Large-scale bioenergy and oil forestry programs in rural China

An institutional analysis

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Thesis

submitted in fulfilment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus
Prof. Dr M.J.Kropff,
in the presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on Tuesday 17 December 2013
at 4 p.m. in the Aula.

Jia Li

Large-scale bioenergy and oil forestry programs in rural China: An institutional analysis

190 pages.

PhD thesis, Wageningen University, Wageningen, NL (2013)

With references, with summaries in English and Dutch

ISBN: 978-94-6173-816-5

Preface

This dissertation results from PhD research conducted within the framework of the SURE (Sustainable Natural Resource Use in Rural China) project, which is funded by the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Chinese Ministry of Science and Technology (MoST). I would like to express my gratitude for their financial support. I am also grateful to Wageningen University for enabling my studies abroad.

This work benefited from the support of many people and organizations. My special thanks go to my promoter prof. Arthur P.J. Mol, chair of the Environmental Policy Group at Wageningen University, for his supervision, encouragement and persistent support through the whole doctoral period. He is always nice and patient to guide my research and to solve problems quickly and efficiently. He also brought my research in the right direction and broadened my horizon. I feel very lucky to be a student of him, because he serves as a model with respect to how to conduct research and showed me enthusiasm to do social science research.

My sincerely gratitude goes to my co-promoter Dr. Bettina Bluemling of the Environmental Policy Group at Wageningen University, who was also my daily supervisor and the coordinator of the SURE project. She is a diligent lady and spends much time on guiding my research. Words cannot express my thanks and appreciation for her five years of persistent supervision and support to my doctoral research, as well as specific and detailed guidance during my fieldwork in China; and for coordinating the SURE project. She also has helped me to establish a research network both in China and abroad. I am also heartily thankful to my other co-promoter Dr. Liesbeth Dries of the Agricultural Economics and Rural Policy Group at Wageningen University. Her supervision, suggestions and support enlightened my research in particular with respect to institutional theory and econometrics. In conclusion, this work would not have come into being without their dedication.

I highly appreciate the support of prof. Shuyi Feng at the College of Public Administration at Nanjing Agricultural University. Her extensive knowledge and in-depth insight about farm household in rural China were reflected by her constructive and critical comments that helped me a lot in improving the questionnaire design and the implementation of the field survey. She also spent time to organize and accompany me during the fieldwork in Jiangxi province.

Working at the Environmental Policy Group (ENP) was not only an important in my academic career, but also a good memory in my life. I really enjoyed working there with my

colleagues from around the world. I appreciate the encouragement and support from my colleagues: Jan van Tatenhove, Peter Oosterveer, Gert Spaargaren, Simon Bush, Kris van Koppen, Machiel Lamers, Megan Bailey, Dorien Korbee, Natapol Thongplew, Joeri Naus, Ching Kim, Sammy Letema, Eira Carballo Cardenas, Hilde Toonen, Marjanneke Vijge, Alice Miller, Radhika Borde, Harry Barnes Dabban, Jennifer Lenhart, Judith Floor, Nguyen Dung, Somjai Nupueng, Thomas Nugroho, Carolina Maciel, Alexey Pristupa, Kari Stange, Linde Van Bets, Elena Degli Innocenti, Debasish K Kundu, Stella Libre, Phatra Samerwong, and Agnes Yeeting. I enjoyed the good work atmosphere in ENP, and am thankful to share such a good time with all of them. Special thanks to Corry Rothuizen, who has coordinated so many details in traveling to and living in Wageningen. She has made my life abroad during the past five years much more convenient.

I would like to express my thanks to all my Chinese friends who were particularly important in my doctoral stage, Chaohui Zheng, Dan Liang, Guizhen He, Qin Tu, Wenling Liu, Jing Wu, Jing Lu, Jinyun Zhang, Lei Zhang, Shumin Yu, Shuqin Jin, Xianlei Ma, Xiaoyun Bing, Yan Feng, Yan Wu, Yuan Li, Jingyi Han, Lihe Xu, Zhen Liu, Xiangdan Meng, Huan Yang, and Xiaoming Wang. Their company made my life abroad less lonely and more colorful.

I am greatly indebted to my beloved family members Ziyao Xu, Ning Xu, Jianxin Xu and Juanyu Zhang for their persistent support, encouragement, and love through the five years. I would like to share my happiness and tears with them on this piece of work.

Nanjing, November 2013

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Abbreviations

ADO	Agricultural Development Office
CCCFL	China Climate Change Framework Loan program
CDM-AR	Clean Development Mechanism-Afforestation/Reforestation
CNOOC	China National Offshore Oil Corporation
CNPC	China National Petroleum Corporation
DCBT	Desertification Combating Program around Beijing and Tianjin
DOF	Department of Finance
DRC	Development and Reform Commission
EIB	European Investment Bank
EPA	Environmental Protection Agency
FA	Forest Administration
FAO	Food and Agriculture Organization
FOI	Forestry-Oil Integration
GAQSIQ	General Administration of Quality Supervision, Inspection and Quarantine
GZREC	Guangxi Zhilian Renewable Energy Company
IPCC	Intergovernmental Panel on Climate Change
ITPP	Industrial Timber Plantation Program
LRO	Land and Resources Office
MCDC	Modern Camellia Demonstration County
MOA	Ministry of Agriculture
MOF	Ministry of Finance

NDRC	National Development and Reform Commission
NFPP	Natural Forest Protection Program
NPRT	New Property Rights Theory
NTFPs	Non-Timber Forest Products
NRCO	New Rural Construction Office
PFPs	Priority Forestry Programs
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RCC	Rural Credit Cooperatives
SA	Standardization Administration
SAT	State Administration of Taxation
SFA	State Forestry Administration
SLCP	Sloping Land Conservation Program
SBDP	Shelterbelt Development Program
UNFCCC	United Nations Framework Convention on Climate Change
WCNR	Wildlife Conservation and Nature Reserve Development Program

Chapter 1. Introduction

1.1 General introduction

1.1.1 Climate change and forestry

Today, the planet experiences severe challenges related to climate change due to greenhouse gas emissions and ecosystem deterioration. Climate change is a predominant global issue. Since the early 1990s, global climate negotiations take place in which nearly all countries meet annually under the United Framework Convention on Climate Change (UNFCCC) to discuss measures and policies for combating climate change issues. But also outside the UNFCCC there are multiple global efforts at cooperation in creating strategies for climate change mitigation and adaptation. The forestry sector in particular plays an important role in climate change mitigation and adaptation because forests absorb large quantities of CO2 every year (Canadell and Raupach, 2008; Bonan, 2008; FAO, 2011). Forestry can also contribute positively to the ecosystem; moreover, forestry provides products and services to improve rural livelihoods and society (FAO, 2011; FAO, 2012). Hence, in addition to carbon sequestration, forests also provide economic, environmental, and sociocultural benefits (Canadell and Raupach, 2008; Bonan, 2008).

Several important international schemes are being implemented in developing countries to promote forest protection and afforestation. In order to combat climate change, under the Kyoto Protocol's Clean Development Mechanism-Afforestation/Reforestation (CDM-AR) initiative, several projects have already paved the way for greenhouse gas mitigation through afforestation and reforestation in voluntary carbon markets (Zomer et al., 2008). Another important global mechanism supporting forestry projects is the so-called REDD+ program (the United Nations collaborative initiative on Reducing Emissions from Deforestation and forest Degradation in developing countries), whose rules and principles were negotiated and agreed upon by the international community. To date, more than four billion dollars have been given to support REDD+ activities in developing countries, which have in turn announced ambitious targets for emission reductions in the forestry sector (UNEP, 2010). Hence, generating appropriate policies and incentives to implement afforestation and reforestation projects is significant for combating climate change (Torres et al., 2010).

Currently, developing countries are a crucial part of global forest conservation and ecosystem services provisioning because the majority of tropical forests are located in developing countries. However, developing countries still depend on resource-based economic development to meet their peoples' basic needs, which means that the process of forest conservation is not easy. Forestry conservation programs in developing countries have a major impact on small farmers' livelihoods, especially forest-dependent farmers. The objective of poverty alleviation is challenging and critical for smallholders in complicated forestry systems. In forestry conservation programs, understanding the smallholder's interests, incentives and forestry practices is significant to set pro-poor targets and to ensure that the large number of indigenous people in developing countries benefit from these programs. Moreover, as many developing countries experience decentralization in forestry sectors (Dahal et al. 2011), the roles of local communities and smallholders are rendered increasingly important in forestry management and governance.

The Chinese government is paying great attention to climate change and the development of green and sustainable economic development strategies. The forestry sector plays an important role in low carbon transitions and climate mitigation in China. In addition to being a carbon sink, the Chinese government indicates that the forestry sector also has other benefits, such as the promotion of biodiversity, ecological conservation, and the improvement of rural livelihoods by increasing farmers' incomes (SFA, 2009a).

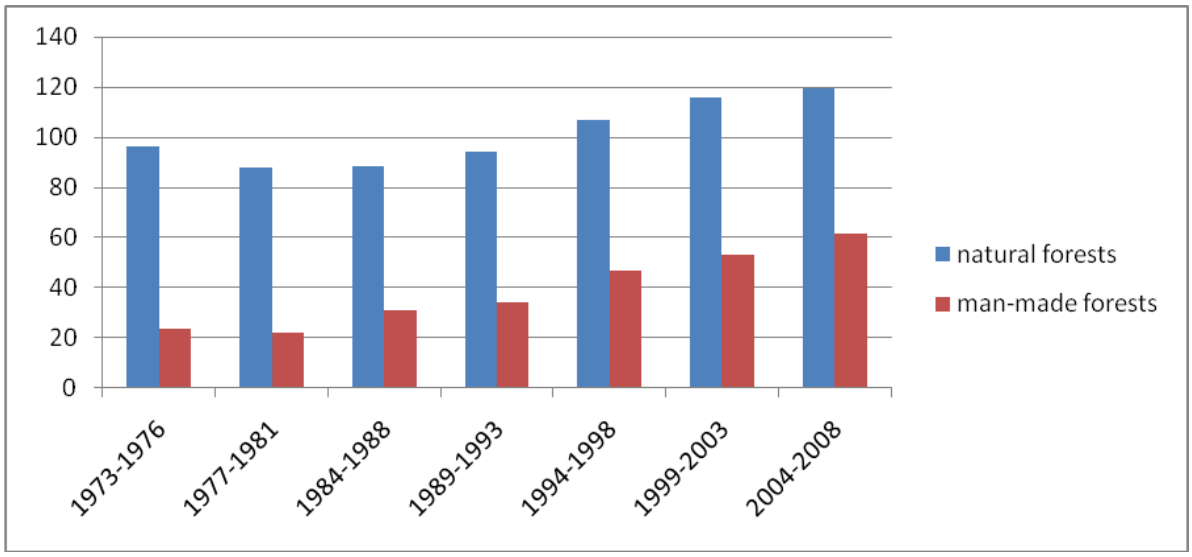
1.1.2 General background of the forestry sector in China

Chinese forestry development

China's forests cover 195.45 million hectares, 20.36% of its total territory (National Bureau of Statistics of China, 2012). Although China's forests account for 5.12% of the world's total forest area, ranking fifth behind Russia, Brazil, Canada and the United States, its per capita forest area is quite low, only 25% of the world's average per capita forest area (FAO, 2011). Society's demand for timber and non-timber forestry products still imposes enormous pressure on China's forest resources. Triggered by the demand for forestry products and several ecological conservation projects from the late 1970s onward, China's forest still extends across almost all provinces (National Bureau of Statistics of China, 2012). China has invested a great deal of effort to develop tree plantations to increase its forest resources for both ecological purposes and economic interests. In 2011, the plantation area reached about 6 million hectares, an increase of 1.47% over 2010 (SFA, 2012a). After years of afforestation, China has the largest area of forest plantation in the world (FAO, 2011).

Figure 1.1 shows the development in the area of natural forests and man-made forests from 1973 to 2008. According to Figure 1.1, the area of natural and man-made forests decreased from 1977 to 1981 because of the forestland reform at the end of the 1970s; after that, the areas of both types of forests increased gradually due to the significant efforts in forest conservation and afforestation. In 2008, natural forests (accounting for 65.99% of the total forest area) reached 1.2 million hectares, a 0.3 million hectare increase from their lowest point in 1981 (SFA, 2009b). Man-made forests (accounting for 34.01% of the total forest area) reached 0.62 million hectares, a 0.4 million hectare increase from 1981. In 2008, economic forests,[1] an important subset of man-made forests, covered 0.2 million hectares, 31.59% of the total area of man-made forests. In conclusion, these statistics show the major achievements in Chinese forest protection and afforestation efforts in the last 30 years.

Figure 1.1: Area of natural and man-made forestsa from 1973 to 2008 (Unit: 10,000 hectares)



Source: State Forestry Administration (2009a)

[a] Natural forests refer to forests with natural origins ; man-made forests refer to the area of stable growing forests, planted manually or by airplanes (FAO, 2010; National Bureau of Statistics of China, 2012)

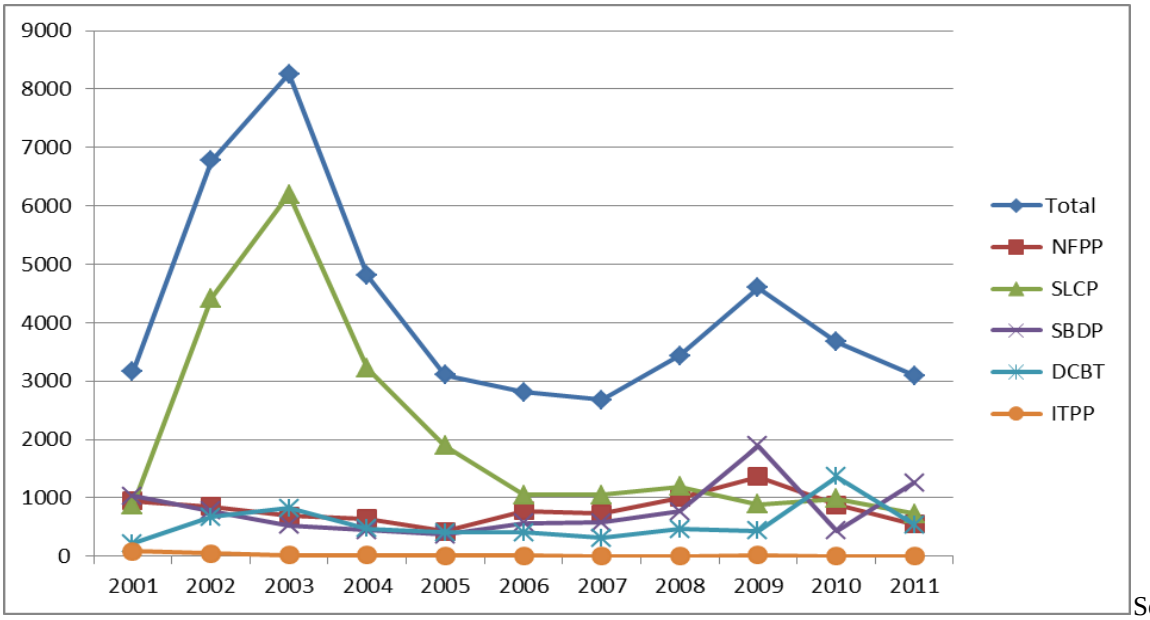
Priority Forestry Programs overview

Since 1998, the Chinese central government has consolidated old programs and initiated new programs in the area of ecological restoration and resource development in the forestry sector and renamed them collectively as "Priority Forestry Programs" (PFPs). These include the Natural Forest Protection Program (NFPP); the Sloping Land Conservation Program (SLCP), also known as the 'Grain for Green' program; the Desertification Combating Program around

[1] Economic forests refer to forests that mainly produce fruits, nuts, oil, beverages, indigents, raw materials and medicinal materials.

Beijing and Tianjin (DCBT); the Shelterbelt Development Program (SBDP); the Wildlife Conservation and Nature Reserve Development Program (WCNR); and the Industrial Timber Plantation Program (ITPP) (Liu et al., 2010; SFA, 2003, 2004; Priority Forestry Programs socio-economic assessment team, 2003). More specifically, NFPP conserved natural forest by completely banning logging in the upper Yangtze and middle Yellow River areas and by promoting afforestation and forest management wherever possible. The SLCP contains a subsidized conversion of cropland to ecological and/or economic forest and grassland. The DCBT uses flexible measures to convert desertificated land into forestland and grassland. The SBDP contributes to shelterbelt development and tree planting in the north and in several important river basins. The WCNR creates protected reserves with the sponsorship of the central and local governments and encourages international participation and the involvement of the private sector. The ITPP attempts to increase the domestic timber supply through government funding, financial support and credit provisions with the participation of state and collectively owned entities including community, private and shareholder-based entities. The implementation of PFPs has played an important role in increasing the forest area (see Figure 1.2).

Figure 1.2: Annual afforestation area of the Priority Forestry Programs (2000-2011) (Unit: thousand hectares).



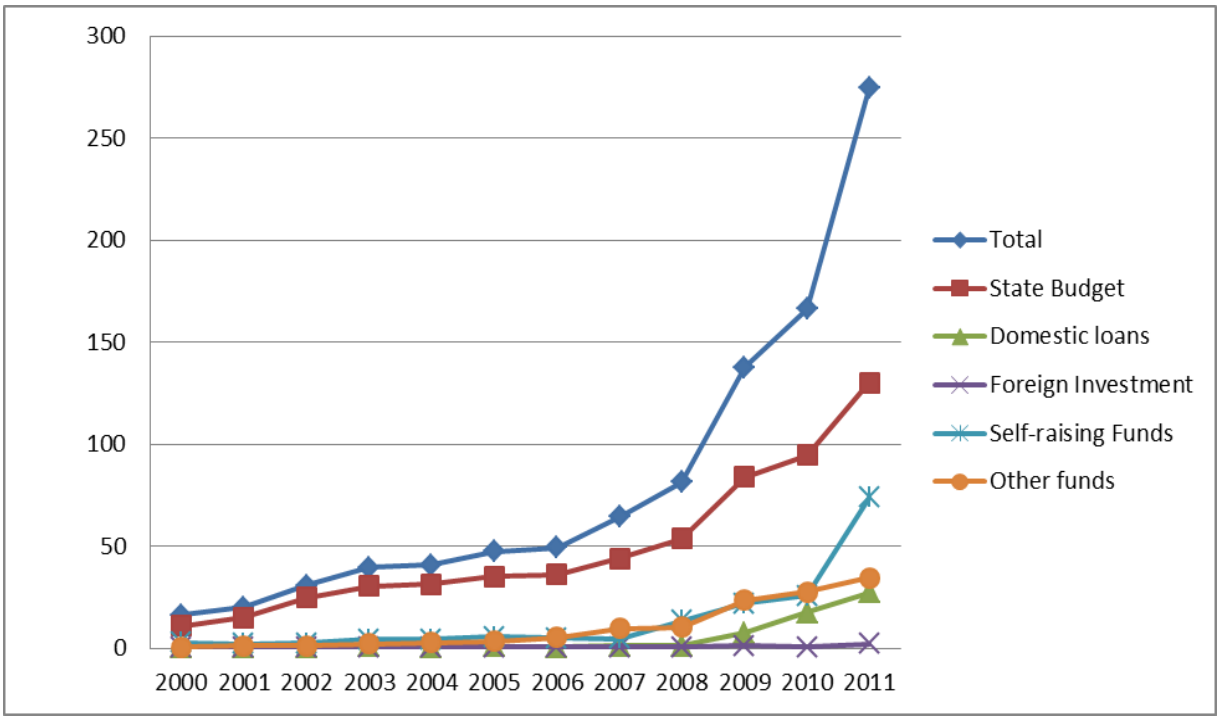
Source: National Bureau of Statistics of China (2012)

The afforestation by PFPs is dramatic, accounting for 62.1% and 51.6% of the total amount of plantation in 2010 and 2011, respectively (National Bureau of Statistics of China, 2012). Among the six programs, the SLCP contributed the highest proportion of afforestation area, with the NFPP, SBDP and DCBT falling in the middle. The ITPP's scale is low compared to the others, but it also planted over 20 thousand hectares in 2009. In conclusion, the success of the six large scale PFPs proved that they have indeed provided incentives to plant more trees and increase the forest coverage area in the last decade. PFPs are a top-down initiative, and the lion's share of their financing, such as the subsidies for the SLCP and NFPP, comes from the central government. The programs are mainly under the responsibility of the State Forestry Administration (SFA), which works in cooperation with local governments and stakeholders. Although one objective of the programs is poverty alleviation, participating farmers have seen only moderate income increases (Xu et al., 2006; Liang, 2012). Finally, the weak cooperation between the SFA and other government sectors and the limited market-based mechanisms are often mentioned as factors that prevented even more successful afforestation (Xu et al., 2006).

Source of forestry investment

The source of funding for forestry investment is presented in Figure 1.3. In 2011, the total funding for forestry investment increased dramatically to 274.4 billion yuan, of which the state budget accounted for 47.45% and foreign investment accounted for 0.83% (SFA, 2012a). Moreover, according to Figure 1.3, the state budget's proportion has increased rapidly, especially between 2010 and 2011. Foreign investment and other funds increased gradually from 2000 to 2011. In 2011, foreign investment funded 272 forestry projects, while the actual amount of foreign investment (including loans, direct investment, and free aid) reached 1.7 million dollars, a 159% increase over the previous year (SFA, 2012a). In summary, budget allocation from the central government remains the main source of funding. Simultaneously, foreign investors and individuals also gradually increased their investment in Chinese reforestation efforts.

Figure 1.3: Source of annual funds for forestry investment[a] (2000-2011) (Unit: Billion Yuan)



Source: National Bureau of Statistics of China (2011, 2012) and SFA (2012a)

[a] Funds from the state budget consist of budgetary appropriations and loans from the state budget; Domestic loans refer to loans of various forms originating from banks and non-bank financial agencies; Foreign investment includes overseas funds, including foreign borrowing and foreign direct investment; Self-raised funds refer to extra-budgetary funds contributed by investing units from central government ministries, local government, enterprises and agencies.

Forestry administration and tenure reform

Forestry governance in China is a complex mix of governmental political systems and forestland property rights systems. In China, the political system generally consists of five levels of government: central, provincial, city, county and township. Each level of government contains organs, such as councils, commissions, ministries and administrations. Agencies are fragmented by function as well as by rank, meaning that each ministry sits atop a functionally-defined hierarchy of government units that exist at each territorial level of government (Lieberthal, 2000; Lieberthal, 2004, pp.177-178). The SFA is at the top of a hierarchy of forestry departments made up of five-level units; but there are no township forestry stations in areas where forestry is not the main industry. Thus, each specialized organ has two potential masters: the highest level of government at its own territorial level, and the office in the same functional sphere one level up in the territorial hierarchy (Lieberthal, 2000). In addition to the formal political system, the administrative village and natural village (hamlet) also make up important informal parts of the governance structure beneath the township level. The administrative village is the lowest level in the government hierarchy,

although it is not a formal level of government (Zhang et al., 2004). In China, an "administrative village" (xingzhencun) is an administrative entity for several "natural villages" (zirancun). While the administrative village is headed by a village council, the natural village does not form part of the formal political structure. Since 2003, the Chinese central government has begun a reform of forestland rights that distributes the user rights of collective forestland to individual households. Individual households' user rights for collective forestland then are devolved through a lease contract (Liang, 2012). In general, the collective forestland is required to be distributed to each household, but if a majority of the villagers in the natural village agree, other management regimes such as collective management and contracts to other private sector entities are also allowed. As a result of the devolution, multiple forestry management practices under various tenure regimes exist, involving a diverse range of actors (SFA, 2009b). In conclusion, after the reform, forestry resource management has been complicated down to the lowest level of the formal political structure and below (village level and natural village level).

According to Table 1.1, 32.1% of forestland is under individual management (SFA, 2009b). Furthermore, individuals managed 82.7% of the economic forest, indicating that individual households play a vital role in economic forests' planting and management. These results are further supported by evidence that manually planted forests and new afforestation areas managed by individuals accounted for 59.2% and 68.5% of the total, respectively (SFA, 2009b). As individual households have taken the lead in afforestation and economic forestry plantation, the implementation of government-initiated forestry programs have become dependent on individuals with the coordination of the forestry administration system and local government. These results also reflect a new phase of forestry resource management and governance.

Table 1.1: Forest resources by forest property right regimes

Items	State	Collective	Individual
Forestland with forest area - in thousand hectares	7, 1436	5, 1770	5, 8175
- in percentage (%)	39.4	28.5	32.1
Economic forest area - in thousand hectares	1008	2527	1, 6875
- in percentage (%)	4.9	12.4	82.7

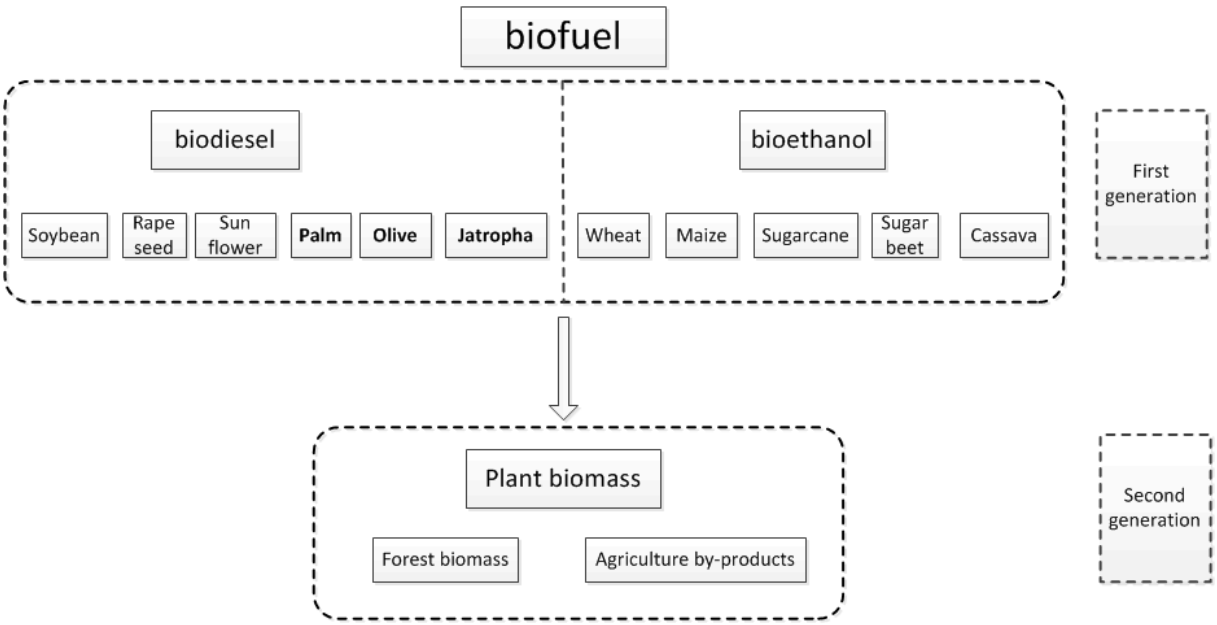
Source of data: State Forestry Administration (2009b)

1.2 Large-scale bioenergy and oil forest development

1.2.1 Global energy and oil forest development

Global warming, high energy prices, an increasing awareness of energy security and greater recognition of the environmental consequences of fossil fuel dependence are creating an urgent need to find ecologically friendly fuels (Scharlemann and Laurance, 2008; Hill et al., 2006). In view of environmental considerations, biofuel is considered carbon neutral because all the CO2 released during consumption has been sequestered from the atmosphere for the growth of plants (although the production of biofuels still consumes energy and thus net CO_2 emissions) (Pandey et al., 2012). Policies to promote renewable bioenergy have mushroomed world-wide over the past several years (van Eijck and Romijn, 2008). Bioenergy accounted for 10.2% of energy sources in the total global energy supply in 2008 (IPCC, 2012). Compared to fossil fuel use biofuels can reduce carbon emissions, increase farm income, improve energy security and create new jobs (Rajagopal and Zilberman, 2007; Mol,2007,2010). First-generation liquid biofuel from oil crops (biodiesel) and sugar and starch crops (ethanol) (IPCC, 2012), such as maize, sugarcane, soybean, and rapeseed, are broadly promoted in the United States, Brazil and Europe (Rajagopal and Zilberman, 2007; Oosterveer and Mol, 2010; Havlik et al., 2011). Figure 1.4 provides an overview of different crops that are used for biofuel production.

Figure 1.4: Overview of biofuel crop resources.



Source: Sanchez and Vasudevan, 2006; AI-Zuhair, 2007; Demirbas, 2008; Naik et al., 2010; de Vries et al., 2010,

In addition to annual agricultural crops, perennial wood species such as palm and olive trees are also used as a biodiesel resource (USDA, 2008; Sanchez and Vasudevan, 2006). Moreover, as Scharlemann and Laurance (2008) argue, biofuels are likely to consume vast areas of farmland, driving up food prices. In order to not compete with arable land and food production, jatropha has become a promising alternative and has been promoted accordingly in different countries. In addition, the production of biodiesel from olive oil waste is also being explored (Arvanitoyannis et al., 2007)

Jatropha is a plant native to Mexico and Central America that now grows across Latin America, Africa and Asia. Jatropha is a vigorous, drought- and pest-tolerant plant that can grow on wasteland and whose seeds and other plant parts have traditionally been used for oil, soap and medicinal compounds (van Eijck and Romijn, 2008; Pandey et al., 2012). Its potential as a biofuel crop was discovered in the early 2000s. Since then, governments, international organizations, and financial funds have begun to develop large-scale plantations for commercial use as well as local rural development. India and a handful of African countries have developed large-scale jatropha-based biodiesel development programs (Wu et al., 2010). There is great hope that jatropha will provide a promising sustainable alternative to fossil fuel. Moreover, it can grow on marginal land that will compete with neither food production nor nature conservation. In this context, a vast number of jatropha projects have been planned and initiated globally.

International organizations have supported jatropha projects in Africa, Latin American and Asia by using jatropha to provide energy to rural areas and local developments in the early 2000s. With more than 900 thousand hectares planted, Asia has by far the largest acreage of jatropha cultivation currently under management worldwide, and the largest jatropha plantations are found in India, Myanmar, China and Indonesia (Gexsi, 2008). The largest projects are government initiatives that typically work with smallholder farmers in Asia, including pro-poor support schemes in India and village programs in Laos and Myanmar (Gexsi, 2008). Significant international and national private companies are also becoming active in this field.

Although jatropha is receiving formal recognition, growers are still unable to achieve optimum economic benefits from the plant, due to various social and economic constraints (Mujeyi, 2009). The experience with jatropha systems in poor and remote areas thus far indicates that the major obstacles are organizational rather than technical (Nielsen, et al., 2012). Institutional intervention and facilitation in remote areas is critical. Poor site selection

has been the root cause of many failures worldwide (Nielsen, et al., 2012). Moreover, the plantations worked by small farmers are not optimal due to the challenges associated with introducing new production systems in remote, underdeveloped areas. The global picture clearly points to a significant majority of private projects; however, public initiatives and public-private partnerships also play a vital role in developing the emerging jatropha industry (Gexsi, 2008).

Access to secure financing for jatropha growers to bridge the gap between planting and harvest is very difficult to obtain, which could be a significant issue. It is also difficult to raise awareness and educate the different stakeholders involved in the jatropha supply chain about the issues surrounding biofuel, carbon footprints and biomass. Communication across the different sectors and support schemes involved in jatropha projects can also be challenging. Effective cooperation between different stakeholders, including local parties such as farmers, district administrators, village level institutions, NGOs, and universities, is vital (Gexsi, 2008).

While small farmers play a vital role in most jatropha projects, approximately 50% of all project developers in Latin America and Asia opted for a cooperative approach, by which a contract to manage a plantation is initiated between a company (or NGO) and a smallholder; two thirds of the projects in Africa integrates smallholders (Gexsi, 2008). The road to large-scale biofuel production for developing countries is bumpy, and what works in a small-scale aid project rarely translates into commercial success (Gilbert, 2011). Additionally, the efficiencies and economies of scale that come from commercializing and centralizing biofuel production have limited benefits for locals (Gilbert, 2011). A good institution that can bridge the gap between the smallholder and large-scale commercial ventures is crucial for jatropha development. These issues are also important for REDD+ projects and CDM-AR projects.

1.2.2 Review of Chinese bioenergy and oil forestry program development

Perennial wood species, as well as bushes and small trees such as jatropha and olive trees, have been promoted globally as oil-bearing crops, and sometimes jatropha is also planted on arable land. In China, oil-bearing small trees, which mainly grow on slope land, are considered to be bioenergy and oil forests, a subset of economic forests. Various tree species in China are defined as part of bioenergy and oil forests, including jatropha, pistacia (Pistacia chinensis Bunge), xanthoceras (Xanthoceras sorbifolia Bunge), swida (Swida Wilsoniana), and camellia (Camellia Olifera) (Qian et al., 2007). Table 1.2 provides an overview of the

bioenergy and oil forest plantations in China. Because China has little additional arable land, energy and oil forests that can grow on slope land and do not compete with food crops for cultivated land have attracted great attention from policy makers and biodiesel industries in China.

The national government has devised a series of laws and policies resulting in tax preferences, subsidies and investment support to promote bioenergy and oil forests. Moreover, in China, the Forestry-Oil Integration (FOI) program, which is part of the Eleventh Five-year Plan, has been established to promote energy and oil forests. This influential program began in 2007 with an agreement between the SFA and the China National Petroleum Corporation (CNPC) to set up a jatropha demonstration base. Two other state-owned companies, the China Petrochemical Corporation (Sinopec Group) and the China National Offshore Oil Corporation (CNOOC), later joined the project as main promoters. Under the guidance of these main stakeholders, some private companies joined the project. Local communities and farmers work on the planting process together with these actors. In addition, other state government sectors, such as the National Energy Department and the National Development and Reform Committee (NDRC), participate through policy making and supportive regulations; further, some research centers contribute by providing training to farmers. In summary, the FOI program has been devised by central government agencies and state-owned companies, while the implementation is carried out by local governments and farmers. The program does not specify details concerning implementation; thus, during implementation, differences will occur across counties.

