on the research activities, some countries might also require a formal permission or a special visa for doing research, or at least a letter from a local host that supports your activities. It is recommendable to inform yourself previously about the required formal procedures, for which in turn you might require a local host.

There are a few things that a Ph.D. student may offer in turn to the local host institutions. In the best case, the local host is working on the same issue and thus has one resource person more working on it. If the topic is not currently on the agenda of the institute, other things to offer are information exchange through preparing a seminar or talk, an outside perspective on local issues, potential future publications in collaboration/acknowledgment of the host, and building collaboration for potential future projects between the host and the home research group. When contacting potential local hosts, it may be helpful to provide a list of what kind of support you are asking for and what you can offer in turn.

For the present case study, I contacted a variety of institutions in Cambodia as well as Southeast Asia. Finally, I was accepted as visiting scholar at the Mekong Institute (MI) for Development and Cooperation in the Greater Mekong Sub-region (GMS), located in Thailand. The MI is an intergovernmental institute that focuses on capacity building, policy and research. Thanks to their status as intergovernmental institute, I could obtain a governmental workers visa for Thailand. Thanks to their knowledge and their contacts, I could receive valuable institutional and intellectual support and got in contact with many other actors from

Cambodia. Among them was the research group of agricultural economics and rural development of the Royal University of Agriculture (RUA), in Phnom Penh, which was very welcoming and helpful for the further work. Thus, both MI and RUA had been important institutional and intellectual contacts for the further case study work.

3.3.2 Entering the case study village

For getting in contact with an adequate case study village, it is recommendable to enter through an institution that has already established contacts. In some cases, this might be the intellectual host; in other cases, an additional contact is needed. Another advantage of choosing an institution, rather than going on your own, is that you may receive help in finding a case study that fits the characteristics you need for your research undertaking. Moreover, relations of trust maybe already established through the host institution, on which you can build when contacting the villagers. Local NGOs might often be good partners through their longstanding cooperation with villages. However, this also may influence the research outcome. At least, the previous interventions from NGOs need to be considered when doing research in the village. Also here, a Ph.D. student can offer in turn the provision of research material and data that the institute or NGO might use later on in their own work. This also helps to focus the research on issues that are relevant not only for the Ph.D. project, but also for a larger audience.

I am thankfully to CEDAC for accepting my collaboration of doing research in one of their project regions. Choosing an NGO that had previous projects in the case study village, fitted well my own research objectives, since I was interested in the new rural livelihood opportunities that were emerging, not at least through the interventions of NGOs. CEDAC not only facilitated me contacts to the case study village, but was crucial in helping me identifying an adequate village for my research as well as in providing feedback on the research questionnaire in terms of relevance and feasibility. CEDAC also offered me help in finding a local field research team.

Once the contact to the case study village was established, the research undertaking needed to be formally approved by the villagers. Usually, there is some official representative, who can be asked to approve your undertaking and it is recommendable to inform yourself previously about the hierarchies and procedures in place. For the presented case study,

permission was obtained first by the commune council and afterwards by the village chief[18]. The permission was obtained orally in an appointment. For the local authorities (police, etc.), CEDAC further recommended to have a letter of my home and/or host university that would state the purpose of my visit in the region.

3.3.3 Finding a local research team

A local research team that helps you conducting field activities becomes crucial as soon as language barriers exist. For my case study research, I needed a field research team due to lack of familiarity with local culture, language barriers and a lack of knowledge of the place (e.g., location of the village, access roads, contacts to key persons of the village such as village chief, etc.). Both RUA and CEDAC were very supportive in helping me finding a local research team.

The rural development research group at RUA agreed to help me finding an undergraduate student who needed, like me, a case study for his final thesis. To do so, I prepared a call for a research assistant that the colleagues from RUA could share with their undergraduate students. For the work of a field research assistant and translator, I offered the student a financial compensation, that amount I previously had discussed with the local research group in order to assure adequacy. I further covered travel expenses, food and accommodation costs for the research assistant. Not at least, we both agreed to share the collected data so that our independent work could be helpful to each other. The student further had a motorbike at his disposal, which we could use to move around – a crucial issue that I did not consider in my planning. We ended up being close friends and I believe that we both could help each other a lot in conducting the field work for our study.

Having a field research assistant and translator who knew about local rural issues (he himself studied rural development and his family were small-farmers too) was a great source of knowledge. Further, it was absolutely indispensable for preparing and conducting the field work (translation of questionnaire and other documents, interviews, etc.) as well as for organizational issues. In rural Cambodia, where tourists don't enter and almost nobody speaks English, I needed assistance even for the smallest things, such as finding a place to stay, etc. In addition to the research assistant, I further needed local enumerators who knew the village sufficiently (e.g. where the village boundaries were, which was not obvious for outsiders) and who were sufficiently educated to conduct a household survey. Therefore, CEDAC put me in contact with their local office in Kampot province, where my case study was

[18] A commune is and administrative unit in Cambodia that consists of various villages. Various communes form a district.

located. I could engage the field staff of CEDAC's former project. They knew the region well, had conducted previous surveys for other project evaluations and had already an established relationship of trust with the villagers. Unfortunately, they did not speak well English, so most of our communication was facilitated by the research assistant.

Summing up, the local research team consisted of four resource persons. One of them was engaged as field research assistant and translator and was an undergraduate student at RUA. The others were engaged as enumerators and were previous CEDAC staff who knew the village and the regions because they themselves lived in close by villages.

4 Research design

4.1 Methodological background

This section provides a brief overview of the MuSIASEM approach applied to rural systems, on which basis the case study was later on analyzed. A detailed theoretical explanation and practical applications are available elsewhere (Giampietro, 2003; Giampietro and Mayumi, 2000a, b, 2009; Giampietro et al., 2009; Giampietro et al., 2011; Gomiero and Giampietro, 2001; Pastore et al., 1999; Ramos-Martin and Giampietro, 2005; Serrano and Giampietro, 2009; Siciliano, 2012). The objective of this section is to provide a general overview, so that the reader is able to contextualize the research design of the case study research.

The used methodology for the analysis of rural livelihood profiles is a farming system analysis that focuses on the allocation of land and human activity in terms of time use of rural households and the associated production and consumption of biophysical and monetary flows. While rural systems in non-industrialized countries across the global are highly different and complex, they share one common characteristic: 'time' and 'land' of a rural household are among the most important resources as well as constraints (Giampietro, 2003; Pastore et al., 1999). 'Time' can be spent as on- and off-farm labor, leisure, local institutions, sleeping, eating, cooking, childcare, education, care of elder people, etc. However, the time budget of a household is limited by its demographic structure and therefore has to be spent carefully. It can be spent in many ways, resulting in different livelihood strategies. Likewise 'time', also 'land' is a crucial resource of rural households and at the same time an important constraint. The 'land budget' can be spent on different farming practices, leading to the production of different agricultural goods that further allow for subsistence and income generation.

The MuSIASEM approach applied to rural systems, focuses thus on the use of land and time, by splitting them into different categories, which are perceived as relevant by the observer. To illustrate this for the time budget, annual total human activity (THA) expressed in hours (family members * 365 days * 24 hours) can be split into fractions of physiological overhead (time for sleeping, healthcare, eating, etc.), social overhead (education and leisure), subsistence work (subsistence farming, cooking, childcare, collecting firewood), and income generating activities (paid work, cash cropping). Land budgets are likewise analyzed, split for example into total available land (TAL), ecological overhead (land for biodiversity, ecological processes), land for subsistence agriculture (home consumption), land to pay farming inputs (share of land needed to cover production costs) and land for income generation (crops or livestock sold on the market). Livelihood strategies can thus be analyzed by looking at the structure of a household's land and time allocation pattern and the related variables of production and consumption. Based on such an analysis, time-, land and labor costs of different livelihood activities can be addressed, while capturing consistently their complex interactions.

While the original Land-Time-Budget analysis (LTBA) was developed a decade ago (Pastore et al., 1999), the approach has advanced enormously during the last years with the development of the related MuSIASEM approach (Giampietro et al., 2009). The MuSIASEM approach established a procedure to conduct such an analysis not only at one scale (e.g. household or village level) but also across scales (e.g. households – village – nation). Serrano and Giampietro (2009) further developed and exhaustive visualization scheme, capable of illustrating the quantitative linkages between land use, time use, and produced and consumed flows. Figure A.3 shows such an example analysis, conducted at the village level in rural Lao PDR (Serrano and Giampietro, 2009). With this type of analysis, it is possible to make a multidimensional quantitative assessment of farming system typologies, which can be used to generate, among others, the indicators presented in table A.1.

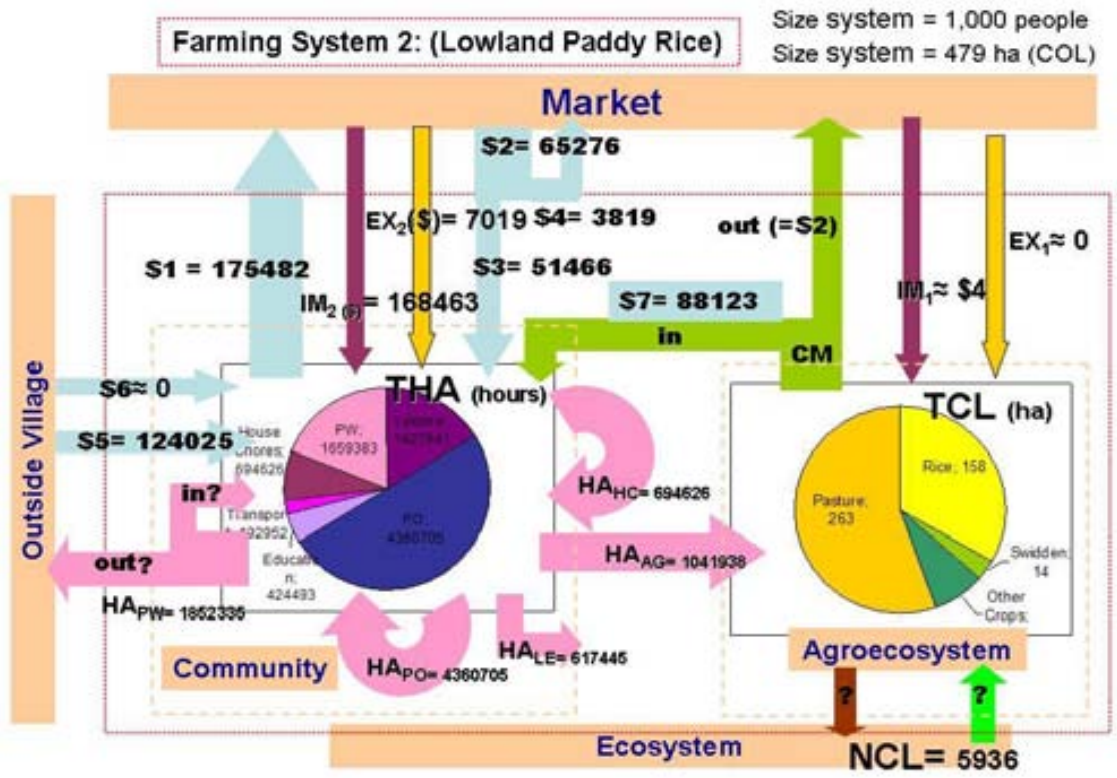


Figure A. 3: Land-Time-Budget analysis of a farming system typology in Laos (Lowland Paddy rice). Note: THA = Total Human Activity; TCL = Total Colonized Land. Blue arrows indicate monetary flows, pink arrows indicate time use, green arrows indicate agricultural flows (food and cash crops), purple arrows indicate material flows and yellow arrows indicate energy flows. IM=imported materials; EX=exosomatic energy; CM= Crop-mix. HApw=Human Activity in paid work; HApo= Human Activity for Physiological Overhead; HAle=Time for Leisure and Education; HAag= Human Activity in Agriculture; HAhc= Human Activity for Household chores (Source: Serrano and Giampietro, 2009.)

Table A. 1: Indicators of the multidimensional rural livelihood analysis, based on the MuSIASEM approach. Source: Own elaboration, based on Serrano and Giampietro, 2009.

Economic dimension	Social dimension	Environmental dimension
Income - Monetary income ($/yr) - HH consumption ($/yr)	**Physiological resilience** - Calorie intake (kcal/cap/day) - Time for sleeping and eating (hrs)	**Demographic pressure** - Colonized/non-colonized land (ha/ha) - Persons/land (hrs/ha)
Expenditure - $/yr	**Social resilience** - Time available for social activities (hrs)	**Environmental loadings** - Fertilizer use (kg/ha) - Pesticide use (l/ha)
Land poverty - Access to land (ha)	**Cultural resilience** - Time for formal and informal education (hrs)	**Energy efficiency** - Crop output/Energy input (kg/J) - Income/Energy input ($/J)
Land productivity of different crops - $/ha - Kg/ha	**Institutional resilience** - Time available for local institutions and cooperation (hrs)	
Labor productivity of livelihood activities - $/hrs - Kg/hrs	**Food sovereignty** - Months of rice surplus (M/HH) - Dietary mix	
Food security/ sovereignty - Months of rice surplus (M/HH)		

As shown in figure A.3, this analysis can be used to analyze the village performance, based on land and time allocation patterns and the associated production and consumption of monetary and biophysical. However, it can be further used at the household level, in order to compare the performance of livelihood strategies of different household types.

While multidimensional poverty assessment have become popular in the recent years (Alkire and Santos, 2010; Cohen, in press), most approaches do not account for how the different dimensions are interlinked, but rather present them in parallel. Hence, they may offer useful tools for the *evaluation* of multidimensional poverty, but are less appropriate for the *analysis* of multidimensional poverty, since no information is provided on how the dimensions are interrelated. The MuSIASEM analysis can account for such linkages, but require the collection of a large variety of data regarding human activity, land use and produced and consumed biophysical and monetary flows.