Table 1.2: Overview of bioenergy and oil forest plantations (Unit: thousand hectares)

Species	Planted area until 2010	Planned plantation area until 2020	Provinces with (planned) plantations
Camellia	164.3	1,680	Hunan, Jiangxi, Guangxi, Zhejiang, Fujian, Guangdong, Hubei, Guizhou, Anhui, Yunan, Chongqin, Henan, Sichuan, Shaanxi
Jatropha curcas L.	164.	1,410	Sichuan, Yunnan, Guangdong, Guangxi, Guizhou, Chongqin
Pistacia chinensis Bunge	139.66	710	Shaanxi, Hebei, Henan, Hubei, Anhui, Gansu, Yunnan, Shandong, Zhejiang, Shanxi
Swida Wilsoniana (Wanger.) Sojak	55	630	Hunan, Hubei, Jiangxi
Xanthoceras sorbifolia Bunge	135.7	940	Neimeng, Liaoning, Shaanxi, Gansu, Qinghai, Xinjiang, Shanxi, Hebei, Henan, Jining, Heilongjiang
Sapindus	14	250	Guangxi, Chongqin, Guizhou, Jiangxi, Fujian,

mukorossi Gaertn			Zhejiang, Anhui, Shaanxi, Hubei, Hunan, Guangdong

Source: calculated based on Yang et al., 2013; SFA, 2009c, 2012a, 2012b.

In this study, we focus on the jatropha and camellia programs. Camellia has the largest planting area and jatropha the second largest in China (see Table 1.2). Jatropha was the species on which the FOI's first bioenergy and oil project was centered and it remains the main species of interest. Moreover, it is largely promoted globally with international aid funds. After jatropha faced problems in China, however, the central government initiated specific programs in order to promote camellia planting.

Jatropha is an alien species, introduced to China long ago and now found mainly in the provinces of Guangdong, Guangxi, Yunnan, Sichuan, Guizhou, Fujian, Hainan and other southern provinces. Despite ambitious goals for jatropha planting, many Chinese projects have failed.

Consequently, China's central government began to focus on camellia programs in 2008. Camellia is a typical Chinese perennial oil-producing wood species, native to sub-tropical areas. Camellia has a long cultivation history in Jiangxi, Hunan, and Guizhou provinces, and the oil produced from the seeds is edible (in contrast to jathropha), with biodiesel as a by-product. Now, with several years of selection and biotechnological modification, some high-yield varieties have been selected and prepared for planting in large areas of China. The better varieties demonstrate high yields in experimental stages. In other words, the initial input for smallholders is quite high, but the profit from the new variety is promising. Thus, in this new era, better camellia varieties are promoted in China. Simultaneously, the central government published a list of policies to support camellia planting. Preferential subsidies as well as credit access for camellia programs are provided by the central and provincial governments. International low-interest loans also support these programs through the China Climate Change Framework Loan program (CCCFL).[2] Due to this support, camellia acreage has increased gradually every year since the inception of the programs in 2008. In 2011, camellia afforestation stretched across 235,000 hectares (SFA, 2012b).

Bioenergy and oil forests have also other benefits. They are beneficial for land sustainability, considering global soil deterioration levels. Furthermore, bioenergy and oil

[2] CCCFL is a contract between the European Union and China dating from the EU-China Summit in 2005 and providing for lower interest loans from the European Investment Bank (EIB) to be used for investment in clean, renewable energy for climate change mitigation objectives in China.

forests offer environmentally friendly development with economic and ecological advantages that include lowering greenhouse gas emissions, increasing rural development, and improving food and energy security. Thus, in addition to generating biodiesel, FOI and especially camellia programs also focus on the objectives of combating climate change by afforestation, improving rural livelihood by involving smallholders and stimulating forest investment through the efficient use of forestland.

1.3 Research problems and objectives

China has experienced numerous difficulties in the implementation of national forestry programs. For example, although the PFPs dramatically increased forest area and suppressed deforestation in some ecologically fragile areas, these programs also faced serious obstacles during implementation (Zhang et al., 2008). Some farmers lack interest in these programs due to difficulties in implementation and poor supporting policies (Du, 2004; Xu, et al., 2003). Challenges faced in carrying out the world's largest ecological rehabilitation projects (China's NFPP and SLCP) include a "top-down" administrative approach, a lack of interagency cooperation and long-term planning, and poorly functioning market-based approaches; hence, major policy efforts must be made to successfully implement these projects (Xu, et al., 2006; Zhang et al, 2008). The heavy reliance on the state for project financing, the lack of coordination between the SFA and other agencies and the tremendous social costs inflicted by the projects have not been adequately assessed or addressed (Xu, et al., 2006). Furthermore, the government has neglected to engage local people in program implementation (Xu, et al., 2006; Liang and Mol, 2013). In addition, some PFPs (SLCP, SBDP and the NFPP, for example) are intended to bring benefits and income to poor rural farmers (Liu et al., 2010). Despite the fact that one objective of the SLCP and NFPP is poverty alleviation, participating farmers have by and large seen only moderate increases in income (Xu et al., 2006; Uchida et al., 2007). Because there have been several barriers during the implementation process of the PFPs, the present Forestry Oil Integration programs, as large-scale government-initiated forestry programs, may face similar institutional problems in their implementation as the afforestation programs mentioned above.

However, given the above presented variety of institutional problems, the question arises how to capture them within one analysis. Institutions can in general be defined as "any form of constraint that human beings devise to shape human interaction"(North, 1990, 4; see also Ostrom and Basurto (2011)). These constraints can both be formal – like laws – and

informal – like norms and traditions. In general, formal rules are the written (e.g. legal) rules, while informal rules are unwritten. Adger et al. (2008) provided another rough distinction of institutions, in the "institutional framework" and "institutional arrangements". However, these divisions may not suffice for a coherent analysis of institutional problems in the implementation of bioenergy and oil forestry programs in China.

In investigating the institutional problems faced in China with the implementation of bioenergy and oil forestry programs, this research will employ a framework of institutions as developed by Williamson (1998), where he provides a four-level categorization of institutions. While these four different categories of institutions are rather different in nature, they are understood as influencing each other. As will be further explained below, the institutions treated in this thesis can be placed at different levels of Williamson's framework. This research will concentrate on the role of three institutions: property rights, the governance structure and farmer incentives. They are assumed to significantly influence the implementation of bioenergy and oil forestry programs in China. The framework developed by Williamson, the place of these three institutions in it, and the operationalization of the institutional analysis for each of the three institutions will be discussed in more depth in section 1.4.

Hence, the general objective of this research is to investigate how these three types of institutions impact the implementation of large-scale bioenergy and oil forestry programs, and in particular, whether and how these institutions determine farmers' participation in these programs. This objective is addressed through four research questions as listed below, which are further elaborated upon in the next section:

1. How and to what extent do different forest property rights affect the investment of farm households to maintain the forestry project sustainability? (RQ 1)

2. How do smallholders benefit from large-scale forestry projects under different project implementation regimes? (RQ 2)

3. How are various stakeholders involved in forestry project governance, particularly under long time horizons? And which factors determine a sustained governance of these projects? (RQ3)

4. Which household-level factors determine farmers' participation in large-scale forestry projects? (RQ 4)

1.4 Conceptual and theoretical framework

This study focuses on three institutions that are assumed to play a major role in the implementation of biofuel and oil tree programs in China. Using Williamson's four-level categorization of institutions, this section outlines the conceptual framework for the institutional analyses in this thesis, the operationalization of the institutional analyses at each of the three studied levels using distinct institutional theories (1.4.2) and the specification of the empirical investigation, research sites and data collection (1.4.3).

1.4.1 Four levels of institutional analysis

With his four-layer model of institutions, Nobel-prize winner Oliver Williamson has provided a systematic framework to classify institutions and illustrate how different institutions are related to and embedded in each other (Williamson, 1998). This four-layer model of institutions and institutional analysis is the consequence of his evaluation that, while social sciences have witnessed significant progress in the study of institutions over the past three decades, we are still far from a unified theory and thus should accept pluralism in the study of institutions (Williamson, 2000: 595). Williamson's framework is particularly apt for this study as it combines different disciplines (among which economics, political sciences and sociology) in studying institutions.

Figure 1.5 presents the four levels of institutional analysis as distinguished by Williamson (1998), which form the basis of the conceptual framework of this thesis. Each level represents a distinct type of institutions that can be analyzed with corresponding theoretical and analytical approaches. While the very different nature of institutions at different levels does not allow for direct comparisons or comparative analyses, institutions at different levels can interact with each other. For instance, institutions at higher levels, such as traditions and religion, put constraints on and structure lower level institutions, such as governance and incentive structures.

'Embeddedness' is the top level of the institutional framework. This level contains what Williamson calls informal institutions, such as traditions, customs and norms, that exist within societies. The embeddedness level also extends to and influences the micro-level of network relationships where the role of norms of reciprocity and trust add an important dimension to the informal rules that shape human interaction (Granovetter, 1985).According to Williamson (1998), informal institutions at the embeddedness level often have a

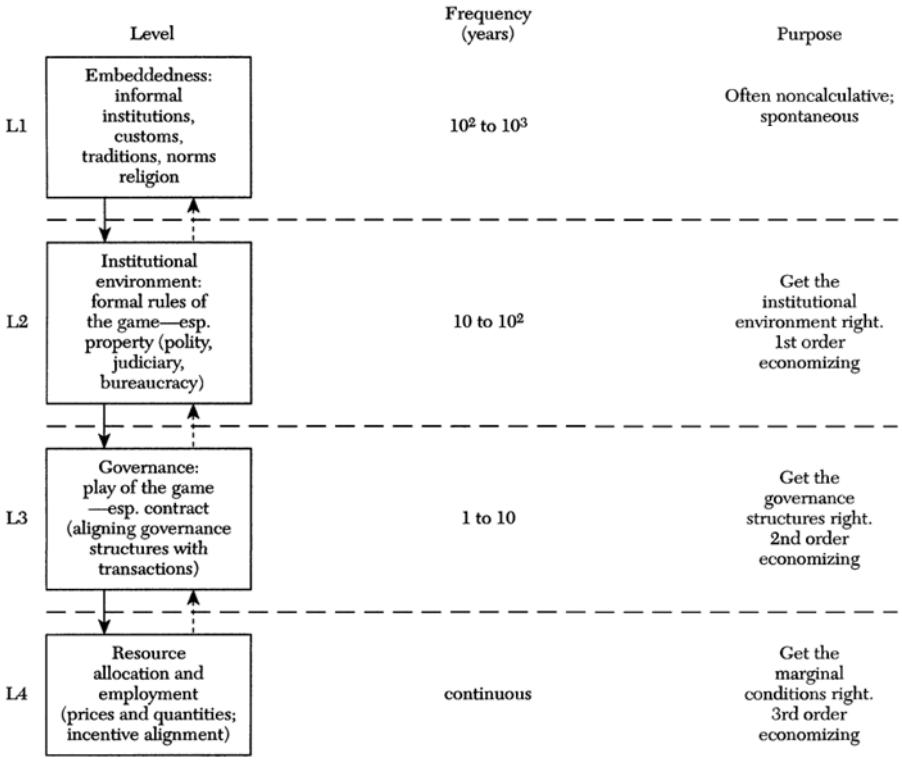
spontaneous origin (third column, Figure 1.5) and they change very slowly (second column, Figure 1.5). As these institutions have a long duration, and this thesis focuses on institutional change through the introduction of large-forestry programs, they were considered out of the scope of research.

The second institutional level of the conceptual framework is referred to as the 'institutional environment' and consists of the set of formal institutions that shape society. Formal institutions or rules of the game include constitutions, or laws and regulations. The purpose of analysis at this level is “to get the institutional environment right”. These institutions change more frequently than institutions at the first level, but are relatively more inert than institutions at the third level.

The institutions of 'governance' are located at the third level of the conceptual framework. The focus of analysis at this level is that of institutional arrangements, for instance contractual relations. The purpose of analysis at this level is to “get the governance structures right”. Transaction costs economics – and more generally the economics of organization – and governance theories are commonly used theoretical approaches that are applied at the governance level. According to Williamson, the transaction becomes the unit of analysis and the organization of this transaction through the governance structure is analyzed in terms of its potential benefits, e.g. to mitigate conflicts or to create mutual gains.

The fourth and lowest level in Williamson's framework includes the analysis of 'resource allocation'. The combination of formal and informal rules and governance structures create a set of incentives to which resource users react. Theoretical approaches that analyze marginal decisions of resource use and allocation include neoclassical analysis and agency theory. The former relies strongly on – potentially distorted – price incentives while the latter gives more attention to the trade-off between ex ante incentive alignment and risk allocation within an exchange relationship.

Figure 1.5: Four levels of institutional analysis



Source: Williamson (1998)

As stated above, each level of analysis represents a distinct set of institutions. In this thesis we focus on three institutions (see the research questions in section 1.3; see also Table 1.3) that are each placed at a different institutional level: property rights are part of the second level, the institutional environment; governance structures are part of the third level; farmers' incentives are part of the fourth level. These three institutions should be further analyzed with different institutional theories, as we still lack an overall theory to adequately analyze such a diverse set of institutions with one theory. The theoretical approaches used for the analysis of each institution are further elaborated below. However, subsequent institutions at different levels are not isolated and interact with and affect each other, also the three selected institutions in this thesis. Hence, analysis of institutions at one level often relates to institutions at other levels (see also the final chapter, section 6.5).

The next section will further elaborate and operationalize how the three institutions – in relation to the four research questions – will be analyzed individually in this thesis, and how interactions between these institutions will be looked at.

1.4.2 Operationalization of the conceptual framework

For each of the four research questions, Table 1.3 relates the research questions to Williamson's levels of institutional analysis, introduces the theoretical approaches used to analyze the institution, indicates the variables that are used in the analysis, and presents the data collection methods. The contents of the table are further elaborated below for each research question separately. The following paragraphs will also outline which relations can be expected between the respective institution and the institutions on other levels of Williamson's framework.

Table 1.3: Framework of Analysis

Research question (RQ)	Corresponding Williamson's level	Type of institution	Theoretical approach	Operationalization variables	Means of data collection	Chapter
RQ 1	Level 2	Property rights	Property rights theory	Tenure regimes Tenure security Residual income rights Residual control rights	Literature and document analysis, key stakeholder interviews and farm household survey	Chapter 2
RQ 2	Level 3	Governance structure	Implementation regime	Local governance institutions, tenure regimes, Project policy, project access, benefit distribution	Literature and document analysis, key stakeholder interviews and farm household survey	Chapter 3
RQ 3	Level 3	Governance structure	Policy arrangement approach	Actors, resources, rules of the game, discourses, Governance/institutional arrangements	Literature and document analysis, key stakeholder interviews and farm household survey	Chapter 4
RQ 4	Level 4	Farmers' incentives	Marginal analysis	Tenure insecurity Information access Household characteristics	Farm household survey	Chapter 5

Research question 1: How and to what extent do different forest property rights affect the investment of farm households to maintain the forestry project sustainability? (RQ 1)

This question focuses on differences in forest property rights, i.e. the second level in Williamson's framework of institutional analysis. Forest tenure regimes constitute the formal rules of how property rights are defined and enforced in the local context. Property rights in most developing countries reflect a diversity of tenure regimes, and property rights regimes are quite complicated under different local contexts (Elbow et al., 1998; Streck, 2009). Since the recent forestland tenure reform in China (a unique change in the formal rules of the game that is still ongoing), forestland and forest resources have been affected by different tenure regimes.

Adding to the existing literature on the implications of tenure security – i.e. the recognition and protection of property rights against acts of others – my focus will be on the effect of different tenure regimes from a new property rights theory perspective. There are two main theoretical approaches in the economic property rights literature. The first, generally referred to as the old property rights theory, defines ownership based on the concept of a bundle of rights, including use, transfer and income rights. The second, the new property rights theory or the Grossman-Hart-Moore (GHM) model, assumes the incompleteness of contracts and analyzes ownership based on residual control and income rights (Barzel, 1997; Besley, 1995; Coase, 1960; Furubotn and Richter, 2005; Hart and Moore, 1990; Williamson, 2000). In this thesis, I analyze and operationalize ownership following the new property rights approach.

Originally, the GHM model was framed as a theory of the firm. Specifically, the decision to vertically integrate (i.e. full ownership of initially separate production units) is based on gaining residual control over assets to influence workers' and managers' incentives. Key in the argumentation is the separation of residual control rights over assets and the entitlement to profit streams (residual income) and the effect of this separation on incentives. In this thesis I operationalize this theoretical approach in the context of bio-energy and oil forestry projects in China. Specifically, the GHM model is operationalized by identifying the degree of residual control over forestry assets and the entitlement to profit streams (residual income) from investments and resource allocation to forestry projects for different forest tenure regimes. Subsequently, the implications are analyzed of a separation of residual control and income rights on households' incentives to invest. The relationship between property rights and incentive alignment is an integral part of this theoretical approach. In terms of the

Williamson framework, linking property rights (level 2) to incentives (level 4) explicitly crosses the boundaries of the institutional levels of analysis. Hence, while the focus of chapter 2 is on property rights for different tenure regimes, I also provide interesting insights on the impact of the institutional environment on resource allocation and incentives.

Chapter 2 will use the case of camellia planting in China to analyze the impacts of differences in property rights in large-scale forestry projects on farm households' investments in forest management. An overview of the forestland tenure reform is given first. Then, the expected incentive effects of present tenure regimes are analyzed on the one hand from the conventional perspective of tenure security and on the other hand from the perspective of the new property rights theory. Finally, whether and how property rights influence household investment is examined using a regression model. Specific explanations will be presented in chapter 2.

Research question 2: How do smallholders benefit from large-scale forestry projects under different project implementation regimes? *(RQ 2)*

The second research question will be addressed in chapter 3 by examining the camellia case study, focusing on level 3 of Williamson's hierarchy. Level 3 examines the institutions of the governance structure and starts from the question which governance structure is more efficient in mitigating conflicts and creating mutual benefits for the different parties to an agreement. The chapter accordingly inquires the effects of local governance on the distribution of benefits. "Benefits" relates this level to level 4, i.e. resource allocation among households participating in the camellia plantation project.

There is a wide diversity of theoretical frameworks available for analyzing governance (see e.g. Adger et al., 2003; Armitage, 2008; Rhodes, 2007). As outlined in the introduction to this chapter, given the difficulties in the implementation of forestry projects, chapter 3 accordingly analyses the governance structures by the means of which projects are implemented. Governance institutions are understood as "institutional arrangements", i.e. "(particular sets of rules) through which decisions are implemented" (Adger et al., 2003: 1100). Chapter 3 specifies these arrangements as "implementation regimes", i.e. the rules and actors that govern the implementation of an institutional arrangement. They stretch across multiple scales and actors, from the county government to smallholders.

Reaching from the county government to smallholders, implementation regimes are also influenced by the institutional environment at the county level. Chapter 3 gives particular attention to how forest tenure regimes influence the implementation regime. Further influences are local governance institutions and project characteristics, resulting in a diversity of implementation regimes. These implementation regimes have various distribution impacts on benefit sharing among smallholders.

While the focus of this chapter is on the governance level of Williamson's framework, linkages are made both to lower and higher level institutions. Tenure regimes (level 2, formal rules) affect and structure implementation regimes of the projects. Local governance institutions (level 3, play of the game) mediate the effects of the tenure regimes. And the forestry implementation regimes affect benefit sharing and incentive structures for local farmers, which are included in the analysis of this chapter (level 4, incentive structures)

Research question 3: How are various stakeholders involved in forestry project governance, particularly under long time horizons? And which factors determine a sustained governance of these projects? (RQ 3)

The third research question, developed in chapter 4, seeks to analyze and understand the failure of two jatropha projects in Sichuan and Guangxi provinces, China, focusing on level 3 of the governance structure. Governance here refers to modes of steering that are no longer the privilege of governmental agencies only, but de facto or de jure the common responsibility of a variety of agencies representing governmental bodies, market agencies and civil society organizations (Leroy and Arts, 2006).

The theoretical framework that forms the basis of this chapter is the policy arrangement approach as developed since the mid 1990s in the Netherlands, and subsequently applied especially, but not only, to environmental and natural resources conflicts and governance in different countries (e.g. van Tatenhove et al, 2000; Arts and van Tatenhove, 2004; Arts et al., 2006; Liefferink, 2006). The policy arrangement framework has also been applied fruitfully to analyzing forest policy and governance (e.g. Arts and Buizer, 2009; Veenman et al., 2009; Wiersum et al., 2013). The policy arrangement approach focuses on the – interdependent – actors in their coalitions; the division of power between these actors, where power refers to "the mobilisation, division and deployment of resources" (Arts et al., 2006: 99); the rules of the game; and the ongoing discourses to analyze the functioning and

change of governance structures and institutions (see Arts et al., 2006).While useful for higher-level policy levels, the concept was deemed less applicable to arrangements that, while implemented within the frame of a policy-arrangement, do not involve policy actors. For arrangements that implement policies and targets on the ground, the concept "institutional arrangement" will be used. Institutional arrangements can be related to a variety of actors, and do not necessarily have to include policy actors.

In chapter 4, the institutional arrangements of two very distinct jatropha projects are analyzed: one characterized by a conventional strong government-driven arrangement, and another characterized by a more novel market-driven institutional arrangement. Government- and market-driven arrangements are analyzed with respect to the actors (relations) involved, decision-making and power (hence, resources), types of contracts and coordination mechanisms (rules of the game in terms of the policy arrangement approach).The chapter also compares government-driven arrangements with market-driven arrangements in regard to whether and how they reduce uncertainty about future outcomes among involved actors over a long period of time. Hence, a long time horizon perspective (Hoogstra and Schanz, 2009) is integrated to understand the failures of institutional arrangements.

The analysis links to institutions at other levels. In chapter 4, focus will be on the influence of the administrative system and its influence on the time horizons of administrations (level 2, institutional environment), as well as the legal institutional environment. They crucially impact the "play of the game" in unexpected and contra productive ways.

Research question 4: Which household-level factors determine farmers' participation in large scale forestry projects? (RQ 4)

The final research question is analyzed in the fifth chapter and focuses on level 4 of Williamson's classification of institutions. Level 4 moves from discrete structural to marginal analysis, dealing with efficient incentive alignment (Williamson, 1998). How well institutions solve the problems of coordination and production is determined by the intentions, reasons and motives of acting agents (North, 1990; Giddens, 1984, 1990). Hence, farm household incentives are analyzed quantitatively starting from a neoclassical theoretical perspective (Rogers, 1983; Besley, 1995; Otsuka et al., 2001; Brasselle et al., 2002).

The focus of this chapter is on the 4th level of institutional analysis using the corresponding theoretical basis of neoclassical, marginal analysis. This theoretical basis is operationalized by focusing on the role of risk attitude and uncertainty about future returns on investment in the household decision-making process. In the empirical analysis, this leads to the inclusion of variables related to household characteristics and access to information. However, explicit linkages are also made that cross the different levels of Williamson's framework. Specifically, the effect of differences in property rights (level 2) is analyzed by looking at the role of tenure insecurity for household decision-making.

Chapter 5 determines farmers' participation in large-scale camellia projects, as well as which parameters affect farmers' participation in international and national projects. A probit model and bivariate probit model are applied econometrically to test the derived hypotheses.

1.4.3 Program characteristics, site selection and data collection methods

Following the general overview of China's bioenergy and oil forestry program development in section 1.2.2., I now provide a discussion of the program characteristics of the jatropha and camellia projects, the study site selection and the data collection methods.

General characteristics of the jatropha and camellia programs

Forest-based biodiesel has attracted significant attention by policy makers and biodiesel industrial companies in China. As a result, the Chinese government devised a series of laws and policies to promote energy crops including jatropha. Moreover, in the Eleventh Five-Year Plan for oil-breeding energy forests, published by the SFA in 2006, an FOI program was formulated in which jatropha plantations were to be increased in 3 provinces: Sichuan, Guizhou and Yunnan (SFA, 2006). Through these programs the state gives subsidies to demonstration and pilot jatropha projects. Provinces also published regulations, policies and subsidy schemes to support the jatropha program. Within the jatropha program, government-driven projects and market-driven projects are implemented (see chapter 4). Government-driven projects are set up between state-owned oil companies and SFA to promote jatropha plantations and jatropha based biodiesel production. CNPC, China's largest state-owned oil company, first entered in a collaborative relation with SFA; two other major state-owned oil companies, Sinopec Group and CNOOC, later joined this cooperation. These projects are implemented with a high involvement of local and higher level government

authorities and organizations. Market-driven projects are set up between private companies and other market stakeholders such as farmers, as part of the jatropha program. Accordingly, the case of a government-driven jathropha plantation project was selected in Sichuan and the case of a market-driven project was selected in Guangxi.

The Chinese government started the large-scale camellia program in 2008 with the objective to plant 1,68 million hectares of camellia by 2020 in China (SFA, 2009). The camellia program is focused on a large number of provinces (see Table 1.2) and supported by a number of policies from the central government and often by subsidies from the central financial budget for planting camellia. In Jiangxi province (our case study area), two types of projects can be distinguished in the camellia program: projects financially supported by the government, and projects (also) financially supported by international projects and donors. Government projects are subsidised from the central financial budget, called 'Modern Camellia Demonstration County' (Xiandai Youcha Shifan Xian Xiangmu), through the MOF and SFA. Apart from central financial support, also provinces and counties provide financial support from their provincial and county financial budgets. Farmers who participate in camellia projects receive subsidies. Some projects are also internationally financed, for instance the European Investment Bank financed the project 'Jiangxi Biologic Energy Forest Demonstration Base Construction'.

Data collection

Three methods of data collection were used: secondary data collection, in-depth interviews with stakeholders, and farm household surveys (see Table 1.4). Through these methods, information and data about bioenergy and oil forestry policies, implementation and performance of bioenergy and oil forestry programs and the forest tenure reform process have been collected at different administrative levels. Household activity data has also been collected through questionnaires.

Table 1.4: Data collection methods

Data collection methods	Tools	Data sources
Secondary data collection	Government databases and websites	Policy documents, statistical data, laws and regulations at national level, provincial level and county level

In-depth interviews	Semi-structured Face-to-face	Provincial level: officials in provincial forestry department County level: officials in county forestry bureaus Village level: village leaders and natural village leaders
Survey	Questionnaires	Village level: village leaders from 30 villages 308 farm households

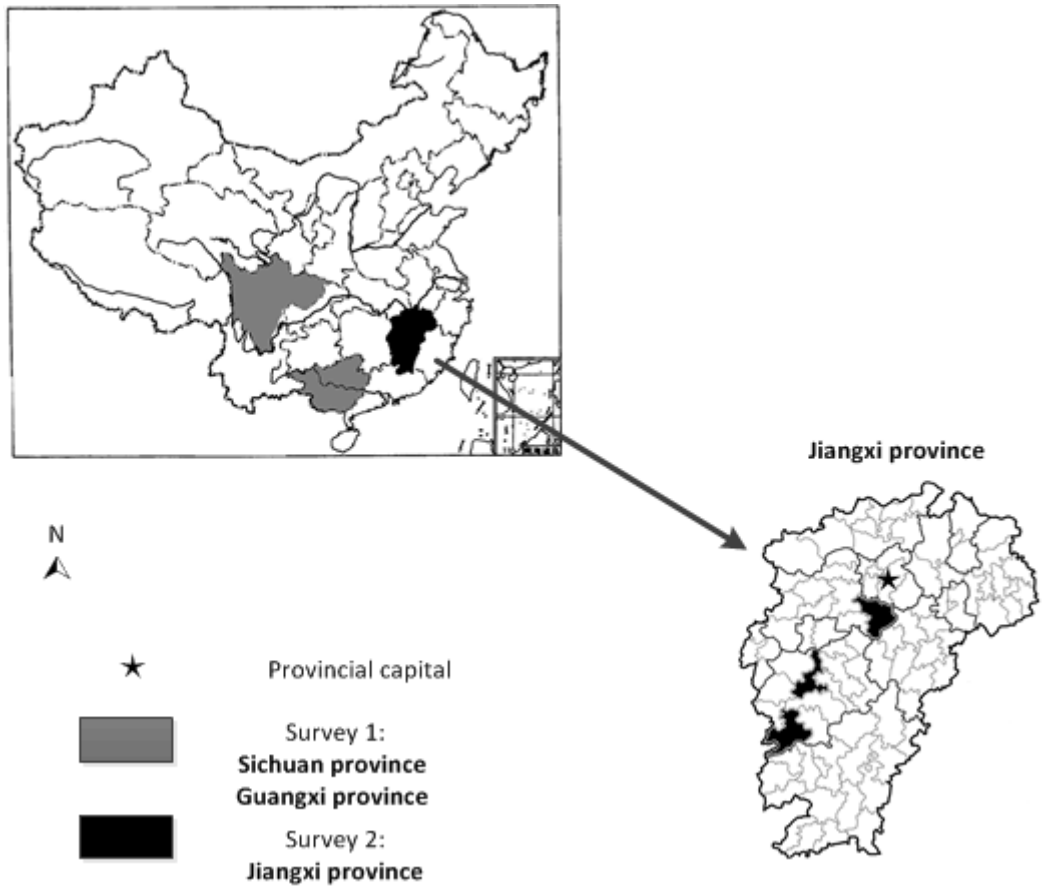
Source: author's survey.

Because of restrictions on time and resources, it was not possible to include all possible oil forest and bioenergy species in the research design (see Table 1.2). Hence, only the most representative species were used: jatropha, which is also globally promoted, and camellia, the only species promoted in China in a significant way after 2008. Moreover, both species have high planting targets and large planting areas, which also indicates that these two species are the most influential in large-scale programs in China.

Survey 1: Jatropha planting

The fieldwork on jatropha was carried out in 2010, with in-depth semi-structured interviews with key stakeholders and document analysis as the main research methods. Decision makers from the provincial level to village committees were included. More specifically, interviews were conducted with officers of provincial forestry departments in charge of jatropha projects, officers of county forestry departments in charge of the jatropha plantations, township forestry officers in areas where jatropha was planted, and leaders of villages taking part in jatropha plantation. Moreover, interviews with scientists as well as NGO spokespeople were conducted. Sichuan Province and Guangxi Province were selected as data collection sites (see Figure 1.6), as both provinces have suitable subtropical climatic conditions to grow jatropha. Through the interviews, project initiation and implementation processes were revealed, as well as reasons for ceasing planting. In Guangxi, previous project demonstration plots were also visited.

Figure 1.6: Map: Survey Area



Survey 2: Camellia planting

The camellia fieldwork was undertaken in Jiangxi province in 2011 (Figure 1.6), using document analysis, in-depth semi-structured interviews with key stakeholders, and fully standardized farm household surveys. Qualitative data on the extent of formal use, income and transfer rights in the context of collectively owned forestland were assembled from official documents. Furthermore, more detailed information on stakeholders' participation in decision making, contracts and coordination mechanisms were collected through stakeholder interviews. In order to examine the regression model, quantitative data were collected through farm household surveys.

First, a pre-test was conducted to examine the questionnaire as well as to decide on survey plots. During the pre-test, three offices in the Forestry Department of Jiangxi Province were visited. The domestic camellia project and international project policies and their implementation were discussed in the interviews, as were tenure reform policies and present forestry management governance. Based on secondary data analysis, Ji'an, Suichuan and Fencheng counties were chosen among those counties which took part in camellia projects

based on economic level and history of camellia tree cultivation. Then, these three counties were visited to continue the pre-test of the questionnaires and make decisions on which villages to visit. In the counties, officers from county forestry bureaus were interviewed first; additionally, in each county, two villages were visited to pre-test and assess the village and household questionnaire design. Finally, based on the local visits, Ji'an, Suichuan and Fengchen counties were confirmed as the survey area (see Figure 1.6).

The questionnaire was revised based on the pre-test results, and student survey team members were trained. During the survey period, a 12-member survey team travelled to different households, filling out the questionnaire through face to face interviews. Village questionnaires were administered to collect basic demographic information and socio-economic data and were structured in six parts. Part 1 covered the basic information about the village leader. Part 2 covered the basic information about the village. Part 3 covered the subsidy situation in the village, and part 4 covered the forestry sector situation. Part 5 covered participation in forestry programs and the implementation of the camellia program. Part 6 covered the forestry tenure condition. Farm household surveys were carried out to gather qualitative and quantitative data on household characteristics, household forestry activities, including camellia plantation activities, and forest tenure regimes. The household questionnaire consisted of seven parts. Part 1 covered the farm household structure and its basic characteristics. Part 2 covered land holdings and forestry management per plot. Part 3 covered camellia plantation management. Part 4 covered the knowledge of previous forestry programs and camellia program policies. Part 5 covered house assets holding and their value. Part 6 covered loans, and part 7 covered forestry tenure. The village and farm household questionnaires have been included in Appendix A. In summary, several staff members from three forestry offices in Jiangxi Province, the county forestry bureaus in the three counties, seven township forestry stations, and village leaders in 30 villages and 12 natural villages were interviewed. In Suichuan County and Fengchen County, 14 villages were selected, and two villages were selected in Ji'an County. In each village, around 10 households were chosen, for a valid sample of 308 households from 30 villages.

1.5 Outline of the thesis

The remainder of the paper thesis is structured as follows. Chapter 2 analyzes whether and how different tenure regimes affect individual farm households' investment in forestry projects. Chapter 3 discusses the benefit distribution of camellia programs to smallholders at

the local level under different local governances with international and national financial arrangements. Chapter 4 explores the failure of jatropha projects in China and discusses how government- and market-driven arrangements try to involve the various stakeholders, particularly under long time horizons, and what may be the source of failure in these arrangements. Chapter 5 investigates the determinants of farm household participation in national and international camellia projects. Chapter 6 concludes the thesis and provides policy recommendations and future research recommendations.

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Chapter 2. Property rights effects on farmers' management investment in large-scale forestry projects - the case of the camellia in rural China[3]

Abstract: Since forestry plays a crucial role in the ecosystem and as carbon sinks, international organizations and governments in developing countries are increasingly setting up large-scale forestry projects. Furthermore, devolution from a centralized forestry governance structure has become a trend in many developing countries. China's central government has carried out a series of collectivization and de-collectivization attempts of forest tenure over time, which led to multiple forest tenure systems and management arrangements within a province. The aim of this paper is to investigate whether the motivation of farmers to maintain forestry is sustained under different forest tenure regimes. First, farmers' incentives to manage forest resources under different forest tenure regimes are discussed conceptually based on the notions of tenure security and residual control and residual claims to income streams. Second, an empirical model based on the data from Jiangxi province is carried out. The estimation results show that various tenure regimes have different effects on household labour and variable input use within large-scale forestry projects. The fertilizer and pesticides input from a farm household under a partnership regime is significantly higher than under the individual property rights regime. Moreover, farm households under company and collective-individual regimes have lower variable input levels.

Keyword: Forestry, forest tenure, farm household, household investment, China

2.1. Introduction

Forestry provides a variety of products and services to improve rural livelihoods, but also contributes to regional and global ecosystem stability (FAO, 2011; FAO, 2012). One of the services that receives increasing attention in recent years is that of serving as a carbon sink. As forests remove carbon dioxide from the atmosphere, the conservation of forests helps to

[3] This chapter is based on Li, J., Bluemling, B. Dries, L., Tenure regime effects on farmers' investment in large-scale forestry projects - the case of the camellia in rural China, submitted to World Development.

mitigate climate change. Therefore, international donor organizations and governments in developing countries have been setting up large-scale projects in which farmers are provided with financial and technical support for continued forest conservation and afforestation. Recent examples are REDD+ and domestic carbon offset projects (see e.g. Ristea and Maness, 2009).

These projects however have been criticized for creating incentives towards centralized governance, as well as for putting community tenure rights at risk (Sandbrook et al., 2010; Larson, 2011). Starting in the 1980s, governmental forest tenure regimes in developing countries have been increasingly devolved to community-based forest tenure institutions (Edmunds et al., 2003). In many parts of Africa and Asia, customary land tenure institutions were furthermore formalized into clearly defined land tenure institutions (Otsuka et al., 2000; Place and Otsuka, 2000; Suyanto et al., 2001), therewith recognizing decentralized customary institutions as institutions in their own right. The devolution of forest tenure, and the recognition of customary land tenure institutions, aimed at a more equitable resource management under the responsibility of communities. Community-based resource management is furthermore assumed to lead to a more sustainable use of a resource (see e.g. Suyanto et al., 2005; Sandbrook et al., 2010; Ambus and Hoberg, 2011).

Particularly in Asia, forest tenure regimes have undergone significant changes in recent decades (Dahal et al., 2011). China is one of the countries where the central government, since the 1980s, carried out a series of forest tenure reforms. In the early 2000s, it started a further forest tenure reform allocating a large share of decision-making power over forest tenure and use rights to the village level. Under a variety of local socioeconomic conditions, this led to villages establishing a diversity of forest tenure and management arrangements within a province (Liu, 2008; Sun, 2008). With such a variety of local forest tenure regimes, China is an interesting case for comparing the effects of large-scale forestry projects under different kinds of decentralized forest tenure regimes.

The aim of this paper is hence on the one hand to investigate whether large-scale forestry projects have indeed led, against previous devolution trends, to a (re)centralization of forest tenure. On the other hand, for achieving a forestry project's long-term goals, the motivation of farmers to maintain forestry, i.e. to invest labour effort and inputs in forestry under different forest tenure regimes, becomes important. A number of recent contributions to the literature have investigated the relationship between tenure rights and investments in China (see e.g. Ma et al. (2013) for an analysis of investments in agricultural land

improvements and Qin and Xu (2013) and Xie et al. (2013) for an analysis of investments in forest management practices). This chapter contributes to the literature by looking at the impact of property rights on farmers' investment incentives not only from the conventional tenure security perspective, but by adding a dimension of analysis based on the New Property Rights Theory. In line with this theory, incentives are not only affected by the security of property rights but also by the distribution of residual control and income rights as a result of the incompleteness of property rights definition. The second objective of this chapter is therefore to apply this extended framework of property rights to different tenure regimes in the context of Chinese oil and bioenergy forestry projects and to derive implications for household incentives and management investments in forestry projects.

In this respect, it is important to point out that throughout the chapter I will refer to management investments measured in terms of labour and variable input use. While this use of the term investment differs from the traditional interpretation in the field of (agricultural) economics, it is in line with studies by Qin and Xu (2013) and Xie et al. (2013) which refer to farmers' investments measured by chemical fertilizer and labour input and forest management investments measured by labour and money input, respectively. In line with these authors, I believe that property rights can also have a substantial effect on these types of incentives and investment decisions, and this holds especially in the case of forestry crops where the benefits from management investments today may only be accessible after a long gestation period.

The remainder of this paper is organized as follows. The second part provides background to the forestry reforms that the Chinese central government has carried out since the 1980s. It describes why the devolution of forest tenure rights led to a multitude of tenure regimes. In section three, I introduce the conceptual framework for analysis of the different tenure regimes and their link with household investment incentives. Section 4 explains survey site selection and data collection, and presents the model to be used for the analysis of the survey data. Empirical results are presented in Section 5. This section starts with qualitative results of the surveyed tenure regimes. I show whether, with the realization of plantations within forestry projects, a recentralization of tenure rights has taken place. Through the application of the previously developed framework, I furthermore provide assumptions about the likely level of incentives under the different regimes. After a brief presentation of descriptive statistics in section 5.2, I develop assumptions in section 5.3 and provide evidence of the effect of the different tenure regimes on farmers' management investment in forestry. These results are discussed in section 6. Section 7 concludes the paper.

2.2. Background

China experienced a series of property rights reforms since the foundation of the People's Republic. These reforms on the one hand resulted in the present complexity of China's forest tenure regime. On the other hand, they created uncertainty over forest property rights and respective investment returns for farmers. Three phases of tenure reforms can be distinguished, i.e. a centralized phase, and two phases of devolution of forest tenure rights.

Centralized phase (1950-1982)

When the People's Republic was founded in 1949, some forest areas were distributed to rural households, while the rest was nationalized.[4] However, the forests that had been distributed to households were collectivized in 1955[5] and from then on, only scattered trees around homesteads were still managed by households (Liu, 2001). These scattered trees finally also became collective property with the creation of the People's communes in 1958 (Liu, 2001), only to be designated as household property again in 1961.[6] However, from 1966 until the 1980s, in the frame of the Cultural Revolution, the rights to these trees were de facto taken away once more by the collective (Liu and Edmunds, 2004). In conclusion, during the centralized phase, only the scattered trees were private for a while, and finally became collective; forests that belonged to households in the very beginning of the People's Republic became collectivized.

First Devolution (1981-2003)

In China, ownership of forestland, according to the Constitution and the 'People's Republic of China Forest Law', belongs to the state or collective. In 1981, the Chinese Communist Party and the State Council started a reform to transfer the management of collectively owned forestland to farm households. This devolution, as well as the following one, addressed collectively owned forestland mainly.

[4] 'People's Republic China Land Reform Law' published by the People's Government Committee in 1950.
[5] 'Agreement on Agricultural Cooperatives' published by the Chinese Communist Party in the 7th committee meeting.
[6] 'Regulation on Property Right Settlement, Forest Protection and Forestry Development (Pilot draft)' ('Forestry 18 regulations' in short) published by the Chinese Communist Party.

The reform introduced the so-called "forestry responsibility system" for collectively-owned forestland[7], comparable to the "household responsibility system" that had been established for agricultural land. The purpose of the reform was to better define forestland property rights to offer security of investment, i.e. to stimulate households to plant trees and manage forest resources sustainably (Xu et al., 2010; Enters et al., 2003). Two important laws were issued that can be considered the foundation of forestland property rights in China.[8] According to these laws, the ownership of forestland remains with the government or the collective, however, individuals can exercise varying degrees of authority over species selection, harvesting practices, sale and use, as well as the distribution of benefits (Edmunds et al., 2003).

After its implementation in some pioneering provinces, the reform led to large-scale deforestation. Given the experiences of collectivization between the 1950s and 1970s, farmers lacked confidence in forest tenure (Liu and Edmunds, 2004), which is why they aimed for short-term gains and logged trees. In 1987, in an attempt to stop deforestation and to strengthen forest resource management, a new policy directive was issued by the Chinese Communist Party and the State Council. The new directive stopped the further devolution of large areas of timber forestland to households. Townships had to organize the protection of already devolved forestland, and in some areas, the village reclaimed the forestland from the households (Xu et al., 2010).

In conclusion, the first devolution of forest tenure, which is a milestone in Chinese forestland property rights history, was not fully and successfully implemented.

New round of devolution (2003 – present)

After the first devolution failed, forestry went back to de jure collective management, and logging was strictly controlled through cutting permits. However, a new devolution attempt started in 2003, with the issuing of the '*Decision about accelerating the development of forestry*'. Fujian, Jiangxi, and Liaoning provinces began the new collective forestland tenure reform as pilot provinces. With the issuing of further supportive policies to strengthen the

[7] The Chinese Communist Party and the State Council publishedthe 'Decision about several questions in forest protection and forestry development'.

[8] 'People's Republic of China Constitution' accepted in the fifth Standing Committee meeting of the National People's Congress in 1982; and 'People's Republic of China Forest Law' accepted in the sixth Standing Committee meeting of the National People's Congress in 1984(revised in the ninth Standing Committee meeting of the National People's Congress in 1998).

reform by the Chinese Communist Party and the State Council in 2008, also other provinces started the devolution of forest tenure rights.

The devolution foresaw that a new forest use regime should be decided by a majority vote of two-thirds of all villagers or of the village council (Xu et al., 2010). The user rights of collective forestland then are devolved through a lease contract of 70 years (forestry responsibility system). While the main objective of the reform is to devolve the user rights of forestland to farm households, it does not provide blueprints for the kind of management schemes to be applied. Some villages, for example, chose to keep collective management (interview with county Forestry Administration Officer). Under the premise that the most efficient management mode shall be implemented, and that a majority vote within the village will decide about the kind of management regime, the government would not intervene into such a decision.

The resulting forest tenure regimes

As a result of the devolution, multiple forestry management practices under various tenure regimes exist, involving a diversity of actors (Liu, 2008). Tenure regimes furthermore are the result of the different physical and socio-economic conditions as well as different governance arrangements at the village level.

Based on these local variations, the literature so far has categorized different kinds of forest tenure regimes in China. According to Holden et al. (2011) and Xu et al. (2008), five tenure categories can be identified. Three of them resemble tenure categories in other countries, i.e. Family Management (managed by an individual farm household), Partnership (a group of farmers form a partnership on a voluntary basis), or Outsider Management Contracts (contracted out to an individual or organization). Two further tenure categories are closely related to China's administrative structure. In China, an "administrative village" (xingzhencun) is an administrative entity for several "natural villages" (zirancun). While the administrative village is headed by a village council, the natural village does not form part of the formal political structure. It is ruled by what Xu et al. (2008) refer to as the "villagers' group" or "a cluster of families". Accordingly, they distinguish two further forest tenure categories, i.e. Management by a Villagers' Group (managed by a cluster of families living in the same neighborhood, often comprising one natural village), and Collective Management (managed by an administrative village council).

Sun (2008) defines four types of property rights regimes, i.e. Individual (equal to Family Management), Partnership, Natural Village Collective Management (equal to Management by a Villagers' Group), and Administrative Village Collective Management (equal to Collective Management). The following section will outline the conceptual framework with which we will analyze in how far these tenure regimes may have different impacts on farmers' investment in forestry.

2.3. Conceptual framework

Our analysis is based on the concept of tenure security. It is claimed that tenure security is crucial for farm households' production incentives in forestry. I first provide a brief discussion of the concept of tenure security. Next, I introduce the New Property Rights Theory (NPRT) which will be applied in the analysis of the tenure regimes in section 5. I argue that the NPRT allows to add more depth to the analysis because it complements the conventional notion of tenure security. Finally, I review the literature that relates property rights to investments in agriculture and forestry.

2.3.1 Tenure security

Land tenure is an institution. It exists of the legal or customarily defined rules that define how property rights to land are allocated within societies. Rules of tenure define how access to land is granted, who has rights to use, control and transfer the land and which associated responsibilities and constraints exist. In other words, land tenure systems determine who can use what resource for how long and under what conditions. Land tenure security can then be defined as the certainty that a person's rights to land will be recognized and protected against the acts of others (FAO, 2002).

Land tenure security can be weak because of conflicts of interest between different parties in society. FAO (2002) distinguishes four potentially intersecting interests: (i) overriding interests exist if a sovereign power can expropriate and reallocate land; (ii) overlapping interests occur when different parties are assigned different rights to the same land; (iii) complementary interests exist when different parties share the same interest in the same parcel of land, for instance on communal grazing grounds; (iv) competing interests exist when different parties contest the same interests in the same parcel. In the case of China, for example, overriding interests over land may occur because government authorities have the power to expropriate land for further land reforms. Furthermore, overlapping interests can

exist in the case of a collective tenure regime in which individuals share the rights to use and benefit from the land.

Arnot et al. (2011) provide an overview of the concept of tenure security in a forest management context. They distinguish between on the one hand tenure security based on assurance and on the other hand tenure security based on substance of rights. Tenure insecurity in terms of assurance refers for example to the uncertainty of rights, the probability of losing rights, uncertainty over changes in government policy or the probability of non-extension or renewal of rights. Studies that investigate tenure security in terms of substance have used indicators such as the duration of rights, the legal title to land, renewability of rights and the right to sell or transfer land.

An important distinction that can be made is that assurance type tenure security is based more on individuals' perceptions of security, while substance type security relates to actual attributes of tenure as defined by customary, legal or contractual rules. According to FAO (2002) security of tenure cannot be measured directly and people's perceptions about security will therefore be the basis for their investment decisions. The reason for this is that attributes of security will change depending on the context (e.g. length of the growing season or gestation period). In line with this view, several authors have criticized the use of substance attributes of tenure security, such as holding a legal title to land, for not adequately representing the perceptions of individuals about tenure security (see Arnot et al. (2011) and Ma et al. (2013)). The majority of studies that have investigated the effect of tenure security on investments from the assurance perspective have focused on the risk of expropriation, or in terms of the FAO's intersecting interests, the effect of overriding interests on land.

In general, there are two main ways in which security of property rights over land can encourage investments: through increased assurance that investors will be able to reap the benefits from their investment; and through improved access to funds, also called the collateralizability effect (Arnot et al., 2011; Besley, 1995; Ma et al., 2013). In the case of management investments, i.e. the investment of variable inputs and labour effort, the focus will be especially on the former effect. In section 3.2, I will provide an extension to the discussion of the role of tenure security for explaining management investment decisions. My claim is that household incentives are not only affected by uncertainty over the protection of property rights but also by the allocation of property rights in itself. In other words, even with secure property rights – in the sense that the perception of expropriation risk is minimal – investment incentives may be low if there is uncertainty over the claim to the benefits of the

effort and variable input investments that have been made. It could be argued that such uncertainty may arise for example in the case of overlapping or complementary interests over land (see FAO, 2002) and hence presents an additional dimension of land tenure security. At the core of this discussion is the notion that all contracts – no matter if they are based on legal, customary or contractual rules – are incomplete. Investment incentives are therefore also importantly driven by what is not specified in laws or contracts. This novel perspective was formalized in the New Property Rights Theory (NPRT). To clarify the distinction with the "old" property rights theory, I start the following section with a discussion of this perspective.

2.3.2 Property rights theory

Furubotn and Richter (2005: 5) defined property rights as embracing "the rights to use and to gain benefits from physical objects or intellectual works and the rights to demand certain behavior from other individuals". Property rights have long been considered as a bundle of rights (see Table 2.1), with property being defined as a set of rights that describe what people may and may not do with resources; the extent to which they have them at their disposal, can use, transform, transfer them or exclude others from their property (Furubotn and Richter ,2005; Slangen et al., 2008). Empirical research on farmers' land tenure often has used this understanding of property rights as a bundle of rights (Besley, 1995; Brasselle et al., 2002). Following this approach, investment incentives would be higher, the more rights an individual can capture from the total bundle of rights to land. In other words, the incentives for an individual to invest in an asset, e.g. forestland, are stronger if he/she holds a larger share of the bundle of rights. However, this "old" property rights theory may not capture the complexity at stake in developing countries, and particularly not of current multiple forest tenure regimes in China.

Table 2.1: Components of the bundle of property rights on forestland

Description	Type of right
The right to use the forestland	User rights
The right to capture the returns of the forestland	Income rights
The right to change the functions of forestland	Alteration rights
The right to exclude others from the forestland	Exclusion rights
The right to transfer the forestland to others through the market	Transfer rights

Adapted from Furubotn and Richter (2005) and Slangen et al. (2008).

The New Property Rights Theory (NPRT) – also referred to as the Grossman-Hart-Moore model of property rights (see also chapter 1.4.2.) – came to the forefront with the development of transaction costs economics and incomplete contract

theories (Coase, 1960). Two basic questions lie at the heart of the NPRT: (i) how can a society (or organization) create incentives for its members that will lead to efficient behavior?; (ii) how can resources be allocated efficiently among members of the society? The starting point for NPRT is that these two questions are closely related because the allocation of resources also affects the incentives of individuals. In essence, the NPRT then investigates the optimal allocation of property rights with respect to the incentive alignment of economic actors. However, property rights are considered as incomplete contracts because under conditions of bounded rationality and environmental uncertainty it is impossible to specify complete contracts. Hence, some details of allocation and use of the resource are left to future specification or the discretion of economic actors. This leads to the notion of residual rights and claims over resources (Grossman and Hart, 1986; Segal and Whinston, 2013).

The notion of property rights is closely related to that of residual claimancy, which depends on the owner's ability to exercise residual control rights over the property and to derive residual income from it (Barzel, 1997). Central in NPRT is the question of who has the residual control rights and who has the residual income rights (Slangen et al., 2008). The residual control right is the right to make any decision concerning an asset that is not explicitly controlled by law or assigned to another person (or organization) by contract. The residual income rights are the rights over the residual income which is the amount that remains from the gross-return of a company, activity, good or service after all the contractual commitments are fulfilled (Slangen et al., 2008). In the discussion of property rights and the respective incentives to make productive investments in land, NPRT states that incentives will be maximized if residual control rights and residual income rights are with the same decision-maker. Separating control of the assets would therefore reduce the incentive to invest (Hart and Moore, 1990). Moreover, rights to determine how to use the land are regularly ignored but have significant impacts on households' inputs (Markussen et al., 2011).

In the next section, I will provide a brief overview of existing studies on the relationship between property rights and investment incentives. Most studies focus on the effect of tenure security, either from the assurance or the substance perspective. My analysis in section 4 will contribute to the existing literature by adding the dimension of residual claimancy to the discussion of property rights effects on management investments.

2.3.3 Property rights and investments

The evolution of property rights and their effects on investment are central issues in the development literature (Besley, 1995). Land tenure security is expected to positively influence investment in land, as it improves the claims on benefits from the investment, access to credit markets and gains from land trading with other farmers (Besley, 1995; Fenske, 2011; Ma et al., 2013). Several studies have investigated the relationship between land tenure security and investment (Goldstein and Udry, 2008; Zikhali, 2010; Deininger et al., 2011; Beekman and Bulte, 2012).

For crops with long gestation periods like trees, property rights are essential for providing management incentives (Holden et al., 2011). Since forestry requires long-term investment, the security and capacity to reap future benefits is crucial. Zhang and Pearse (1996) present empirical evidence on the relationship between different kinds of forest tenure and investment in silviculture in British Columbia, finding that investment under private ownership is higher than under forest licenses. They support the hypothesis that more secure forms of tenure over forestland lead to improved reforestation and more intensive silviculture. Nautiyal and Rawat (1996) find that the duration of tenure and its security are crucial attributes for investment by forestry firms; longer and / or more secure tenure will attract more capital. In a literature review, Godoy (1992) discusses the factors that affect smallholders' tree cultivation. Tenure security appears to be the most important determinant, next to output prices. Simmons et al. (2002) found that tenure security affects tree plantation. Also Mekonnen (2009) shows that land-tenure insecurity influences the decision to grow trees. The study of Ali et al. (2011) suggests that more secure and transferable land rights promote long-term investment such as in perennial trees. Koo (2011) found that formalizing land rights induces farmers' investment including the planting of trees.

For China, only a few studies exist that discuss the influence of forest tenure on forest management. Land rights do have impact on household decision-making because village collectives officially own the land but some individual households have fixed-term contracts to use the land for their own production activities (Mullan and Kontoleon, 2011). Based on a comparative qualitative analysis, Gao and Zhang (2012) find that the recent forestland reform that intended to increase households' forest tenure security and decision-making power, indeed increased farmers' motivation to invest. As a result, rural farmers' income increased and natural resource conservation and biodiversity improved. The forestry reform furthermore gave farmers greater power to make decisions about their forest management (Liu, 2008; Gao

and Zhang, 2012). The study of Sun (2008) found, based on qualitative research, that monetary investment and labour investment per unit of land is higher for individual management than under partnership management. The lowest investment intensity was observed under systems with management by the collective. Finally, a number of recent academic contributions has also quantitatively investigated the impact of property rights reforms, land rights and tenure security on forestry management investments in China (Qin and Xu, 2013; Xie et al., 2013).

Literature hence suggests that for long-term forestry projects, tenure security is crucial to maintain farmers' investment. In section 4, we will add the dimension of residual claimancy to this discussion of property rights effects on incentives.

2.4. Methodology

2.4.1. Data collection

Jiangxi province was selected as the survey area because it is the second province to start the new forest tenure reform, and collective forest tenure covers around 85% of the total forest area. Furthermore, a number of large-scale forestry programs have been implemented in Jiangxi.

Jiangxi province is located in the south of China (see Figure 2.1) and is one of the most forest-abundant provinces with 158 million mu[9] (10.54 million hectare) of forestland (National Bureau of Statistics of China 2011). The forest coverage rate is 58.32% which is nearly three times higher than the national average of 20.36%. Jiangxi ranks second among China's provinces in terms of forest coverage (National Bureau of Statistics of China 2011).

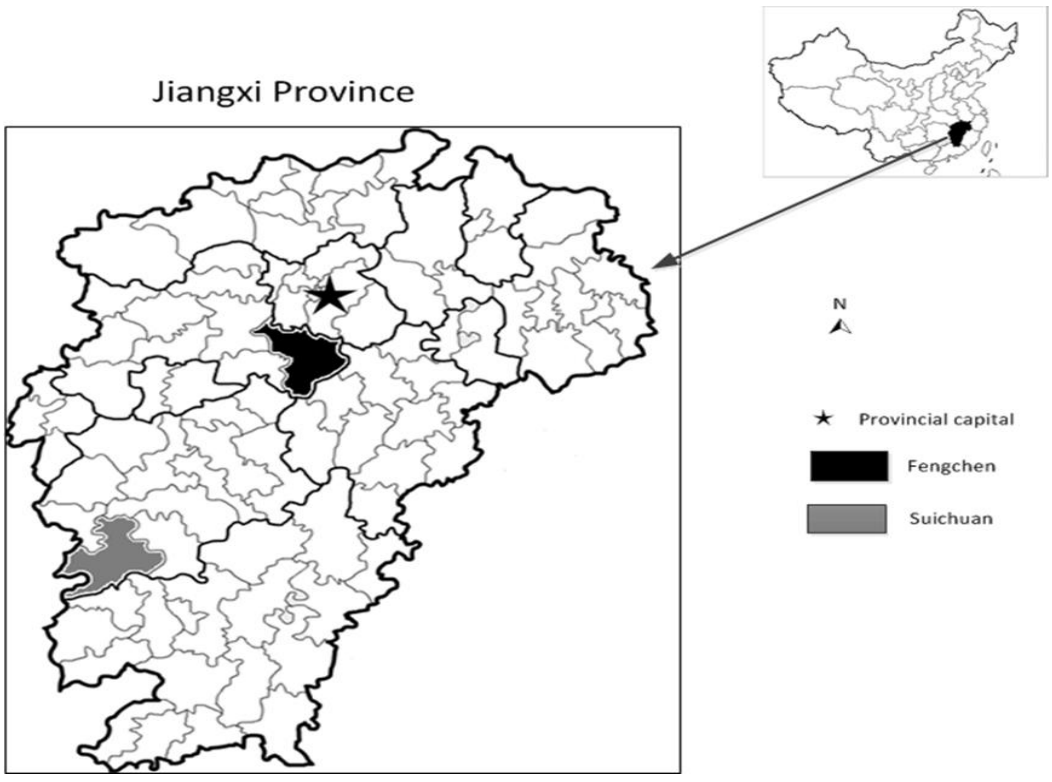
During the first devolution of forest tenure in the early 1980s, Jiangxi devolved the majority of forestland to farm households. However, in the late 1980s, much of the forestland was reclaimed by the collectives when the redistribution stopped (see Holden et al. 2011). From 2004 onwards, Jiangxi started the new devolution reform as a pioneer province.

In Jiangxi, a number of large-scale forestry programs have been carried out, covering a variety of forest functions, e.g. the mitigation of erosion, the promotion of bio-energy forests for increasing energy security, carbon sequestration, food security, afforestation and reforestation (Forestry Department of Jiangxi Province, 2012). This paper takes the case of a

[9] 1 mu = 1/15 hectare.

current governmental program to promote camellia in Jiangxi. Camellia are traditional, tropical, oil-bearing species in China. Their seeds can be processed to cooking oil and biodiesel, however, their promotion furthermore aims at the establishment of carbon sinks and the prevention of soil erosion. The Chinese government set a target to plant 24,870,000 mu (1, 658, 000 hectare) of camellia by 2020 in the whole of China (State Forestry Administration, 2009). A subsidy program has been devised for large-scale camellia projects, and Jiangxi is one of the key provinces in the government's large-scale program. With a plantation area target of 4, 000, 000 mu (266, 667 hectare) by 2020, it accounts for 16% of the total target (State Forestry Administration, 2009). Plantation took place from autumn 2008 until 2011, forest plantations hence are still in the initiation stage. In this study, two large-scale camellia projects were selected, one making use of subsidies from the central government, the other from foreign loans.

Figure 2.1: Location of survey areas



For this research, a survey was carried out in Jiangxi province from July to August 2011. Two counties were selected based on the difference in economic development levels, geographic conditions and camellia development levels. Suichuan county (with both a domestic and a foreign loan project) is located in the south of Jiangxi province (see Figure 2.1) which is

relatively poor and less developed, while Fengchen county (with a domestic project) is located in the north of Jiangxi which is relatively rich and more developed. Both counties have a long camellia plantation history (Development and Reform Commission of Jiangxi Province, 2011). Table 2 .2 summarizes the main characteristics of these counties.

In each county, 14 villages were randomly selected. For each village, around ten villagers were randomly selected and interviewed. After checking the survey, we found that 139 out of the 280 interviewees participated in the camellia projects, with 182 camellia forestry land plots belonging to the projects. Apart from basic household characteristics (age, gender, education, family size, assets), we included questions on the investment for each forest plot and the characteristics of each plot (slope, soil quality, distance to home), as well as on the kind of forest tenure regime.

Table 2. 2: Summary description of the two counties

Characteristics	Suichuan	Fengchen
GDP per capita （RMB/person）	9, 746	17, 556
Forestry output value (10, 000RMB)	35,646	15, 938
Forest area (Hectare)	177, 490	103, 319
Primary Industry Value-added in total (percentage)	19.8%	18.0%
Secondary Industry Value-added in total (percentage)	47.8%	52.8%
Tertiary Industry Value-added in total (percentage)	32.4%	29.1%
Rural Employed Persons (1, 000 persons)	264, 837	489, 303
Number of Employed Persons in Secondary Industry (1, 000 persons)	3, 393	28, 975
Number of Employed Persons in Tertiary Industry (1, 000 persons)	12, 041	27, 735
Degree of urbanization	41%	45%
Population density (person/square kilometer)	175.88	482.25
Rainfall (mm/year)	1, 421.2	1, 552.1
Altitude (m)	82-2, 120.4	20-1, 169.1
Mean temperatures (℃)	15.1-18.7	15.3-17.7
Average yields of grain crops (ton/hectare)	5.49	6.37

Source of data: Own calculations based on Bureau of Statistics of Jiangxi Province (2011)

2.4.2 Empirical model and variables

Equation (2.1) presents the regression model that I use to examine the link between land property rights and farm household management investments (based on Besley (1995), Fenske (2011), Ali et al. (2011)).

$$y_{ij} = \beta_0 + \beta_1 R_j + \beta_2 TS_{ij} + \beta_3 x_{ij} + \beta_4 z_i + \varepsilon_{ij} \quad (2.1)$$

where y_{ij} is the measure of investment by household *i* on a given plot j. I estimate two investment models. In the first model, the dependent variable y_{ij} includes labour use (*Labour*) and in the second it includes capital investment (*Capital*) defined as purchased inputs (i.e. fertilizer and pesticides). *Labour* refers to the labour use (including hired labour) on the plot during the second year after plantation, divided by the size of the plot. The unit is Working days/Mu. For both, *Capital* and *Labour*, data of first year investment was not used since the government, the natural village or the camellia processing company financially supported first year investment in seedling and soil preparation for part of the survey households. Therefore, second year investment after the establishment of the plantation is a better proxy to estimate individual households' investment in their forestry land. *Capital* comprises the expenditures for fertilizer and pesticides on the plot during the second year after plantation, divided by the size of the plot. The unit is Yuan/ Mu.

$\mathbf{R_j}$ refers to the different tenure regimes. Dummy variable are created to estimate the impact from the different regimes. A dummy is 1 for a plot under a certain regime, and 0 otherwise.

TS_{ij} is a proxy for tenure (in)security and is measured as the risk of expropriation in the next ten years as perceived by the respondents. It takes the value of 1 if expropriation risk is perceived as high.

$\mathbf{x_{ij}}$ is a vector of plot-specific characteristics. It comprises *Slope*, *Soil quality*, *Size*, and *Distance*. *Slope* is defined as a dummy that is 1 for plots that have an inclination of 25 degrees or more, and 0 otherwise. *Soil quality* is defined as a dummy, where 1 indicates good quality soils, and 0 medium or bad quality soils. *Distance* is the distance from the household homestead to the forest plot. *Size* is the area of the plot.

$\mathbf{z_i}$ includes measures of household characteristics. *Age* is the age of the household head. *Gender* is the gender of the household head. *Education* is the years of schooling of the household head. *Household size* denotes the number of household members. *Value of house* presents the value of the house and is often recognized as a more accurate measure of wealth

than income (Uchida et al., 2007). I therefore use *Vaulue of house* as a proxy for wealth, also because homeownership is very important for villagers in Jiangxi province.

2.5. Results

Three different kinds of results are presented. The qualitative results in section 5.1 show in how far a recentralization of forest tenure regimes has taken place with the implementation of large-scale camellia forestry projects. Combining the property rights dimension of tenure security with the NPRT, I develop hypotheses about the extent to which the different tenure regimes that were identified may provide different incentives for farmers' management investments. After presenting some descriptive statistics to provide insight into the survey sample, I will test the hypotheses in section 5.3.

2.5.1 Tenure regimes

From the survey, five types of forestry management tenure regimes are identified, which are distinguished based on the different kinds of property rights (see Table 2.3). The table shows that even if these plantations are realized within the frame of large-scale projects, no recentralization of forest tenure is observed for the case of Jiangxi. Furthermore, as will be shown in section 5.2, with the exception of *Partnership*, the observed regimes are rather equally distributed in their occurrences. A variety of tenure regimes persists under the large-scale projects.

Table 2.3 shows that the forest tenure regimes of the survey have some similarities but also some differences with those in literature (Xu et al., 2008; Sun, 2008; Holden et al., 2011). The regimes "*Individual*" and "*Partnership*" are the same as those mentioned by Sun (2008), Xu et al. (2008) and Holden et al. (2011). The regime "*Company*" is a kind of "Outsider contract management" described by Xu et al. (2008). Management by a Villagers' Group (Xu et al., 2008) / Natural village (Sun, 2008) is divided into two different regimes, i.e. the "*Collective*" and the "*Collective-Individual*" on the level of the natural village. In both regimes, the village representatives are of crucial importance. In general, village representatives are responsible to manage the collective land (forestland and agricultural land) as well as public goods such as infrastructure. In Jiangxi, representatives are not formally elected but become representatives based on e.g. their influence, membership of a larger clan, or previous professional activities (e.g. teacher, soldier) (interview with the natural village representative). Under the *Collective-Individual* regime, the village representatives coordinate

the start of the plantation with all villagers, and then the village representatives distribute the forestland plots to individual households to manage the forest afterwards. Under *Collective* regime, the village representatives manage the forest together with the villagers. Even if under these two regimes, benefits and income formally belong to all villagers, malversation and corruption is reported for the activities of some villages' representatives.

Collective regime by an administrative village council (Xu et al., 2008; Sun, 2008; Holden et al., 2011) was not part of the survey sample, which is why it will not be considered in the analysis.

Table 2.3: Tenure regimes in the survey area

		Collective	*Company*	*Collective -Individual*	*Partnership*	*Individual*
Residual control rights	Labour	Individual	Individual	Individual	Individual in partnership	Individual
	Capital	Natural village	Individual	Individual	Individual in partnership	Individual
Residual income rights		Natural village	Individual / Company	Individual	Individual in partnership	Individual
Tenure security		LOW	LOW	LOW	MEDIUM	HIGH
Management investment incentives		LOW ----------> HIGH				

Source of data: Own survey.

Next, I discuss the different tenure regimes in terms of the associated property rights. In line with section 3, I distinguish two dimensions of property rights, on the one hand tenure security and on the other hand residual control and income rights. Tenure security is interpreted here in terms of assurance, namely whether individual households hold land rights and hence can control the future destination of the land (security is high) or not (security is low).[10] In the discussion of the tenure regimes in terms of the residual control and income rights, I distinguish between residual control over capital input and labour input. The reason for this is that different parties may be responsible for decisions over labour and capital. This is also reflected in the empirical approach that we will undertake in section 5.3.

Under the *Collective* regime, management of forests is coordinated by the natural village representatives. Natural village representatives control the level of capital investment. Individuals are assigned the tasks of working on the forestland and making day-to-day

[10] Note that in the Chinese context, forestland can only belong officially to the government or the collective. Individual land titles should hence be interpreted as user rights for a certain duration set by the central policy.

decisions about the labour effort they put in and the care they take in performing the assigned tasks. Hence, individuals have residual control rights over labour. The natural village community, however, has residual income rights. Tenure security under the *Collective* regime is low as land titles are held collectively. In the case of the *Company* regime, the company and village representatives agree on the management of the camellia plantation at the start of the project. Households are involved in the daily management and have the residual control rights. The company and the natural village representatives are monitoring the project. Residual income rights are shared between individuals and the company in the short-run, where the contract specifies that the company receives the largest share of the residual. However, in the long-run, the company and the village representatives hold the power to decide on the future of the forestland and as a consequence, tenure security is low under this regime. Under the *Collective-Individual* regime, the village representatives distribute the forestland plots to individual households who manage them, thus the residual control and income rights are transferred to the farm households, and the farm household decides on the labour and capital use. However, as the households do not receive a forestland certificate, the representatives still have the power to redistribute the forestland at a later stage, which means that farmers' tenure security is low in the long-term, where uncertainty about the duration of use rights exists. Under *Partnership*, individual farm households join together in a partnership and take joint decisions on the plantation and inputs and outputs, more specifically, the labour and capital use are generally decided by a joint decision in the partnership. Residual control rights belong to the individuals in the partnership. The individuals in the partnership decide to share the residual income. Incentives are expected to be stronger under the partnership regime than under the previously discussed regimes because residual control and income rights are assigned to the same parties. However, decision-making – especially in the long-run – is the result of mutual agreement between the members of the partnership. This may mean that there remains some uncertainty over long-run residual income distribution as partner motivations and the impact of future events on partners' decision-making is not known. Furthermore, tenure security may be lower for the partnership as a whole as individual land rights are bundled in the partnership. Under the *Individual* regime, residual control and residual income rights belong to the individual. Moreover, land tenure rights are assigned to individuals and hence the tenure security is strong.