4.2 Simplification of complex rural systems – some considerations

As seen in the above section, conducting a MuSIASEM analysis applied to rural systems requires the collection of a multitude of data, particularly regarding human activity, land use, material, energy and monetary flows of a case study village. However, it is important to acknowledge that it is not possible to capture all the complexly related flows of money, time, materials and energy associated with a rural system. There will be always some things left out, partly stemming from activities and/or other things that the interviewed people do not remember or do not want to share with the researchers, and partly from the fact, that some things that are not asked because they are not relevant for the analysis to be done. Thus, every kind of data collection is always a 'heroic simplification' of a complex rural system and the issue is rather to find the adequate simplification, which allows answering some relevant research questions. The painting process offers a metaphor for the simplification of complex systems (figure A.4). First you see what is there, secondly you focus on the elements you consider crucial in your observation (you never draw everything you see) and finally you find some proxies to represent them. For painting, the used proxies might consist of paper, pencils and colors. In research, the used proxies are the collected data and the subsequent analysis.

Figure A. 4: Simplifying complex rural systems. Source: Own elaboration.

When simplifying the representation of complex rural systems through data collection via a research questionnaire, a few trade-offs need however to be considered. Asking too many details, the farmer may stop answering because it will take too much time. Asking to little details, the researcher might not be able to address all the research questions. Further, farmers may not always be able to answer all types of question that the research might want to know. For example, recalling labor requirements of particular activities might not be possible on a too detailed scale, but only in rough categories. For example, there is not always a clear cut between the labor requirements of preparing the seedbed and leveling the whole land for rice farming, because it goes together. Participative observation approaches may help here, but are time consuming, and in my case have not been possible. Thus, the adequate depth of data collection needs to be considered within the individual constraints of the research project. When designing the case study research, the related potentials and limitations of data need to be known for the further analysis. The following section explains on which basis the case study was selected and under which criteria and information depth the research questionnaire was developed.

4.3 Case study selection

In order to find an adequate case study village for the planned research, a series of criteria was defined, on which basis a village was purposively selected. The criteria were derived from my research objectives on comparing different livelihood strategies within different individual household contexts. As previously mentioned, there was a strong focus on SRI farming as a new livelihood activity for the case study selection, which however was not pursued afterwards in the analysis. The focus is the subsequent analysis was rather on other emerging livelihood activities, such as the cooperation processes at the village level. They seemed to me more interesting and more feasible to study. Nevertheless, based on the initial criteria, a document was prepared that described these criteria. The document was used to consult experts from CEDAC in order to help me finding a village that would fit to the research objectives. The village *Khcheay Khang Lech* (hereafter KKL), located in Damnak Sokram Commune of Dang Tong district in the coastal province Kampot (figure A.5), was selected as case study village. Table A.2 summarizes some general characteristics of KKL in 2008.

Figure A. 5: Location of Damnak Sokram Commune, Kampot province. Source: www.cambodiaatlas.com (21.06.2012).

Table A. 2: General characteristics of the case study village Khcheay Khang Lech in 2008. Source: (NIS, 2008a).

Community Profile

(based on the General Population Census of Cambodia 2008) 25/02/2013

Area: Village - 03 Khcheay Khang Lech [07 05 01 03]

Age / Sex distribution

Age group	Total	Males	Females	Sex ratio
Total	725	360	365	98.6
0-4	83	45	38	118.4
5-9	82	40	42	95.2
10-14	82	41	41	100.0
15-19	97	52	45	115.6
20-24	94	47	47	100.0
25-29	64	33	31	106.5
30-34	39	16	23	69.6
35-39	58	28	30	93.3
40-44	35	20	15	133.3
45-49	19	8	11	72.7
50-54	20	6	14	42.9
55-59	11	3	8	37.5
60-64	9	5	4	125.0
65-69	18	12	6	200.0
70-74	4	0	4	0.0
75+	10	4	6	66.7
Median Age	20.2	19.3	21.0	
Dependency Ratio	62.6	N.A.	N.A.	

Household Information

	Total	Regular
# Households:	188	188

Average household size: 3.9

Occupancy status:

Owner	Rented	Free	Other
188	0	0	0

Source of Light:

City	Generator	Both C/G	Kerosene
4	0	0	102

Candle	Battery	Other
0	82	0

Cooking Fuel:

Firewood	Charcoal	Kerosene	LPG
188	0	0	0

Electric	None	Other
0	0	0

Toilet Facility:

None	Sewerage	Septic	Pit	Other
187	0	0	1	0

Drinking Water:

Piped	Pipe Well	P.Dug well	N.Dug well
1	14	1	128

Rain	Spring,River	Bought	Other
0	44	0	0

Access to improved water: 8.5 %

Population indicators		Total	Male	Female
Child Woman ratio		410.9	N.A.	N.A.
Singulate mean age at marriage (years)		19.6	21.3	18.4
Proportion Heads of Households		100.0	79.8	20.2
Proportion Migrants		9.38	10.00	8.77
Number of Disabled persons (Since + After Birth)		13	5	8
Adult Literacy Rate (aged 15 and above)		72.2	82.5	62.3
Percentage aged 6 and above attending school		28.94	33.66	24.36
Educational Level of Literate persons aged 25 years and above (in %)	1.None	0.00	0.00	0.00
	2.Primary not completed	0.00	0.00	0.00
	3.Primary School	0.57	0.99	0.00
	4.Lower Secondary	60.23	57.43	64.00
	5.Secondary/Tech. Diploma	23.30	22.77	24.00
	6.Beyond Secondary	15.91	18.81	12.00
Crude Economic Activity rate		56.83	52.78	60.82
Employed persons by Industrial Sector	1.Primary	99.27	98.42	100.00
	2.Secondary	0.00	0.00	0.00
	3.Tertiary	0.73	1.58	0.00
Secondary Activity of Economically Active persons (in %)	1.None	1.70	2.63	0.90
	2.Crop farming	6.31	13.16	0.45
	3.Live-stock farming	91.50	83.68	98.20
	4.Other	0.49	0.53	0.45

Note: P.Dug Well = Protected Dug Well, N.Dug Well = Unprotected Dug Well

KKL had some characteristics that were common to many other smallholder villages in Cambodia, such as the demographic structure, land use patterns and main livelihood activities. The primary economic activity was agriculture, in particular wet-season, low-land rice cultivation based on non-industrialized techniques. These characteristics made KKL an interesting case study to analyze common challenges of rural development, faced by many smallholders in Cambodia.

KKL however had also some special features, such as the co-existence of both SRI and non SRI-farmers and a high degree of cooperation and local institutions among the villagers, partly due to previous activities of NGOs regarding community development. Local institutions included a grassroots village community with democratic elections every three years. The village community operated a variety of villager groups, such as a rice paddy bank, a community based savings group that could provide micro-credits to villagers, as well as a women group, youth group and poorest group that fostered empowerment of certain social groups. These features turned KKL into an interesting case study for the analysis of emerging opportunities from new activities and new institutional arrangements.

4.4 Development of the research questionnaire

Once, the case study village and the related region was selected, I started with the design of the household survey and the research questionnaire. This data collection method seemed to be the most feasible option to survey the livelihood activities both at the village and at the household level, within the limited amount of funds and time available. The additional data collection method and field research activities are documented in Section 5. The final research questionnaire was developed during three research phases that entailed the development of a preliminary version, a draft version and the final research questionnaire. The development of the three versions involved the following research steps (table A.3):

Table A. 3: Steps in the development of the research questionnaire.

Version of questionnaire	***Research steps***	***Validation methods***
Preliminary questionnaire	Literature review	Feedback from CEDAC experts
Draft questionnaire	Participative observation Formal and informal interviews Landscape reading	Test-interviews in the field
Final questionnaire	Experience from test-interviews in the field	Field interviews

a) Preliminary questionnaire: This first version of the questionnaire was elaborated, based on a literature review on livelihood activities in Cambodia, with a particular attention to Kampot province and SRI farming communities. The scientific literature was reviewed (published research articles and dissertations), as well as CEDAC field reports and other assessment studies. Feedback on early versions was given from CEDAC experts, who revised the questionnaire and provided comments for further improvement, on which basis the preliminary questionnaire was prepared. In order to estimate the duration of the interview, the questionnaire was tested with a colleague.

b) Draft questionnaire: After having elaborated the preliminary questionnaire, I visited with the research assistant and translator the case study village in the context of a home-stay with a rice farmer's family. The contact was established through CEDAC and we stayed about one week day and night with a farmer's family. During this time, we did participant observation, 'landscape reading' (i.e., identifying the most important crops and agricultural practices as well as biophysical conditions of the village), formal interviews and informal talks. Based on this experience, the preliminary questionnaire was revised and the draft questionnaire was developed.

c) **Final research questionnaire:** After having elaborated the draft questionnaire, we returned to the case study village, in order to conduct some test-interviews. These were crucial for developing the final version. The draft version contained too many 'closed questions', in which the units were already pre-defined, such as 'amount of annual rice production in kg'. The test-interviews however showed that most questions with pre-defined units were difficult to answer by the farmers, as some knew the information for example in 'kg', others in 'bags of rice' and others in 'baskets of rice'. Thus, for the final questionnaire, most pre-defined units were removed and the enumerators instead were trained to ask for additional information where necessary. For example, if the answer was '12 baskets of rice', the size of the baskets in terms of kg was further asked. Further, the draft questionnaire was too long; one respondent left after two hours because she had other things to do. This forced me to reduce the detail of many questions and simplify the planned representation of the rural system. Also, I noted that many questions, particular regarding time use, could only be answered in a rough way, with certain uncertainty. This forced me to skip the objective of making a detailed comparison between labor requirements of SRI and non-SRI rice farming, for which purpose self-reporting did not seem to be the adequate data collection method. In this light, the collected time use data from the research questionnaire may be used only as a rough approximation to human activity of the different households. The final questionnaire was translated by the research

assistant into a bilingual questionnaire, in which Khmer was the main language, but notes in English were maintained. The final research questionnaire was validated in the field on the first field research day with the enumerators. A copy of the questionnaire is available in the final section of this document.

4.5 Sampling

The planned household survey in KKL pursued two objectives. First, to obtain a representative sample at the village level, in order to analyze the village performance based on the MuSIASEM approach. Second, to obtain detailed information on individual household, on which basis an in-depth analysis of individual household types could be conducted. To be able to conduct a MuSIASEM analysis, data on demography, land use, livelihood activities, income and expenditure, time use and institutional activities of the sampled households were required (see the final research questionnaire in the last section for detail on the collected data). In order to reach these two objectives, a random household sample, representative at the village level was planned, as well as a few additional purposive household samples that would focus on previously selected characteristics (i.e., land-poor and non-land poor households, etc.).

For the preparation of the survey, the number of the total households was obtained in an interview with the village chief and cross-checked with the commune council. At the time of field research (March - May 2011), KKL was home to 195 households. Assuming a normal distribution of selected characteristics across the surveyed population, a minimum sample size of 65 households was required in order to obtain a random sample that would be representative with a confidence level of 95% and a margin of error of 10%. In order to counteract potential 'dropouts' (questionnaires that were dropped later on due to mistakes, see Section 6.2) and to increase the information available from single households that might further serve as individual household case studies, the random household survey was planned to reach a minimum of 90 households. In addition, around 10 purposively selected household samples were planned, in order to analyze individual household case studies based on previously defined characteristics (land-poor, non-land-poor, SRI and non-SRI farmers).

The sample that was finally obtained after conducting the household survey consisted of a total of 104 households, of which 92 households were part of the random sample, and the remaining 12 households were purposively selected. Six questionnaires from the random sample dropped out (see Section 6.2 for its justification), resulting in random sample of 86

households out of a total of 195 households. This is a representative sample at the village level, with a confidence level of 95% and a margin of error of 8%.

5 Field research in practice

5.1 Research team, training sessions and quality checks

The research team available in the field consisted of five persons: a research coordinator (the author of this report), a research assistant and three local enumerators.

On the first day, a training session was organized, with the purpose to inform the enumerators well about the structure, objectives and definitions of the household survey and the related research questionnaire. For this purpose, a bilingual explanatory document was prepared that addressed general points of the questionnaire, as well as specific questions with potential difficulties (see last two sections of this report). Conventions were established on how to fill in the questionnaire. During the first part of the day-long training session, the questionnaire was introduced with help of the explanatory document. During the second part, a role play was organized, in which the enumerators interviewed each other, playing the role of the interviewer and respondent. The training session was hold at the local CEDAC office in Chhouk town, Kampot province. The enumerators were compensated for the training session with the payment of a full work day (17$ per person).

Further, due to the existing language barrier, it was important to establish a good information flow between farmers, enumerators, the research assistant and me to assure quality of the household survey. For this purpose, the research team usually met three times a day during the field work period; once in the morning to inform the team about the daily planned activities, then for having lunch together and finally one hour before the end of the workday. The objectives of the daily meeting at the end of the working day were (i) to discuss all issues and difficulties that appeared during the day, (ii) to transmit as much as possible all formal and informal information gathered during the interviews, and (iii) to assure that the enumerators always had written down all the necessary information, in particular the varying units provided by the farmers (kg, tons, baskets, riels, dollars, etc).

During evening and night, the research assistant and I briefly checked the quality and completeness of the collected data. If there were issue to be improved, feedback was given the day after in the morning meeting.

Finally, we organized a few social events within the research team (going for dinner, visiting nearby places) that also helped to maintain a good relationship and good mood over the period of intensive field work.