In conclusion, these five forms of forest tenure regimes differ in various property rights dimensions, implying different degrees of tenure security and residual claimancy for

farm households. Based on the qualitative results in table 2.3, we hypothesize that the regime with the highest incentives for individual investment is the *Individual* regime. In this case, residual control rights and residual income rights are with the same decision-maker and tenure security is high. The *Partnership* regime may also motivate individuals to make management investments since the individuals in the partnership hold both the residual control rights and income rights. However, some uncertainty remains with respect to the other partners' decision-making motivations and the security of tenure rights for the partnership as a whole. Investment incentives hence will be lower than in the Individual regime. While residual claimancy is high, tenure security will be relatively low in the *Collective-Individual* regime since it will be uncertain for the farmers if the village representatives intervene in their land property rights in the future. This will negatively affect the incentives of individuals under *Collective-Individual*. Under *Company* regime, residual control rights are with the farmer, however, residual income rights are shared with the company and in the long-run, also village representatives play a role in residual income distribution. Incentives for investment hence will not be as high as with the above regimes. Finally, *Collective* is the least optimal regime because residual income rights and residual control rights are not with the same decision-maker. Furthermore, tenure security is low under this regime, investment hence is assumed to be low.

In the following, I will test these assumptions based on our survey data.

2.5.2 Descriptive statistics of survey sample

Descriptive statistics in table 2.4 show that many of the survey villagers, i.e. 36.3%, were part of the *Collective-Individual* regime, and 35.2% were part of the *Individual* regime. 21.4% of the interviewees cooperate with a company, and only 7.1% joined in a *Partnership* with other farmers.[11] The distribution of these different tenure regimes again shows that large-scale forestry projects do not seem to result in a centralization of forestry tenure in the case of Jiangxi. A multitude of different tenure regimes exists. Furthermore, perceived tenure insecurity seems to be high: for more than 75% of the sampled plots, households indicate that there is a high risk of expropriation in the next ten years.

[11] Note that the Collective regime is not included in the analysis because survey households were not much involved in forestry management under this regime and are hence not familiar with the situation.

Second year investment in the cultivation of camellia cannot be considered high with an average labour intensity of 3 days / mu, and a capital input intensity of 35 Yuan per mu. It is lower than the general technical requirements stipulated by the government.

While cultivation conditions are favorable in terms of slope (only 25.1% of the trees grow on land with a slope of more than 25 degree steepness), and a relatively short distance to the households (on average around 1.2 kilometers), plot size is small (average size of 15 mu or 1 hectare), and also the percentage of good soil quality is only 17.6%, with the majority of plots being of medium quality. However, in general, the conditions for forest plantations may be considered as favorable.

Table 2.4: Descriptive statistics of variables used in the analysis

	Mean/Percentage	Std. dev.	Min	Max
Investment				
Labour (Days/ Mu)	3.20	3.54	0	30
Capital (Yuan/Mu)	34.76	56.87	0	300
Partnership (Dummy)	7.1%		0	1
Collective-Individual (Dummy)	36.3%		0	1
Company (Dummy)	21.4%		0	1
Individual (Base)	35.2%			
Tenure insecurity (Dummy)	76.9%		0	1
Size (Mu)	15.69	28.53	0.23	200
Distance (Kilometre)	1.19	1.13	0.05	7.5
Slope (Dummy)	25.1%	0.43	0	1
Soil quality (Dummy)	17.6%	0.38	0	1
Gender (Dummy)	97.8%	0.15	0	1
Age (Years)	49.68	11.21	24	78
Education (Years)	6.87	3.07	0	14
Household size	5.16	2.02	2	13
Value of house (thousand Yuan)	55.72	72.15	0.02	600

Source of data: Own survey.

For the remote mountainous areas in China, household characteristics may to some extent be considered representative. Survey household heads are male and on average 50 years old, with a rather low education level of 7 years (first year middle school). Elder generations are not well educated, however, younger generations typically spend 9 (compulsory) to 12 years in school. While the younger generation still lives together with their parents, young adults have migrated out of the village to work in urban areas.

Interviewees however still consider them as part of the household, so that the average household size is 5 members, consisting of three generations in a household. The average housing value is 55,000 Yuan which is around 10 times higher than the average net income per capita in the rural areas of Jiangxi province. It shows that households considerably invest in their housing estate, which again proves that the value of house is a good indicator of wealth.

2.5.3 Regression results

Because household investments in labour effort and input use are censored at the lower bound, i.e. the lower bound is zero when no effort or inputs are applied, I used a Tobit regression model. This was especially relevant for estimating the capital investment model because 53% of the sampled plots received no fertilizer or pesticide inputs in the second year after plantation.

Before turning to the results, I want to draw attention to two issues related to the inclusion of the tenure security variable. First, as table 2.3 shows, tenure security and tenure regimes may be correlated. An investigation of the correlation coefficients between the four tenure regimes and tenure insecurity confirms the existence of such correlation, especially in the case of the *Collective-Individual* regime. This is important because high degrees of multicollinearity may result in insignificant coefficients in the estimation model. However, I think it is useful to include both these indicators of property rights in the model because it allows me to separate the effect of tenure insecurity from the residual control and income effects related to the tenure regimes, as hypothesised in section 3. Second, there is an extensive debate in the literature about the potential endogeneity of the variable tenure security in investment models (see Ma et al. (2013) for a comprehensive overview). I therefore also present a discussion and an estimation model that takes into account this endogeneity effect in Appendix IV. Because the endogeneity model and the Tobit model provide largely similar results, I limit the following discussion to the results of the Tobit estimation, presented in table 2.5.

The results show that the only management regime that has, in comparison to the *Individual* regime, a positive impact on capital investment, is management under *Partnership* (significant at 5% level). Labour use under *Partnership* is however not significant. This result leads to the conclusion that *Partnership* has higher fertilizer and pesticide inputs than the *Individual* regime. This result contradicts our assumption in section 5.1 that incentives are

lower under *Partnership* than under the *Individual* regime. A reason for this may be that farmers who join a *Partnership* are often friends and relatives, which means that they may put more trust in the long-term stability of the arrangement and therefore perceive a high security of investments within this relationship. Furthermore, since partners have joint responsibility for the partnership, they may not be likely to abandon the plantation afterwards. As a result, farmers in a *Partnership* may have a higher management investment intensity compared to the *Individual* regime. Trust in the continuation of the current arrangement[12] hence seems to be a crucial factor for farmers' management investment. This finding is supported by other research having pointed at the importance of trust in economic decisions (Tu et al., 2011). A further reason for higher capital investment can be related to partnerships' easier access to credits (interview with county officer), which increases partners' financial capacity to buy capital inputs. Findings to some extent are supportive to the central and local government's policy to promote partnerships. During the survey, some farmers indicated that they join together to get access to subsidies and credit, but the management was practiced individually which might result in the impact on labour investment not being significant.

Results show that under the *Company* regime, investment is significantly lower than under the *Individual* regime, both for labour and capital. This is in line with our expectations and confirms that under the *Company* regime, the residual control and income are not completely under the authority of the individual. Similarly, the farm household investment level is quite low under the *Collective-Individual* regime. A reason for this may lie in the fact that the village representatives decided about the realization of the forestry project, while not all farmers may be interested in participating (interview with farmers). Labour use intensity under *Collective-Individual* is even lower than under the *Company* regime. This may be explained by the village representatives' or company's random monitoring visits. During these visits, they check whether farmers work on the field and monitor the seedlings survival rate. Such monitoring does not exist for the *Collective-Individual* regime. In conclusion, the regression results prove that under the different tenure regimes, farm households' investment of labour and capital differs. The *Partnership* regime turns out to be the regime with the highest investment. Individual investment under *Collective-Individual* regime and *Company* regime have lower investment levels.

[12] Note that the continuation of a (contractual) relationship can be related to the assurance perspective of tenure security. This is, however, distinctly different from the perception of long-term tenure security as captured by the variable TS (*tenure insecurity)*.

Next, I discuss the results related to tenure insecurity, i.e. the perceived risk of expropriation. Because both tenure insecurity and tenure regimes are included in the model, the interpretation of the coefficients should be done under the *ceteris paribus* assumption. In other words, all else equal what will be the effect of increased tenure insecurity? The results show that there is a significant effect of tenure insecurity on households' management investment incentives, regardless of the property rights effects that were already discussed for the different tenure regimes. Specifically, I find a significantly negative effect of tenure insecurity on labour investments. This result supports the hypothesis that uncertainty about the future forestland distribution may be an obstacle for security of investment.

Table 2.5: Regression results for household investment

Variable	Labour		Capital	
	Coef.	z-statistic	Coef.	z-statistic
Partnership	-0.82	-0.84	85.45***	3.25
Collective-Individual	-2.66***	-4.25	-80.20***	-4.20
Company	-1.72**	-2.50	-81.24***	-3.73
Tenure insecurity	-1.02*	-1.73	25.69	1.46
Size	-0.03***	-3.08	0.43*	1.72
Distance	-0.13	-0.57	7.31	1.17
Slope	1.35**	2.38	-5.96	-0.36
Soil quality	-0.57	-0.90	6.53	0.34
Gender	-2.21	-1.36	68.51	1.46
Age	0.06**	2.52	0.72	1.01
Education	-0.01	-0.08	-6.34**	-2.46
Household size	-0.48***	-3.87	0.78	0.22
Value of house	-0.01*	-1.68	0.00	-0.04
Constant	7.63 ***	3.17	-64.61	-0.89
Pseudo R^2	0.06		0.05	
Number of observations	182			

* Significant at 10% level, ** Significant at 5% level, and *** Significant at 1%.

Apart from the tenure regimes and tenure insecurity, results in Table 2.5 show that characteristics of plots also affect farm households' labour and capital investment levels. The size of the plot has a negative impact on labour intensity and a positive impact on capital investment. For each mu increase in size, the labour use intensity decreases and the capital use intensity increases. Smaller farm households hence use relatively more labour and spend less money to purchase fertilizers and pesticides. Furthermore, in China, forestland is allocated based on household size. This means that small forest areas relate to small households which may have less monetary capital to invest and then use labour to substitute for capital. The positive and significant slope coefficient in the labour investment regression implies that a plot with a steeper slope requires more labour input. However, steep slopes are not compensated for with higher capital input. Interestingly, distance and soil quality prove not to have a significant influence on investment intensity.

At the household level, results show that the age of the household head has a positive impact on labour use (significant at 5% level), i.e. the older the household head, the higher the investment of labour on forestland. Education has a negative impact on capital input (significant at 5% level), which is in line with studies on agricultural production costs (Tan et al., 2008). The reason may be that farmers with a higher education level are more skilful in forest activities, which decreases investment inputs. Moreover, household size has a negative impact on labour use (significant at 1% level), because the larger households may adopt better management methods and may be more able to manage the crop in a timely manner (Tan et al., 2008). However, for the capital variable, household size is not significant. Finally, the value of the house estate has a negative impact on labour use intensity which means that wealthy households spend less labour on the plot (significant at 10% level).

2.6. Conclusion

Many international organizations and developing countries are taking measures to facilitate farmers' participation in forest cultivation and management by establishing large-scale forestry projects. Also in China, a lot of projects have been initiated with multiple functions, e.g. to prevent erosion, for carbon sequestration and for poverty alleviation. The findings of this research provide some important insights for the design and implementation of large-scale forestry projects.

Qualitative results of my research show that in the case at hand, large-scale forestry projects did not lead to a centralization of forest tenure. A variety of tenure regimes exist, with none of them dominating. From the persistence of this variety of tenure regimes, it can be conclude that, after a series of forest tenure reforms, forest tenure regimes in China may have become more stable.

This paper furthermore examines whether property rights, and more specifically tenure security and different tenure regimes, affect household investment, measured by labour use and capital use intensity. We find that in Jiangxi Province, China, the tenure regime with the highest level of farmers' investment in pesticides and fertlizers is the *Partnership* regime. The success of the *Partnership* regime may be explained by factors of trust and associates' authority over alteration rights. A further reason for the high level of capital investment may be the easier access to bank loans. With only 7.1% of the sample farmers having joined a partnership, investment of the large majority of farmers is hence not optimal within the given projects. The constraint in accessing credits may be a reason for farmers under the *Individual* regime not revealing the highest level of management investment.

It is also worthwhile to place these results within the specific context of China. First, some uncertainty on land property rights remains because of the redistribution rights of natural villages, hence the tenure security of *Collective-Individual* regime is lower than that of *Partnership* and *Individual* regimes. I also find evidence of this in the data where uncertainty is higher and investment incentives are lower, i.e. in the *Collective-Individual* regime.

Finally, the dominance of the *Partnership* regime in the results on investment incentives can also be viewed in light of the specific Chinese context, namely the importance of guanxi (connection) within family relations. High levels of trust in these relations may lead to strong incentives in partnerships.

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Chapter 3. Benefit distribution among smallholders in large-scale forestry projects: the case of camellia in China[13]

Abstract: While internationally, large-scale forestry projects have gained in importance for climate change mitigation (e.g. CDM, REDD+), the implementation of such projects, particularly in regions with smallholder forestry like Southeast and East Asia, faces various obstacles. Hereby, the equity of benefit distribution is generally considered vital to support a balanced socio-economic development in poor rural areas and guarantee long-term project success. China presents an especially interesting case of smallholder forestry. The conversion from 2003 onwards from collectively-managed to household-managed forests has increased the number of small farmers in large-scale forestry projects substantially. Using two cases of (inter)national camellia plantation projects, this research analyzes the distribution of benefits under different so-called forestry project implementation regimes. Empirical research was undertaken in thirty villages in three counties of Jiangxi province, China, applying semi-structured stakeholder interviews and a survey among over 308 smallholders. Results show that five implementation regimes of camellia plantations can be distinguished, i.e. Individual, Partnership, Collective-Individual, Collective, Company, each having their own specifics of project access and benefit distribution among smallholders. Collective-individual, Collective, and Company forest implementation regimes perform better in terms of program access and equal benefit distribution than Individual and Partnership regimes. But also for the former three regimes, village leaders and companies may seize substantial project benefit reducing the benefits to and marginal smallholders. These conclusions are policy relevant as in formulating (inter)national forestry projects the local implementation regimes need to be taken into account, reducing the possibility for standardized forestry projects in China.

Keyword: Governance, institutions, forest tenure, EIB, Jiangxi

[13] This chapter is based on Li, J., Bluemling, B., Mol, A.P.J., Feng, S., Benefit distribution among smallholders in large-scale forestry projects: the case of camellia in China, to be submitted to Journal of Rural Studies.

3.1. Introduction

According to the UN's Intergovernmental Panel on Climate Change, deforestation and forest degradation contribute to about 17% of all greenhouse gas emissions worldwide (IPCC, 2007). This makes forestry the third most important sector for climate change mitigation after global energy supply (26%) and industrial sectors (19%). Afforestation and reforestation increase global carbon sinks, which remove carbon dioxide from the atmosphere. Afforestation and reforestation projects also contribute to income increase, poverty alleviation and ecological benefits. China achieves great success in increasing its forest area by afforestation and reforestation projects for both ecological purposes and economic interests. A list of large scale forest projects such as Natural Forest Protection Program (NFPP) and the Sloping Land Conservation Program (SLCP) have been undertaken. After years of afforestation, China has the largest area of forest plantation in the world (FAO, 2011; Liang and Mol, 2013).

In developing countries, forestry is often carried out in a smallholders' context. The payment for carbon sequestration accordingly needs to reach a large number of smallholders in a project. In these contexts, projects face high transaction costs for the coordination of smallholders' contribution to carbon sequestration, as well as for setting up local institutions to monitor and distribute benefits (Reynolds, 2012; Roshetko et al., 2002). As collaboration with many and dispersed smallholders imposes high transaction costs, mechanisms "need to be created to overcome the obstacles that transaction costs can create to the participation by the poor" (Pagiola et al., 2005: 245), so that it will be possible for smallholders to access international funds (Roshetko et al., 2002; Coomes et al., 2008). To overcome transaction costs, capacity building, simplified modalities and monitoring, as well as 'pooled projects', are considered suitable measures (Smith and Scherr, 2003). Moreover, various organizations (e.g. governments, non-governmental organizations and international research organizations) have a potential role in minimizing transaction costs in smallholder forest-carbon projects (Cacho et al., 2003). Setting up cooperation between local people and NGOs is considered crucial to minimize transaction costs.

Such collaborations are particularly important for the remote poor to enhance participatory monitoring in forest management (Skutsch, 2005). Empirical research has shown that local involvement in project implementation is a vital determinant for project success (Reynolds, 2012). To this end, community-based management has been considered crucial as communities will know best how to integrate local conditions into a management regime. In

community based environmental management, collective action is important to coordinate individual or group activities, and a strong internal organization is necessary to establish management and to settle disputes (Rosa et al., 2004). For a large-scale carbon sequestration project, this would imply that groups of smallholders join the project collectively rather than individually via a system of collective contracting, as exemplified by Pagiola and colleagues (2005). Smallholders projects thus need careful design and implementation so that they can take into consideration the complexity of the local context (Boyd et al., 2007).

Forestry projects in developing countries hence have the potential to benefit the poor, if their design both encourages the participation of smallholders (Cacho et al., 2003) and reduces transaction costs. Apart from this, an equal distribution of benefits within a project has been considered important for the long-term success of large-scale forestry projects involving smallholders. 'Pro-poor' or at least not increasing inequity is one of the principles identified in international carbon stock projects (Hoang et al., 2013). Benefit-sharing, including providing access to non-timber forest products (NTFPs) on carbon forestry sites, was another clear determinant of project success (Reynolds, 2012). Moreover, equity is also a key component of sustainable development (Brown and Corbera, 2003). Equity and benefit distribution in rural poor areas are crucial concerns in developing countries, and are also aims of most international projects and donors.

Although equity and benefit distribution in forestry projects have raised increasing concern, there are few studies that analyse benefit distribution mechanisms and their impacts, particularly on the level of local communities. The aim of this study is accordingly to understand the mechanisms of benefit distribution and how smallholders benefit from large-scale forestry projects under different project implementation regimes, taking China as example. China presents a particularly suitable context for such an analysis as in recent decades, China's forestry sector underwent devolution, i.e. the user rights of forestland have increasingly been transferred to households (Lu et al., 2002). Moreover, the Chinese government promotes large-scale afforestation and reforestation projects.

In this research, we understand forestry projects as nested multi-level governance arrangements, where stipulations on the upper levels will have distributional impacts on community and smallholders on lower levels. However, such stipulations will be co- and re-defined in the context of the community. We hence will find project stipulations being adapted to the context of local communities, which will influence the distribution of benefits.

The structure of the paper is as follows. The second section describes the analytical framework used to analyse benefit distribution of two large-scale forestry projects. The third section introduces the research site and data collection methods. The fourth section introduce the major factors that determine benefit distribution: local governance institutions, forest tenure and forestry project design. The fifth section analyses and compares the five forest project implementation regimes on their benefit distribution mechanisms and outcomes across various scales. The last section concludes the article.

3.2. Analyzing forest project implementation: an analytical framework

Forestry projects can be understood as nested multi-level governance arrangements, which have effects on the distribution of benefits among stakeholders. The design and implementation of forest projects determine how benefits are distributed among forest smallholders. The first section develops the notion of forest project implementation regimes and discusses the factors that influence these regimes and thus benefit distribution. The second section operationalizes benefit distribution as the dependent variable of this research.

3.2.1 Analysis of forest project implementation regimes

As projects are understood as nested multi-level governance arrangements, their analysis will focus on their "implementation regimes" which cross different governance levels. Project implementation regimes can be defined as the rules and decision making actors that govern the implementation of (forest) projects. As such, they are similar to "institutional arrangements" as defined by Adger et al. (2003: 1100) who sees these arrangements as "(particular sets of rules) through which ... decisions are implemented".

This study focuses on two major factors that co-determine the project implementation regimes that function at the local level where forest smallholders operate: local governance institutions and forest tenure. The design of forest projects, a third factor included in this study, does not directly influences the forest project implementation regime but is essential in benefits distribution (Figure 3.1).

Previous research has shown that local governance institutions play a critical role in explaining variations in local forest resource management (Agrawal and Yadama, 1997; Geist and Lambin, 2001; Gibson et al., 2005; Andersson and Gibson, 2007). Agrawal and Yadama (1997) suggest that local governance institutions mediate the influence of exogenous and

higher level drivers of forest management. Anderson and Agrawal (2011) equally show that local institutional arrangements moderate the effects of higher level socioeconomic factors and thus affect socioeconomic outcomes in local contexts. Local institutions for resource access and control mediate benefit distributions outcomes (Mcdermott, 2009). Hence the implementation of supra-local forestry projects is moderated and specified by local governance institutions.

But higher level institutions, including formal (e.g. forestry policies, collective action institutions) and informal (e.g. traditional practices for natural resource management) institutions (Corbera et al., 2007), do still (strongly) influence the local governance of projects. Forestland property rights or forestland tenure forms an important example of how formal and informal institutions are affecting the effectiveness of local forest management (Agrawal and Ostrom, 2001). However, the devolution of forest tenure in developing countries not only affects local forest management, but also the implementation of forestry investment projects (Sunderlin et al., 2009). Larson (2011) has shown that land tenure reform and different land tenure regimes can have detrimental impacts on the implementation of REDD+ climate change mitigation projects. Hence, among the higher level institutions, forest tenure is an important institution in shaping forestry projects implementation regimes.

A further factor that is assumed to determine benefit distribution among smallholders and stakeholders comes from the forestry projects themselves. Here, the most important determinants are located on the local or intermediary project level (Hoang et al., 2013). This is why it is important to focus the analysis on project design and project management, as well as on the behavior of key stakeholders within the project (Reynolds, 2012). Within this study, the focus of analysis for international and national projects will hence be on how they translate to and are operational zed on the local levels.

At the local level, the five different forest project implementation regimes that are empirically determined are labeled Collective, Collective-Individual, Company, Partnership and Individual regimes. This denomination is based on their different tenure regimes.

3.2.2 Benefit distribution and equity

For the analysis of benefit distribution, we will focus mainly on the forest smallholders, while paying some attention to benefits distributed to natural village cadres and involved companies. We analyse benefit distribution on two levels (Figure 3.1). First, we look at the access to

project resources of those smallholders willing to participate in a project. Through the project, participants will get access to resources from the project, which is why access determines final benefit distribution. Also other studies have taken access rights as a parameter to measure benefit distribution (Pagdee et al., 2006; Brown and Corbera, 2003).

Distribution or allocation of resources *within a project* is the second level of analysis. In addition, among the project participants, benefit distribution differs among different local villages due to different project implementation regimes. Benefit distribution is differentiated into the distribution of direct and indirect gains (Angelsen et al., 2012). Direct gains include monetary gains from international and national finance, forest products and income from providing ecosystem services. Indirect benefits relate to institutional improvements that lead to better governance, such as clarifying tenure rights and law enforcement that come with project implementation (Angelsen et al., 2012). Clarifying tenure rights refers to the fact that the project implementation can clarify and reinforce informal user rights of farmers without legal certificate, which increases certainty to these farmers regarding forestland user rights for a specified period. Finally, project implementation regimes might result in substantial benefits for villages cadres (also through corruption) and companies involved in project implementation, reducing total benefits left for distribution among forest smallholders.

Figure 3.1: Analytical framework

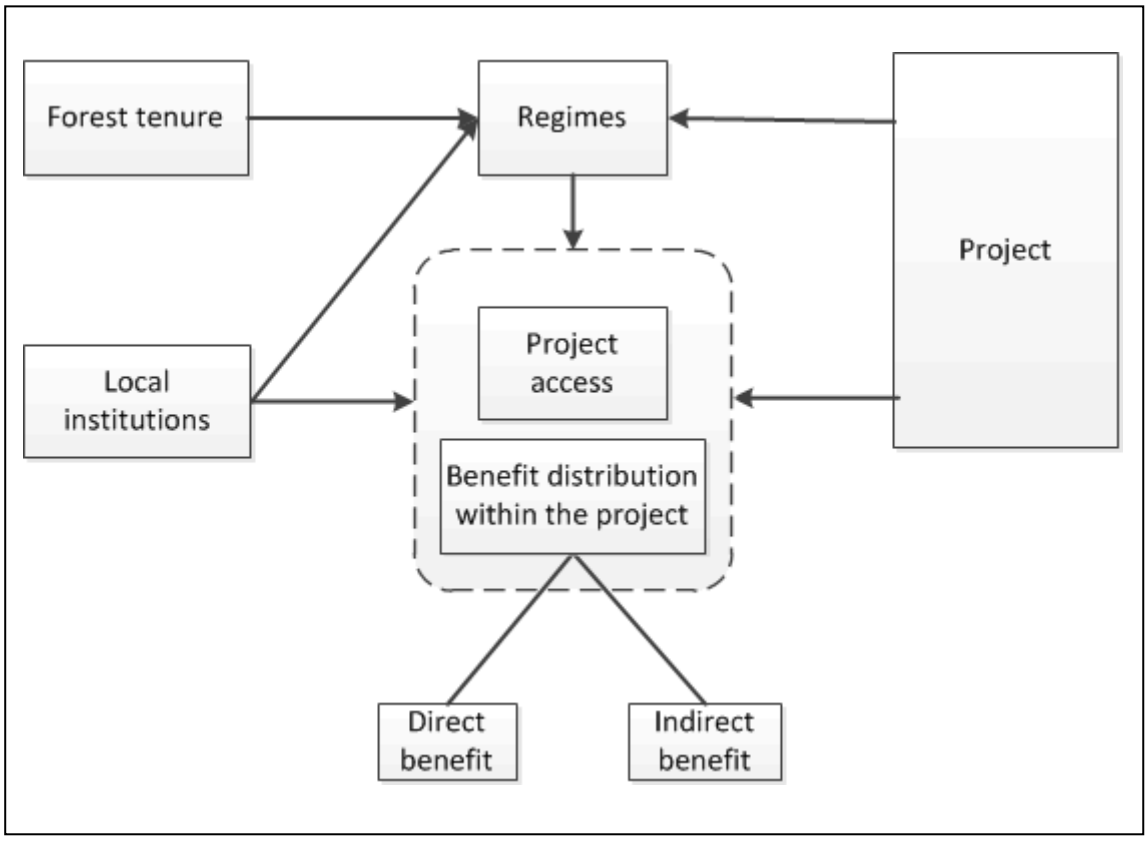


Figure 3.1 shows the analytical framework which will be applied to study various villages and projects. Benefit distribution results will then be further assessed against the notion of equity or equal/just distribution of benefits (Pagdee et al., 2006; Mahanty et al., 2006; Lawrence, 2007; Mcdermott and Schreckenberg, 2009). Mahanty and colleagues (2006) have analyzed how and to what extent equity comes with the distribution of benefits. While benefit distribution in this article is an analytical term to reveal how (through what mechanisms and factors) benefits are distributed, the concept of equity is a normative concept related to the fairness of benefit distribution.

3.3. Study sites and data collection

In order to explore mechanisms of benefit distribution through large-scale forestry projects, this paper looks at current governmental programs to promote camellia in Jiangxi province. China's central government began to focus on camellia projects in 2008. Camellia is a typical Chinese perennial oil-producing wood species, native to sub-tropical areas. Jiangxi province is located in the southeast of China and is one of the most forest-abundant provinces with about 158 million mu (or 10.54 million hectare) of forestland, and a forest coverage rate of 58% compared to a national average of 20% (National Bureau of Statistics of China, 2012). The province ranks second among China's provinces in terms of forest coverage. Jiangxi province was also selected as a study area because it is the second province to start forest tenure reform (see section 4 for further explanation of the reform). Furthermore, a number of large-scale forestry projects have been implemented in Jiangxi, covering a variety of functions, e.g. the mitigation of erosion, the promotion of bio-energy forests for increasing energy security, carbon sequestration, food security, afforestation and reforestation (Forestry Department of Jiangxi Province, 2012). Two of these projects have been selected and will be introduced in the next section.

For the fieldwork, three counties were selected from the counties taking part in the two projects of the camellia Program, and thirty villages were randomly selected from these three counties. To understand the nested multi-level project implementation regimes of this program, as well as their impacts on participants and non-participants at the local level, the fieldwork is based on semi-structured stakeholder interviews and a farm household questionnaire. Interviews and survey were conducted in June through August 2011. The stakeholder interviews included staff from three sectors in the Provincial Jiangxi Forestry

Administration, the county Forest Administration (FA) in the three counties, seven township FAs, village leaders in thirty administrative villages and twelve natural village[14] leaders. From a survey among randomly selected farm households 308 valid questionnaires were obtained, both from participants and non-participants in camellia projects and equally distributed over the thirty villages.

At the time of the survey, camellia projects had just had started, and thus the analysis will not reveal a quantification of the benefit distribution among smallholders and other stakeholders.

3.4. Project implementation regimes of camellia projects

Based on the theoretical framework, analysis will be done across three parts, i.e. the camellia projects, the local governance institutions, and forest tenure.

Project policy

Within the camellia promotion programme, two distinct projects have been selected for this study of Jiangxi: a project financed by central government subsidies, and an international loan project. The project "Modern Camellia Demonstration County (MCDC)" (*Xiandai Youcha Shifan Xian Xiangmu*) is subsidized by the central financial budget. The foreign low-interest loan project is called the "Jiangxi Biologic Energy Forest Demonstration Base Construction Project" and is funded by the European Investment Bank (EIB). The EIB project is the first project financed by the EIB within the China Climate Change Framework Loan. As EIB offers loans which are required to be paid back within 25 years, there is a guarantee requirement from project participants. In Suichuan and Ji'an counties where the project is realized, the EIB project has a limitation requirement which stipulates that participants in the project should bring into the project a forestry area of at least 50 mu (see below). The MCDC does not have a scale requirement.

Financial support from these two projects differs across different counties. In Ji'an, the subsidy consists of 200 RMB/Mu from central finances, 50 RMB/Mu from provincial

[14] The natural village derives from the production team and the family clan, and is a subgroup of the administrative village.

finances, and 75 RMB/Mu from county finances in 2009, with an increase of the latter to 200 RMB/Mu in 2010. In Suichuan, subsidies in 2009 were composed of 200 RMB/Mu from central finances, and 50 RMB/Mu from provincial finances in the frame of the MCDC project, and an additional 625.55 RMB/Mu loan from the EIB project. Finally, in Fengchen, the 2009 subsidy consists of 200 RMB/Mu from central finances, 50 RMB/Mu from provincial finances, and 200 RMB/Mu from the county. This basically means that the subsidies from the MCDC are the same in Ji'an and Fengchen, while the subsidies in Suichuan from the government are lower, however, the EIB project provides low-interest loan.

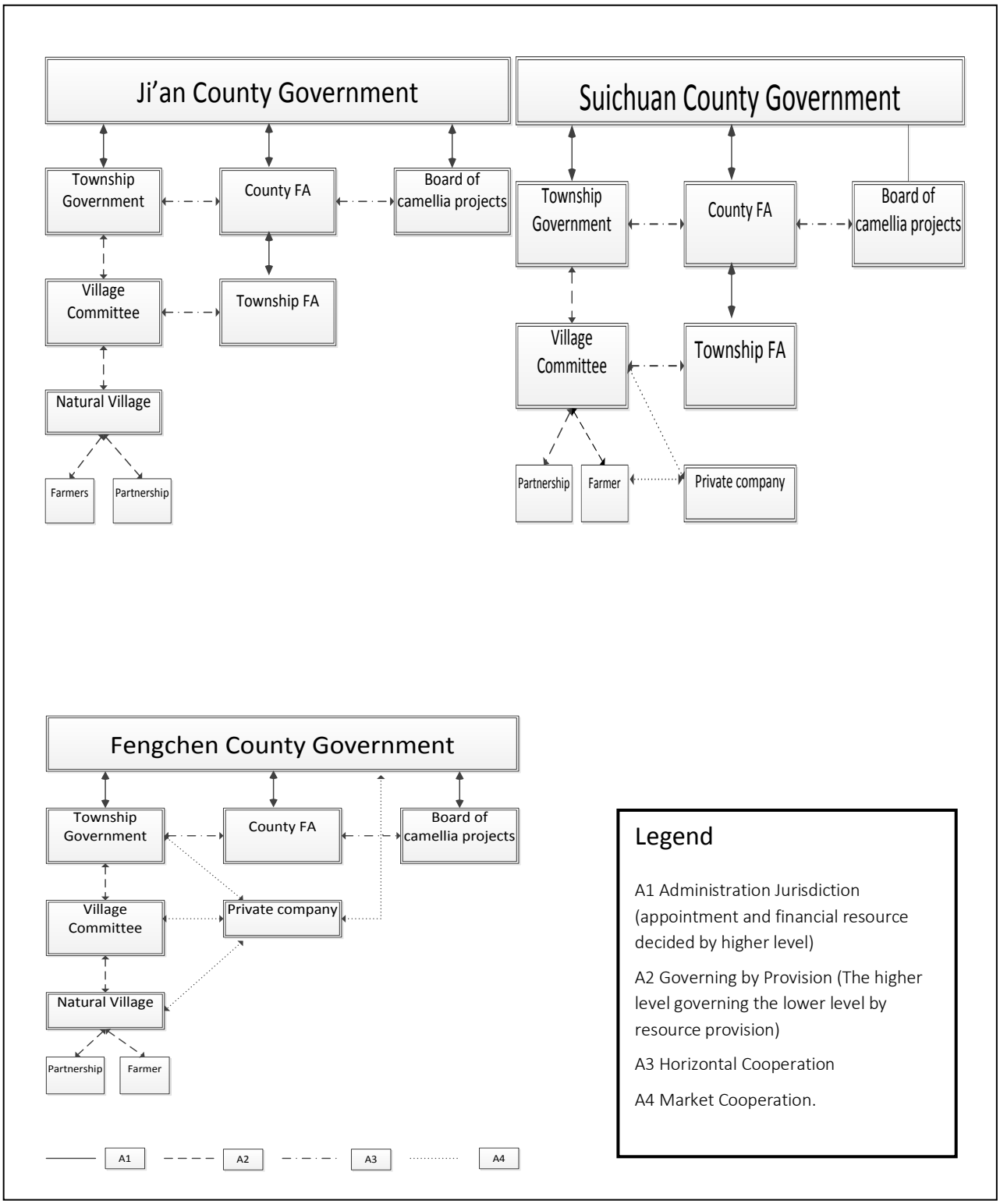
Local governance institutions

Local institutions are examined in how they co-determine forest project implementation regimes. In China, the government political system generally consists of five levels: the central level, provincial level, city level, county level and township level. An administrative village is the lowest level in the government hierarchy although it does not formally form a government level (Zhang et al., 2004). Each level of government contains a variety of organs, e.g. a council, commissions, ministries and respective administrations and authorities, which are ordered by function as well as by rank, so that each ministry sits atop a functionally-defined hierarchy of government units that exist at each territorial level of the government (Lieberthal, 2000). This means that the State Forestry Administration (SFA) sits atop of a hierarchy of Forestry Administrations (FA) at five lower levels. In some areas, however, the hierarchy stops at the fourth level, as no township FAs exist.