5.2 Principal field research activities

The field research activities mainly consisted of conducting the household survey with 104 households, but further involved 19 semi-structured interviews to key actors and experts, the study of village documents (savings group accounts, village report book, etc.), as well as various visits to key places in KKL and the surrounding villages (i.e., the village dam, the next administrative district center, etc.). Table A.4 provides a summary of the research activities, including the participant observation on which basis the research questionnaire was developed.

The household survey was conducted during the first weeks of May 2011. This was just after Khmer New Year (14-16 April 2011) and at the turn of the agricultural season: It was after harvest and before the new rice cultivation cropping activities would start. As the majority of villages in Cambodia, KKL has only one rice yield per year, cultivated during wet-season. This had the advantage that the farmers could be interviewed regarding the last agricultural year that just came to an end. Thus, household data from the survey refer to the 2010/2011 agricultural year. Only the savings group accounts were managed based on the calendar year, thus the savings group account data refer to the 2010 banking year.

While the enumerators conducted the household survey with the research questionnaires, the research assistant and I conducted the interviews and all other tasks. In addition to the main research activities summarized in table A.4, key landmarks in the village were recorded using GPS. A field diary was written, in order to keep all the informally obtained information available for the time of 'office research' (analysis of collected data).

Table A. 4: Principal research activities during field research.

Research activity	***Key tasks***	***Duration/Quantity***
Participant observation, landscape reading, informal talks	Home stay with a rice farmer's family. Spending time in the village	One week of living in the rice farmer's home (during day and night). Various further visits and stays in the village (during the day) over a period of three months.
Household survey	Data collection through a research questionnaire, conducted by local enumerators	104 household samples, obtained within a period of 3 weeks.
Semi-structured interviews	Semi-structured interviews, conducted by me and the research assistant (translator)	19 interviews, obtained over 3 months with: *Public administrative bodies:* Commune leader (1 interview) Village chief of KKL (2 interviews) Other village chiefs in the commune (4 interviews) *Formal village institutions representatives:* Village community committee president (1 interview) Savings group secretary (3 interviews) Paddy rice bank committee member (1 interview) Infrastructure group president (1 interview) Women group president (1 interview) Youth group president (1 interview) Poorest group committee (1 interview) *Farmers associations and NGOs:* Rice mill association president (1 interview) Farmer-Nature Network president (1 interview) National Bio-digester Program officer (1 interview)
Study of village documents	Photocopy of all documents that the village members agreed to share with us	Village report book Savings group account Rice mill association account Latest district statistics (2008) Document and statistics from previous community development projects conducted by NGOs

6 Data processing

This section briefly describes the different data processing steps that followed the data collection in the field. During data processing, a memo was written to record the main processing steps.

6.1 Digitalization of field data

A digital save copy of all information obtained in paper (questionnaires, copies of village documents, etc.) was made by taking digital photographs of each page. The notes from the semi-structured interviews were passed to the computer, with the contextual information (place, time, people present, etc.). This was a precautionary measure taken against baggage loss, which, although not often, may happen.

Once back to office, the questionnaires were checked for quality and consistency, and further processed by transferring the raw information to Microsoft Excel (and later on to Microsoft Access). During this process, it was intended to maintain the maximum information available from the questionnaire. Thus, at this step data were transferred 'as they were' (e.g. no unit conversions were made at this step). Written comments from the farmers or enumerators were recorded using Excel's comment function. A copy of the original raw data in Excel, including all informal comments, has been maintained separately until present. Afterwards, the data were normalized and processed into Microsoft Access for further analysis.

6.2 Dropouts

During the field work and the subsequent quality check in the office, six questionnaires from the random sample were dropped for the following reasons (table A.5):

Table A. 5: Dropout questionnaires and justification.

Household ID of questionnaire	***Reasons and justification for dropout***
1	Mistakes in units, unanswered questions. This was the first household interview of Enumerator 1.
9	Inconsistent data, particularly labor data. This questionnaire was from the first day of Enumerator 1.
11	Inconsistent data, particularly income and expenditure. This questionnaire was from the first day of Enumerator 1.
32	Inconsistent data, zero income in one year. This questionnaire was from the day, Enumerator 2 had a hangover, because the day before he attended a wedding party.
33	Inconsistent data. This questionnaire was from the day, Enumerator 2 had a hangover, because the day before he attended a wedding party.
X	According to the Enumerators, towards the end of the interview, the respondent got crazy about something and they had to stop the interview.

Moreover, all data regarding the amount of vegetable produced (in terms of kg), as well as on the amount of fish yielded from fish ponds, was not used further, because the collected data were inconsistent. This was partly due to my fault; I did not define well in the questionnaires which vegetables were included (e.g., no specification if herbs are included, if only vegetables from the field, or from the home-garden etc.). Data on vegetables were further weak, because many households were just not able to answer well the question of vegetable production, since farmers usually just go on the field or home garden when they need some vegetables, without counting the amount they collect. (This is different with paddy rice production; because harvest is at a particular time in the year and the yielded paddy rice is stored in bags, so the farmers know generally very well how much they produce). I do not think that any meaningful analysis can be drawn from the available data on vegetables, for which reasons an analysis of vegetable production in terms of amount of production was not further pursued. Note, however, that income data from selling vegetable are available and have been used in the further analysis.

6.3 Data normalization

During data normalization, all data from the household questionnaires were converted into common units. If a temporal dimension was involved, data were converted to 'per year' values, referring to the agricultural year 2010/2011.

Monetary units were generally converted to riels/year. Indications in dollars were converted to riels, based on an exchange rate of 1 dollar = 4100 riels. Note, that the exchange rate tended to change between 4000 and 4100 riels. 4100 riels was however the most common exchange rate found in *Chhouk* (the next close-by town) during the survey period. See also http://www.xe.com/currencycharts/?from=USD&to=KHR&view=2Y for 2010/2011 exchange rates (accessed on 13.06.2012).

Agricultural production data were normalized to kg/year and livestock production data were normalized to either animals/year, kg/year, or eggs/year, depending on the item. Labor data were recorded both in workdays/year and hours/year, depending on the particular tasks. An additional table was created in Microsoft Access, in which all labor tasks were converted to hours/year. For this purpose, workdays were converted into hours, based on additional information and interviews regarding the particular labor tasks.

Land units were converted into hectares/household. For agricultural land, a conversion procedure needed to be established, since the majority of farmers in KKL did not

know the amount of land they owned in terms of hectares, but rather used 'slak' as a land unit. Slak, however, does not refer to land area, but is a slightly different concept, because it refers to the amount of rice bundles that can be planted on a given area. Hence, the relationship between slak and hectare also depends on the rice planting density. A conversion factor (CF) was used to convert slak into hectare, based on the following ratio:

CF='total ha of agricultural land in the village'/'total slak of agricultural land in the village'.

Information on 'total ha of agricultural land in the village' was obtained based on an interview with the village chief. Information on 'total slak of agricultural land in the village' was calculated based on *average slak/household*total amount of households*. Average slak/household was obtained using a representative random sample of 78 households out of 195 households (= all the households of the random sample that indicated agricultural land in slak). The obtained CF was 0.5. Note that with this procedure, land holdings could be sufficiently approximated in terms of ha in order to conduct a general analysis at the household level. However, in reality there might be a slight variation in the land holdings due to different planting densities.

Time use data were recorded at the daily level for general activities (hrs/day) and at the task level for seasonal activities (hrs/task). In order to arrive at an annual account of human activity, annual time use of a household needed to be reconstructed, because information from both the daily level (e.g., daily activities such as eating, sleeping, household work, etc.) needed to be integrated with information from seasonal activities (e.g., rice cultivation tasks, off-farm work, non-farm work during dry season, etc.). The annual human activity in terms of hours/category/household/year was reconstructed for each household as presented in table A.6.

Note, that time use data, collected with daily activity sheets and the self-reported labor requirements (workdays and working-hours) of different livelihood activities, only represent a rough approximation to human activity at the household level. Thus, these data are not adequate for an 'anthropological' characterization of the household, which would require a more detailed collection of time use data. However, their 'resolution' is well enough to get the general picture of human activity of a household and to analyze the general livelihood profile with the MuSIASEM approach with a focus on available time as both resource and constraint for rural livelihoods. The further interested reader on time use in Cambodia, is also referred to the available time use study from the National Institute of Statistics, Cambodia, which is a valuable source for conducting a MuSIASEM analysis at the national level (NIS, 2007).

Table A. 6: Reconstruction of annual human activity at the household level [hours/year].

Acronym	***Description***	***Annual Reconstruction [hrs/year]***	***Data source***
THA	Total Human Activity	= Household population * 24h * 365 days	HH Questionnaire, table 2.1
HA_PO	Physiological Overhead	= Daily hours of sleeping, eating, personal care * 365 days	HH Questionnaire, table 9
HA_HC	Household chores	= Daily hours of household work * 365 days	HH Questionnaire, table 9
HA_LE	Leisure time	= Daily leisure activities * 365 days	HH Questionnaire, table 9
HA_ED	Educational Activities	= Daily educational activities * 231 school-days[b]	HH Questionnaire, table 9
HA_Rice	Rice cultivation activities	= Sum of total family rice cultivation activities + Total rice labor exchange hours [hrs/year]	HH Questionnaire, table 8.4
HA_Live	Livestock activities	= Daily livestock activities * 365 days	HH Questionnaire, table 7
HA_Off	Off-farm activities	= Sum of all off-farm activities [hrs/year]	HH Questionnaire, table 6.4
HA_Non	Non-farm activities (including related transport hours)	= Sum of all non-farm activities, including related transport hours [hrs/year]	HH Questionnaire, table 6.5
HA_Other[a]	Residual hours, to arrive at the full time budget of the household population during the whole year	= THA – (HA_PO + HA_HC + HA_LE + HA_ED + HA_Rice + HA_Live + HA_Off + HA_Non)	Residual calculation, based on other categories

[a] HA_Other = Remaining activities not mentioned in other categories, including: agriculture other than rice such as vegetable gardens, chamkar, fruit gardens, market work (selling products), fishing, maintenance of rice fields during dry season, administrative works, etc. [b] The school-year in Cambodia consists of 231 schooldays (UNESCO, 2008).

6.4 Calculation of village data

The previous steps have shown how data were obtained and processed at the household level. In order to arrive at a representation at the village level (i.e., total agricultural production, total village income, total village expenditures, etc.), the average household values were calculated, based on the representative random sample (86 households). Once, the average household values were obtained; they were multiplied by the total amount of households (195 households). The obtained values were used as a proxy to analyze the village performance.

A note on the village population: The total population *calculated* (741 inhabitants) based on the random sample is lower than the population *indicated* in the village report book (799). This difference of 7% between the survey estimate and the village report book is within the margin of error of the survey design (8%). There is however also a further explanation, which is related to the definition of 'household member' in the survey, which included only those persons that spend more than 50% of their time in the village (thus, those that live more than 6 months/year in KKL). Hence, for example sons and daughters who study in Phnom

Penh, may not appear as household member in the research questionnaire, but may appear as such in the village book.

In order to be consistent with the definition of a household member in the survey design, any analysis at the village level thus only refers to those villagers that spend more than 50% of their time in the village. Thus, the population size in the analysis at the village level, corresponds (if not indicated otherwise) to the survey estimates and not to the population size indicated in the village book, which would include those working or living most of the time outside the village.

7 Background information, observations and reflections

This last section provides background information, qualitative observation and a few subjective reflections from the field research. It presents a general overview of various aspects of the village, based on my own observations, formal and informal interviews and talks with the villagers during March and May 2011. Finally, this type of qualitative information was crucial to be able to contextualize and to give meaning to the obtained survey data. All pictures in this section were taken during the field research by the author of this report.

7.1 The meaning of *Khcheay Khang Lech*

Khcheay Khang Lech (KKL) is the name of the case study village and means 'in the edge of the west'. Its meaning is thus related to its location. However, KKL is located at the eastern border of Damnak Sokram Commune. Thus, the name actually comes from the other commune located at the eastern border. From their perspective, KKL is located in the west.

7.2 Land and physical infrastructure in KKL

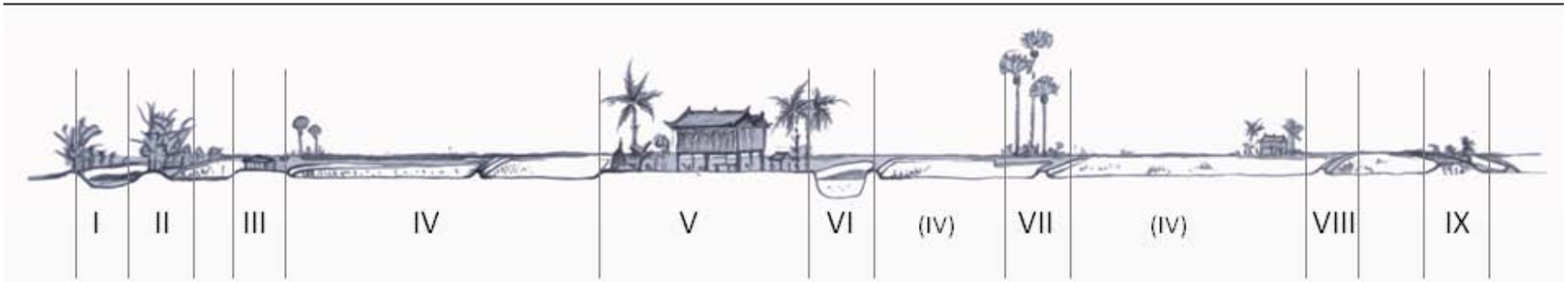
7.2.1 Land use

Land is among the most crucial livelihood resources in KKL. According to the village chief, total available land in KKL amounts to 195 ha, whereas agricultural land amounts to 170 ha, followed by household land (ca. 21 ha). The remaining 4 hectares are covered by roads, canals and protected areas. Being home to 195 households, agricultural land in KKL is a scarce resource and there is no unused land available for new villagers. According to the village chief,

it is unlikely that the landless household in KKL will receive a Social Land Concession (SLC), because of lack of land in the village.

Figure A.6 shows the land use and settlement patterns in KKL from the satellite view. It can be seen that houses are scattered across the landscape in a diffuse settlement pattern. Since the road in KKL is relatively new (it was constructed only a few years ago), the houses are not necessarily constructed close to the road, as it may be known from other villages. Most farmers have their rice plots just next to their house, which is built on the household land, surrounded by fruit-trees. Only a few farmers have their plots located away from their house, due to heritage and/or marriage into other villages. The profile map in figure A.7 provides an overview over the main land use categories at the village level.

Figure A. 6: Land use and settlement patters in KKL - satellite view. Source: Google Earth.



	I	II	III	IV	V	VI	VII	VIII	IX
Land use & Cover	**Canals**	**Shrubbery**	**Tombs & Temples**	**Paddy fields**	**Household land**	**Fishponds**	**Sugar palms**	**Paddy boundaries & Paths**	**Road**
Main Societal Functions	Recreation, Fishing, Water control, Irrigation Ecological regeneration	Fuel-wood source, Stabilization of canals	Cultural use	Staple crop production, Pasture	Housing, Fruit-gardens, Vegetable gardens, Animal stables	Fishing, Water control, Irrigation source for home-gardens and nearby paddy fields	Cash crop production, Sugar production for subsistence	Access-ways to fields and houses, Water control of paddy fields	Access-ways to administra-tive centers, markets, other villages

Figure A. 7: Main land use categories and their societal function in KKL. Source: Own elaboration.

7.2.2 Infrastructure and land marks

While the majority of the land in KKL is used for agriculture, there are a few important landmarks with administrative, cultural and ecological importance. They are briefly presented below.

Commune center, village community hall and rice paddy bank

The commune center is located in the nearby village *Trapaing Tameas* (about 200 meters from the border to KKL) and consists of a school (primary and secondary), a police station, the pagoda and the administrative commune center. In addition, KKL has its own grassroots village community that owns a community hall and the rice paddy bank building (figure A.8). The community hall is mainly used for meetings, but serves on weekends as a location for a weekend school, in which English is taught. Next to the hall is the rice paddy bank, which mainly opens at the beginning of the rainy season, when rice supply from the previous season may become short.

Figure A. 8: Community hall (in the front) and rice paddy bank (in the back).

River and protected area

The river sets the western boundary of KKL. It has an important function for water supply and also provides various ecological niches and thus serves as a habitat for biodiversity. The river flows in from the North and passes through the commune towards the South. A small area of the river is formally protected (figure A.9). This area is used by the villagers for recreational activities such as taking a bath and

Figure A. 9: River and protected area (blue sign) at the border of KKL.

swimming, as well as a place for environmental regeneration and the protection of species. It is forbidden to fish as well as to collect firewood in the protected area.

Dam and canals

The dam is an important element of the village, providing a crucial function for small-holder agriculture. The dam allows controlling the water flow when the rainy season starts and is connected with a canal system that goes through the village. Thanks to this canal system, also the villagers that do not live next to the dam have their water supply assured.

Figure A. 10: The dam of KKL

The dam was constructed by the villagers, with support from NGOs, who provided technical assistance and food for the workers. The dam is maintained by the infrastructure group of the village community. Each year, the infrastructure group collects funds and food from the villagers, which is then used for repairing the dam. The workers are voluntary workers from the village, who are compensated with food supplied during the working days. Sometimes also machinery is needed to maintain the dam, which has to be paid by the collected funds.

There are some typical conflicts between downstream and upstream villagers. Downstream villagers complain that they lack sufficient water supply, while upstream villagers say that the dam does not affect the water flow and if the dam would not exist, the water would just flow down the river without benefiting anybody. Personally, I guess that both positions are somehow right. However, I believe that the dam and the associated canal system benefit substantially more villagers upstream than those who live next to the river, downstream. Only a few people mentioned this conflict, so I did not get the impression that it was a big issue in the village.

Figure A. 11: Monks in front of the pagoda in the neighboring commune, next to KKL.

Pagodas and Tombs

With regard to religious and cultural land uses, the most important land mark in KKL is the pagoda, located in the commune center in *Trapaing Tameas* village. Four monks live in the pagoda, depending on gifts, particularly food, from the villagers. Since only one pagoda exists for the whole commune, KKL doesn't have a pagoda on its territory, but another pagoda is located in the neighboring commune in the Southeast of KKL. Villagers also go to this pagoda for their religious activities. It is open to all persons, no matter to which village they belong (figure A.11).

Figure A. 12: A big tomb between the rice fields

There are further some tombs located between the rice fields. These tombs are of private use and belong to different families. While most of the tombs are rather small constructions, there are a few exceptions that mark the landscape. Figure A.12 shows one of these bigger tombs.

Transport ways

While there are many small paths and cart-ways crossing the village in an anarchic way, there is only one bigger dirt road going through KKL, with a total length of 3500 m (table A.7). It was constructed in 2002, with support from the German aid agency GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit)[19]. GTZ compensated the villagers involved in the construction of the road by providing food during the work days. All the workers came from KKL. It can be assumed that prior to the construction of the dirt road no larger road existed in KKL, which may explain the diffuse settlement pattern (figure A.6). The households are scattered across the landscape, but not necessarily located next to the road. This has some advantages in terms of proximity to the rice fields, but also disadvantages regarding trade and transportation.

[19] GTZ is now called GIZ(Deutsche Gesellschaft für Internationale Zusammenarbeit).

Public transport

A regional 'public' transport system exists that connects the market and administrative towns such as *Chhouk Town* with the surrounding villages. The transport vehicle consists of a motorbike, connected to a big clinger, which can carry easily fifteen to twenty persons and much more if they squeeze together. Further, it allows transporting bulky materials such as timber for house construction, etc. The transport system is operated by private agents. One return ride from KKL to *Chhouk* costs around 5000 Riels (=1.2$).

Figure A. 13: Public transport in Chhouk and surrounding villages.

Table A. 7: A typology of transportation ways in Dang Tong District. Source: Own elaboration.

Road type	***Road cover***	***Width***	***Characteristics***	***Examples***
Paths	Soil & grass	0,3 – 1m	• Small paths between the rice paddy fields. They connect the farmer's houses from the road, and give access to the paddy fields. • Walking, Motorbikes and bicycles	
Cart ways	Soil & grass	1 – 2m	• Access ways to the fields and houses • Motorbikes, bicycles, cart loader, tractors	
Roads	Red cravel	2 – 6m	• Connect villages and districts • Motorbikes, bicycles, cart loaders, cars, public transport, broker's trucks (Picture: Small road in KKL)	
National Roads	Asphalt/cement	< 6m	• Connect provinces as well as some districts • Any type of transport vehicle (Picture: National road in *Chhouk*)	

Market towns

The most important market town near KKL is *Chhouk*, which has quite a big market, a transport center, and many little shops (figure A.14). *Chhouk* has further public transport connection to *Phnom Penh,* as well as to *Kampot* and *Kep*. It offers definitely more services, than the rather small district center *Dang Tang Town*. However, also *Dang Tang Town* has a small market area.

Figure A. 14: Chhouk is the most important market town next to KKL.

Administrative district center

The administrative center for KKL is *Dang Tang town*, which is the district center of *Dang Tang district,* to which KKL belongs to (figure A.15). Here, the corresponding office for social affairs is located (responsible to pay the pensions and governmental jobs), as well as the local agricultural office (in charge of reporting agricultural data on an annual basis to the higher administrative centers). In comparison to *Chhouk*, *Dang Tang town* is rather a small town. However, this might change soon, if rumors become true that the current dirt road is going to be developed to a national road. The road connects with Vietnam and therefore has high potential to become one of the main transport and trade routes in the region in the near future. This would also largely affect KKL.

Figure A. 15: Dang Tong town, the administrative center of Dang Tang district, in which KKL is located.

7.3 'Social Infrastructure' in KKL – formal institutions

There are mainly two formal institutional systems that are important parts of the 'social infrastructure' of KKL: i) the governmental administrative system, represented through the commune leader, the commune council, the village chiefs and the associated workers, and ii)

the village community, represented through the village community committee and the village community members. Table A.8 provides an overview of the different formal institutions available in KKL.

Table A. 8: Formal institutions and their features in KKL and the commune. Source: Own elaboration, based on interviews to representatives of different institutional arrangements.

Institution	***Level***	***Nature***	***Key functions provided***
District center	District	Governmental	• Administrative services • Office of social affairs (payment of pensions)
Rice mill community	District	Grassroots	• Stabilize and increase prices for smallholder (Rice cartel) • Seed conservation • Provide credits • Dividend to share holders
Commune center	Commune	Governmental	• Administrative services • Education (School) • Security and state control (Police)
Commune council	Commune	Governmental	• Administration and Planning • Provision of information
Village committee	Village	Governmental	• Administration • Provision of information
Savings group	Village +	Grassroots	• Help and foster saving • Provide credit and increase household liquidity • Assure village liquidity • Benefits for shareholders • Avoid capital outflow of village
Rice bank	Village +	Grassroots	• Provide rice credit • Increase food sovereignty at the household level • Increase food sovereignty at the village level • Allow farmers to adopt to price fluctuations • Support community activities (e.g. provide rice for voluntary dam construction)
Infrastructure group	Village	Grassroots	• Maintain village infrastructure • Enhance infrastructure • Foster village cooperation
Women group	Village	Grassroots	• Knowledge exchange • Women empowerment • Foster cooperation between women
Youth group	Village	Grassroots	• Knowledge exchange • Youth empowerment • Foster cooperation between young villagers • Avoid emergence of criminal youth gangs

Note: "+" indicates that the institution is based and maintained by the village, however, its services are not exclusively restricted to villagers of KKL.

KKL, in comparison to other villages in Cambodia, shows a high degree of cooperation between the villagers. This can be seen in the existence of a strong village community that jointly operates a community based savings-group, a community based paddy-rice bank, a women group, a youth group, a poorest group and a helping group (see table A.8). The name of the village community is *'Rathanak Samaky Rung Roeung'*, and means *'sharing and helping each other in order to be prosperous'*. The village community is organized as a democratic grassroots group with a president, a cashier, a secretary and other positions, that are elected every three years. The group was established with support from national and international NGOs and aid organizations. As explained by the village community secretary in an interview, the idea for such a villager groups was first introduced by CEDAC in 2003 and also GTZ were active in promoting different ideas such as the establishment of a rice paddy bank. However, the villagers underpinned that the inhabitants of KKL were responsible of establishing the groups and its rules. CEDAC only shared cases of best practices from other areas and countries, which served as inspiration for the villagers to found a formal village community with 6 members in 2005. At the time of field research (March - May 2011), the village community had 168 members, 118 of them female.

7.4 Reflections on the relationship between the villagers and the research team

Finally, I would like to share some reflections on the different perceptions that may have existed between the research team and the villagers. As these surely have influenced our relationship and trust regarding facilitating information, they might also influence in some way the research outcome. Making them transparent, I think, is one way to increase the quality of the research.

I believe that my relationship with CEDAC was most important in shaping perceptions and relations between me and the villagers. However, there are other elements that influenced our relationship; mainly that I was European, that I was working at a University and that my research assistant was a young and educated Cambodian, whose parents were farmers themselves.

I had the feeling that I received some respect for working in a European University, and that the farmers were curious about this. I remember that once we wanted to interview a woman for the test-interviews. When I wanted to introduce myself, she said it was not necessary, she knew already who I was. Thus, I was sure that there was some rumor, but, at least in my impression, in a positive manner. Another example I remember was, when we (the

research team), went to a Cambodian soup restaurant for having dinner. Coincidently, we met the leader of the infrastructure group. He was extremely friendly and I was touched by his attitude and warmth towards us. We spent some time talking and expressing our gratitude to have met each other here coincidently. I could also see the good relation he had with the enumerators from CEDAC. When we talked about our research activities in the village, he said that we should have told him before and that he would have liked to help us where possible. As said before, in general I had the feeling that farmers were proud and happy to share information, as well as curious to know more about me, being a foreigner from Europe. I personally have to say that I also was extremely happy to be able to be there, to be able to learn from the farmers and that people shared their knowledge with me. I believe that the villagers, particular those involved in the village community, could feel this and that generally our relationship was based on deep respect for each other.

Further, I guess that some farmers associated me with foreigners from aid agencies from abroad which had been to the village before. I think that GTZ and CEDAC were the most important agencies that intervened in KKL. I had the impressions that they had done good work, or at least that the villagers had had a good experience with foreign interventions and were open to receive foreigners. Hence, this might be another positive aspect that helped building our relationship. However, it might also have contributed to the issue that, in my opinion, farmers tended to state their expenditures more in detail than their incomes. The poorer they appear the higher the chances to receive some aid? I think there are always some problems of data accuracy related to self-reporting. However, there also may be a certain bias from the farmers themselves regarding their income and expenditure, which also may be related with the issue that people just more easily remember their expenditures rather than their incomes?

Having a young Cambodian student of rural development as research assistant was not only crucial for being able to conduct the research, but also for entering the village. I think the assistant was well accepted in the village as a young student who was working in the village to finish his studies. While I was doing research in Phnom Penh, the research assistant spent quite some time in the village for doing his own research. During that time, the villagers got to know him well and I am sure that he, as a very kind and educated young Cambodian, whose parents were farmers too, left a good impression on the villagers.