Camellia projects in this study are implemented at the level of the county, so the county context and governance institutions are very important. The county government and FA work as the coordinators between the local level and higher levels. Because the set-up of the administrative structure varies across counties, various county governance structures exist (see Figure 3.2).

For the implementation of camellia projects Ji'an county set up a leadership group ("board" in Figure 3.2), which consists of representatives from the county committee, the Ji'an county FA, the Development and Reform Committee of Ji'an county (DRC), the county

Figure 3. 2: Local governance structure for forest project implementation in the three counties



Department of Finance (DOF), the county Agricultural Development Office (ADO), the County Rural Credit Cooperatives (RCC) and the township government. The camellia project is implemented within the vertical government structure, as well as the structure of the FA, i.e. from the county government/FA to the township government/FA and then to the village committee and natural village. In Ji'an, the board set a 50-mu scale requirement for project participation, which means that the natural village and farm households can only participate if the forest land under the project is larger than 50 mu.

Also Suichuan county has set up a board for the implementation of camellia project, including representatives from the county government, the DOF of Suichuan county, the FA of Suichuan county, the county DOA, the county DRC, the county Environmental Protection Agency (EPA) and the township government. From previous experiences with foreign forestry projects, the county FA also set a scale limitation of 50 mu in Suichuan county. The reason is that villagers plant on small-sized and scattered plots. Coordinating a large-scale project with many smallholders will increase management/transaction costs. Furthermore, single smallholders may face difficulties in following the requirements for camellia cultivation, which in the end may not lead to the expected camellia outputs. The scale limitation, however, sets a barrier for individual smallholders to participate.Smallholders are therefore encouraged by the county FA to construct partnerships to take part in the project. Furthermore, a company also cooperates with farmers who individually want to participate in the project. This collaboration is called 'Company Plus Farm Household' (*Gongsi Jia Nonghu*), because the use rights of forestland are with the farm household, while the company applies for the project.

Like in Ji'an county, the implementation of the projects takes place from the county government/FA to the township government/FA, and then to the village committee. However, as the scale limitation reduced the number of participating farmers, the natural village is not involved as an intermediary between smallholders and the upper level government.

Fengchen county set up a high-yield camellia development leadership team (see "board" in Figure 3.2), which included the governor and vice governor of Fengchen county, and representatives from the county FA, the county Land and Resources Office (LRO), the county Agricultural Office (AO), the county DRC, the county New Rural Construction Office (NRCO) and the township government. In Fengchen, the implementation of the project involves the county government/FA, and then the township government, the village

committee and finally the natural village. On the level of the natural village, various actors participate, i.e. individual smallholders, a company which cooperates with smallholders, and the natural village leaders which coordinate implementation. When the company cooperates with farmers, the natural village leaders function as a coordinator/mediator between the company and farmers, to set trust between them and to lower transaction costs. This collaboration is called the "Three Unified-One separate" (*San Tong Yi Feng*) implementation scheme, which means that only cooperation with the natural village is needed in order to reduce monitoring and transaction costs, compared to interacting with small households individually. At the same time, the involvement of natural village leaders can lead to an unequal distribution among smallholders due to favoritism; corruption in the natural village has been reported by villagers during fieldwork.

The implementation structures in the three counties share some characteristics. First, the implementation of the plantation involves various levels, i.e. from the county government to the township government, to the village and then to the natural village and/or farmers. Only in Suichuan, we can see a difference as the natural village is not involved. The implementation is partly structured by the administrative system. There are however also some differences in the implementation structures. Ji'an county and Suichuan county have township FAs, but Fengchen county do not have a township FA, which means that the monitoring and coordination power in the local area is weak compared to the other two counties. Furthermore, access to the projects will be affected by the 50 Mu scale requirement in Ji'an and Suichuan counties. A further difference is the involvement of private companies in Suichuan and Fengchen counties, which adds a further stakeholder in the governance of the camellia projects.

Forest tenure

Since 2003, China's central government has started a forestland reform, the main objective of which is to distribute the use rights of forestland to village households. The reform stipulated that the new forest use regime should be decided by a majority vote of two-third of all villagers or by the village council (Xu et al., 2010). The new regime only manages the *use* rights of land: the forestland still remains collective property, i.e. the legal owner of the forestland is the administrative village. The use rights of the collective forestland are devolved through a lease contract of 70 years. In general, most of the collective forestland is

required to be distributed to all village households, but if over two-third of all villagers agreed not to distribute the forestland, the forestland can still be collectively managed by the natural village. This is why, apart from individual forestland management, also other kinds of management regimes exist, such as collective management of forestland and contracting land use rights to private actors.

As a result, in Jiangxi province a diversity of forest tenure regimes exist. Jiangxi started this reform from 2003 on and finished it around 2007. For most natural villages in Ji'an county, and some villages in Fengchen county, the forestland was not distributed to the farmers and the forestland is still managed by the natural village. In Suichuan county, the majority of the forestland was distributed to farm households when the forestland reform started in 2003. As included in the analytical framework, we assumed that these different forest tenure regimes will also have their impact on the implementation of the national and international project in terms of local benefit distribution from the projects.

3.5. Benefit distribution among smallholders in five project implementation regimes

In this section, benefit distribution will be analyzed by looking at project access, and benefit distribution within the project, including direct benefits and indirect benefits. "Project access" indicates the share of farm households participating in the project. It is assessed qualitatively with the dimensions "high" and "low". Direct benefits include monetary benefits and (expected) forest output. More specifically, in the camellia programme context, monetary benefits include subsidies, land preparation, and other benefits like wages and rent. The monetary benefits are evaluated in terms of whether smallholders get them or not. Forest output is the (expected) output from camellia. Distribution rules of final camellia output can be "distribution per household" or "according to family size". Finally, indirect benefits in the case at hand refer to an improvement of clarifying land tenure.

Above we have indicated that county level stipulations create different pre-conditions for local forest project implementation. "Company Plus Farm Household" is a type of arrangement where the company directly interacts with farmers for camellia plantation. In the following this regime will be referred to as the "Company regime". The "Three Unified-One Separate" arrangement involves the natural village as a coordinator between individual smallholders and company. This forms the basis for a regime referred to as the

"Collective-Individual regime". Apart from these regimes, three other regimes could be identified in our survey. These are labeled the Collective regime, the Individual regime and the Partnership regime. The five regimes will be further defined and analyzed below.

3.5.1 Collective regime

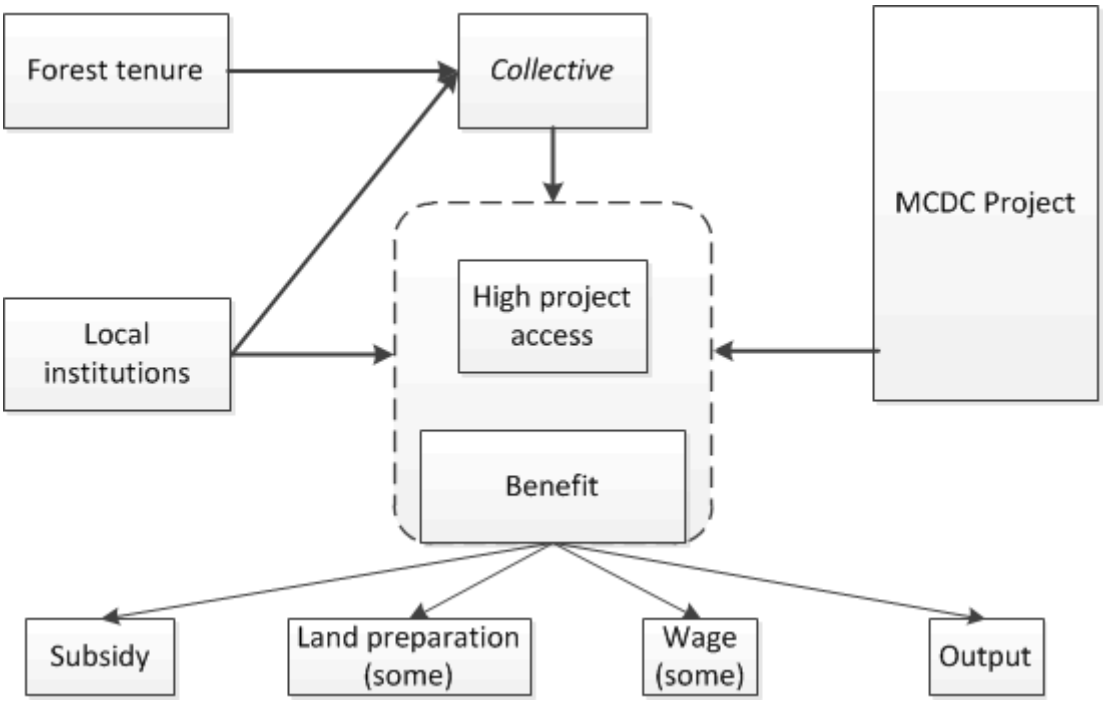
In the Collective regime, the natural village (hamlet) participates in and implements the project collectively. The use rights of forestland are collectively owned and managed by the natural village. Among the 30 villages of our sample, 3 villages in Ji'an and Fengchen counties are under the collective regime. All villages implement the MCDC project. One reason for the collective implementation of the project may be local institutions such as good relations ("*guanxi*") between villagers and the natural village leaders. However, their collective forest tenure is the primary reason to result in a collective regime for the implementation of the camellia project. In Ji'an county, a further reason is the 50-mu scale requirement. It is easy to reach the requirement by implementing the project under the collective regime. In Ji'an, natural villages with collective forestland tenure have a comparative advantage to join the project, in comparison to villages with individual land use rights.

As the entire village participates in the forest project under a Collective regime, access to the project is assessed as high. The natural village leadership group organizes the plantation. The costs for productive resources, such as fertilizer and seedlings, are spent by the collective, and the subsidy is also distributed by the leadership of the collective. The subsidy for the natural village is 450 RMB/Mu for 2010, both in Ji'an and Fengchen counties. The implementation process is slightly different across different counties. In Ji'an county, in one village, each household should offer one labour to work for a couple of days, and if the labour is absent for one day, then the household will lose 25 kilogram of camellia seeds in the end. The leader will organize the labour every day at a certain location within the village by whistle. They will reap the fruits of their labour in the end, when camellia seeds are distributed to farmers on a per household basis.

In Fengchen county, the land preparation is done by hired machines, paid by the village leaders from subsidies. After the land preparation is finished, the natural village organizes the villagers to plant trees. For working on the forestland, farmers get wages in the range of 15-30 RMB/day for men and 15-28 RMB/day for women, which is considerably lower than the market price of local labour (about 80-100 RMB/day). The final product will

be distributed to farmers based on family size. We can see from these cases that direct benefits can differ greatly across villages in different counties. In Fengchen county, subsidies are used to pay villagers for the time they spent on the camellia plantation and for hiring machines. This benefit distribution may not be equal but is fair, from which poorer households can benefit. Project implementation does not involve indirect benefit of clarifying land tenure, as land tenure remains collectively owned.

Figure 3.3: Benefit distribution within the Collective regime

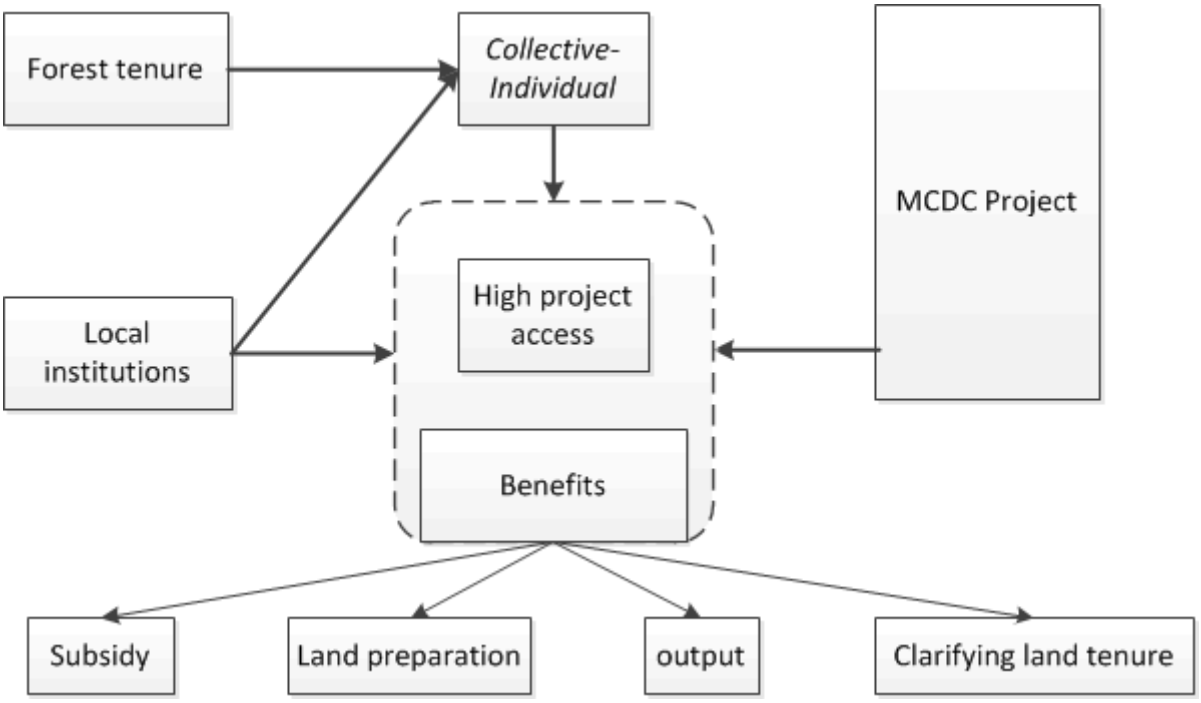


3.5.2 Collective-Individual regime

Under this regime, forestland use rights are also collectively owned. Accordingly, the natural village initiated the camellia projects; however, it distributes the management of plots to individual households. All households within a village have hence access to the project. In our survey of 30 villages, the Collective-Individual regime is found in 6 villages. The regime only exists in Fengchen county, which can be attributed to a high rate of collective forest tenure in the county. Furthermore, as Fengchen county does not have a township FA, it also promoted the Collective-Individual regime as it makes the coordination of smallholder easier for the county FA because natural villages serve as intermediate. Moreover, a good collective management history and good relations within villages also explain the prevalence of this regime in these villages in Fengchen county.

Under this regime the natural village applies for the subsidy from the county FA, and the 450 RMB/Mu are not distributed to the households, but spent by the natural village leadership on land preparation, which is done with the help of a hired machine. The seedlings are also provided to the farmers from the subsidies. After land preparation, management 'rights' are distributed to farm households within the natural village, based on family size. Then farm households are in charge of planting and the management of the camellia plantation. Accordingly, the output belongs to the households. Moreover, as an indirect benefit, clarifying land tenure exists because the management 'rights' of forestland are distributed to each farm household informally.

Figure 3.4: Benefit distribution within the Collective-Individual regime



3.5.3 Company regime

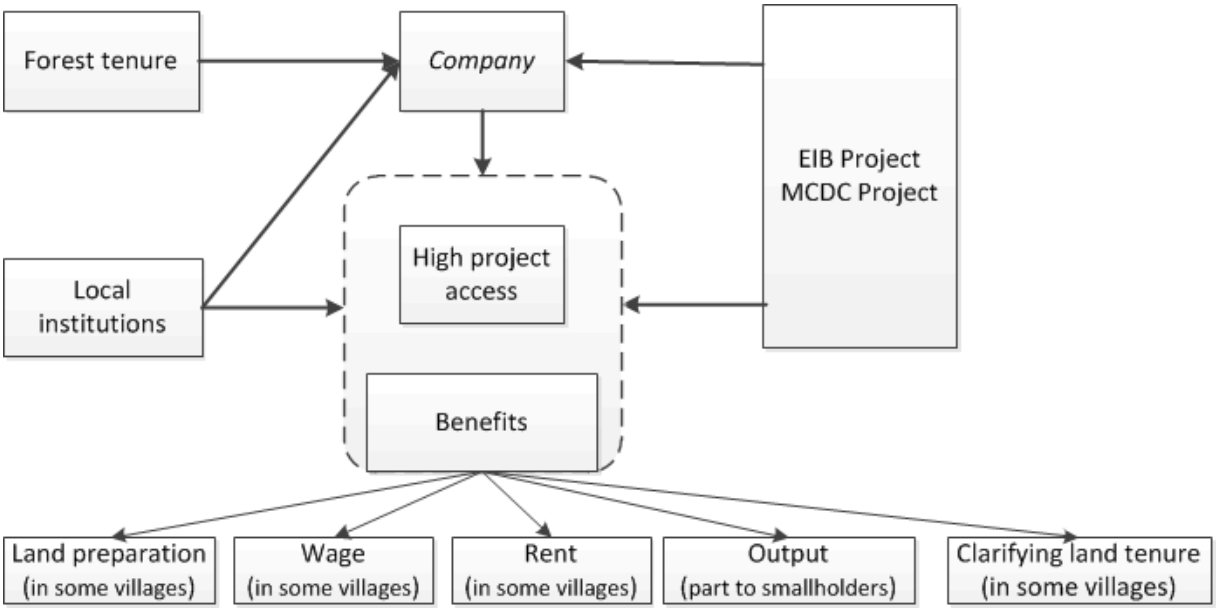
Under the Company regime, a company rents land from the natural village or farmers, and therewith obtains the user rights of forestland. Contracts span over a period of 30 years. As the company applies for the camellia project, the government subsidy is distributed to the company. Companies have different arrangements with different contracts with the farmers. Among the 30 villages of our sample, 3 villages in Suichuan and Fengchen counties are under the Company regime.

One company in Fengchen rents land from a natural village with a collective tenure regime. Access to the project is hence equally distributed within the village. The company provides land preparation, seedlings and wages (160 RMB/Mu, paid annually to the households) to the farm households. Moreover, as the land has originally a collective tenure regime, the forestland is then distributed to individual farmers to manage the land according to the terms of the contract. How land is distributed to the villagers differs across natural villages. In one natural village of our sample, the plots are distributed per household, in another village, distribution takes place based on family size. Farm households are then responsible for planting and cultivating the camellia trees. In the initial stage without harvest, the company pays a rent for the forestland of 60 RMB/year/Mu. When it comes to the fruit stage, a farm household will get 40% of the final output, the other 60% are for the company. Different from wages, the company pays the rent to the natural village leaders, and then the leaders distribute the rent to the farm households. Some villagers reported corruption in the rent distribution. Hence, direct benefits like wages and seedlings are equally distributed, while forestland rent is not equally distributed. An indirect benefit is that the company regime in Fengchen county clarifies forestland tenure as it distributes land management 'rights' to farmers per family size or per capita.

The other company rented land from farmers directly, because here the forestland was earlier distributed to individual households. Our data provide evidence that all farmers had access to the company if they wanted to participate in its plantation project. But the area distribution might be not that equal. The company only provides land preparation and seedlings to farmers, while farm households are responsible for the planting, the cultivation and harvest. The company and farm households share the output in the proportion of 3:7 in the first 10 years and 4:6 in the remaining 15 years.

Comparing these two companies, the distribution of benefits in the second case seems to be rather straightforward, while there are less benefits on the whole for smallholders. Furthermore, smallholders will only earn money in the harvesting stage. It is unclear how farmers can gain access to the company. The first company provides more direct as well as indirect benefits to farmers, i.e. annual wages and rent from the first year onwards. Furthermore, the access to the project is in principle equal across the villagers. However, with the natural village leaders being intermediaries, the distribution of rent gets distorted.

Figure 3.5: Benefit distribution within the Company regime



The kind of forestland tenure, i.e. whether it is collective or individual forestland tenure, is the main reason for the differences in the Company regime. Moreover, local institutions such as market access are also one of the factors shaping the Company regime, for example when there exists a local camellia processing market in the county. In addition, in Suichuan county, the scale requirement set by the county for the EIB project, was a reason to attract a company to participate in project implementation, as a mechanism to allow small farmers also to join.

3.5.4 Partnership regime

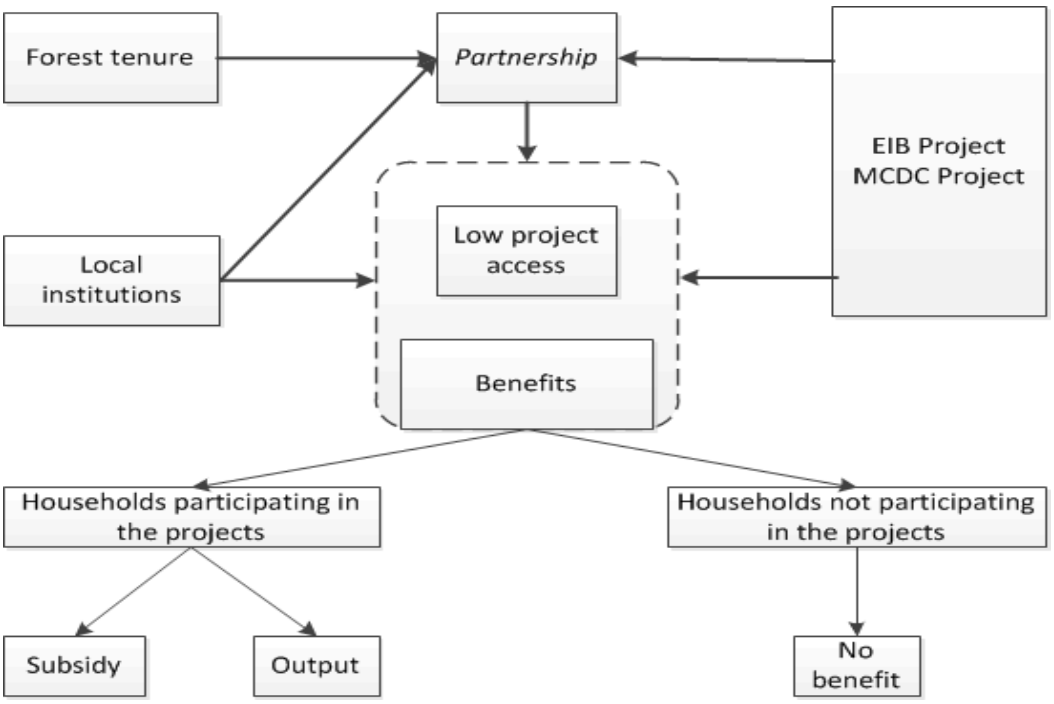
Under a Partnership regime, several households join together to participate in the camellia project. In eight of the 30 sample villages, Partnerships exist. Partnerships were formed under conditions of individual forestland rights in Suichuan county, especially in order to fulfill the 50 Mu scale requirement that the county board set for the EIB project. In Ji'an county and Fengchen county, under this regime natural villages with collective forestland use rights lease the forestland to individual households or directly to partnerships. But this is a contract relation, which does not clarify land tenure rights for farmers without legal certificate, and hence brings no such indirect benefits. As also in Ji'an county, the 50 Mu scale requirement exists, and partnership regimes can be found here in large numbers.

In principle, as every household has the possibility to set up a partnership, access to the project can still be considered as high. However, in our sample villages only 7% of the smallholders join a partnership. Partnership requires the trust between smallholders who are

capable to join together to plant at least 50 mu camellia trees. Furthermore, in Suichuan county, where the EIB project is realized, smallholders do not get—as is the case in the national camellia project—450 RMB/Mu subsidies, but 250 RMB/Mu subsidy, and a low-interest loan of 625.55 RMB/Mu. The higher risks that are involved under the EIB project have to be shouldered by the Partnership, and that may be one reason why partnership participation of smallholders is low.

Individuals under the Partnership regime have user rights of the forestland. The farmers in the partnership jointly apply for the subsidies which they then distribute among themselves. The planting and management of camellia trees are decided within the partnership. For example, in one case, five households established a partnership. Each member has a specialized function in the partnership; for example, one person is in charge of the financial budget, and another is in charge of management of the forestland. The division of the final product depends on the forestland area shared in the partnership.

Figure 3.6: Benefit distribution within the Partnership regime



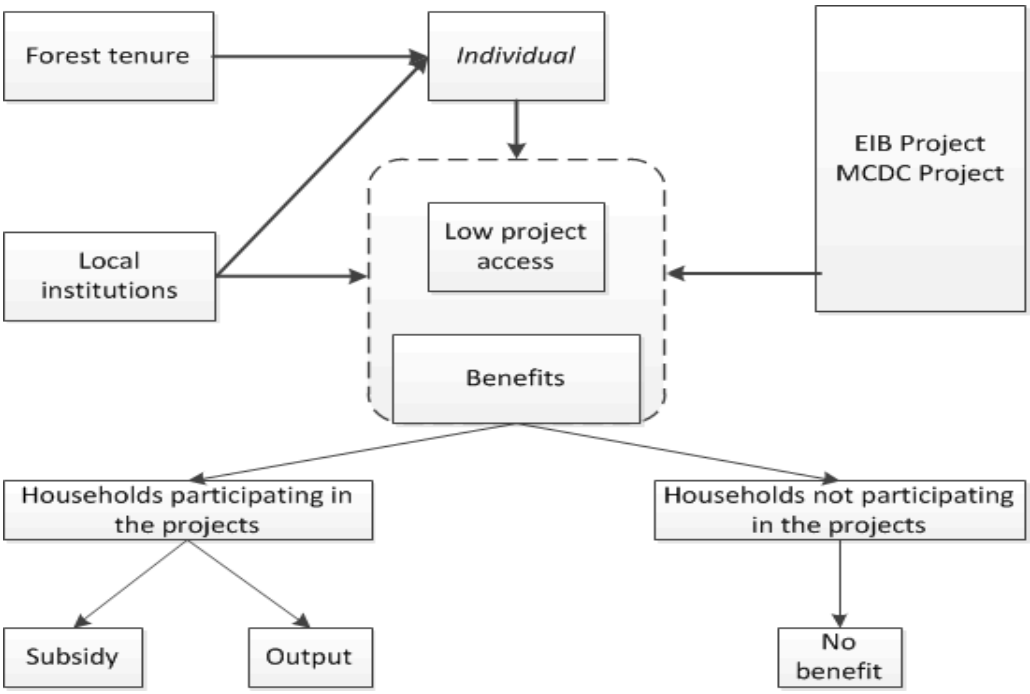
3.5.5 Individual regime

Based on our survey, 30% of the farm households in our samples participate in camellia projects under an "Individual regime". In 19 out of the 30 surveyed villages individual regimes can be found. They exist more often in Suichuan county where the user rights have

been distributed to individual farm households. Fourteen villages in Suichuan have individual regimes because the individual farm households have the user rights of the forestland before the projects had been implemented. In the other cases in Ji'an county and Fengchen county, natural villages choose to lease the land with originally collective use rights to few individual households, so that they can participate in the project. But when the contract is over, the forestland will have to be returned to the natural village. These cases are different from the Collective-Individual and Company regimes, as no clarifying of land tenure rights takes place.

In these cases, an individual farm household applies to the camellia project and receives the subsidies, implements the planting and manages the plantation individually. The farm household gains the full final output. In counties where the 50 Mu requirement exists, individuals with less than 50 Mu land do not have access to the benefits of the project. Furthermore, these benefits will differ depending on the project, i.e. under the EIB in Suichuan county, the subsidy is only 250 RMB/Mu and a 25 year low-interest loan of 625.55 RMB/Mu, while for the MCDC project subsidies were 450 RMB/Mu in 2010.

Figure 3.7: Benefit distribution within the Individual regime



3.5.6 Comparison of benefit distribution

Local governance institutions, forest tenure regimes and forestry project characteristics all influence the implementation of large-scale forestry projects and the related benefit

distribution among smallholders. The distinguished five different forestry project implementation regimes bring about different mechanisms and outcomes of benefit distribution across smallholders and other stakeholders. Table 3.1 compares the five regimes regarding smallholder benefit distribution.

Table 3.1: Distribution of benefits from forestry projects to smallholders of different regimes

Items / Regimes	Project access	Monetary Benefits			Forest output	Clarifying land tenure	Distribution equity*	
		Subsidy	Land preparation	Other benefits (wages, rent)			Between participants and nonparticipants	Among participants
Collective	High	Yes	Yes (in some villages)	Wages (in some villages)	Per household/ family size	No	5	5
Collective-Individual	High	Yes	Yes	No	Family size	Yes	5	5
Company	High	No	Yes	Wages, rent (in some villages)	Per household/ family size (40%/60%/70% for family)	Yes (some)	3	5
Partnership	Low	Yes	No	No	Individual land size	No	1	5
Individual	Low	Yes	No	No	Land size	No	1	5

*1 to 5 indicates the estimated level of equal access and fair distribution; 1=low, 5=high.

In conclusion, different regimes have a different benefit distribution effects on farm households. As shown in Table 3.2, all villagers have access to the project and subsidies under the Collective regime. Some villagers even get further benefits and final outputs. The distribution of the final product among smallholders is based on either family size or per household, which can be considered fair and this rule is used for a long time in natural villages. However, Collective regimes do not clarify the forestland holdings. Hence, the benefits for individual farm households are still uncertain compared to the other regimes with (some form of) individual user rights or clarifying of forestland tenure.

Under Collective-Individual regimes, villagers also get equal project access. Besides project access, subsidies and land preparation are also shared by the smallholders. Significantly, farm households in the natural villages obtain informal management/user 'rights' of the forestland as well as the forest product on the distributed forestland, as the natural village distributed the management of the land to farm households after land preparation. Hence, the informal clarifying of land tenure brought by this regime provides more security of benefits for the farm households. The distribution of forestland is based on family size, as a common and fair rule, in order to provide incentives to the farmers.

The Company regime also provides equal project access to farmers because the company cooperates with farmers by using farmers' land. Therewith, the companies reduce farmers' individual investment uncertainty. The company in Suichuan county cooperates with farmers directly. The company in Fengchen county cooperates with the natural village, and the natural village leaders coordinate between the company and the households. Farm households hence get access to the project and get direct benefits provided by the company. But the company will get a significant proportion of the final product, and some companies even get more than 50% of the outputs. Moreover, the Company regime also clarifies land tenure for farm households. Farm households work on the land distributed to them and get part of the final output at the fruiting stage. The objective of distribution is to guarantee smallholders' commitment, and at the same time it brings security and indirect benefits to farm households. But not only companies obtain a significant proportion of the final product, also reported corruption of natural village leaders interfere in the benefit distribution between smallholders and other stakeholders. Hence the distribution equity is slightly lower (3) between participants and nonparticipants.

Under the Partnership and Individual regimes smallholders have lower access to the project within a village compared to the other regimes, because most farmers have less incentives and capability to participate. Because the Partnership is supported by the projects and local officers, this regime also gets access to international financial supports from EIB. The farm households under Partnership and Individual regimes obtain the final product. The Individual regime and Partnership regime provide security to the smallholders who participate in the projects. However, a number of other smallholders, particularly marginal farmers, do not have access to it.

3.6. Discussion and conclusion

Forest conservation, afforestration and reforestation raise a lot of attention internationally as a climate change mitigation strategy. However, the implementation of large-scale forestry projects in smallholder contexts involves high transaction costs, and requires a project design that integrates the particularities of the local context, as well as the active participation of smallholders. Furthermore, for the long-term success of projects, as well as for a balanced socio-economic development in poor rural areas, a fair distribution of benefits from such projects among smallholders is assumed pivotal.

China presents a smallholder forestry context that is particularly interesting for the implementation of large forestry projects. But little is known on benefit distribution mechanisms and outcomes for smallholder from large scale forestry projects in China. This study into the implementation of large-scale forestry projects suggests that local governance arrangements are critical in the translation of national and international forestry projects into the local context where smallholders become involved. Five different forest project implementation regimes at the local level were distinguished for China, i.e. the Collective regime, the Collective-Individual regime, the Partnership regime, the Company regime and the Individual regime. The regimes are mainly determined by local governance institutions and forestland tenure regime. Together with the forest project characteristics these regimes determine the mechanisms and output of benefit distribution across forestry smallholders in the project locations. The Collective, Collective-Individual and Company regimes provide better project access and equal benefit distribution among smallholders. However, in cases natural village leaders and involved companies can take some of the (financial) project benefits, they lower the benefits for smallholders. Access to the Partnership and Individual regimes is more difficult and unequal, and benefit distribution between smallholder more unequal.

Analyzing project access of and benefit distribution among smallholders is important to understand equity and livelihood of smallholders when projects are implemented. Although the discourse of national and international forestry projects is in general pro-poor, and projects are often formulated with such objectives, implementation of (inter)national projects through various levels in the local village often is quite a different story. This study contributed to understanding why forestry project formulation and local implementation are two different things, as local institutions, project design and forest tenure regimes come in between. Hence, forestry projects need to be designed for local-specific forestry project

implementation regimes. Only then realistic goals of pro-poor development and equal benefit distribution among smallholders can be met.

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Chapter 4. Stagnating jatropha biofuel developments in China: does time matter?[15]

Abstract: For some time biodiesel from jatropha has been considered as a promising alternative to fossil fuels. However, in many smallholder contexts, biodiesel production from jatropha did not bring about the expected results. This paper claims that we can better understand this failure by taking into consideration the dimension of time among stakeholders involved in biodiesel production from jatropha. In analyzing two cases of failed jatropha plantations in China, we find that expectations and time perspectives do not match across governmental levels, rural households and business, contributing to the failure of jatropha plantations. Furthermore, while farmers and government agencies are mutually dependent on each other, involved companies are not, making it easy for the latter to withdraw from jatropha plantation projects. Disaster insurances for companies, better implementation of the rule of law, mandatory blending requirements and consistent financial support may improve continuation of jathropha plantation schemes.

Keywords: oil companies, smallholders, discourses, biodiesel, Sichuan, Guangxi

4.1. Introduction

Global warming, high fossil fuel prices, an increasing alertness for energy security and greater recognition of the environmental consequences of fossil fuels create an urgent need to enlarge the development of renewable energy sources (Scharlemann and Laurance, 2008; Hill et al., 2006). At the same time liquid biofuels, as one of these renewable energy sources, have been criticised among others regarding their competition with food crops for arable land. Policies to promote liquid biofuels have mushroomed world-wide over the past decade (van Eijck and Romijn, 2008; Mol, 2007 and 2010; Oosterveer and Mol, 2010). Not unlike most countries, China has also shown an interest in promoting liquid biofuels as one of the options to

[15] This chapter has been submitted to Energy Policy in July 2012 as: Li, J., Bluemling, B., Mol, A.P.J., Herzfeld, T., Stagnating jatropha biofuel developments in China: does time matter? (*Under review*).

diversify energy sources, to meet its ever increasing energy consumption, and to prevent environmental problems related to fossil fuel based energy use. Because of China's limited per capita farmland and in the face of potential food security risks and global food price spikes in 2006-2007, the Chinese government prohibited the production of biofuels from grain (i.e. corn, rice, wheat) and other major food crops. In this situation, biofuel production from oil trees on marginal lands appears as a promising alternative (Wu et al., 2010). Especially jatropha (Jatropha curcas) is considered to be a promising crop for generating raw material for biodiesel production. The Chinese government consequently started to promote jatropha; but also the Chinese biodiesel industry started to show interest in jatropha.

Jatropha trees produce seeds rich in oil that can be easily converted into biodiesel (Maes et al., 2009). Processing of the seeds involves low technology and low cost equipment (Boerstler, 2010). Ideally, plants are to be exposed to 1000 and 1400 mm rainfall per year. They cannot stand frost.Trees are said to be vigorous, drought resistant and pest-resistant, and to be able to grow on marginal land (Francis et al., 2005), which makes them less criticisedthan other energy crops that compete for land, water and nutrients. However, jatropha cultivation is labour and fertilizer intensive.

Globally, jatropha trees are planted both as community and large-scale plantations. While community plantations have shown signs of success, the "road to large-scale biofuel production for developing countries is bumpy" (Gilbert, 2011, p.19). Moreover, the largest share of investment in biofuel production goes into the establishment of large-scale plantations (Gilbert, 2011). However, in smallholder contexts of developing countries, the implementation of large-scale plantations involves a considerable number of stakeholders who need to cooperate for a lengthyduration of time, i.e. from plantation to seed harvesting.

A number of authors analyzed the context and conditions under which jatropha is planted as an energy crop for biofuel productionin India (Ghosh et al., 2007; Gonsalves, 2006), Latin America (Ghosh et al., 2007) and Africa (Openshaw, 2000). Such research shows that often the initiative for setting up jatropha production is taken by governmental departments, while the actual implementation (plantation, cultivation, harvesting and processing) is realized by local stakeholders (farm households, commercial farms, large-scale plantation holders, and processing companies). Frequently, problems occur in the process of implementation, related to a lack of community commitment and involvement, ashortfall in supervision and participation of private companies and investors, and proven evidence of too optimistic initial (economic) assumptions and predictions in terms of yields. In Zambia, a company reneged on

the contract and disappeared after farmers just started to harvest seeds (Gilbert, 2011). An empirical study in Tamil Nadu, India, found that a lack in agricultural labour, low government involvement, and the non-fulfillment of company promises (e.g. on loans) in contract farming led to the failure of jatropha plantations (Ariza-Montobbio et al., 2010). While companies and governments faced low risks, high incentives and long timeframes in the Indian case study, farmers faced high risks, short time frames and limited room for alternative action (Ariza-Montobbio et al., 2010). In Kisarawe district, Tanzania, the widespread introduction of jatropha was not accompanied with a regulatory framework. Implementation suffered from a lack of information on compensation to village farmers for using their land, and from the postponement of the benefits for farmers (Habib-Mintz, 2010). These kinds of failures of large-scale jatropha projects led Kant and Wu (2011) to coin current developments as the 'collapse of jatropha as a global biofuel'. The last two cases have in common that within these projects, the time perspectives of stakeholders differed. "Time perspectives" are "composite cognitive structures that characterize the way an individual projects, collects, accesses, values, and organizes events that reside in distinct temporal loci" (Hoogstra 2008, 14f). In India, the government and companies had projected different temporal loci for jatropha returns than farmers. In Tanzania, the postponement of farmers' benefits brought about a negative valuation of their future returns. Physical realities of jatropha production include a rather long time horizon. There is almost no harvestable production within the first three years (Ye et al., 2009). Jatropha trees reach full production potential in the fifth year and produce seeds for up to 50 years (Ye et al.2009; Sigh et al., 2008). In China, the large-scale jatropha plantations are usually set up at one time. Thus, plantations are of one age class.

In China, so far, two different institutional arrangements to establish plantations have been identified. Whereas market driven arrangements, where farm households cooperate with private companies, appear as the standard in Western contexts, government driven arrangements with a high involvement of local and higher level government offices are still quite common in China today. To what extent and how each of these institutional arrangements can help to overcome the differences in time perspectives that we have depicted above, has, to the best of our knowledge, hardly been looked at. Our main objective is to investigate in how far the two institutional arrangements contribute to reducing uncertainty of future outcomes, comparing two case studies from China. First, we will analyse the expectations and time perspectives of the different stakeholders involved. Second, we will compare the development of the two different—market and government driven

—arrangements in the time perspectives that they create. Finally, we develop conclusions how arrangements could be redesigned to lead to more enduring jatropha plantations.

The remainder of the paper is organized as follows. Section 2 provides an overview of Chinese policies to promote jatropha and introduces theoretical concepts applied in the analysis. Section 3 discusses the research methodology and analytical framework. Section 4 reports on the detailed case studies in Sichuan and Guangxi. Section 5 discusses our findings and the last section concludes the paper.

4.2. Background and theory: policies, institutions and time

4.2.1 China's jatropha biofuel policy

As biofuels are new energy sources that have currently higher production costs than fossil fuels, most governments have heavily supported and subsidized initial liquid biofuel developments (Mol, 2007). China has been no exception to this rule. In China, the cultivation of jatropha was initiated and organized by the central government, while the implementation of concrete jatropha projects falls under the responsibility of village committees and farmers. The national government devised a series of laws and policies to support and promote jatropha plantations (see Table 4.1).

Table 4.1:National supportive policies for jatropha biofuels（1998~2011）

Year	Name of law/policy	Publishing authority *	Most relevant content
2005	Renewable Energy industry development supervision catalogue	NDRC	Support the plantation and better variety selection of energy crops including jatropha; support technological research, demonstration projects etc.
2006	National energy forest construction plan	SFA	13 Mio ha energy forests including jatrophaas target in 2020, which will supply raw material for 6 million ton biodiesel and 15 million watt electricity.
2006	"The Eleventh Five-Year" construction scheme for oil-breeding energy forest base	SFA	During the eleventh five-year plan (2006-2010), development of 400,000 ha jatropha in Sichuan, Yunnan, Guizhou, and 433,000 ha other oil-breeding forest.
2006	Interim instrument on Renewable Energy Development Special Funds	MOF	Special fund provided by Central government and targets also biodiesel from seeds. Procedures of application and approval, financial management and monitoring are regulated. Setting a subsidy standard of 3,000 RMB per ha for energy forest including jatropha

			Contract farming with pilot company is required.
2006	Implementation Guideline on financial and tax support for renewable energy and biochemical industry	MOF NDRC MOA SAT SFA	Introduced the principle "Not compete with grain" and encouraged using marginal land. Encourage utilization of jatropha seeds to produce biofuels. Financial and tax support includes: subsidy for enterprises when crude oil price is lower than price for oil from jatropha seeds; subsidy for energy forests and demonstration plots; tax preferences. Outlines qualifications for getting support and monitoring of financial support.
2007	Medium-long-term development plan on renewable energy	NDRC	Biodiesel production from energy crops one of the foci. Several jatropha-breeding biodiesel experimental projects in Sichuan and others provinces established. Annual target of biodiesel use in 2010 is 200,000 tons, in 2020 2 Mio tons. To improve the market, oil companies should blend petroleum and diesel with liquid biofuel.
2007	Management instruction on financial subsidy supporting the crops which produce non-grain Renewable energy and Biochemical products	MOF	Qualifications to receive and use financial support. A refinery and capacity is required to be qualified to get the subsidy. More than 20 thousand ha plantation and more than 33.3 ha nursery field are required.
2007	Biodiesel Blend Stock (BD100) for Diesel Engine Fuels	GAQSIQ SA	Setting a quality standard for biodiesel
2011	Biodiesel Fuel Blend (B5)	GAQSIQ SA	2%~5% biodiesel blending with 95%~98% diesel

* *NDRC*National Development and Reform Committee; *MOF* Ministry of Finance; *MOA* Ministry of Agriculture; *SAT*State Administration of Taxation; *SFA*State Forestry Administration; *GAQSIQ* General Administration of Quality Supervision, Inspection and Quarantine; *SA* Standardization Administration;
Land area is given in *ha*, on the base of the original Chinese unit of *Mu* (15 *Mu* = 1 ha).

Table 4.1 shows that especially from 2005 onwards, a national supportive policy to promote biofuels from jatropha has been developed in China. Different governmental agencies have set numerous measures to facilitate, stimulate and regulate renewable energy production from jatropha biofuels. Five governmental agencies have formulated guidelines for financial support and facilities to stimulate liquid biofuel production: Ministry of Finance (MOF), Ministry of Agriculture (MOA), State Administration of Taxation (SAT), National Development and Reform Committee (NDRC), and State Forestry Administration (SFA). However, these guidelines have not necessarily contributed to stable long-term favorable perspectives for jatropha forestry plantations. SAT's tax exemption for biodiesel, published in

2005, has already been abolished in 2008. In 2007, standards were published for biodiesel production. The Biodiesel Blend Stock (BD100, 100% biodiesel) for Diesel Engine Fuels was published in 2007, and the Biodiesel Fuel Blend (B5, 5% biodiesel) was published in 2011. In contrast to many developed countries, which created a liquid biofuel market by setting compulsory targets for blending, China has no mandatory blending target for biodiesel. National policies have hence so far not yet built up a robust market environment.

Apart from creating a national niche market for jatropha biodiesel, clearly outlined programs and plans can also create clear and shared time perspectives for jatropha plantations. In The Eleventh Five-Year construction scheme for oil-breeding energy forest bases, published by the SFA in 2006, a Forestry-Oil Integration (FOI, linyou yitihua) plan was formulated in which jatropha plantations were to be increased in 3 provinces: Sichuan, Guizhou and Yunnan (SFA, 2006). In this plan, a policy arrangement was set up between state-owned oil companies and SFA to promote energy forest plantations and biofuel production. CNPC, China's largest state-owned oil company, first entered in a collaborative relation with SFA, and two other major state-owned oil companies, SINOPEC and CNOOC, later joined this cooperation. Following these state-owned companies and further attracted by governmental promotional policies, private companies became also involved in jatropha plantation.

In China, provinces often complement such national programs and plans with regulations and policies. Sichuan and Guizhou provinces put jatropha promotion in their Eleventh Five-Year Development plan (Sichuan People's Government, 2006; Guizhou People's Government, 2006), aiming for 600,000 and 400,000 hectares planted with jatropha in 2020 respectively (Wu et al., 2010). Biodiesel industry development from jatropha was also written into the No 1 document[16] of Guizhou People's Government in 2007 (SFA, 2006). But besides these three, also other south-western provinces have developed policies to stimulate jatropha plantation, and downstream biodiesel production and use. Provincial programmes and plans hence may provide some common time perspective for jatropha stakeholders.

[16] Guizhou provincial party committee and People's government, "Comments on developing modern agriculture and promote socialist new rural construction" (in Chinese) ([2007] No 1).

4.2.2 Institutional arrangements

The Forestry-Oil Integration plan set up a "policy arrangement" between state-owned oil companies and SFA to promote energy forest plantations and biofuel production. A policy arrangement is a temporarily stabilized actor network with a certain division of power among its actors, specific rules of the game, and an underlying discourse. While useful for higher-level policy-making, the concept was deemed less applicable to arrangements that, while implemented within the frame of a policy-arrangement, do not involve policy actors. For arrangements that implement policies and targets on the ground, the concept "institutional arrangement" will be used. "Institutional arrangements" are "(particular sets of rules) through which ... decisions are implemented" (Adger et al. 2003: 1100). They can be related to a variety of actors, and do not necessarily have to include policy actors. The analysis of such institutional arrangements will draw from the variables of the policy arrangements approach: actors and their coalitions; the power to mobilize and deploy resources; the rules of the game and current discourses (see below for their operationalization).

As briefly mentioned above, we can roughly divide the currently existing jatropha institutional arrangements in China as government driven and market driven. The term government driven arrangements refers to plantation projects that are initiated by governmental stakeholders and implemented by governmental and/or other stakeholders. In these arrangements, governmental authorities might use fiscal incentives (e.g. subsidies) or power to get things done. The term market driven institutional arrangements refers to plantations that are initiated and implemented by market actors such as companies and smallholders. In such arrangements companies usually have a rather direct interaction with the farm households or their representatives and will optimally motivate them by using appropriate incentives. Market driven institutional arrangements have no direct involvement of government departments or officers.

Institutional arrangements might reduce uncertainty about future outcomes via three different ways. First, we assume that uncertainty is reduced when each stakeholder contributes with resources to the arrangement and rules prevent the withdrawal of different stakeholders. Resources can be land property, seedlings, financial and staff support, knowledge, access to certain actor groups or means of communication, legal power or committee membership, market channels (Van Gossum et al., 2011; Liefferink et al., 2006). Contribution with any of these resources shows commitment as well as vulnerability in case the agreement fails. Furthermore, actors are vulnerable to other actors withdrawing their

resources, which is referred to as “mutual resource dependency” (Arts and van Tatenhove, 2004). The contribution of resources to the arrangement will be examined for both, the stipulations within the institutional arrangement, as well as its implementation. Crucial is furthermore the contribution of resources over time. It is assumed that future outcomes for actors will be clearer where actors are involved over several time steps, bridging to future outcomes.

Second, the rules of the game, such as executive sanctioning mechanisms, will prevent stakeholders from withdrawing from the agreement and bring protection of vulnerable stakeholders. We follow Arts et al.(2006: 99) in defining rules of the game as the ‘actual rules for political and other forms of interaction’. Ideally, sanctioning mechanisms lead to a reduction of uncertainty.

Third, uncertainty of future outcomes is reduced when actors share a discourse around the arrangement. The concept of discourse refers to “the views and narratives of the actors involved” (Arts et al., 2006: 99). A discourse is here understood as “a dominant interpretative scheme” by which meaning is given to the respective joint initiative (Arts and van Tatenhove, 2004: 343). Given the long duration of the jatropha institutional arrangements, “discourse” gets the notion of a “vision”, which has the potential to mobilize stakeholders (Olsson and Folke, 2004). However, a discourse may also imply persuasion, employing the “power of arguments” and defining what legitimate behavior is (Arts and van Tatenhove, 2004). Hence, convergence of different discourses around the arrangement would keep the persistence of the institutional arrangement over time by reduce uncertainty. However, if the discourse is divergent, then uncertainty might increase.

4.2.3. Diverging time perspectives

Obviously, actors in these institutional arrangements might differ in expectations, and time perspectives. “Time perspectives” are “composite cognitive structures that characterize the way an individual projects, collects, accesses, values, and organizes events that reside in distinct temporal loci” (Hoogstra 2008, 14f).Long-time horizons are known to fail in evoking commitments (Hoogstra and Schanz, 2009) as they involve a “range of uncontrollable and unpredictable factors operating in the future” (Hoogstra and Schanz, 2008a: 316). Under such conditions, institutional arrangements are crafted to create time perspectives which bring added value to today’s risk-taking decisions (Hoogstra and Schanz, 2008b).

Long-term profitability and short-term liquidity are important characteristics in a plantation's planning (Kurttila et al., 2001). Delay in investment return is a crucial aspect for planters with liquidity constraints (Mary et al., 1998). Some actors in jatropha institutional arrangements (farmers, local government staff) focus on annual income revenue to cover their cost, especially when their yearly expenses are relatively high. For other actors (companies and central government), biofuel production from jatropha might just form a minor share of their total activities and budgets. Therefore, for them future income or general profitability of the project is more important in determining success. These diverging (time) perspectives in jatropha investments are to some extent comparable to other sectors. For instance, investment in forestry needs to deal with a long time horizon before returns capitalize, which is problematic for small forestry farmers (Convery, 1973; Hoogstra and Schanz, 2009). Even more similar to jatropha, investments in orchards face a distribution of financial returns over a long period with a time lag of several years (Dorfman and Heien, 1989).

4.3. Methodology: case study

Case study methodology is employed to analyse large-scale jatropha projects in China. Case study methodology is especially valuable when investigating a contemporary complex phenomenon within its real-life context, where boundaries between phenomenon and context are not clearly evident, and 'how' and 'why' questions are being asked (Yin, 1989; Verschuren, 2003). In comparing government and market driven arrangements in their contribution to creating a long-term perspective and actor commitment, in depth analysis of a limited number of cases is considered appropriate.

As case study methodology has its limitations in terms of generalization of results and external validity, the selection of case studies is crucial. A two-step selection process was performed. First, two Chinese provinces were selected out of those provinces that have favorable conditions for jatropha cultivation and have installed policies to stimulate jatropha. Sichuan and Guangxi were selected, as both provinces are located in southern China and have suitable subtropical climatic conditions to grow jatropha. Secondly, a case of government driven jathropha plantation arrangement was selected in Sichuan and a case of market driven arrangement was selected in Guangxi. Sichuan has the largest area of established jatropha plantations in China (Qian et al., 2007). Moreover, the first project in the FOI scheme, in which the state-owned CNPC cooperated with SFA on jatropha, started in Sichuan. Since

Sichuan has its own jatropha related policies, the province is a representative case for a government-driven institutional arrangement where both, the national and provincial government have devised a long-term perspective for jatropha biodiesel production. Guangxi also has established jatropha plantations, but does not belong to the initial three provinces of the FOI and has no jatropha projects involving state-owned companies. In Guangxi, jatropha plantations are predominantly initiated by private companies and hence are typically market-driven institutional arrangements. As such, the two provinces differ substantially in how actor configurations and policies approach the development of jatropha plantation and related liquid biofuels production.

In each of the provinces, provincial level representatives of the SFA provided an overview of the large-scale jatropha plantation projects that had been initiated over the past years. From their list, one project in each of the provinces was selected, based on the criteria of accessibility, available information and minimum scale.. The fieldwork on the two cases was carried out in 2010, using in-depth semi-structured interviews with key stakeholders and document analysis as the main research methods. Key stakeholders included decision makers from four administrative levels and from the village committee, scientists and company officials. More specifically, interviews were held with state forestry administrations in charge of energy crops including jatropha (2), provincial forestry department officers in charge of jatropha projects (2), county forestry department officers in charge of the jatropha plantation (2), township forestry officers where jatropha was planted (2), as well as village leaders of villages taking part in the jatropha plantation (2). Moreover, interviews with three scientists, one previous staff of the private company, two staff from the state-owned company as well as three NGO spokespersons were conducted. The semi-structured interview was designed by mapping out the relevant actors, resources, rules of the game and discourse characteristics around the two jatropha projects (Arts et al., 2006). Time perspectives of different actors are measured by comparing the stakeholders' views and expectations about past experience and present situation and future developments related to the respective jatropha projects.

4.4. Analysis of two institutional arrangements

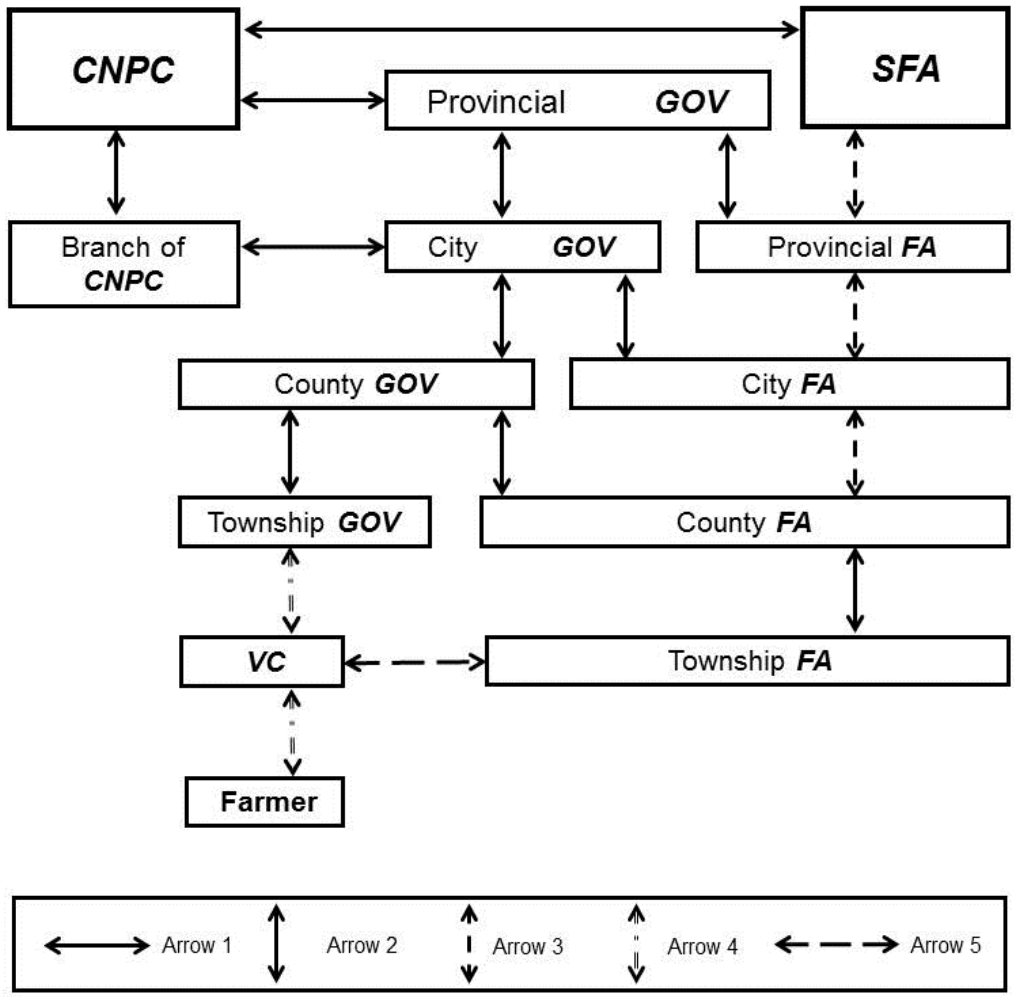
This section introduces and analysesthe two institutional arrangements. Each case will be described by starting with the respective arrangement and itsimplementation, with a focus on actors' contributions, resource dependencies and the arrangement's embedding in a discourse. Subsequently, the performance ofeach institutional arrangement will be presented in terms of de facto plantedarea and realized biodiesel production.

4.4.1 Government driven arrangement: Sichuan province

Institutional arrangement

Within the FOI plan, the long-term planning target for new jathropha plantations in Sichuan province is 600,000 ha until 2020, while the five-year plantation target from 2007 onwards, is 200,000 ha (interview Sichuan FA officer). To achieve these targets, the Sichuan provincial government set up an arrangement in which CNPC plays a pivotal role (see Figure 4.1). CNPC is a financially independent state-owned company, developed out of the Ministry of Oil Industry in 1988 as part of China's development towards a market economy. However, CNPC still has close ties to the government, as the leaders of CNPC are appointed by the Chinese Communist Party and CNPC is considered a ministry level state-owned company (hence, its highest leader is equal to a minister). The cooperation between CNPC and SFA as well as the Sichuan provincial government can be considered as a horizontal cooperation between different government sectors.

Figure 4.1: Jatropha project governance structure in Sichuan province



Arrow1 Horizontal Cooperation, *Arrow 2* Administration Jurisdiction (appointment and financial resources decided by higher level), *Arrow 3* Supervision (the lower level implements policy from higher level and is under higher level supervision), *Arrow 4* Governing by Provision (the higher level governs the lower level by resource provision) (Kern and Alber, 2009) *Arrow 5* cooperation based on agreement (the actors work together according to oral agreement or written contract). *VC* Village Committee, *GOV* Government, *FA* Forest Administration

These two parties signed an agreement on jatropha projects in 2006. According to this agreement, both parties will work together to realize a '100 thousand – ton scale' jatropha based biodiesel pilot plant. The provincial FA did a survey of marginal land suitable to grow jatropha and of the original distribution of wild jatropha, and presented survey results to CNPC. Based on the results and a field trip, the provincial FA and CNPC selected project plots and set a planting target for a five-year period. They agreed upon the realization of jatropha plantations in Panzhihua City and Liangshan minority autonomous city. Also for these levels, it applies that the cooperation between the branch of CNPC in charge of these projects, and Liangshan city government and Panzhihua city government can be considered as

cooperation on an equal footing. CNPC signed an agreement with Liangshan city government to plant an area of 120,000 ha jatropha demonstration plots, and with Panzhihua city government to plant an area of 80,000 ha jatropha demonstration plots. The realization of this long-term goal was to be realized in several steps. In 2007, Panzhihua and Liangshan governments were obliged to plant together 13,330 ha with jatropha, and in 2008, 16,670 ha.

In these agreements, Liangshan and Panzhihua city governments would ensure forestland availability, promised to coordinate the implementation of plantations, i.e. to arrange labour and provide planting supervision, as well as to organize the harvest, the collection of the seeds and transport them to CNPC. Township Forest Administrations would support the collection of seeds by farmers, and CNPC would pay a small fee to the township FA for this service. CNPC ensured to provide subsidies for the plantation as well as promised to purchase all jatropha seeds and process them to biofuel. CNPC would buy these seeds at a market price, if it exceeded the guaranteed price of 3 RMB/ kg. The collected seeds would be transported by the township FA to a simple extracting plant, which produces the raw product which was then to be transported to a more centrally located refinery. Nanchong refinery of CNPC was a registered project at the NDRC, which consists of a 60 thousand ton production line to extract the raw jatropha oil. The realization of this agreement received support by the Ministry of Finance MOF and CNPC, who each would contribute 50 % to the planned budget.

In conclusion, the institutional arrangement sets time-steps and concrete quantitative future outcomes. Furthermore, actors of the whole production chain are involved and contribute resources. We can assume that future outcomes of the agreement are rather certain. National government together with city and county / township governments contribute the most in terms of resources (see Table 4.2).

Table 4.2: Contribution of resources to the government driven arrangement

Actor	Resources contributed to arrangement		
	Category	Description	Time dimension
MOF	Finance	50% of cultivation investment (seeds, labour) in planned budget	The subsidy of 2007 distributed after plantation in 2007 The subsidy of 2008 distributed in 2010
Liangshan/Panzhihua governments	Staff	Staff for coordination of jatropha plantation, of seed harvest, collection* and	Plantation period and harvest period

		transport Technical service staff for jatropha cultivation	
	Infrastructure	Transportation	Before and during harvest period
	Access	Access to forestland	Before and during plantation period
County FA / township government	Access	Access to farmers : use of argumentative power for persuasion Access to higher level: use of subsidies from MOF for persuasion Access to CNPC	Before and during plantation period Before and during plantation period Before and during plantation period, harvest period
CNPC	Finance	50% of cultivation investment (seeds, labour) in planned budget Purchase of all jatropha seeds at 3 RMB/kg or higher (market price).	The subsidy of 2007 distributed after plantation in 2007 The subsidy of 2008 was not paid
Villagers	Labour		Plantation period and harvest period

*Against a small fee by CNPC.

For the implementation, the planting task was distributed downwards via the county and township governments to the village committee. The Forestry Administrations at each level are in charge of implementation. The subsidies of the MOF had to be distributed via the county FA to the participants. In the four counties, the county FA and the township government employed their access to those realizing the plantation, i.e. they persuaded large (institutional) forest landholders and village committees. The village committee persuaded the villagers to take part in jatropha plantation by supplying seedlings, fertilizers, paying wages and by promising that CNPC will purchase the final product with the help of the township FA. Persuasion of farmers did refer to the national level's discourse around jatropha, but rather applied economic arguments of increasing villagers' incomes. Costs for setting up jatropha plantations are covered by the subsidy of the MOF (3,000 RMB/ ha), and CNPC Ltd (3,000 RMB/ ha). During the implementation, subsidies only address expenses for the first year.

The arrangement is furthermore related to higher level policymaking in that it is part of the FOI plan. The plan is embedded in general governmental discourses on measures for combating global warming, on building on forests' ecological functions[17] and on the contribution of renewable (energy) resources to sustainable development[18.] These higher level discourses however are not fully translated to the local level. More specifically, SFA and CNPC legitimate jatropha through discourses of combating global warming and increasing renewable energy sources. But for provincial FA, county FA and township FA reporting on political achievements, such as plantation targets, are crucial. Also village leaders are held accountable on their political achievements in fulfilling orders from higher level government. In regard to their time perspectives, SFA, provincial FA and CNPC are especially concerned about jatropha seeds and future biodiesel production. For these stakeholders, future outcome is more important than present performance. For county FA and township FA, the present plantation and costs have priority over future seeds and biodiesel. For village leaders and villagers, present cash income is the most important element to cover their daily life and consumption.

Performance

The planted area in 2007 was 14,667 ha, i.e. more than the target for that year; in 2008, 15,333 ha were planted, which was a bit less than the original target. The average area of the two years' plantations reached the annual targets. Out of the two sources of subsidies, MOF and CNPC, the MOF paid its subsidies to the provincial Department of Finance (DOF) after inspection. The latter transferred it to the county DOF and the county DOF then to the county FA, who transferred the money to the planters and employed farmers. However, subsidies from CNPC over 2007 and 2008 did not arrive at the county level until 2010. For the start of the FOI scheme, the county government and FA paid this part of CNPC's investment from their own resources. Hence smallholders who were involved in the jatropha plantation of 2007 received the subsidy on time. However, MOF subsidy for new jatropha plantations in the second year, due in 2008, was distributed to the county FA only in 2010. The reason for this delay lies in the requirements for receiving MOF subsidies. MOF stipulates that for receiving

[17] State Forestry Administration, "Promote forest-based biofuel and biomass- the seventh knowledge learning from Hu Jintao speech (in Chinese), http://swzny.forestry.gov.cn/portal/swzny/s/776/content-516699.html, accessed May 2012.

[18] Xinhua Web, "China will foster its high-quality energy forest base to 200 Mio Mu until 2020". http://env.people.com.cn/GB/146189/168051/168296/10005369.html, accessed May 2012.

subsidies, a jatropha plantation needs a contract with a pilot company, and the enterprise needs to have a refinery in its vicinity. In the second year, CNPC withdrew from the project, and with the withdrawal, also the construction of Nanchong refinery stopped after 2008, before it came into production stage (interview with FA officer). This implied that farmers' jatropha plantations did not have access to a refinery, which led MOF to stopping financial flows. However, after farmers lobbied at the local FA, and the latter lobbied at higher level FA departments, subsidies were finally transferred to farmers. Even though with considerable delay, the national government in the end paid the subsidy and farmer wages could be paid. After withdrawing from the arrangement, CNPC did not pay the second year subsidy. As a consequence, the local government and farmers stopped planting and cultivating jatropha. A county report[19]showed that the county FA had a large debt because of their spending on seedlings and fertilizers, causing absence of payments to large forestry farmers and their employees. This created conflicts between employed farmers and the local government.

Due to low investments for intensive cultivation the productivity and yield of jatropha is considerably lower than initially expected. Nowadays, jatropha plantations from the first and second year still exist, however, the average production each year is around 750 kg/ ha compared to the initially expected 4500 kg/ ha.

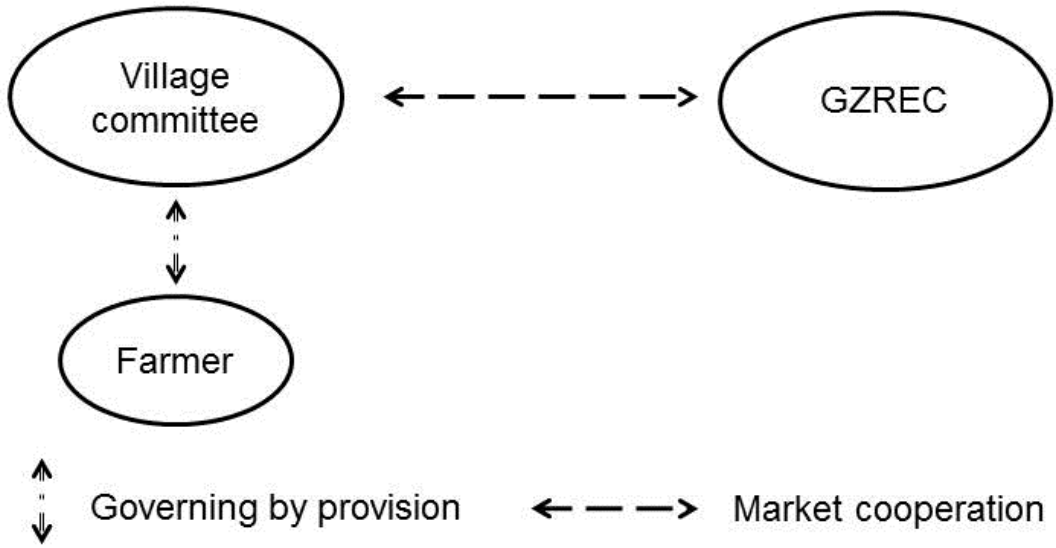
4.4.2 Market driven arrangement: Guangxi province

Institutional arrangement

In Guangxi, private companies rather than state-owned oil companies initiated jatropha plantations. Guangxi Zhilian Renewable Energy Company (GZREC) was the biggest and most famous private energy company involved in jatropha-based biofuel production. GZREC was set up in 2007, cooperating with the International Jatropha Association, specialized in jatropha genetic research, seedling cultivation, jatropha forest construction, and biodiesel production (Interview with Guangxi FA officer). The company started plantation by using a contract farming scheme with the village committee.

[19] Report on the problems in jatropha forest base constructions published by Yanbian County People's government (in Chinese).

Figure 4.2: Jatropha contract farming scheme in Guangxi province



The company started plantations in Pingguo County because Pingguo has a large area of marginal forestland and jatropha has a long history in the county. GZREC came into contact with the rather impoverished Burong administration village in Pingguo County through the introduction by the office of poverty alleviation. After initial contacts, the company negotiated directly with the village leader. The village leader then investigated in Nanning city (the capital of Guangxi province) several jatropha biofuel companies, and checked information on the internet on the company and on biofuel production. Only then he decided to cooperate with GZREC. The private company decided on the planting area after discussing with the village committee. The two actors hence had a vision of feasible future outcomes in terms of planted area. The company and Burong village committee signed a written contract. The cooperation between the company and villagers can be seen as contract farming, which is a market arrangement. This contract arranged that the village would supply land and coordinate labour, while the company would supply seedlings, fertilizers, compensate for labour costs, and provide technical services. The company agreed to offer basic labour wages, around 30 RMB per person per day. The company also agreed to buy the seeds at a guaranteed price, and if the market price was higher than the guaranteed price they would buy the seeds at the higher market price. For the realization of the agreement, GZREC applied for subsidy from MOF (interview with village leader). From this arrangement, there was not much risk involved for farmers, and income generation was secured for initial labour investment.