Finally, I believe that some villagers, especially those from the village community committee, were also proud of what they have achieved in their village. KKL developed strong social capital and the villagers enjoyed a high degree of cooperation between farmers, which

is not necessarily common in Cambodia. During the interviews with the village community committee members, I had the feeling that they were all proud of what they had achieved. All of them were extremely helpful in providing information, including sensitive information, such as the documents of the savings group accounts that indicated monthly payments, debts, etc. Thus, in general I perceived the majority of the villagers as very friendly people, who were interested to exchange their knowledge with me and who were curious themselves about foreigners who visited their village with interest in their activities.

Final research questionnaire for the household survey

Time- & land-use for livelihood activities in Kcheay Khang Lech Village, Damnak Sokrom commune, Kampot province, Cambodia

Questionnaire Nr. _____

អ្នកសំភាសន៍/Enumerator:	កាលបរិច្ឆេទ/Date:	ហត្ថលេខា/ Signature:

ជំរាបសួរបងប្អូនទាំងអស់គ្នា ខ្ញុំមកពីសាកលវិទ្យាល័យ បាសុឡូណា ទ្វីបអឺរ៉ុប ហើយខ្ញុំនឹងធ្វើការសិក្សាស្រាវជ្រាវទៅលើសកម្មភាពចិញ្ចឹមជីវិតរបស់ប្រជាកសិករនៅទីជនបទ នៅឃុំ ដំណាក់សុក្រំ ដោយមានការជួយជ្រំជ្រែងពីអង្គការ សេដាក ។ ខ្ញុំសូមអនុញ្ញាតធ្វើបទសំភាសន៍ និងសាកសួរអំពីបទពិសោធន៍ក្នុងការប្រកបរបរចិញ្ចឹមជីវិតរបស់បងប្អូន។ បទសំភាសន៍នេះនឹងចំណាយរយៈពេលប្រហែល១ម៉ោង៣០នាទី ហើយខ្ញុំសូមអរគុណចំពោះការចូលរួម និងការចំណាយពេលវេលារបស់បងប្អូន។ សូមអរគុណសម្រាប់ការផ្តល់ពត៌មានរបស់បងប្អូន។ ខ្ញុំសូមធានាថារាល់លទ្ធផលនៃការស្រាវជ្រាវគឺសម្រាប់តែហេតុផលនៃការសិក្សាប៉ុណ្ណោះ ហើយរាល់អត្តសញ្ញាណ និងពត៌មានរបស់បងប្អូននឹងត្រូវរក្សាការសំងាត់។

Dear participant, the Autonomous University of Barcelona in Spain, Europe, is conducting with help from CEDAC a study on rural livelihood activities in Damnak Sokrom commune. We kindly would like to interview you and ask your experience. The interview will take about 1 ½ hours. Thank you very much for your cooperation and time. Your information is greatly appreciated. We assure you that the results of this survey are only used for study reasons and that your identity and information will remain STRICTLY CONFIDENTIAL.

Internal Use:

ID of Data entry: _____

Entry done by (Name): _____

Date of data entry: _____

Comments:

1) អ្នកដែលត្រូវធ្វើការសំភាសន៍/ Respondent

នាមត្រកូល/ (a) Family Name	នាមខ្លួន/ (b) Given Name	ភេទ/ (c) Sex	អាយុ/ (d) Age	អ្នកជាមេគ្រួសារឬ?/ (f) HH head?	
				☐ បាទ.ចាស/Yes	☐ ទេ/ No

2) ស្ថានភាពគ្រួសារ / Household structure

2.1) តើក្នុងគ្រួសាររបស់អ្នកមានមនុស្សរស់នៅប៉ុន្មាននាក់(រស់នៅយ៉ាងតិចពាក់កណ្តាលឆ្នាំក្នុងគ្រួសារ) / How many people live in your household? (more than half of time)

(2.1.x)	ទំនាក់ទំនងទៅនឹងមេគ្រួសារ(ដូចជា ប្រពន្ធ, កូនប្រុស, ឪពុកជាដើម......) (a) Relationship to Family Head? (wife, son, father, etc.)	ភេទ/ (b) Sex		អាយុ/ (c) Age	កម្រិតវប្បធម៌/ (d) Highest grade of education	កូសគ្រីសចំពោះមេគ្រួសារ/ (e) Indicate Household head
		ប្រុស/ Male	ស្រី/ Female			
1		☐	☐			☐
2		☐	☐			☐
3		☐	☐			☐
4		☐	☐			☐
5		☐	☐			☐
6		☐	☐			☐
7		☐	☐			☐
8		☐	☐			☐

2.2) ផ្ទះរបស់អ្នកមានទំហំប៉ុន្មាន/ How big is your house? ____________________________ម៉ែត្រ/m2

3) រៀបរាប់ពីដីដែលអ្នកមាន/ Farm census

3.1) តើអ្នកមានដីស្រែប៉ុន្មានហិចតា/អា/ស្លឹក?/ How much land do you own? ______________

3.1.1)តើអ្នកមានដីភូមិប៉ុន្មាន?/ What is the size of your household land? _____x_______

3.2) តើអ្នកមានជួលដីពីអ្នកដទៃទេ?/ Do you lease additional land from other farmers?

☐ គ្មាន/No; ☐ មាន/ Yes; សូមបញ្ជាក់please explain:

3.2.1) តើអ្នកជួលដីពីអ្នកដទៃប៉ុន្មានអា?/How much land do you lease? ____________________

3.2.2) តើអ្នកចំណាយលុយប៉ុន្មានសម្រាប់ដីដែលជួលពីគេ?/How much do you pay for the leased land?

☐ ថ្លៃបង់អោយគេ/Fixed rent of ___________រៀលសម្រាប់រយៈពេល/Riel for a period of ___________ខែ/months

☐ ចំណែកទិន្នផលអោយទៅម្ចាស់ដី/Share cropping: ____________ភាគរយ/percent for the land owner

3.3) តើអ្នកមានជួលដីអោយទៅកសិករដទៃឬទេ?/ Do you rent out your land to other farmers?

☐ គ្មាន/No; ☐ មាន/ Yes; ចូរពន្យល់please explain:

3.3.1) តើអ្នកជួលដីអោយគេប៉ុន្មានស្លឹក/អា/ហិកតា/How much land do you rent out? _________________

3.3.2) តើអ្នកទទួលបានថ្លៃជួលប៉ុន្មាន?/How much do you get paid?

☐ ថ្លៃជួលទទួលបាន/Fixed rent of _______រៀលសម្រាប់/Riel for a period of ________ខែ/months

☐ ចំណែកទិន្នផលដែលទទួលបាន/Share cropping: ______ភាគរយសម្រាប់អ្នក/percent for you

1

3.4) សូមរៀបរាប់ពីទ្រព្យដែលគ្រួសារអ្នកមាន/Specify the number of assets your household owns:

	ទូរទស្សន៍/ (a) TV	វិទ្យុ/ (b) Radio	ម៉ូតូ/ (c) Motor-bikes	កង់/ (d) Bicycles	ម៉ាស៊ីនកិនស្រូវ (e) Rice-mill	ត្រាក់ទ័រ/ (f) Tractors	ប្រព័ន្ធឧស្ម័ន/ (g) Biogas system	ម៉ាស៊ីនភ្លើង/ (h) Power generator:
ចំនួន/ Number:								

4) ការប្រើប្រាស់ធនធាន/ **Resource consumption**

4.1) តើគ្រួសារអ្នកប្រើប្រាស់អ្វីបរិភោគអស់ប៉ុន្មានក្នុង១ថ្ងៃ ឬក្នុង១ខែ(អាចគិតជាគីឡូ ឬចំនួន)?/ How much food does your HH consume? (kg or nr?, per day or month?)

(4.1.x)	អង្ករ(គីឡូក្រាម) (a) Milled rice	បន្លែ(គីឡូ/ (b) Vegetables	សាច់ជ្រូក(គីឡូ/ (c) Meat & Fish
ការប្រើប្រាស់អ្វីបរិភោគសរុប/ Total food consumption			
ភាគរយដែលទិញពីផ្សារ/ Percentage from market			

5) ចំណាយក្នុងគ្រួសារ/ **Household Expenditures**

5.1)ប្រៀបរាប់ពីចំណាយមធ្យមក្នុងគ្រួសារអ្នកទៅលើទំនិញនិងសេវាកម្មខាងក្រោម(គិតចាប់ពីដើមដូវធ្វើស្រែឆ្នាំមុនរហូតដល់ឥឡូវ) / Describe your average regular HH expenditures on the following goods and services (2010/2011)?

ទំនិញ, សេវាកម្ម និង សកម្មភាពផ្សេងៗ/ Good, Services and Activities (5.1.x)	ចំណាយ(ក្នុង១ថ្ងៃ? ១ខែ? ឬ១ឆ្នាំ?)/ Expenditure (per day? Per month? Per year?)
អ្វីបរិ/ .1 Food	
សាំង/ .2 Gasoline	
អុស/ .3 Firewood	
សំលៀកបំពាក់/ .4 Clothing	
សំភារៈប្រើប្រាស់ក្នុងផ្ទះផ្សេងៗ/ .5 Housing	
សុខភាព/ .6 Health-care	
ការធ្វើដំណើរតាមយានជំនិះសាធារណៈ/ .7 Public Transport	
ការទូរស័ព្ទ/ .8 Telephone	
ការសិក្សា(គិតតែសមាជិកដែលស៊ាមក្នុងផ្ទះ)/ .9 School & Education (only HH members	
លំហែកំសាន្តផ្សេងៗរួមទាំងចំណាយលើចំនងដៃអពាពិពាហ៍/ .10 Money spent on weddings in the last year (2010-2011)	
ប្រាក់ដែលចំណាយលើការកំសាន្តនិងសកម្មភាពទាក់ទងនឹងសាសនា(ដូចជាថ្ងៃសីល, បុណ្យភ្ជុំ, ចូលឆ្នាំ, កឋិន មាយប្បជាជាដើម)ក្នុងអំឡុង១ឆ្នាំចុងក្រោយ២០១០-២០១១/ .11 Money spent on Leisure and religious Activities (Going to Pagoda, etc.) during the last year (2010-2011)	
ចំណាយផ្សេងទៀត .12 Other:_____	

2

5.2) តើអ្នកមានអាគុយប៉ុន្មានទ?ហើយប្រភេទណាខ្លះ:**(40kw, 50kw, 70kw)**?/ How many and which type of batteries (40KW, 50KW, 70KW) do you own?

_____

5.2.1) តើអ្នកបញ្ចូលភ្លើងប៉ុន្មានដងក្នុង១ខែ ឬប៉ុន្មានថ្ងៃទើបបញ្ចូលភ្លើងម្តង?/How often do you recharge them?

_____

5.3) តើអ្នកមានផ្ញើលុយអោយសាច់ញាតិនៅក្រៅភូមិទែ(ដូចជាកូនរៀននៅភ្នំពេញជាដើម)?/ Do you send money to relatives who live outside the village? (Example: Daughter studying in Phnom Penh)

☐ គ្មាន/ No: ☐ មាន/ Yes:សូមបញ្ជាក់ please specify:

(5.3.1)	អស់លុយប៉ុន្មាន// (a) How much money?	ប៉ុន្មានដង?ក្នុង១ខែ? ក្នុង១ឆ្នាំ?/ (b) How often? (per month? Per year?)
រៀល/ Riel:		

5.4) តើអ្នកមានចំណាយមិនមែនកសិកម្មផ្សេងៗដែលបានរៀបរាប់កន្លងមកឬទេ?/ Do you have any other regular expenditure apart from farming costs which you have not mentioned so far?

☐ គ្មាន/ No: ☐ មាន/ Yes: សូមបញ្ជាក់please list:

1.)_____

2.)_____

3.)_____

6) ចំណូលក្នុងគ្រួសារ/ **Household Revenues**

6.1) តើអ្នកមានតូបលក់ឥវ៉ាន់ទែ?(រួមទាំងកន្លែងបញ្ចូលភ្លើងអាគុយ) Does your HH has a petty trade? (Including recharging batteries, etc)

☐ គ្មាន/ No: ☐ មាន/ Yes: សូមបញ្ជាក់ please specify:

(6.1.1)	ចំណាយក្នុង១ថ្ងៃឬ១ខែ?/ (a) Expenditures (per day or month?)	ចំណូលដុល(ចំណូលសរុប)ក្នុង១ថ្ងៃឬ១ខែ?/ (b) Gross Revenues (per day or month?)
រៀល/Riel:		

6.2) តើគ្រួសាររបស់អ្នកមានសមាជិកក្នុងក្រុមសន្សំទែ?/ Is your HH member of a savings groups?

☐ ទេ/ No: ☐ បាទ/ចាស៎/ Yes: សូមបញ្ជាក់ please specify:

6.2.1	អ្នកបង់ជាមធ្យមប៉ុន្មានរៀងរាល់ខែ?/ (a) Average monthly payments?	ប្រាក់សរុបរបស់អ្នកនៅក្នុងក្រុមនៅចុងឆ្នាំ២០១០/ (b) Your capital stock in 2010?	តើអ្នកដកលុយប៉ុន្មាននៅចុងឆ្នាំ២០១០(ខែ១២)? (c) How much money did you take out in the end of the year 2010	តើអ្នកបានខ្ចីលុយពីក្រុមសន្សំប្រាទេនៅឆ្នាំ២០១០?ខ្ចីប៉ុន្មានអស់រយៈពេលប៉ុន្មានខែ?/ (d) Did you borrow money from the group in 2010? How much and for how many months
រៀល/ Riel				

6.3) តើគ្រួសាររបស់អ្នកមានទទួលប្រាក់សោធនិវត្តន៍, ឬលុយពីសាច់ញាតិបងប្អូនឬទេ?/ Does your HH receive pensions or money from relatives who do not live in your household?