The village leader informed the farmers on the technology, market and policies and compiled a handbook. In order to involve farm households in jatropha plantation and cultivation, the village committee and secretary on the one hand persuaded farmers to participate. On the other hand, the village committee also gave away its control over the use rights of collectively-owned forestland and distributed the land among the farmers to incentivize farmers' participation and to organize jatropha planting. Finally, the village committee convinced farmers that the company can be trusted. The farmers were highly motivated because the private company and village committee took a lot of measures (see also table 4.3 for the contribution of resources).

For establishing a joint vision and discourse, during the planting phase the company also invited television for broadcasting this project to a wider public. This publicity increased confidence and trust among the villagers (interview with village leader). Furthermore, the company organized an introductory meeting and seminar, inviting village leaders from other areas and explaining the economic value of jatropha, the technology of jatropha plantation and the cooperative arrangement between private company and village committee, to attract more participation. GZREC planned to grow 3,333 ha in Pingguo County, and started to grow jatropha on 133 ha in 2007 in Burong village. The private company offered important resources and attracted more participation through media and a seminar.

Table 4.3: Contribution of resources to the market driven arrangement

Actor	Resources contributed to arrangement		
	Category	Description	Time
Village leaders	Staff	Coordination of labour	Plantation period and harvest period
	Access	Access to forestland	Before plantation
		Access to farmers : use of argumentative power for persuasion	Plantation period and harvest period
		Access to company	Before and during plantation period, harvest period
	Social capital	Trust of farmers in village government	Plantation period and harvest period
Company	Finance	Production costs (seedlings, fertilizer, labour cost)	Plantation period
		Purchase of all jatropha seeds at 3 RMB/ kg or a	Harvest period

		higher market price.	
	Access	Access to market Access to media	Harvest period Plantation period
	Staff	Company staff provides technical service to villagers.	Plantation period and harvest period
Villagers	Labour		Plantation period and harvest period
	Expertise	Know-how of jatropha cultivation and harvest.	Plantation period and harvest period
	Land use right*		In the beginning of the plantation

* Provided by the village committee.

This market driven arrangement was based on market opportunity and economic interest. The private company at that time envisaged a market chance and promising bioenergy industry support by government subsidies. The village leader wants to spur rural development by increasing employment and household incomes. Villagers need continuous income streams and are interested in improved living conditions. For the private company, jatropha seeds and future biodiesel production are more important. The village leader's and the villagers' interest focused on liquidity. Thus, the private company's time perspective exceeds the rural household's time perspective.

Performance

About 4 months after the initial planting of 133 ha, in the beginning of 2008, frost destroyed the young jatropha forest. The program was not continued after the frost and the hills were left barren. The company disappeared without fulfilling the contract, and hence the farmers did not receive any wages. Although there was a written contract between the village committee and company, it was difficult to follow-up on this as the company disappeared and the village committee was not capable to effectuate the contract before court.

One reason why GZREC withdrew after the frost was that it expected (in vain) to receive subsidy from MOF. According to the 'Management instruction on financial subsidy supporting the crops bases which produce Renewable Energy and Biochemical products' published by MOF, jatropha plantations receive subsidy only if they reach 20 thousand ha plantation and have at least an area of 33.3 ha nursery fields. Even if a refinery was under

construction, GZREC did not qualify for the subsidies. The frost may just have been the trigger to quit the project.

4.5. Discussion

This paper's focus on two cases that both failed might raise concerns of potentially biased outcomes of the study. However, these two failed projects are not singular cases. There are more failures of jatropha plantations and biofuel production from jatropha seeds in China. At the end of 2006, the US Company Beck Ltd withdrew from China, after having invested 2.6 million RMB in jatropha plantations. The UK Company Sun biofuel left China because the company could not agree with Panzhihua city government, Sichuan Province, about how much it had to invest in order to continue jatropha production (Huaxi City News, 2011). Various other jatropha projects of CNPC, SINOPEC and CNOOC discontinued and CNPC and CNOOC have stopped investing money in jatropha projects (Science Times, 2011). Moreover, according to Hainan Daily (2011), in the beginning of 2009 the area of jatropha plantation has been around 2,660 ha in Hainan, until 2011 the number decreased as several private companies withdrew. Our general aim is not to compare successful and unsuccessful projects but to discuss whether the two kinds of institutional arrangements result in different development paths of the respective plantation. The analysis of the two presented cases provides important insights into why arrangements can fail and which mechanisms have been missing to prevent failure.

The rules of the game of government driven institutional arrangements are characterized by the embeddedness in the present organization of the Chinese economy, i.e. a sort of market style with strong government characteristics and top down administrative planning and regulation. The withdrawal of CNPC from the plantation and the closure of their Nanchong refinery can partly be attributed to a leadership change in CNPC. The former leader was enthusiastic about jatropha and showed commitment and vision. The new CNPC leader was hardly interested and terminated the subsidies, a development that is not uncommon in China (Wang et al., 2009). Furthermore, the cooperation between the city government/ FA and CNPC was based on a quite general agreement, without any provisions on punishment in case of non-compliance, and not on a standard contract with legal power. The agreement was quite vulnerable to external shocks. What moreover played a role is that CNPC is not a full market player. It is a ministry level state-owned company, and higher ranked than SFA, so that it is difficult for SFA to control or enforce CNPC's commitments.

However, even with contracts and promises, the private company in Guangxi could also withdraw. This case reflects the state of the rule of law in transitional China: the legal system is underdeveloped. There is insufficient coordination and supervision to legally sanction private (and state) actors not behaving according to written contracts. The lack of involvement of higher governmental levels and the non-fulfillment of company promises in contract farming reinforced the difficulties of jatropha plantation, not unlike in other Asian cases (e.g. Ariza-Montobbio et al., 2010). A further factor for the failure in Guangxi was the strictness of subsidies from MOF, i.e. in terms of the size of plantation area and the requirement to have a refinery close to the plantation. This led to the private company not getting subsidy.

In the case in Sichuan, the local government and farmers seem to be in a situation of mutual resource dependency: The government depends on farmers' willingness to contribute with labour; the farmers depend on the government for access to programs and monetary resources. Both parties lose future options of cooperation if they defeat on the arrangement. However, CNPC is not such a place-based actor and can seek future options at other places. Compared to local government and farmers, CNPC is less dependent on the other actors and more flexible to step out and move resources to other places and investments. If two actors are mutually dependent, and a third actor is not, the latter may easily withdraw and hereby harm the relationship of the others. Due to the absence of mutual resources dependency uncertainty of future outcomes could not be reduced.

While the national government embedded jatropha plantation in a discourse of combating climate change and improving the environment, this discourse did not translate to the local level where officials' goal achievement is on local income increase and on measured annual planting area, as in the Sichuan case. The private company in Guangxi made a better case of building up a discourse on jatropha as a market opportunity, through trainings and seminars. However, this discourse was confronted with the above described weaknesses in the rules of the game.

Finally, liquidity and uncertainty in terms of long time horizon are significant constraints. Time perspectives of stakeholders hence do not converge. The national government has a long time perspective which spans until the final production of biodiesel from jatropha, however, its FOI plan basically offers a one year subsidy for the new plantation, i.e. it does not offer long-term security. In the case of Sichuan, time perspectives of local governments were accordingly rather short. County and township governments were only in

the first year compensated for coordinating jatropha planting. Further support to farmers to establish new contacts to biofuel producers would not pay off for them. For local government employees, goal achievement moreover is measured on the scale of the first year, i.e. they only need to report the area planted to the higher level, and they will not be asked about the amount of biodiesel produced. Village leaders and villagers however need liquidity. The arrangements did not provide sufficient measures to align these differing perspectives.

In addition, several other lessons can be drawn from failing jatropha development in China. First of all, executive rules to prevent the withdrawal of a company are crucial to keep them committed. Hence a powerful sanction mechanism and monitoring will help to reduce the probability of moral hazard. Moreover, support through subsidy from the central government and disaster insurance services from insurance companies (Shi et al., 2008; Oh et al., 2009) for private companies could reduce probabilities of early drop out of private companies. Finally, institutional arrangements should provide substantial measures to reduce the gap between stakeholders with different liquidity and long-time gains. For example, the government and companies may need to provide strong and timely payment support to smallholders who need an annual cash income.

4.6. Conclusion

Jatropha was seen as a promising fuel stock by the Chinese government, given that jatropha is generally known for surviving on marginal land and under harsh conditions, and hence does not compete with food crops on agricultural land, and given the country's large marginal land endowment. However, despite the government's promotion of jatropha, it did not build up a robust market environment. The rather late formulation of standards for biodiesel (especially the B5) and the absence of mandatory targets for biodiesel illustrate the underdeveloped biodiesel policy and regulation during the first decade of the new Millennium in China. Through programs and plans, the government nevertheless devised some investment environment. China therewith stands also for other developing countries where policies are not always well developed but programs are devised for establishing a new sector (Habib-Mintz, 2010).

The focus of this article has been on examining how, through executive rules, mutual resource dependency and shared visions, institutional arrangements may help to reduce uncertainty over future outcomes and thus sustain commitment of all involved actors over a

long time horizon. However, as our case studies show, the institutional arrangements within programs of two failed projects have been rather weak. Specific characteristics of the technology suggest a list of criteria which might be crucial for project's success: Like other perennial plantations jatropha requires institutional arrangements which keep stakeholders of the biodiesel production chain involved over a long time. Arrangements face even more challenges where a large number of smallholders are involved. The analysis reveals that, while the national government employs a rather comprehensive discourse around the use of forests for biodiesel production, and while it shows a rather long-term perspective, subsidies for local governments are only for first year investment and relating to the area of plantation, not final outputs. Moreover, discourses and time perspectives do not match across governmental levels and towards non-governmental stakeholders. Furthermore, with MOF subsidy requirements for jatropha plantations (refinery and area size), small-scale private initiatives like that of Guangxi are made nearly impossible. At the same time, state-owned enterprises are not reliable in devising future perspectives. And sanction rules are not sufficient to effectively prevent state-owned and market companies from withdrawal.

In conclusion, both the government driven and market driven arrangement failed to establish sustainable commitments with different actors over a long time period. Potential measures to enhance shared long-term perspectives may relate to hazard insurance services that could strengthen the commitment of market parties, as well as mandatory blending requirements which would increase planning certainty. In addition, independent monitoring of contract farming and legal services to farmers are significant to create reliable market relations. Moreover, jatropha plantations may need strong payment support from government and companies to provide shared long-term perspectives and reimburse smallholders according to their annual's time-horizons.

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Chapter 5. Smallholder participation in large forestry programs: the camellia program in China[20]

Abstract: In recent years, many forestry projects have been implemented in developing countries. Especially in China, a variety of large-scale afforestation and reforestation programs have been carried out for multiple objectives such as livelihood improvement, ecosystem services or carbon sequestration. Like in many developing countries, these projects are implemented foremost in a smallholder context. This paper raises the question what may be the determinants for smallholders' participation in a large scale forestry project? Using the case of a camellia project, it explores the determinants of smallholders' participation using a probit regression model. Furthermore, to distinguish between participation in international and government-run projects, a bivariate probit regression model is estimated. Findings show that only 37% of the households in the sample participated in the camellia project. A major reason for the low participation rate is households' perceived tenure insecurity. Results of the bivariate probit model show that the education of the household head and household size have a positive impact on the likelihood of a household to participate in the international project. The more off-farm activities are taken up in a household, the less likely a household participates in the international project. For the government project, household size also has a positive impact on the likelihood of participation. It is concluded that Chinese forestry shows trends of diversification after the devolution of forestland use rights, with a majority of households hesitating to invest, while others take the opportunity and risk for investment, and still others depend on government subsidies. If the Chinese government wants to achieve its goal of 1,68 million hectares under camellia tree, improving tenure security seems to be crucial.

Keywords: Smallholders, Forestry, Forestry programs, China, Tenure

[20] This chapter has been submitted to Outlook on Agriculture in July 2013 as: Li, J., Bluemling, B., Dries, L., Feng, S., Smallholder participation in large forestry programs: the camellia program in China (*Under review*).

5.1. Introduction

In recent years, the role of forests in mitigating climate change, in sustainable ecosystem development, and in improving rural livelihoods has gained increased attention in international debates. Forests play a crucial role in climate change mitigation as forests globally sequester billions of tons of CO_2 every year (Canadell and Raupach, 2008; Bonan, 2008; FAO, 2011). Furthermore, forests can help enhance ecosystem resilience and significantly reduce environmental risks (FAO, 2012). Moreover, forests and forestry products and services could be key to improving rural livelihoods, reducing poverty, and promoting equity (FAO, 2012). They offer a variety of economic, environmental and sociocultural benefits (Canadell and Raupach, 2008; Bonan, 2008).

As a result, there has been an increasing interest in increasing forestation and reforestation in developing countries. In the Asian and the Pacific region as a whole, the forest area grew by 1.4 million hectares per year over the period 2000-2010. This was primarily due to large-scale afforestation efforts in China, where the forest area increased by 2 million hectares per year in the 1990s and by 3 million hectares per year on average since 2000 (FAO, 2011). This success in afforestation and reforestation was the result of programs such as: the Natural Forest Protection Program; the Sloping Land Conversion Program; Protection of Forest by Yellow and Yangtze river; and the Fast Growing Timber Program (Xu et al., 2006; Liu can, 2010). Since 2006, the Chinese central government is promoting the camellia (Camellia oleifera) program with the introduction of a new type of high yield seedling. Camellia is a typical perennial oil-producing forest species in the sub-tropical areas of China. The objective of the program is to increase the supply with edible oil as well as afforestation and reforestation. In addition, the large-scale program will offer employment in rural areas, and in this way improve rural household income sources. Furthermore, camellia side products can be used to produce biodiesel (Jiangxi Academy of Agricultural Science et al., 2008). Finally, some projects of the program explore the possibility of generating carbon credits (EIB, 2010). Hence, apart from the potential to improve rural livelihoods, the camellia program also targets policy objectives related to diminishing carbon emissions and increased biofuel production.

The camellia program is supported by a number of policies from the Central government. The State Forestry Administration (SFA) provides guidance to nine provinces to

promote camellia.[21] Moreover, SFA will offer a subsidy from the central financial budget to support the plantation of camellia. In 2007, the state council published a document named 'Opinions on promoting oil crops production' which stresses the importance of exploring the development of camellia trees and of increasing productivity. The 'National camellia industry development plan (2009-2020)' was published by the Ministry of Finance (MOF), the National Development and Reform Committee (NDRC), and SFA in 2009. This is an exhaustive plan that lays out the planning, the technical support and subsidy scheme regarding the camellia program. Subsequent to these policies, large-scale programs have been established to plant camellia trees. The overall objective of the programs is to have an area of 1,68 million hectares planted under camellia until 2020 (SFA, 2009b). One project is subsidized through the central financial budget ('Modern Camellia Demonstration County'[22], hereafter referred to as the 'government' project) while the other is an international project financed by the European Investment Bank ('Jiangxi Biologic Energy Forest Demonstration Base Construction', hereafter referred to as the 'international' project). The international project is the first project financed by the European Investment Bank within the China Climate Change Framework Loan.

Since the last tenure reform within the forestry sector, where user rights to forestland have been transferred to households, about 60% of the forestland in China belongs to individuals or communities (SFA, 2009a). This means that large-scale forestry programs such as the camellia program are implemented foremost in a smallholder context. Not all smallholders will be interested in participating in such a large-scale program. Given the ambitious goal of 1,68 million hectares under camillia plantation by 2020, the question hence arises what kind of smallholders are most likely to participate? The objective of this paper hence is to find out which factors affect farmers' participation in large-scale camellia projects. More specifically, we are interested in identifying the factors that drive -or hinder- farmers' participation in government initiated projects on the one hand and internationally initiated projects on the other.

There are several reasons why the investigation of such large-scale forestry programs in China can lead to interesting results. First, there is increased global attention for large-scale afforestation and reforestation projects that are being implemented under the Reducing

[21] The policy is documented in 'The Opinions on Developing Camellia' (SFA, 2006)
[22] 'Xiandai Youcha Shifan Xian Xiangmu'

Emissions from Deforestation and Forest Degradation (REDD+)[23] scheme. Hence, this study can provide fruitful experiences for the implementation of other large-scale forestry projects as well as REDD+ projects. Second, the behavior of smallholders is crucial for the realization of global carbon sinks in developing countries, and understanding the factors that affect the decision of smallholders towards participating in large-scale projects, is pivotal for the success of such projects (Thangata and Hildebrand, 2012). The Chinese context is especially interesting to investigate because a number of large-scale projects meet a huge amount of forestry smallholders. This context makes the large-scale forestry program implementation challenging, and the question of the constraining and enabling factors for smallholders' participation particularly interesting.

The remainder of this paper is structured as follows. Section 2 discusses the differences between the government- financed and internationally financed camellia programs. Section 3 provides an overview of the conceptual framework of the research based on a literature review of technology adoption. The survey area and the econometric model are discussed in section 4. Section 5 presents the probit regression results, bivariate probit regression results, and a discussion. Finally section 6 concludes the article.

5.2. Description of the two camellia projects

5.2.1 Government project

In order to develop modern agriculture and improve rural livelihoods, the central financial budget established a specialized fund to promote grain and oil production and increase farmers' incomes. In line with this development, the government-financed project to support camellia industry development was introduced in 2008 and will continue until 2020. This project started in the provinces Hunan and Jiangxi, and was then extended to Guangxi, Zhejiang, Fujian, Guangdong, Hubei and Anhui. In each province, several counties participated and in total around 100 counties were selected by the SFA and NDRC. Participating county forestry bureaus have to formulate an implementation proposal.

During the implementation, MOF and SFA support this project financially and through the provision of technical coordination. Counties that participate have the task to look

[23] Formally defined as 'Reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries'(UNFCCC, 2010).

after the implementation of the project. Apart from the central financial support, also counties and provinces provide financial support to the project from their budgets. From the overall project budget, participating farmers receive subsidies to buy high yielding seedlings. These seedlings are identified by a specific label. The subsidy can also be used for soil preparation and irrigation. Technical training, extension, and demonstration trips are provided by the county forestry department. The project does not set any requirements as to the minimum forestland area of a participating smallholder. However, some counties have introduced their own rules and limit participation to households that can assign at least 50 mu[24] to the project (based on the interview with a provincial forestry department officer).

5.2.2 International project

The internationally funded 'Jiangxi Biological Energy Forest Demonstration Base Construction' project is an international cooperation project between Jiangxi government and the European Investment Bank. The aim of the project is to fulfill the responsibility of low carbon emission through the promotion of clean energy, climate change mitigation, and sustainable forestry development in China. The project is implemented from 2009 to 2013. The total investment is 370 million Yuan, of which 207.97 million Yuan (25 million Euro) is funded by a loan of the European Investment Bank. The loan has to be repaid within 20 years, after a grace period of the first 5 years after the start of the project implementation period. The project plans to plant 378.9 thousand mu (25.3 thousand hectare) camellia and 30 thousand mu (2 thousand hectare) bare skin forests.

The Development and Reform Committee, the Forestry Department, the Department of Finance and the Environmental Protection Department in Jiangxi province cooperate with European Investment Bank in this project. In this project, county selection is very strict and based on the criteria of geographic condition, suitable forestland resources, and availability of co-financing funds from the county. The project insists on a voluntary and bottom-up implementation process. Hence, the investment and plantation scale are based on the county capacity and requirements. Moreover, the structure and implementation of this project are stricter. The loan is granted through the MOF to the People's Government of Jiangxi province. From there the money is transferred to the People's Government in the district and then on to the county level. Loan ownership is specified at each level from the MOF to the farmers. Participating farmers have to sign a contract with the county Department of Finance.

[24] 15 mu=1 ha

While both the government and the international project are focused on the introduction of better variety seedlings to improve camellia productivity, the implementation of the projects differs. Table 5.1 provides an overview of the main characteristics of the two projects.

Table 5.1: Comparison between the government and the international project

Parameters	Government	International
Initiation	Government funded and implemented	Funded by European Investment Bank, implemented by the government with European Investment Bank
Period	2008-2020	Plantation stage 2009-2013
Provinces	Jiangxi, Hunan, Guangxi, Zhejiang, Fujian, Guangdong, Hubei, Anhui	Jiangxi
Counties	100 counties are selected	19 counties are selected
Support	Subsidy (200 Yuan/Mu)	Loan (630 Yuan/Mu) Loan repayment within 20 years
Seedlings	High quality seedlings (labeled)	High quality seedlings (labeled)
Contract	No contract is necessary	The county forestry bureau or the financial bureau signs the contract with the participants.
Access	No min. area requirement in general, few counties have own area requirements but not strict.	No area requirement at the provincial level, but counties have their own area requirements, for example, at least 50 mu.
Implementation rules	Targets and implementation proposal submitted each year by the county.	Feasibility and environmental impact report is required, a detailed proposal on input use, budget, targets, and technology submitted by the provincial SFA with research consultancies.
Targets	Ambitious target	More practical target and planning
Motivation	Political achievement, economic incentives.	Political achievement, economic incentives and ecologic benefit

5.3. Conceptual framework

Risks and uncertainty are at the basis of explaining the obstacles in smallholders' participation in technology innovation projects. Differences in the relative rate of adoption of modern technologies have been attributed to risk aversion and credit constraints (Feder, 1980). Furthermore, uncertainty about the present and future probability distribution of economic returns and the value of sunk investment costs from the new technology can play a role (Arrow and Fisher, 1974; Ghadim et al., 2005; Marra et al., 2003). A literature review on innovation adoption and forestry project participation led to three categories of determinants, each linked to the effect of risk and uncertainty: tenure security; access to information; socioeconomic characteristics.

5.3.1 Tenure security

Property rights and tenure security have an impact on smallholders' forestry behavior because property rights security determines whether and how smallholders will benefit from participation. Tenure insecurity leads to long-term risk and uncertainty and is therefore especially relevant in forestry because of the long gestation period of investments in forestry plantation (Pattanayak, et al., 2003). Empirical results on the impact of tenure security on forestry innovation and plantation vary widely. Reasons for this diversity in results may be related to the difficulty of assessing the level of tenure security and the fact that different researchers have used different indicators. A positive relationship between forestry investment and tenure security was found by Otsuka et al. (2000), Fenske (2011), Coulibaly-lingani et al. (2011), Thacher et al. (1996), Zbinden and Lee (2005) and Dolisca et al. (2006). Others have found that the relationship between tenure security and new forestry investment is not significant (Besley, 1995; Brasselle et al., 2002). In this article we follow the theoretical expectation that tenure insecurity will lower the likelihood of participation in innovative forestry projects.

5.3.2 Information access

Better access to information about a project or an innovation will decrease uncertainty and hence increase the likelihood of participation in the project or adoption of a new technology (Rogers, 1983; Besley and Case, 1993). Several studies have found that better information transfer to local communities strongly affects participation rates in farmer projects (Raintree, 1983; Nagubadi et al., 1996; Skaggs, et al., 1994). On the other hand, the effect of extension services has a more ambiguous influence on project participation. While Thacher et al. (1996) and Zbinden and Lee (2005) find a significantly positive effect of extension, Dolisca et al. (2006) and Coulibaly-lingani et al. (2011) find opposite results. We hypothesize that better access to information increases the likelihood of project participation.

Social networks can be important channels through which information is transferred and as such can also influence adoption (Wejnert, 2002). Studies have found a strong correlation between the social network and local project participation (Nuggehalli and Prokopy, 2009; Lise, 2000; Dolisca et al., 2006). In the Chinese context, political status is an important determinant for access to information within a certain socio-political network, especially in rural areas. Membership in the Communist Party is one of the most important forms of political status in rural China, as party members belong to a select group, through

which they can gain access to valuable political and economic information (Morduch and Sicular, 2000). Party membership is restricted to individuals who distinguish themselves and have proven their political commitment and involves several kinds of privileges (Secondi, 1997). Party membership is also examined to be significant in the participation in the Sloping Land Conversion Program (Xu et al., 2010). In this case of large-scale camellia projects, both the government-funded and the international project are implemented by government agencies. We therefore expect that party membership will be an important determinant of participation in these projects.

5.3.3 Socioeconomic characteristics

Several household characteristics have been examined in existing studies as potential determinants of project participation and innovation adoption. We will include: age, gender, education, household size, wealth, off-farm activities.

There are several ways in which age can affect participation. On the one hand, old farmers are expected to be more risk averse, which would suggest that younger farmers are more likely to adopt new varieties. On the other hand, old farmers are more experienced, giving them an advantage over young farmers in terms of knowledge and skills required to adopt new technologies. As a result, empirical results are ambiguous (Otsuka et al., 2000; Uchida et al., 2007; Nuggehalli and Prokopy, 2009; Skaggs, et al., 1994; Dolisca et al., 2006; Lise, 2000; Zbinden and Lee, 2005).

Gender is assumed to affect decision-making behavior because it is linked to different attitudes towards risks and differences in social status. The effect of gender is also likely to differ depending on region, culture and level of economic development. Some studies have found a significant relationship between gender and participation in forest conservation (Besley, 1995; Coulibaly-lingani et al., 2011). Surprisingly, Dolisca et al. (2006) found that female farmers were more likely to participate in social and environmental activities such as reforestation than male farmers. Finally, Lise (2000) found that the link between gender and participation is highly dependent on the specific case that is investigated.

Education is expected to affect participation because highly educated people are less risk averse and have a better capacity to process information and master new skills. This relationship is confirmed in a number of studies (Lise, 2000; Zbinden and Lee, 2005; Dolisca et al., 2006).

Larger households are expected to show a higher likelihood to participate in new projects because they have better capacity in facing the uncertainty and risk. Results from previous studies confirm this expectation for different forest management projects (Dolisca et al., 2006; Coulibaly-lingani et al., 2011). Uchida et al. (2007) also find a positive effect of household size on participation in the Sloping Land Conversion Program in China.

Afforestation includes labour-intensive activities in the short run, but may be perceived as a way to decrease labour demand in the long run (Zbinden and Lee, 2005). Employment in off-farm activities not only decreases labor availability but may also generate positive externalities such as better information access and the acquisition of administrative skills (Zbinden and Lee, 2005). Smallholders that are involved in non-farm activities are therefore more likely to be enrolled in reforestation incentive projects (Skaggs, et al., 1994; Thacher et al., 1996; Zbinden and Lee, 2005; Dolisca et al., 2006). Moreover, off-farm employment and migration become increasingly important in the Chinese context and their impact on the availability of rural labour should therefore not be ignored (Zhang, et al., 2001; Taylor, et al., 2003; De Brauw, et al., 2008).

Wealthier households are more risk tolerant and are therefore more likely to participate in forestry plantation projects in rural areas. Smallholders that are financially constrained have less opportunity to overcome the loss of income during the first years of plantation (Boulay et al., 2012). Family income was shown to have a positive influence on the level of participation in Dolisca et al. (2006). On the other hand, Lise (2000) found that the relationship between household wealth and participation was ambiguous and differed between cases. Moreover, the poverty status of a household did not seem to be a determining factor of participation in the Sloping Land Conversion Program in China (Uchida et al., 2007).

5.4. Methodology and data

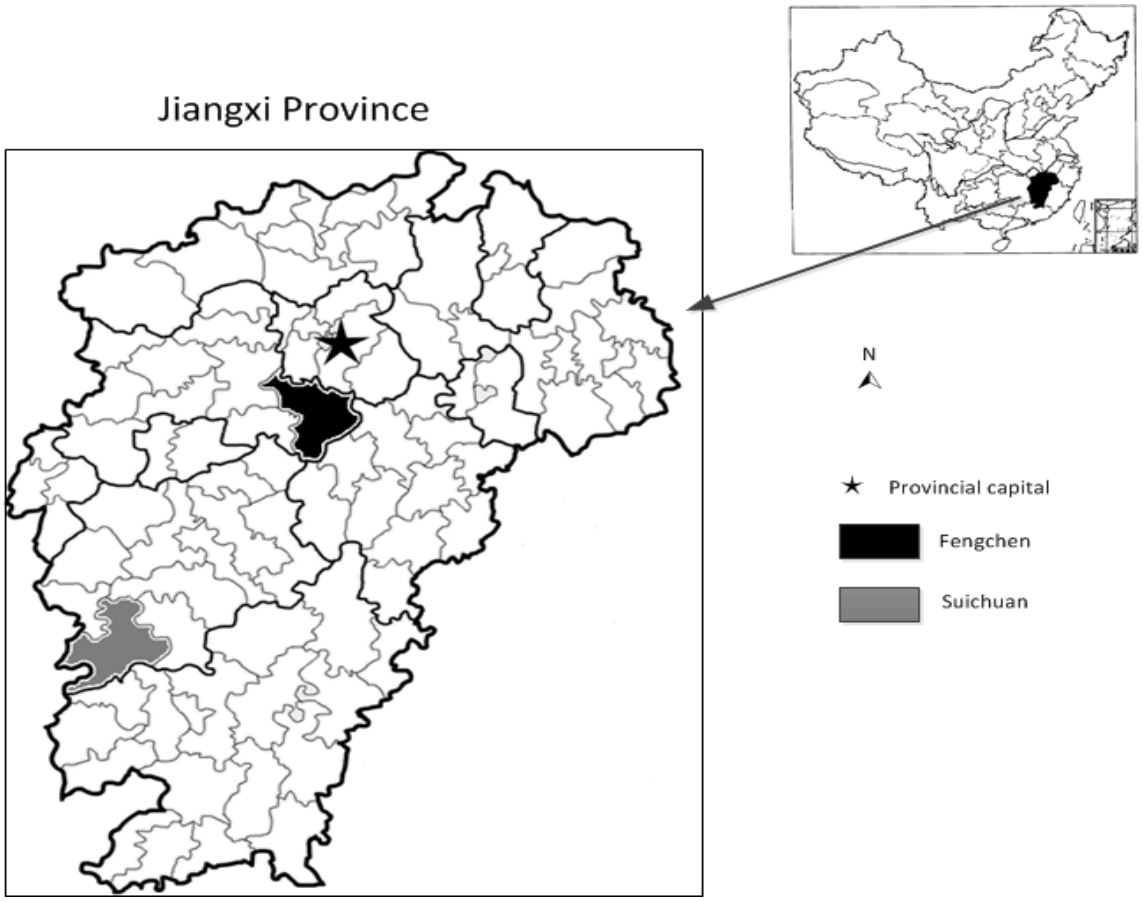
5.4.1 Survey and data collection

A survey was carried out from July to August 2011 in Jiangxi province. Jiangxi province is located in the southeast of China and is one of the most forest-abundant provinces in China with about 158 million mu (or 10.54 million hectare) of forestland (National Statistical Yearbook, 2012). Jiangxi can be considered an important forestry province in China because the forest coverage rate is 58% which is much higher than the national average of 20% (National Statistical Yearbook, 2012). Furthermore, Jiangxi was selected as a survey area

because it is one of the first provinces to promote the adoption of the high yielding camellia seedling. Moreover, as described in section 2, two large forestry projects were set up in Jiangxi province to promote the adoption of a new type of camellia tree and the provincial target of the total plantation area in the large-scale camellia program is 14, 746 thousand mu (or 983 thousand hectare) which accounts for 22% of the total target at national level. At the same time, Jiangxi is also one of the more underdeveloped provinces, with a GDP per capita of 17, 335 yuan in 2009 (which is well below the national average of 25, 575 yuan). In other words, Jiangxi also reflects an underdeveloped economy with a high share of small household farms and hence can render important insights for the future introduction of large-scale forestry projects in small farm communities in other provinces in China and in other developing counties.

Data were collected in a cross-section survey of households in two counties: Suichuan and Fengchen (see figure 5.1). County selection was based on a number of criteria, such as economic development level, geographical conditions and involvement in camellia programs. Suichuan county is located in the southwest of Jiangxi province and is less developed than Fengchen county located in the middle of Jiangxi. Fengchen has one demonstration site and has started adoption of the high yielding camellia seedlings earlier than Suichuan county. 14 villages were selected for the survey in each county, and around 10 villagers were interviewed per village. However, only four villages in Fengchen county are finally included in the data analysis, because in the other 10 villages, the natural village is the main decision-maker in regard to project participation. Determinants on the household level will here not play a role for the participation in the camellia project. Apart from basic household indicators (age, gender, education, family size, assets), the survey questionnaire also covers questions about tenure security, and information access variables.

Figure 5.1: Location of survey areas



The government-financed project and the international loan project have both been implemented in Jiangxi province. Suichuan county has combined the international and the government projects, meaning that people who participate in the international project also receive government subsidies. On the other hand, there may also be some cases of households that receive the government subsidy but do not participate in the international project. An interesting observation is that participation in the international project is limited to those farm households with an area of at least 50 mu in Suichuan county. As mentioned in section 2, the government project does not apply such strict access limitations. Fengchen county only has the government-funded project. Fengchen was one of the first counties in the government program because it has one of the best seedling experimental sites. Furthermore, a lot of trainings are offered by the county SFA to farmers in which experts are invited for lectures.

5.4.2 Regression model

Participation in camellia projects is estimated based on the following model:

$$Participation_i = \beta_0 + \beta_1 Tenure\_insecurity_i + \beta_2 Information\_access_i + \beta_3 Household\_characteristics_i + \beta_4 County_i + \varepsilon_i \quad (5.1)$$

Where *Participation* is a measure that is 1 if the household participates in a project and 0 otherwise. Moreover, Participation requires an individual decision to plant trees and to manage the forest plantation after it has been planted. For this reason, forest plantations under collective or collective-individual management have been excluded because under these regimes, the planting decision is made at the collective level and not at the individual level.

Tenure_insecurity is an indicator of the risk of expropriation in the next ten years as perceived by the respondents and it takes the value of 1 if expropriation risk is perceived as high. Different measures of tenure (in)security have been used in other studies: the value of property rights based on a cluster of rights that are held and different types of property rights relations (Fenske, 2011); the possession of a legal land title (Thacher et al., 1997; Zbinden and Lee, 2005; Dolisca et al., 2006); and risk of expropriation (Jacoby et al., 2002; Kazianga and Masters, 2006; Laurent-Lucchetti and Santugini, 2012; Kung and Liu, 1997). The risk or frequency of land reallocation (Mullan et al., 2011; Kung and Liu, 1997; Krusekopf, 2002), the length of time households have farmed their land (Guo et al., 1998; Krusekopf, 2002) are also used as measures of land-tenure security. In China, holding a forestland certificate does not necessarily reflect security of tenure because forestland certificates have just been distributed and not all farmers know the function of the certificate. Moreover, the certificate is regarded more as part of a rental relationship instead of a proof of ownership. We have therefore chosen to include the perceived risk of expropriation in this study as an indicator of tenure insecurity.