☐ ទេ/ No: ☐ បាទ/ចាស៎/ Yes: សូមបញ្ជាក់ please specify:

(6.3.1)	ចំណូលពីប្រាក់សោធនិវត្តន៍/ (a) Revenues from pensions:	ចំនួនទឹកប្រាក់ទទួលពីសាច់ញាតិបងប្អូន/ (b) Money received from relatives:
រៀល/Riel		

3

6.4) តើគ្រួសារអ្នកមានចំណូលពីការលក់កម្លាំងពលកម្មនៅកសិដ្ឋានអ្នកដទៃក្នុងភូមិទេ?(ស៊ីឈ្នួលគេ)(គិតតាំងពីដើមរដូវធ្វើស្រែឆ្នាំ២០១០រហូតដល់ឥឡូវ)?/ Did your HH work on other farms in your village during the last season (2010/2011)?

☐ គ្មាន/ No: ☐ មាន/ Yes: សូមបញ្ជាក់please specify:

(6.4.x)	អាយុ/ (a) Age	ភេទ/ (b) Sex	ការពិពណ៌នាពីការងារ(ឧ. ភ្ជួររាស់, បោកស្រូវ, ច្រូតកាត់ជាដើម......)/ (c) Description of work	តើគ្រួសារអ្នកធ្វើការបានប៉ុន្មាន?(អាចជាចំនួនថ្ងៃដែលបានធ្វើការឬចំនួនកញ្ចប់ស្រូវដែលបានច្រូតពេលគិតស្រិយប្រភេទការងារ) (d) How much did your HH members work? (workdays? Nr. of harvested paddy rice bundles?, etc).	រៀបរាប់សំណងពីការងារដែលបានធ្វើ(អាចជា ការប្រវាស់ដៃ, ជាលុយ, ជាស្រូវ, ឬផ្សេងទៀត)គួរតម្លៃពេលមួយថ្ងៃ ឬក្នុងមួយបំពេញការ?)/ (e) Describe Compensation (Labor exchange?, Riel?, rice?, other?) (per day? Per task?)
សមាជិកគ្រួសារ/ HH member					
សមាជិកគ្រួសារ/ HH member					
សមាជិកគ្រួសារ/ HH member					
សមាជិកគ្រួសារ/ HH member					
សមាជិកគ្រួសារ/ HH member					
សមាជិកគ្រួសារ/ HH member					

6.5) តើគ្រួសាររបស់អ្នកមានចំណូលពីការងារមិនមែនកសិកម្មដទៃទៀតពីទេក្នុងអំឡុងពេល១ឆ្នាំចុងក្រោយ(គិតពីដើមរដូវធ្វើស្រែឆ្នាំមុនរហូតដល់ឥឡូវ)?/
(ឧទាហរណ៍ កម្មករកាត់ដេរ, គណៈកម្មាធិការក្រុមសន្សំប្រាក់, ការងារសំណង់, គណៈកម្មាធិការភូមិឃុំ, គ្រូបង្រៀន, ប៉ូលិស, តេម៉ូតូឌុប, ដឹកអុសលក់/
Did your HH have revenues from other non-farm work during the last year (2010/2011)? (Examples: Work in: Garment factory, Savings group committee, Construction sector, Commune/village committee, Teacher, Policeman, Moto taxi driver, collect firewood etc.)
☐ គ្មាន/ No: ☐ មាន/ Yes: សូមបញ្ជាក់please specify:

(6.5.x)	អាយុ/ (a) Age	ភេទ/ (b) Sex	ប្រភេទការងារ/ (c) Description of work	នៅក្រៅភូមិ?/ (d) Outside the village?		រយៈពេលធ្វើដំណើរទៅធ្វើការ/ (e) Transport time	ចំនួនថ្ងៃឬចំនួនខែដែលអ្នកធ្វើការ(ចាប់តាំងពីដើមរដូវធ្វើស្រែរហូតដល់ឥឡូវ)? (f) Describe how much you have worked in 2010/2011? How many days? How many months?	តើអ្នកធ្វើការប៉ុន្មានម៉ោងក្នុងមួយថ្ងៃ (g) How many hours per work day	នៅរដូវណា/ (h) Season		ជួបរាប់ពីចំណូលសរុប(ចំណូលក្នុងមួយថ្ងៃ, ចំណូលក្នុងមួយខែ, ឬចំណូលក្នុងមួយឆ្នាំ?) (i) Describe Total Revenues ? (per day? month? Year?)
				នៅ Yes	មិននៅ No				វស្សា Wet	ប្រាំង Dry	
សមាជិកគ្រួសារ/ HH member				☐	☐				☐	☐	
សមាជិកគ្រួសារ/ HH member				☐	☐				☐	☐	
សមាជិកគ្រួសារ/ HH member				☐	☐				☐	☐	
សមាជិកគ្រួសារ/ HH member				☐	☐				☐	☐	
សមាជិកគ្រួសារ/ HH member				☐	☐				☐	☐	
សមាជិកគ្រួសារ/ HH member				☐	☐				☐	☐	

6.6) តើអ្នកមានប្រភពចំណូលមិនមែនកសិកម្មផ្សេងទៀតក្រៅពីប្រភពចំណូលដែលបានរៀបរាប់ខាងលើឬទេ?/ Do you have any other income sources other than farming which you have not mentioned so far?
☐ គ្មាន/ No: ☐ មាន/ Yes: សូមបញ្ជាក់please specify:_____

_____

7) ផលិតកម្មសត្វ, ចំណូលនិងចំណាយ(ចាប់គិតពីដើមឆ្នាំធ្វើស្រែឆ្នាំមុនរហូតដល់ឥឡូវ)/ Livestock production, revenues and expenditure in 2010/2011

ប្រភេទសត្វដែលអ្នកមាន/ (7.1.x) Which animals do you have?	ចំនួនសត្វចិញ្ចឹមដែលអ្នកមានឥឡូវ/ (a) How many animals do you own now?	ចំនួនសត្វដែលទិញសម្រាប់ឆ្នាំ២០១០-២០១១?/ (b) Nr. of animals bought in 2010/2011?	ចំនួនលក់ក្នុងមួយខែ/ឆ្នាំ/ (c) Amount sold per:			តម្លៃលក់ (រៀល/១ក្បាលឬរៀល/គីឡូ?)/ (d) Price of selling animal? (Riel/animal?) (Riel/kg?)	ចំណាយសរុបលើចំណីសត្វនិងចំណាយផ្សេងៗក្នុងមួយខែឬមួយឆ្នាំ?/ (e) Total production costs? (feedstuff and other) (per month? per year?)	ទំហំទ្រុង(ម៉ែត្រការ)/ (f) Cage Size? (m2) (A x B)	តម្រូវការពលកម្មជាមធ្យម(ម៉ោង/ថ្ងៃ)/ (g) Average Labor Requirements? (hrs/day)
			ចំនួនឬគីឡូ?/ Number? Kg?	ខែ/ Month	ឆ្នាំ/ Year				
☐ គោ/ .1 Cattle	___ចំនួន/ Nr			☐	☐				
☐ ក្របី/ .2 Buffaloes	___ចំនួន/ Nr			☐	☐				
☐ សេះ/ .3 Horses	___ចំនួន/ Nr			☐	☐				___ម៉ោង/ថ្ងៃ/Hrs/day
☐ មាន់/ .4 Chicken	___ចំនួន/ Nr			☐	☐				
☐ ទា/ .5 Ducks	___ចំនួន/ Nr			☐	☐				___ម៉ោង/ថ្ងៃ/ Hrs/day
☐ ជ្រូក/ .6 Pigs	___ចំនួន/ Nr			☐	☐				___ម៉ោង/ថ្ងៃ/ Hrs/day
☐ ចំនួនស្រះចិញ្ចឹមត្រី និងត្រី / .7 Fishpond & Fishes	___ចំនួនស្រះដែលមានត្រី/ Nr of Fishponds		..........ត្រីដែលបានលក់(ចំនួនត្រីឬគីឡូក្រាម)/ Nr of sold fish (kg)	☐	☐				___ម៉ោង/ថ្ងៃ/ Hrs/day
☐ សត្វផ្សេងៗ/ .8 Other: ________	___ចំនួន/ Nr			☐	☐				___ម៉ោង/ថ្ងៃ/ Hrs/day

7.2) ផលិតកម្មស៊ុតមាន់ ទា និងចំណូល(គិតចាប់ពីដើមឆ្នាំធ្វើស្រែរហូតដល់ឥឡូវ)/ Egg production and revenues in 2010-2011

ប្រភេទស៊ុតដែលផលិត/ Which eggs do you produce?	ស៊ុតផលិតជាមធ្យម(ក្នុងមួយថ្ងៃ?ឬក្នុងមួយខែ?)/ (a) Nr. of eggs produced? (per day? month?)	ចំនួនស៊ុតដែលបានលក់(ក្នុងមួយថ្ងៃ, ឬមួយខែ?)/ (b) Nr. of eggs sold? (per day, month?)
☐ ស៊ុតមាន់/ .1 Chicken eggs		
☐ ស៊ុតទា/ .2 Duck eggs		

១ការ៉ៅ= ____________kg
(8.1.5) 1 Basket = ________kg

8) ផលិតកម្មកសិកម្ម ចំណូល និងចំណាយ នៅឆ្នាំ២០១០/២០១១ Agricultural production, revenues and expenditures in 2010/2011

តើអ្នកដាំដុះអ្វីខ្លះ?/ (8.1.x) What do you cultivate?	[illegible] (a) On how much land/? (sleg?are? ha?)	[illegible] (b) In which season?		[illegible] (c) Total Crop Production: (Kg? Baskets?) (per day, month, year?	[illegible] (d) How much chemical fertilizers did you use? (kg? bags?)	[illegible] (e) How much chemical pesticides did you use? (liter? bottles?)	[illegible] (f) How much seeds did you need? (kg? baskets?)	[illegible] (g) Total Labor requirements? (hrs/day?) (hrs/week?)	[illegible] (h) Only for Home consumption?	[illegible] (i) Amount sold:			[illegible] (j) For which price?
		វស្សា /Wet	ប្រាំង /Dry							[illegible] (Kg? baskets?)	ខែ Month	ឆ្នាំ Year	
☐ ស្រូវ ប.ត.ស/ .1 SRI rice		☐	☐						☐ មាន/ Yes		☐	☐	
☐ [illegible] .2 Conventional rice		☐	☐						☐ មាន/ Yes		☐	☐	
☐ [illegible] .3 Vegetable garden / Chamkar		☐	☐					___ម៉ោង/ថ្ងៃ/H/d	☐ មាន/ Yes		☐	☐	
☐ [illegible] .4 Other crops (e.g. SugarCane): ______		☐	☐					___ម៉ោង/ថ្ងៃ/H/d	☐ មាន/ Yes		☐	☐	

8.2) [illegible]/ Which plants do you have in your Vegetable Garden/Chamkar in which season?

____

____

8.3) [illegible]/
Do you have income from agricultural production that you have not mentioned until now? For example selling Cassava, Selling, sugar from Sugar Palm, selling Mango, selling Coconut, selling rice cakes,

____

8.4) សូមបញ្ជាក់ពីតម្រូវការកម្លាំងពលកម្មសម្រាប់ការធ្វើស្រែក្នុងសកម្មភាពនីមួយៗ? / Please indicate the labor requirements for **rice farming** for each activity:

(8.4.x)		ពលកម្មជួលនិងការប្រវាស់ដៃ/ **Hired labor and Labor Exchange**			ពលកម្មក្នុងគ្រួសារ/ **HH labor**	
សកម្មភាព Activity	ខែចាប់ផ្តើម/ (1—12) (a) Starting Month	តើអ្នកមានជួលគេឬទេ?ចំណាយសរុបអស់ប៉ុន្មានសម្រាប់ជួលគេ?(អាចគិតជាលុយ(រៀល)ឬជាមាណស្រូវ(តៅ))/ (b) Did you hire labor? What were the total costs of hired labor? (Riel, Paddy Rice basket,)	ចំនួនមនុស្សដែលអ្នកជួល?/ (c) How many persons did you hire?	តើអ្នកមានប្រវាស់ដៃឬទេ?មានប៉ុន្មាននាក់?ហើយធ្វើការអស់ប៉ុន្មានថ្ងៃ?/ (d) Did you exchange labor? How many people for how many days?	តើមានមនុស្សប៉ុន្មាននាក់ក្នុងគ្រួសារអ្នកដែលធ្វើការក្នុងកិច្ចការនេះ? (e) How many persons of your HH did work in this activity?	តើអ្នកចំណាយពេលអស់ប៉ុន្មានថ្ងៃដើម្បីបំពេញកិច្ចការនេះ? (f)How many days did you need to finish this activity
ភ្ជួររាស់ និងរៀបចំថ្នាលសំណាប/ Seedbed preparation, Ploughing and land leveling						
1.) ដកសំណាប Uprooting,						
2.) ដឹកជញ្ជូនសំណាប Transport of seedlings						
3.) ស្ទូង Transplanting						
ដាក់ជីគីមីជីធម្មជាតិនិងថ្នាំសម្លាប់សត្វ/Application of fertilizers, manure and pesticides						
1.) ច្រូតកាត់ Harvesting						
2.) បោកបែន Threshing						
តើអ្នករៀបចំធ្វើជីកំប៉ុសឬទេ?/ Do you prepare compost?						
តើអ្នកដកស្មៅកាត់ស្មៅឬទេ? Do you weed the field?						
សកម្មភាពផ្សេងៗទៀត Other important activities ?						

9) ស្ថានភាពនៃប្រើប្រាស់ពេលវេលា/ **General time use profile**

9.1) សូមបញ្ជាក់ថាតើសមាជិកគ្រួសារអ្នកធ្វើអ្វីខ្លះជារៀងរាល់ថ្ងៃ(គិតក្នុងពេលបច្ចុប្បន្ន)?(ឧទាហរណ៍ ដេក ងូតទឹក ចំអិនម្ហូប បរិភោគបាយ ធ្វើកិច្ចការផ្ទះ ធ្វើការងារនៅលើដីស្រែចំការ ជួបជុំមិត្តភ័ក្ត ជងទឹក ប្រមូលអុស ទៅវត្ត ។ល។Please describe what your household member do on a normal day (now)? (Examples: Sleeping, Washing, cooking, eating, housework, working on the field, meeting friends, fetching water, collecting firewood, going to the pagoda, etc.)

(9.1.x)	អាយុ/ (a) Age	ភេទ (b) Sex	4am	5am	6am	7am	8am	9am	10am	11am	12am	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm	12pm
សមាជិកគ្រួសារទី១/ HH member1																							
សមាជិកទី២/ HH member2																							
សមាជិកទី៣/ HH member3																							
សមាជិកទី៤/ HH member4																							
សមាជិកទី៥/ HH member5																							
សមាជិកទី៦/ HH member6																							
សមាជិកទី៧/ HH member7																							
សមាជិកទី៨/ HH member8																							

10) សហគមន៍អភិវឌ្ឍន៍និងស្ថាប័នក្នុងតំបន់/ Cooperation and local institutions

10.1) សូមគូសបញ្ជាក់ថាតើសកម្មភាពណាខ្លះដែលគ្រួសារអ្នកពាក់ព័ន្ធ?/ Please indicate in which village activities your HH is involved?

សកម្មភាព/ Activities: (10.1.x)	តើសមាជិកប៉ុន្មាននាក់ជាមធ្យមក្នុងគ្រួសារអ្នកចូលរួមក្នុងការប្រជុំជាទៀងទាត់រាល់ការប្រជុំ?/ How many HH members go on average to the regular meetings?		ចំនួនដងនៃការប្រជុំក្នុង១ខែ/១ឆ្នាំ?/ (c) How many meetings per month or year?			តើការប្រជុំមួយដងមានរយៈពេលប៉ុន្មានម៉ោង(ជាមធ្យម)?/ (d) How many hours takes one meeting (Average)?
	ស្រី (a) Females	ប្រុស (b) Males	ចំនួន/ Number	ក្នុង១ខែ/ per month	ក្នុង១ឆ្នាំ/ per year	
☐ បណ្តាញកសិករធម្មជាតិ(FNN)/ .1 Farmer Association (FNN)				☐	☐	
☐ ក្រុមផលិតស្រូវសរីរាង្គ(សេដាក)/ .2 Organic rice producer group (CEDAC)				☐	☐	
☐ ក្រុមសហគមន៍ម៉ាស៊ីនកិនស្រូវ/ .3 Rice mill community				☐	☐	
☐ ក្រុមសន្សំ/ .4Savings groups				☐	☐	
☐ ក្រុមស្ត្រី/ .5 Women group				☐	☐	
☐ ក្រុមយុវជន/ .6 Youth group				☐	☐	
☐ ក្រុមជួយសង្គ្រោះ/ .7 Helping group				☐	☐	
☐ ក្រុមសាងសង់/ .8 Infrastructure group				☐	☐	
☐ ក្រុមក្រីក្រ/ .9 Poorest group				☐	☐	
☐ សកម្មភាពផ្សេងៗ/ .10 Other activities: ______				☐	☐	

11) រៀបរាប់ពីស្ថានភាព ស្រូវ ប.វ.ស/ SRI profile.

11.1) តើអ្នកអនុវត្តស្រូវ ប.វ.ស ទេ? Do you practice SRI?

☐ មិនអនុវត្ត/ No ☐Yes មាន សូមប្រាប់ថាតើមានប៉ុន្មានជំហានដែលអ្នកបានអនុវត្ត/ Yes: please tell us how many steps____________________

11.2.x	ការអនុវត្ត/ **Practice**		
1	☐ជ្រើសរើសពូជល្អសម្រាប់សាប / Selecting good seeds for sowing		
2	☐ សាបសំណាបលើថ្នាលដូចថ្នាលដាំបន្លែ/ Sowing seeds on the bed nursery like a vegetable bed		
3	☐ ដកសំណាបដោយថ្នមៗនិងស្ទូងភ្លាមៗ/ Careful uprooting and immediate transplanting		
4	☐ ស្ទូងតែសំណាបល្អ/ Transplanting only good seedlings		
5	☐ ស្ទូងតែសំណាបខ្ចី/ Transplanting only young seedlings	→ តើសំណាបដែលអ្នកស្ទូងមានអាយុប៉ុន្មានថ្ងៃ?/ How old are the transplanted seedlings?	ថ្ងៃ/ _____days
6	☐ ស្ទូងដោយត្រាំតែក្បាលឫសជាប់ដី(ស្ទូងរាក់)/ Transplanting the seedlings shallow rooted	→ តើអ្នកស្ទូងសំណាបជម្រៅប៉ុន្មាន?/ How deep do you plant the seedlings?	សង់ទីម៉ែត្រ/ _____cm
7	☐ ស្ទូងសំណាបតែមួយទៅពីរដើមប៉ុណ្ណោះក្នុងមួយគុម្ព/ Transplanting only a few seedlings per planting hill	→ តើអ្នកស្ទូងសំណាបប៉ុន្មានដើមក្នុងមួយគុម្ព?/ How many seedlings per hill?	_____
8	☐ ស្ទូងដោយមានចំងាយស្មើគ្នាពីគុម្ពមួយទៅគុម្ពមួយទៀត/ Transplanting with equal distance between seedlings	→ តើការស្ទូងរបស់អ្នកមានគម្លាតពីគ្នាប៉ុណ្ណា?/ What is the planting distance?	សង់ទីម៉ែត្រ/ cm
9	☐ សំអាតស្មៅដំបូងនិងញឹកញាប់/ Weeding early and frequently		
10	☐ គ្រប់គ្រងទឹកដោយរក្សាអោយដីមានសំណើមជានិច្ច/ Managing water by keeping the soil most		
11	☐ ប្រើប្រាស់ជីកំប៉ុស្ត ឬជីធាតុពីស្លឹកឈើ/ Using more compost or forest humus		
12	☐ ដាំជីបៃតង/ Planting green manure	→ ☐ មុនពេលស្ទូង/ before transplanting → ☐ ក្រោយពេលច្រូត/ after harvesting	
13	☐ គ្របដីសរីរាង្គ/ Mulching the soil with organic matter		
14	☐ ជ្រើសរើសពូជល្អៗសម្រាប់ការដាំដុះលើកក្រោយ/ Select the best seeds for the next crop		

Explanatory document, prepared for the enumerators

សេចក្តីណែនាំនិងការពន្យល់ពីបញ្ជីសំណួរ

CHECKLIST and EXPLANATION of the Questionnaire

1.) [illegible]
Write clearly – Bunchhorn has to be able to read your handwriting ;-)

2.) [illegible]
Finish each table by filling in each row after the other. Fill in every space; including "0" (see point 5 of checklist)!

3.) [illegible] M [illegible] F [illegible]
Sex: Use **"M"** for male, and **"F"** for female

4.) [illegible] (**0,1,2,3,4,5,6,7,8,9**)
Numbers: For numbers use the roman alphabet **(0,1,2,3,4,5,6,7,8,9, ……)**

5.) [illegible] **(0)** [illegible] **"---"** [illegible] **?** [illegible]
Fill in every space!! Use **"0"** to indicate "nothing"; use **"---"** to indicate "no, or "not available", use **"?"** to indicate that people do not know the answer. Example:

[illegible]/ Rice bought from the market?	[illegible]/ Do you receive a pension?	[illegible]/ Credit taken in 2010
0	---	?

6.) [illegible]

[illegible] Q3.1 [illegible]

[illegible] Q3.1 [illegible]

[illegible] Q4.1 [illegible]

[illegible] Q4.1 [illegible]

[illegible]

[illegible] Q7 [illegible] **១២ ០០០**[illegible]

[illegible] Q7 [illegible] **២០ ០០០**[illegible]

Always write down the measurement units that the respondent tells you. Be flexible when writing down the answer, but never forget to write down the units.
Land area: Always write down the land units that the respondent tells you.Most may use **"slag"**; some may know **"are"**; some may know **"hectare (ha)"**:

*Example 1: Q3.1 How much land do you own? 1 **slag** and 2 **plowns***

1

*Example 2: Q3.1 How much land do you own? 2,5 **ha***

Time period: Always write down the **time units** that people use (i.e. **hours; day; month; year**).

*Example 1: Q4.1 Total rice consumption: 1,25kg **/day***

*Example 2: Q4.1 Total meat consumption: 4kg **/Month***

Price units: Always write down the **price units** that people use: Riel**/kg,** Riel**/animal,** Riel**/basket**

*Example 1: Q7 Price of selling animal: 12,000 Riel**/kg***

*Example 2: Q7 Price of selling animal: 20,000 Riel**/chicken***

7.) **ចំពោះម៉ែត្រការ៉េ(m 2) ៖** ប្រសិនបើអ្នកសួរប្រជាជនថាតើគាត់មានផ្ទៃដីប៉ុន្មានម៉ែត្រការ៉េ ហើយគាត់ឆ្លើយ ៥x៣m អ្នកមិនចាំបាច់សរសេរដូចគាត់បានប្រាប់អ្នក។

ឧទាហរណ៍៖ Q2.2 តើអ្នកមានផ្ទះទំហំប៉ុន្មាន? ៖ ចំលើយ ១០x៥m ពី ៥០ម៉ែត្រការ៉េ)

Square meter (m2): If you ask for square meter, the respondent may answer for example 5 x 3 m, instead of 15 m2. This is no problem, just write down what they tell you:

*Example: Q2.2: "How big is your house?": **10 x 5 m** (or 50m2)*

8.) ចំពោះរដូវ**(២០១០/២០១១)** មានន័យថាសួរពីប្រតិទិន**ឆ្នាំ២០១០** ។

- ពត៌មានទាំងអស់ដែលត្រូវសួរតឹសំដៅទៅមួយរដូវចុងក្រោយ(**ខែមេសាឆ្នាំ ២០១០ រហូតដល់ ខែមេសាឆ្នាំ ២០១១**)
- លើកលែងតែពត៌មានដែលទាក់ទងទៅនឹងក្រុមសន្សំប៉ុណ្ណោះដែលសំដៅទៅប្រតិទិនឆ្នាំ(ខែមករា ឆ្នាំ២០១០រហូតដល់ ខែមករា ឆ្នាំ ២០១១)

Season (2010/2011) vs. calendar year (2010):

- All the information that is asked refers to the last season (April 2010 until April 2011).
- Only the information regarding the savings group refers to the calendar year (January 2010 – December 2010)

ការពន្យល់អំពីសំណួរទៅតាមចំណុចសំណួរនីមួយៗ

Explanation of specific questions:

Q2.1: តើមានមនុស្សប៉ុន្មានទាក់ទងរស់នៅក្នុងផ្ទះរបស់អ្នក?

សំណួរនេះសំដៅទៅលើមនុស្សដែលរស់នៅក្នុងគ្រួសារលើសពីពាក់កណ្តាលនៃពេលវេលារបស់ខ្លួនៗមនុស្សក្នុងគ្រួសារ(ដូចជាកូនប្រុស កូនស្រី) ដែលរស់នៅក្រៅផ្ទះរបស់ខ្លួនជាងពាក់កណ្តាលនៃឆ្នាំ(លើសពី៦ខែ)មិនបានចាត់ទុកជា**សមាជិកក្នុងផ្ទះ**ទេ។

ឧទាហរណ៍ទី១៖ កូនដែលទៅសិក្សានៅភ្នំពេញរហ័យត្រឡប់មកផ្ទះនៅថ្ងៃចុងសប្តាហ៍មិនត្រូវបានគិតជា**សមាជិកក្នុងផ្ទះ១**ទ ពីព្រោះគាត់រស់នៅក្នុងផ្ទះតិចជាងពាក់កណ្តាលនៃពេលវេលារបស់គាត់។ ប្រសិនបើឪពុកម្តាយផ្ញើរលុយឲ្យទៅកូន អ្នកត្រូវបញ្ចាក់នៅក្នុងចំណុច **Q5.3.**

ឧទាហរណ៍ទី២៖ កូនប្រុសដែលទៅធ្វើការនៅភ្នំពេញអស់រយៈពេលខួបនៃឆ្នាំក្នុងរដូវប្រាំង ប៉ុន្តែរស់នៅក្នុងផ្ទះនៅរដូវស្រូវត្រូវចាត់ទុកជា**សមាជិកក្នុងផ្ទះ:** ពីព្រោះគាត់បានរស់នៅលើសពីពាក់កណ្តាលពេលវេលារបស់គាត់ក្នុង១ឆ្នាំ(លើសពី៦ខែ)។ អ្នកត្រូវបញ្ចាក់ថាគាត់ទៅធ្វើការនៅក្រៅភូមិនៅចំណុច **Q6.5**

Q2.1 "How many people live in your household?"

This question refers to those people who live in the household more than half of their time. Family members (e.g. son or daughter) who live outside the household more than half of a year in total do not count.

*Example 1: A daughter who studies in Phnom Penh and comes home for the weekend **is not a household member**, because she lives less than half of the time in the household. If the parents send money to this daughter, you have to indicate this in Q5.3.*

*Example 2: A son who goes during the dry season for a few months to work to Phnom Penh but lives during rainy season in the household **is a household member,** because he lives more than half of the time in the household. You have to indicate that he works outside the village in Q6.5*

Q4.1: [illegible]

Q4.1 "How much food does your HH consume? (kg or nr?, per day or month?)"
This question is sometimes difficult to answer for the villagers. Try to be fast and don't spend too much time on this question, make rough estimates. It is OK if the answer is not totally correct. It is a "guesstimate".

Q5.1 [illegible]

Q5.1 "Describe your average regular HH expenditures on the following goods and services"
This question refers only to monetary expenditure. Sometimes people do not know the price, but know what they buy each month/year. Then you can write down what they need to buy:

> *Example 1: Expenditure on Clothes: If the people do not know how much money they spend on clothes, but they know that they buy 2 shirts and 2 trousers every year, that you can write down:* ***"2 shirts and 2 trousers per year"***
>
> *Example 2: Expenditure on Firewood: If the respondent does not buy firewood because they collect it themselves, or they do not need firewood because they have a biogas system, then the answer is* ***"0".***

Q6.1: [illegible]

Q6.1 "Gross Revenues" of petty trade:
People tend to give "Net Revenues" as the answer. They subtract already the costs. But we need the "Gross Revenues". "Gross Revenues" is all the money that they receive in one day or in one month from selling goods and services, without subtracting the costs that they had when they bought the good. You have to take care that they give the right answer.

Q6.3 [illegible]

3

Q6.3 "Does your HH receive money from relatives who do not live in your household?"
This question refers only to relatives or friends **<u>who do not live</u>** in the household, or live less than half of the time in the household.

> *Example: Household members, who go to work for 4 months to Phnom Penh during dry season and send money back, **<u>do not count</u>**.*

Q6.4 [illegible] (២០១០/២០១១)?

[illegible]

Q6.4 "Did your HH work on other farms in your village during the last season (2010/2011)?"
This question refers to work on other farms such as **"ploughing the land"**, **"harvest"**, **"transport of seedlings"**, **"trashing"**. People may give different answer to the question of "how much work", for example, they may answer **"workdays"**, "one morning", **"one evening"**. They also can answer in terms of what activities they have done, for example: **"Transporting 2 plown"** of rice seedlings; **"Harvesting 10 bundles of paddy rice"**. The compensation for the work can be **"Riel"**, **"Labor Exchange"** or **"rice"**. Write down what the people answer you.

Q7 ផលិតកម្មសត្វ ចំណូល និងចំណាយ៖ ស្រះ និងត្រី

[illegible]

Q7"Livestock Production, Revenues and Expenditure: Fishponds and Fishes"
In this question, one row is about "Fishponds and Fishes". The question in the first line "how many animals do you own" refers to the number of fishponds: Here you have to answer how many fishpond the respondent owns. The next question "Amount sold" refers to the fishes. Here you have to write down how many fishes they sell per month or year. People may answer in kg, but some people also may answer in "number of fishes". Write down the correct unit. The line **with** the question "cage size" refers to the size of the fishpond.

Q8 ផលិតកម្មកសិកម្ម ចំណូល និងចំណាយ

1) ឯកតា

[illegible]

- → [illegible] (Q8).

4

2) [illegible]

[illegible] ☐ Yes [illegible]

Q8 "Agricultural Production, Revenues and Expenditure"

<u>1.) Units:</u>

Be carefully with filling in this table, because different respondents will give different answers. Some may answer in "slag", others in hectare; some will answer in "baskets" others in "kg". You <u>always</u> have to write down the unit that people use.

- ➔ VERY IMPORTANT: If the people answer you using "baskets" as unit, you have to ask "How many kg has one basket?" You can write the answer down in the box in the upper right corner of Q8.

<u>2.) Household consumption</u>

If the respondent only produces for household consumption, than tick the box " ☐ Yes", and continue with the next row (You do not need to ask "amount sold"). If the respondent produces not only for household consumption, but sells a part of the production, than do not tick the box and continue to the question "Amount sold".

Q8.3 - [illegible]

[illegible]

Q8.3 "Do you have income from farming activities that you have not mentioned until now?"

This question refers for example to selling mango, coconut, cassava, sugar from sugar palm, etc. This is an open question, just write down what the people answer.

Q11.1 [illegible]

[illegible]

11.1 "SRI Profile"

If the farmer is a SRI practicing farmer, ask him if he can tell you the SRI techniques that he is practicing and "tick" the corresponding boxes. DO NOT READ HIM ALL THE STEPS. This takes too much time, and the farmer might say "yes" to almost any question.

5

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ANNEX II

OTHER ACADEMIC ACHIEVEMENTS OBTAINED DURING THE PH.D. PROJECT

This Ph.D. dissertation was funded by a three years research grant (FI-DGR-2009), from the Catalan government, Spain, thanks to which I was assigned a position as research personnel at ICTA-UAB. During this time I could further make the following academic achievements (not mentioned previously), which also inspired and helped me in elaborating this dissertation.

Peer-reviewed article

During the first year, I was able to publish my Master thesis, mainly written at the Institute of Social Ecology, IFF Vienna, Alpen-Adria University:

- Scheidel, A., Krausmann, F., 2011. Diet, trade and land use: a socio-ecological analysis of the transformation of the olive oil system. *Land Use Policy* 28, 47-56. DOI: 10.1016/j.landusepol.2010.04.008

Special issue (forthcoming)

As member of the rural system analysis group at ICTA-UAB (www.ruralsystems.org), I am participating as guest editor in the elaboration of a special issue, entitled *"Pathways of rural change: An integrated assessment of the metabolic pattern of emerging ruralities".* The special issue proposal has been accepted in the journal Environment, Development and Sustainability (Springer).

- Short summary: *This special issue sheds light on the current dynamics, policies and pathways of rural change, as well as on the new ruralities that are emerging as responses across Asia, Latin America and Europe. While transformations in the rural sector are nothing new in human history, the current processes of rural change occur at a pace and scale that is unprecedented, involving dramatic changes in the use and access over land and rapid transformations of the metabolic patterns of rural systems.*

  In order to discuss the new forms of rural life that are emerging, this special issue draws on a common methodological framework of integrated assessment of societal metabolism. We focus on the effects of regional to global policies on current rural dynamics and analyze the functioning and resource use patterns of local rural systems with the aim to address the multi-dimensional challenges they face today.

  The introductory paper will elaborate on the dynamics of rural change and introduce the common theoretical framework used to analyze rural systems. A series of 10 case studies of emerging ruralities from Latin America, Asia and Europe will present insights from the local perspective. The attempt of bringing together, under a common theoretical framework, the insights from cases of rural change across three continents constitutes the main added value of the proposed special issue.

Deliverables for EU-projects

- Scheidel, A., Giampietro, M., Serrano, T., 2010. Report on trade-offs in relation to the goal of poverty reduction and environmental protection in developing countries, Barcelona. http://www.smile-fp7.eu/?id=deliverables

Organized conferences

- 7th Biennial International Workshop on *Advances in Energy Studies 2010 – Can we break the addiction to fossil energy?* Local organizing committee. Institute of Environmental Science and Technology (ICTA) Autonomous University of Barcelona (UAB), Spain. October 2010.

- 2nd International Conference on *Sustainable Degrowth for Ecological Sustainability and Social Equity, 2010*. Organizing committee. Institute of Environmental Science and Technology (ICTA), Autonomous University auf Barcelona (UAB) in collaboration with the University of Barcelona (UB), Catalonia, Spain. March 2010.

Visiting fellowships

- Visiting researcher at the Environmental Symbiosis Studies research unit, under the supervision of Dr. Kozo Mayumi. *University of Tokushima, Japan*. October – November, 2012.

- Visiting scholar at the Mekong Institute, Thailand. *Intergovernmental organization for development and cooperation in the Greater Mekong Subregion* (GMS). February 2011 – July 2011.

- Collaborating researcher with CEDAC, Cambodia. *Cambodian Center for Study and Development in Agriculture.* February 2011 – July 2011.

Invited lectures

- Invited guest lecture on: *challenges of multidimensional poverty analysis*, held at the Department of Rural Development and Agricultural Economics, Cambodian Royal University of Agriculture (RUA), Phnom Penh. May 2011.

- Invited lecture on: *societal metabolism and land grabbing*, held at the 2nd Summer School on Political Ecology, Environmental Justice and Conflicts, Institute of Environmental Science and Technology, Autonomous University of Barcelona. July 2012.

ANNEX III

CURRICULUM VITAE

Personal Information

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Date of Birth	31.10.1981
Nationality / Sex	Austrian / Male

Education

2009 – present	Ph.D. candidate in Ecological Economics and Integrated Assessment Institute for Environmental Science and Technology (ICTA) Autonomous University of Barcelona (UAB), Spain
2007 -2009	Master in Social Ecology and Human Ecology *(high distinction)* Institute of Social Ecology Vienna (SEC) Alpen-Adria University of Klagenfurt (AAU), Austria
Feb. 2008 – June 2008	Erasmus Exchange Program Autonomous University of Barcelona (UAB), Spain
2003 – 2007	Bachelor in Biodiversity and Ecology Karl-Franzens University of Graz (KFF), Austria

Work and Research Experience

Oct. 2012 – Nov. 2012	Visiting scholar at the *Tokushima University*, with Dr. Kozo Mayumi Environmental Symbiosis Studies Unit Japan
Feb. 2011 – June 2011	Visiting scholar at the *Mekong Institute* - Intergovernmental Organization for Development and Cooperation in the Greater Mekong Sub-region - Khon Kaen University Thailand
Feb. 2011 – July 2011	Collaborating researcher with CEDAC - *Cambodian Center for Study and Development in Agriculture* Cambodia
Feb. 2010 – Jan. 2013	Research personnel in training Institute for Environmental Science and Technology (ICTA) Autonomous University of Barcelona (UAB) Spain
Oct. 2008 – Feb.2009	Researcher in the project *The Social Ecology of the Food System* Institute of Social Ecology Vienna (SEC) Alpen-Adria University of Klagenfurt (AAU) Austria
Nov. 2006 – Apr. 2007	Scientific assistant at *PGE – Produktionsgemeinschaft Egger Gmbh* Livestock, agriculture and environmental ecology Austria
May 2006 – Dec. 2006	Bachelor thesis research on the diversity of epiphytes and hemi-epiphytes in the *Piedras Blancas National Parque* Field station *La Gamba* Costa Rica

Languages

German	Mother tongue
English	Fluent
Spanish	Fluent

Prizes and Grants

Oct. 2012	Winner of a visiting fellowship at Tokushima University, Japan Catalan Government, Spain (BE-DGR-2011)
Feb. 2010	Winner of a three-years Ph.D. research grant from the Catalan Government, Spain (FI-DGR-2009)
July 2008	Winner of the 1st award of the Ph.D. paper competition at the European Society for Ecological Economics
June 2008	Winner of the 3rd award for the best student poster International Society for Industrial Ecology

Publications

International, peer-reviewed journals

Scheidel, A., Giampietro, M., Ramos-Martin, J., in press. Self-sufficiency or surplus: Conflicting local and national development goals in Cambodia. *Land Use Policy* 2013.

Scheidel, A., 2013. Flows, funds and the complexity of deprivation: Using concepts from ecological economics for the study of poverty. *Ecological Economics* 86, 28-36.

Scheidel, A., Sorman, A.H., 2012. Energy transitions and the global land rush: Ultimate drivers and persistent consequences. *Global Environmental Change* 22, 588-595.

Scheidel, A., Krausmann, F., 2011. Diet, trade and land use: a socio-ecological analysis of the transformation of the olive oil system. *Land Use Policy* 28, 47-56.

Working papers, reports

Scheidel, A., 2013. From MuSIASEM theory to practice: Reflections and experiences from field research in a rural Cambodia. *Working Paper on Environmental Sciences*. Institute of Environmental Science and Technology (ICTA) Autonomous University of Barcelona (UAB), Barcelona. http://hdl.handle.net/2072/209216

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International Conferences and Workshops

July 2012	Speech on *societal metabolism and land grabbing*, held at the 2nd Summer School on Political Ecology, Environmental Justice and Conflicts, Institute of Environmental Science and Technology, Autonomous University of Barcelona, Spain
October 2010	Organizing committee of the 7th Biennial International Workshop *Advances in Energy Studies 2010: Can We Break the Addiction to Fossil Energy?* Barcelona, Spain
June 2010	Participation in the 1st Summer School on *Political Ecology and Environmental Justice*, Institute of Environmental Science and Technology, Autonomous University of Barcelona, Spain
May 2010	Participation in the 2nd Workshop on *Social Metabolism of Agricultural Systems.* University of Barcelona (UB) Spain
March 2010	Organizing committee of the 7nd International Conference on *Degrowth for Ecological Sustainability and Social Equity*, Barcelona, Spain
July 2009	Speech at the 8th International Conference of the European Society for Ecological Economics, Ljubljana, Slovenia
June 2009	Poster presentation at the 5th International Conference of the International Society for Industrial Ecology, Lisbon, Portugal
July 2008	Participation in the 5th international liphe4 summer school on *Multi-Scale Integrated Analysis of Societal and Ecological Metabolism (MuSIASEM) for Participatory Assessment of Sustainability Issues*, Barcelona, Spain
January 2008	Organizing committee of the 5th congress of junior scholars of environmental sociology (NGU). Faculty of Interdisciplinary Studies, IFF Vienna, University of Klagenfurt, Austria

Other Commitments

2010 onwards	Member of the *Rural System Analysis Group* at ICTA-UAB (www.ruralsystems.org)
2009 onwards	Member of *ProjectA - Theater for social change*, Barcelona
2009 onwards	Member of the *European Society for Ecological Economics*
2008 onwards	Founder of the re-use and recycle website www.nurgeschenkt.at (Austria, Germany, Switzerland)

Other Passions

	Music (saffran.bandcamp.com; www.facebook.com/saffran), Social Theater (www.facebook.com/projecta.teatrosocial), Hiking.