Information_access is a vector of two variables: *Knowledge* and *Political_status*. Existing studies have measured information access based on the use of extension services and participation in field trips (Thacher et al., 1997; Zbinden and Lee, 2005; Dolisca et al., 2006; Coulibaly-lingani et al., 2011). However, both these indicators may potentially suffer from an endogeneity problem because seeking extension and participating in field trips may be driven by the fact that you are participating in a certain project. In other words, the causality of the

effect may be reversed. To overcome this flaw, we use the knowledge of past forestry projects as an exogenous indicator of access to information of a certain household. The variable *Knowledge* is defined as the number of past forestry projects that are known by the household. *Political_status* is defined as a dummy variable that takes the value of 1 if the household head is a party member. This variable was also used by Xu et al. (2010) and is a proxy for the social network of the household head.

Household_characteristics includes various household variables. *Age* represents the age of the household head. *Gender* denotes the gender of the household head and is 1 for male and 0 for female household heads. *Education* represents the education level of the head of the household and is measured as the years of schooling. *HH_size* is the household size defined as the number of people living in the household. *Off-Farm* is a proxy for off-farm employment by household members and is measured by the number of migrant household members. *Wealth* refers to the wealth of the household and is measured as the value of durables. All the household variables refer to the year 2008, i.e. before the decision of whether to participate in the camellia project.

County is the county dummy that is 1 for Suichuan county and 0 for Fengchen. This control dummy is included to account for the effect of differences in economic conditions and locality.

5.5. Results

5.5.1 Descriptive statistics

Descriptive statistics for the variables used in the empirical analysis are presented in Table 5.2. The participation rate is 37%, meaning that 37% of the interviewed households participate in the government and/or the international project. About 71% of the households perceive that there is a risk of expropriation in the next 10 years. Project participants perceive less risk than non-participants. In terms of information access, farm households know about the implementation of on average 2 forestry projects in the past, which is considerably lower than the actual number of implemented forestry projects which is around 10. Knowledge of past projects by project participants is also slightly higher than that of Non-participants. Furthermore, about 22% of the household heads are party members and therefore have access to this social-political network. However, the party membership percentage among not participating households is 23.5%, which is higher than that of participating households. 79%

of the interviewed households are located in Suichuan county. The underrepresentation of households in Fengchen is due to the fact that 10 out of 14 villages in Fengchen are collectively managed and participation in projects cannot be interpreted as the result of an individual decision-making process. These villages were therefore excluded from the sample. Household heads are predominantly male, on average 49 years old and with a rather low level of education (only 7 years which corresponds to the first year of secondary school). The average household includes 5 members, consisting of three generations in a household. The education year and household size of participating households is slightly higher than of households that do not participate. Migrant workers are also still counted as part of the household. On average there are 1.3 migrants per household, which shows the importance of migrant labour in rural China.

Table 5.2: Statistical results of variables

Variables	Total Sample (189)		Participant (70)		Non-participant (119)	
	Mean[a]	Std. Dev	Mean[a]	Std. Dev	Mean[a]	Std. Dev
Participation	37%	-	-	-	-	-
Tenure_insecurity	71%	-	61.4%	-	76%	-
Knowledge	1.92	1.71	2.06	1.77	1.85	1.68
Political_status	22%	-	20%	-	23.5%	-
County	79%	-	64.3%	-	88.2%	-
Age (years)	49.48	10.20	48.59	11.38	50.01	9.46
Gender	95%	-	92.9%	-	95.8%	-
Education (years)	6.96	3.17	7.19	3.48	6.82	2.98
HH_size	4.80	1.93	5.2	2.19	4.57	1.73
Off-Farm	1.28	1.30	1.34	1.49	1.24	1.18
Wealth (thousand yuan)	4.49	7.19	6.35	9.99	3.40	4.55

[a] Percentages are presented for dummy variables

5.5.2 Participation in general

Before identifying the determinants of participation in the government and international project separately, we first analyse the effect of different variables on camellia project participation in general. The results of the probit regression model – with the dependent variable being Participation –are presented in table 5.3.

The coefficient for tenure insecurity is -0.38, which confirms the hypothesis that tenure insecure households are less likely to participate in forestry projects. The risk of expropriation reduces the farm household's incentive to invest in camellia tree plantation in the frame of a project. Because participation in a camellia project involves a long-term

investment (the fruiting stage is only 5 years after plantation), tenure insecurity is a crucial determinant in the individual participation decision.[25]

The information access variables are not significant. Being informed does not lead to a higher likelihood of participation. Party membership also does not affect the participation behavior. Information diffusion is easier within the party network and party members were often considered to be pioneers in government initiated programs. However, the results do not confirm this in the case of the camellia program.

Household size has a significant impact, meaning that with every increase in the number of household members, the likelihood of participating will increase. Large farm households have a better capacity to face events of uncertainty and risk and as a result, they have a higher likelihood to invest in camellia plantations. The wealth variable is also found to have the expected effect on participation in the camellia projects. Richer families are more likely to participate because they have a higher resource endowment and can overcome the high investment intensity in the first years of plantation, before the time of fruition of the camellia trees.

The county dummy is significant with a negative coefficient. This indicates that farmers in Fengchen county are more likely to participate than in Suichuan county. The reason for this may be that Fengchen introduced the pilot earlier than Suichuan county. Other local differences, such as economic development level, may also help to explain this result.

[25] Note that a potential endogeneity problem is created by the inclusion of the variable Tenure_insecurity in the participation model. Most of the existing studies on tenure security and land investments – of which forest plantation and management could be seen as a sub-set – in China, do not address this endogeneity problem. The reason for this is that land reforms are generally decided at the village level and are independent of household-level investment decisions (Brandt et al., 2004; Liu et al., 1998; Ma et al., 2013; Qin and Xu, 2013). However, endogeneity can also occur because of unobserved variables that create correlation between Tenure_insecurity and the participation model error term (Ma et al., 2113). Following Knapp and Seakes (1998) I performed a Hausman test for endogeneity by performing a bivariate probit model with Participation and Tenure_insecurity as dependent variables. The chi^2 test statistic showed that ρ (the correlation parameter, which reflects the extent of correlation between the error terms of the two probit models) was not significantly different from zero at the 5% significance level. Hence, I conclude that there is no problem of endogeneity in my analysis. A similar test procedure was followed for Participation in the international and the government project in section 5.3, where separate bivariate probits were performed for the two projects and Tenure_insecurity. The insignificance of the correlation parameter ρ again shows that there is no problem of endogeneity.

Table 5.3: Probit model showing the influence of tenure, information and socio-economic characteristics on participation in general

Variables	Coefficient	z-statistic
Tenure_insecurity	-0.381*	-1.71
Knowledge	0.066	1.07
Political_status	-0.028	-0.11
Age	-0.015	-1.40
Gender	-0.185	-0.40
Education	-0.005	-0.15
HH_size	0.148**	2.29
Off-Farm	-0.010	-0.11
Wealth	0.033*	1.85
County	-1.038***	-4.13
Constant	0.727	0.93
Observations	189	
Pseudo R ^{2}	0.142	
Log likelihood	-106.8	

* Significant at 10% level, ** Significant at 5% level, and *** Significant at 1%.

5.5.3 Participation in the international and the government project

To understand the determinants of participation in the two different camellia projects, we have also performed a bivariate probit regression analysis. The first dependent variable is therefore defined as follows: IP**=1,** if the household participated in the international project, IP**=0,** if the household did not participate in the international project; the second dependent variable is GP**=1,** if the household participated in the government project, GP**=0**, if the household did not participate in the government project. Only the data from Suichuan will be included in the bivariate probit regression, because the international project was not implemented in Fengchen county. Thus, we did not include the county dummy in the bivariate regression. The regression results are presented in table 5.4.

Table 5.4: Bivariate probit model showing the influence of tenure, information and socio-economic characteristics on participation in the international and the government project

Variables	Coefficient	z-statistics
International project		
Tenure_insecurity	0.217	0.71
Knowledge	0.060	0.67
Political_status	0.156	0.46
Age	-0.018	-1.06
Gender	-0.487	-0.76
Education	0.080*	1.82
HH_size	0.310***	3.87
Off-Farm	-0.373***	-2.66
Wealth	-0. 003	-0.16
Constant	-1.925*	-1.85
Government		
Tenure_insecurity	-0.375	-1.52

Knowledge	0.042	0.63
Political_status	0.129	0.49
Age	-0.007	-0.59
Gender	-0.339	-0.64
Education	0.021	0.58
HH_size	0.131**	1.93
Off-Farm	-0.070	-0.67
Wealth	0.023	1.45
Constant	-0.523	-0.62
Observations	150	
Log likelihood	-105.300	
/athrho	12.388	
Rho	1	
Likelihood-ratio, chi ₹(1)	49.879	
Test of ρ=0, Prob>chi ²	0.000	

* Significant at 10% level, ** Significant at 5% level, and *** Significant at 1%.

The estimated correlation of the error terms is positive and significantly different from zero. This result indicates that a bivariate probit model, rather than two univariate probit models, is more appropriate because of the correlation between participation in the two projects.

We observe several interesting differences between the relevant determinants of participation in the two projects. The significant determinants for participation in the international project are education of the household head, household size and migrant household members. Education is found to have positive impact on participation in the international project. Learning improves the farmer's ability to implement a new technology and allows the farmer to make better decisions about the new technology (Marra et al., 2003). Larger households also show a higher likelihood of participating in the international project. This result may be linked to the 50 mu area requirement for participation in the international project. Because camellia is a labour intensive forest species in the fruit season, large families have an advantage in providing the necessary labour. This reasoning is in line with the result that households with more migrant labour are less likely to participate in the international project.

Participation in the government project is significantly affected by household size. Larger households also show a higher likelihood of participating in the national project. This result is the same with the finding for the international project above that, as camellia is a labour intensive forest species in the fruit season, large families have an advantage in providing the necessary labour.

5.5.4 Discussion

The recent property right reform of 2004 distributed the user rights of forestland to the farm household in an attempt to offer more stable rights to forestland. However, the results of our analysis show that smallholders still perceive a high insecurity over their forestland. This may be because the reform was only completed as recently as 2007 in Jiangxi province. In addition, at the local level, the distribution and implementation of the property rights reform did not go smoothly and many conflicts occurred, contributing to the perception of insecurity. Hence, a stable forestland user rights system has not yet been established. Moreover, the probit regression results indicate that the risk of expropriation reduces a farm household's incentive to invest in the better variety camellia projects. This result confirms other empirical studies on the relationship between forestry investment and tenure security (Otsuka et al., 2000; Fenske, 2011; Coulibaly-lingani et al., 2011; Thacher et al., 1996; Zbinden and Lee, 2005; Dolisca et al., 2006).

The insignificant results for the indicator of political status are to some extent contradictory to other studies that showed that party membership plays a significant role in household decision-making in rural China (Cook, 1999; Gustafsson and Shi, 1998) as well as in large-scale forestry program participation (Xu et al., 2010). In this study, the likelihood of participation did not increase with party membership for either project. The assumption that party membership improves information access, especially in regard to the government project, cannot be confirmed. A possible reason is that, with the development of information technology and media, information diffuses more quickly and people, not only party members, have equal opportunity to access project-related information.

Findings of this research are in line with the general assumption that larger households have a better capacity to cope with uncertainty, and therefore more easily undertake long-term investments. These results also confirm that richer households are more likely to participate in long-term projects, as they can overcome the high investment intensity of the first years. If separated for difference across projects, results show that particularly for the international project the higher the education level of the household head, the more likely a household will participate in the international project. We may explain this result with the fact that during the implementation of the international project, households need to be capable to understand contract related issues and capture the large quantity of information relevant for the international project. This will be difficult for less educated household heads.

Results also show that forestry in China is starting to diversify. This might be a result of the forest tenure reform that led to a devolution of use rights to households. According to the results of this study, households take up different strategies for the use of their forestland. Only 37% of the households decided to participate in one of the two projects, which can be explained by the low level of trust in tenure security. Those who invested in camellia plantations, again differ in their profiles. For households that participate in the government project, forestry may only be one source of household revenues. For households in the international project, this may be different. As the international project provides a loan, not subsidies, these households took the risk to take a credit, which may imply that they see forestry as an important future source of household income. The finding that households with less off-farm labour are more likely to participate in the international project, may show a trend that this rural credit program supports a move of rural inhabitants back to the countryside. This is also a target of the agricultural development plan of the central government that tries to initiate migration back to the countryside to develop agriculture and forestry. However, interestingly, rather the international than the national project contributes to this target.

5.6. Conclusion

Since forests play an important role as a global carbon sink, many afforestation and reforestation projects have been implemented in developing countries. Especially in China, a variety of afforestation and reforestation programs have been carried out that fulfilled different targets of providing ecosystem services, improving rural livelihoods or contributing to climate change mitigation. The Chinese government often pursues rather ambitious area targets for such forestry projects, as in the presented case of a camellia tree program, where until 2020, 1,68 million hectares should be planted by camellia.

In China, like in many developing countries, these projects are implemented foremost in a smallholder context, which means that, after the forestland tenure reform in 2007, the participation of smallholders in the camellia forestry project is voluntary. Against this background, this paper raises the question what kind of smallholders are most likely to participate in the camellia project? The objective of this paper hence was to find out which factors affect farmers' participation in large-scale camellia projects.

The paper finds that only 37% of the sample households participated in the camellia project. A major reason for the low participation rate is households' perceived tenure insecurity. If the Chinese government hence wanted to achieve its goal of 1,68 million hectares under camellia tree, improving tenure security seems to be crucial.

Among those households that participate in the camellia projects, two different kinds of households were identified. Households participating in an international project, take up a loan and are requested to have a certain minimum area of forestland. These households are more likely to have a higher educated household head, more household members and less members working off-farm. The camellia project seems to be understood as an opportunity for investment in a more prominent role of forestry in the household's income. Households that participate in the domestic project led by the government, receive subsidies for their investment. Survey results do not reveal distinct characteristics, only that with more household members, these households are more likely to participate in the camellia project. It is concluded that Chinese forestry shows trends of diversification after the devolution of forestland use rights, with a majority of households still hesitating to invest, while others seem to take up the opportunity and risk for investment, and still others depend on government subsidies to take initiative and invest in forestry.

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Chapter 6. Conclusion

6.1 Introduction

It is widely agreed that the forestry sector plays a vital role in climate change mitigation and adaptation. A number of large-scale forestry programs, sometimes under international schemes, are implemented in developing countries with the objectives of forest conservation and afforestation. Forestry can also bring economic benefits and improve the rural livelihoods of smallholders. Accordingly, increasing the forest stock by 1.3 billion cubic meters above 2005 levels by 2020 is one of the Nationally Appropriate Mitigation Actions of China (Asian Development Bank and the Asian Development Bank Institute, 2013). Hence, China has put major efforts in promoting forest plantation programs for achieving both ecological and economic benefits. Recently, with energy and oil security high on the political agenda, the central government of China has begun to promote bioenergy and oil forest crops plantation programs. Bioenergy and oil forest crops can be categorized as Economic Forests that generate Non-Timber Forest Products (NTFPs). These and other forestry programs (see Liang, 2012) resulted in a dramatic increase in the area of natural forests and man-made forests in the current Millennium. After years of afforestation, China has now the largest area of forest plantation in the world (FAO, 2011a). Despite these successes in forest growth, large-scale forestry programs experienced severe institutional challenges. A "top-down" administrative approach, a lack of integrated cooperation and long-term planning, and poor coordination have largely been identified as major barriers in forestry program design and implementation (Xu et al., 2006). Furthermore, the engagement and participation of local people has so far been neglected in program design and implementation, and farmers have gained only moderate benefits from these projects (Xu et al., 2006; Uchida et al., 2007). An institutional analysis on the strengths and limitations of large-scale bioenergy and oil forestry programs could provide significant insights for the design and implementation of future forestry projects in China.

Large-scale bioenergy and oil forestry programs in China are embedded in a general governmental discourse on measures for combating global warming, as well as on a discourse that sees forests in their ecological functions, i.e. as forest resources and renewable energy resources. Beyond the discourses, the programs however face institutional barriers related to

complicated transitional forestry management and local governance after the recent forest tenure reform. Since 2003, China experienced a reform of forestland rights, where user rights of collective forestland were redistributed to individual households. Simultaneously, other management regimes such as collective management and contracts to other private sector entities also emerged after the reform. Hence, multiple forestry management practices under various tenure regimes involve a wide range of public and private actors, all aiming at promoting investment in the forestry sector, on generating benefits for market actors and on maintaining a large area as forest (SFA, 2009). Moreover, the bioenergy and oil forestry programs intend to increase farmers' incomes and alleviate rural poverty, but as forest investment is a long-term investment, the involvement of smallholders is still limited and problematic in China.

Against this background, this study aimed to explore the role of property rights, the governance structure, and farmers' incentives in the design and implementation of large-scale bioenergy and oil forestry programs, and how these three institutions influence and condition farmers' participation in such programs. The following research questions with respect to bioenergy and oil forestry have been addressed.

1. How and to what extent do different forest property rights affect the investment of farm households to maintain the forestry project sustainability?

2. How do smallholders benefit from large-scale forestry projects under different project implementation regimes?

3. How are various stakeholders involved in forestry project governance, particularly under long time horizons? And which factors determine a sustained governance of these projects?

4. Which household-level factors determine farmers' participation in large-scale forestry projects?

This study on large-scale forestry program implementation in rural China adopted institutional theories and applied qualitative and quantitative empirical methods. Throughout the four chapters, the governance and institutions of forestry programs and forestry resource management are explored. Moreover, some of the challenges of implementing large-scale forestry programs in rural China are addressed by linking socio-economic factors and institutional factors in farm household econometric models, in an attempt to contribute to a discussion about farmers' investment, participation and benefits in forestry programs. In doing so, the research revealed and confirmed the governance aspects that are critical in the

design and implementation of large-scale forestry programs. It also found that forest tenure devolution has significant impacts on farmers' participation and investment. And it can be concluded that large-scale bioenergy and oil forestry programs bring different benefits to smallholders under different projects implementation regimes.

This final chapter summarizes the main findings and conclusions for all four research questions. It also links the findings from the four empirical chapters to the broader context of forestry devolution and how the design of large-scale forestry projects may incorporate a sustained participation and cooperation among different stakeholders. The next section (6.2) presents and discusses the findings on the design and implementation of large-scale forestry projects in the transition to a market economy (research questions 3 and 4). Section 6.3 provides a concrete analysis of how forestland property rights influence present forest resource management and affect the individual investment of smallholders (research questions 1 and 4). Benefit distribution to smallholders in bioenergy and oil forestry programs is discussed in section 6.4 (research question 2). Section 6.5 discusses how this research contributes to theory. Finally, this chapter concludes with policy recommendations in section 6.6 as well as research limitations and a future research agenda in section 6.7.

6.2 The design and implementation of large-scale forestry programs

Many developing countries lack mechanisms to ensure the participation and involvement of all stakeholders in forestry planning and development. Good governance, which includes stakeholder participation, plays a crucial role in the success of large-scale forestry programs. As forestry entails long-term investment, how to set-up a good and sustainable governance architecture is very important, but also challenging. Moreover, in developing countries without a perfect market and absence of a transparent and effective legal system, this task is even more difficult. It is evident that large-scale forestry programs in China are moving from government-organized, centralized, top-down governance architectures to multi-level and multi-actor governance arrangements, which involve market-based mechanisms and private actors such as private companies, NGOs, international agencies, communities and individual farmers. This study aimed to find out how a better governance structure and institutional environment should be designed and implemented, to make forestry programs sustainable over the long-term. The findings can be summarized in four aspects linked to program implementation: the role of government and markets; the international investment regime; the

monitoring mechanism; and the time horizon for large-scale forestry programs. These four crucial factors for the successful introduction of governance arrangements are discussed below.

6.2.1 The role of government and market in forestry programs

Large bioenergy and oil forestry programs in China can be distinguished into those driven and implemented by the government and those driven and implemented by market arrangements. Both government-driven and market-driven arrangements have been defined and investigated in chapter 4, using the case of jatropha. The concept of government-driven arrangements refers to forestry plantation projects that are initiated by governmental stakeholders and implemented by governmental and/or other stakeholders. The concept of market-driven institutional arrangements refers to forestry plantations that are initiated and implemented primarily and mainly by private market actors, such as companies and smallholders. In the latter arrangements, companies usually have direct interaction with farm households or their representatives and will attempt to motivate them by using suitable market incentives. The cultivation of camellia (see chapter 2 and chapter 3) was initiated and organized by the central government or by the government in conjunction with an international agency, while the implementation of the projects fell under the responsibility of village committees and farmers. The camellia projects that were developed with assistance of an international agency can be seen as an in-between arrangement, as these were initiated by market and governmental stakeholders and implemented by governmental and private stakeholders.

In a large-scale forestry program, various county governance structures exist across counties (as detailed in chapter 3). In general, in government-driven programmes, the implementation of bioenergy and forestry oil programs is based on the administrative structure from the county level to the township level, to the village and then to the natural village and/or farmers. In addition, the county Forestry Administration is important for implementation (chapters 3 and 4). This structure is in line with bureaucratic or government administration structures. The structure is different for the projects where an international agency is involved. If a county had applied for subsidies, then companies could directly apply for these subsidies at the county government, and realize the project with farmers or a natural village. Administrative villages and natural villages in both cases play an important role in project implementation, as village committee members and natural village representatives serve as coordinators who use their argumentative and authoritative power to motivate and

direct farmer participation in the projects (chapter 2, 3, and 4). This result is in line with the political and economic transition in China, from a centrally planned economy to a market based economy, in which both government and market actors participate.

Both the government-driven and the market-driven forestry projects try to attract participation of market actors such as private companies and individual farmers. For example, the private company (GZREC) invited a television station for advertising the jatropha project to a wider public to enhance farmer participation (chapter 2). Furthermore, the company organized an introductory meeting and seminar, inviting village leaders from other areas to explain the economic value of jatropha cultivation, the technology of jatropha plantation, and the cooperative arrangement between the private company and village committees, to attract more farmer participation. Moreover, international actors also helped to set up a market mechanism and institutions, such as market contract relations with farmers (chapter 3 and chapter 5). This research shows that contracts are common within collaborations between forestry stakeholders (Chapter 3, 4 and 5). In Ji'an county, the county Forestry Administration signed a contract with the natural village and with farmers. In Suichuan county, the county Forestry Administration signed contracts with farmers, which clearly indicated the rights and responsibilities of both sides (chapter 5). In Fengchen county, the private company signed contracts with natural villages and farmers (chapter 3), while in the jatropha case the private company signed a contract with the village committee (chapter 4).While hence contracts are a common instrument for collaborations, their implementation still falls short or is ineffective (see 6.2.3).

This thesis contributes to the literature on governance of large-scale bioenergy and oil forestry programs by an analysis of multi-level hybrid governance arrangements in which governmental authorities and market actors interact. As such it adds to the general literature in new institutional economics, which identifies firms, markets, hybrid contracting and public bureaus as different modes of governance (cf. Williamson 1998). It also adds to the literature in political sciences/public administration, which considers governance no longer the privilege of governmental agencies, but de facto and even de jure the common responsibility of a variety of governmental bodies, market agencies and civil society organizations (Leroy and Arts, 2006). The multi-level hybrid governance structure in bioenergy and oil forestry programs involves a number of governmental departments, state-owned companies, private companies, international agencies, villages, local communities and farmers based on bureaucratic power and market contracts. As such this structure confirms that new roles and

interaction patterns between government and markets are present in contemporary transitional China.

The contribution of this thesis to literature is especially important because of the focus on China. Economists claim that the market theoretically has advantages in resource allocation and use efficiency under resource-constraint conditions (Arrow, 1969). There exists a discussion on the relation between governments and markets in East Asian economic development, whether governments should intervene little in the market or should govern markets (Aoki et al., 1998). This study proves that the market has transformed the state-led economy into a hybrid market economy, still characterized by significant government involvement (Guthrie, 2012; Fligstein and Zhang, 2011). The present state of the market in China's forestry sector is constrained because of the path-dependent and developmental stage of China. But in a dynamic analysis, we see significant and increasing roles of the market actors and a widespread use of contracts in forestry collaborations.

6.2.2 International investments' and their effectiveness on the local level

International agencies, including private companies and NGOs, invest a lot in bioenergy and oil forestry projects globally, particularly in developing countries (Gexsi, 2008; Gilbert, 2011; IPCC, 2012). Many biofuel projects start with safeguarding support from farmers in planting biofuel crops and then linking them to companies and international agencies (Bijman et al., 2009). The local impact of international bioenergy projects has been analyzed using the case of jatropha investment. There are several failures of jatropha plantations and biofuel production from jatropha seeds in China because of the withdrawal of foreign companies. At the end of 2006, the US Company Beck Ltd. withdrew from China, after having invested 2.6 million RMB in jatropha plantations but before finalizing the project (Chapter 4). The UK Company Sun biofuel equally left China because the company could not agree with Panzhihua city government, Sichuan Province, on the investment level to continue jatropha production (Huaxi City News, 2011).

This study provides general insights into the international bioenergy and oil projects' effectiveness on the local level in developing countries. Some foreign companies that have abandoned a jatropha project in one country are active also in other developing countries (Ariza-Montobbio et al., 2010; Ariza-Montobbio and Lele, 2010; Habib-Mintz, 2010; Gilbert, 2011; Nielsen, et al., 2012). In such projects foreign companies hold most of the cards, while local farmers and officials often lack the experience to negotiate favorable terms and have

little power to hold the companies accountable (Gilbert, 2011). However, there are internationally supported projects that continue with donor aid such as the EIB project in camellia case.

International projects (EIB project) on camellia are also more widely observed and analyzed (chapter 5). In our case-study, the adoption of new high-yielding camellia varieties was stimulated in two ways, first by a government project subsidized through the central financial budget, and second by an international project providing low-interest loans financed by the European Investment Bank. The international project was the first project financed by the European Investment Bank within the China Climate Change Framework Loan. Several interesting differences regarding participation of farmers in the two projects have been identified (chapter 6). Participation in both projects was significantly affected by household size, with larger households showing a higher likelihood of participation in the international project. In the international project, education of the household head was found to have a positive impact on participation, probably because learning improves the farmer's ability to implement a new technology and allows the farmer to make better decisions about the new technology (Marra et al., 2003). Households with more migrant labour are less likely to participate in the international project. Overall, farmers who participate in the international project have quite different household characteristics from those in the government project. This may be explained by the fact that households participating in the international project took the risk to take a credit, which may imply that forestry is seen as an important future source of household income. Moreover, the international credit program may support a move of rural inhabitants back to the countryside, a trend that matches with the target of the agricultural development plan of the central government to develop agriculture and forestry. Finally, our camellia case also contributes to the literature on how farmers adapt their behavior to project characteristics (Dolisca et al., 2006; Coulibaly-lingani et al., 2011; Lise, 2000; Zbinden and Lee, 2005).

6.2.3 Effective monitoring and sanctioning in forestry program design and implementation

Jatropha's failure in China can also be attributed to the institutional environment, such as poor implementation and enforcement of monitoring and sanctioning rules. Rules to prevent the withdrawal of a company and executing such rules are crucial to keep companies committed (Chapter 4). Hence, a powerful sanctioning mechanism and monitoring arrangement help to reduce the probability of moral hazard (Chapter 4). The withdrawal of the private company in

the jatropha case may reflect the state of the rule of law in transitional China: the legal system is underdeveloped and there is insufficient coordination to legally sanction private (and state/international) actors not behaving according to written contracts (see chapter 4). Coordination and supervision to sanction private actors not behaving according to written contracts is also vital for successful project execution. Findings show that random monitoring by village representatives or the company helps to sustain investment from other parties, like farmers (chapter 2).

Lack of involvement of higher governmental levels and non-fulfillment of company promises in contract farming are also found in African cases of failed jatropha projects (Ariza-Montobbio et al., 2010). Effective monitoring and legal services to farmers are crucial in program design and implementation. This is in line with Nee (1992)'s claim that creating legal norms and regulations and means to enforce them facilitates the functioning of market structures. Explicit mechanisms for monitoring and enforcement of contracts are required too in afforestation and reforestation projects (Stringer et al., 2009) and in long-run natural resource management (Barrett et al., 2005).

6.2.4 Time perspectives in forestry programs

The failed jatropha project in this study indicates that convergent "time perspectives" of different actors in forestry institutional arrangements are important. Forestry, and thus also bioenergy and oil crop forestry, has a long-time horizon with long-term profitability, which contrasts with short-term liquidity requirements (see chapter 4). In the jatropha project, some actors (farmers and local government staff) focus on annual income revenues to cover their costs and expenditures, especially when their yearly expenses are relatively high. For other actors (companies and the central government), biofuel production from jatropha might just form a minor share of their total activities and budgets and for them future income or general benefits and the profitability of the project are more important in determining success. These diverging (time) perspectives in jatropha investments exist in many multi-stakeholder, large-scale forestry programs. A lack of rules to cope with diverging perspectives is an important reason for program failure (chapter 4). However, in the camellia case-study, one company provides cash income to cover labour costs and rent to farmers, which gains commitment from farmers (chapter 3). The company, aiming for future income and long-term profitability, provides short-term liquidity to cooperating farmers to cope with the diverging perspectives.

Hence, this study contributes to understanding the relevance of time in forest-based biofuel programs. Looking at time perspectives of stakeholders improves our understanding of the structural complications of involving smallholders in large-scale forestry programs with long-term investments in developing countries. It confirms the findings of other studies which found that time matters (Convery, 1973; Hoogstra and Schanz, 2009; Dorfman and Heien, 1989), and that program design should include measures to align differing perspectives.

6.3 The impact of forest property rights devolution on forest resource management and investment

China experienced a series of property rights reforms since the foundation of the People's Republic. Since 2003, there is a new trend of devolution in forest property rights in China. From the preceding chapters it can be concluded that the complicated forest property rights reform made forest property rights vague, particularly at the local level. Moreover, different forest management regimes with differing levels of forest tenure security affect farmers' investment and participation.

6.3.1 The property rights reform has led to different forestry management regimes

China initiated a series of property rights reforms, which resulted in a variety of forest tenure regimes. In 2003, a new devolution attempt started with as a main objective to distribute the user rights of forestland to farm households. However, other kinds of management schemes such as collective use and contracting to private actors are also allowed (chapter 2). Hence, multiple forestry management practices exist under various tenure regimes, following different physical and socio-economic conditions as well as different governance arrangements at the village level.

Five different forest tenure regimes have been identified and analyzed in the preceding chapters: *Collective*, *Collective-Individual*, *Company*, *Partnership*, and *Individual* (chapter 2 and chapter 3). Under the *Collective* regime, natural village representatives coordinate the management of forests. Individuals are assigned tasks of working on the forestland. Final forestry products are distributed to the households. In the case of a *Company* regime, the company and village representatives agree on the forestland rental and management at the start of the project. Households are involved in the daily management and share the final product. However, in the long-run, the village representatives hold the power to decide on the

future of forestland. Under the *Collective-Individual* regime, the village representatives coordinate the start of forest plantation with all villagers, and then village representatives distribute the forestland plots to individual households who manage the plots. However, as the households do not receive a forestland certificate, the user rights farmers holding is still uncertain in the future. Under *Partnership*, individual farm households join together in a partnership and take joint decisions on the plantation. More specifically, the investment and share of output are jointly decided in the partnership. Under the *Individual* regime, individual farm households manage the forest resource and investment by themselves.

The identified forest tenure regimes are partly in line with findings of other research. For example, Holden et al. (2011) and Xu et al. (2008) identified family management, partnership, outsider contract management, villager group, and collective management. The regimes "*Individual*" and "*Partnership*" are also mentioned by Sun (2008), Xu et al. (2008) and Holden et al. (2011). The "*Company*" regime is a kind of "Outsider contract management" as described by Xu et al. (2008). Management by a Villagers' Group (Xu, et al. 2008) /Natural village (Sun 2008) is divided in our study into two different regimes, i.e. the *Collective* and the *Collective-Individual*. Chapters 2 and 3 indicate that the recent property rights reform resulted in decentralized forest management at the local level. Although the descriptive statistics in chapter 2 are not representative for the whole of China, the results of this case still show that a multitude of different tenure regimes exists after the recent forestland property reform.

These findings indicate that the devolution process in property rights reform redistributed the user rights to local stakeholders. It also confirms that the de-collectivization process and the property rights reform have resulted in a diversification of management forms including individual households, collective forestry farms, communities, national private enterprises (FAO, 2011b). In the past decade, many countries have initiated efforts to reform their tenure arrangements for forests and forest land, moving towards the devolution of access and management rights to non-state stakeholders, mainly households, private companies and communities (FAO, 2011b); hence the developments that are observed in China fit into this wider process. Because property rights reform is generally linked to the devolution of forest resource management, community forestry programmes, together with forest restitution and privatization are essentially passing rights over forests to a local community, individuals or the corporate sectors (FAO, 2011b).

6.3.2 Forest property rights and farm household behavior

Following the recent property rights reform, the preceding chapters have looked into how forest property rights have affected farmers' investment and participation behavior. Chapter 2 confirms that in general, tenure regimes with higher degrees of tenure security will trigger higher household investment. *Collective-individual* regimes resulted in the lowest level of investment. This can be explained by uncertainty about possible redistribution in the natural village. Chapter 5 also indicates that the risk of future expropriation affects farmers' participation in forestry projects. Thus, the research provides empirical evidence of how property rights influence farmer investment behavior.

Based on the New Property Rights Theory, the five forest tenure regimes differ in terms of residual control and income rights, implying different degrees of tenure security for farm households. Based on this theory, the prediction is that tenure security increases from *Collective*, to *Company*, to *Collective-Individual*, to *Partnership*, and to *Individual* regime. The regression results in chapter 2 prove that under the different tenure regimes, farm households' investments in labour and capital differ. More specifically, under the *Company* regime and the *Collective-Individual* regime, individual investment is significantly lower than under the *Individual* regime. This is in line with our expectations and assumptions. However, the *Partnership* regime has higher investments in terms of fertilizer and pesticide inputs than the *Individual* regime. This can be explained by the trust relation (or importance of *guanxi* connection) within the *Partnership* regime, which consists often of friends and relatives. While the *Partnership* tenure regime has the highest level of farmers' investment, only 7.1% of the sampled farmers joined a partnership.

Results of chapter 5 show that about 71% of the households perceive a risk of expropriation of land tenure. Only 37% of the households decided to participate in forestry projects. Moreover, regression results confirm that tenure insecure households are less likely to participate in forestry projects. The risk of expropriation reduces the farm households' investment in better variety camellia projects. Because participation in a camellia project involves a long-term investment (the fruiting stage occurs only 5 years after plantation), tenure insecurity is a crucial determinant in a household's decision to participate.

The evolution of property rights and their effects on investment are central issues in the development literature (e.g. Besley, 1995). From this literature, it can be concluded that land tenure security positively influences investment in land, as secure land rights provide an

incentive to invest, improve access to credit markets, and enable land trading with other farmers (Besley, 1995; Fenske, 2011). Our results are in line with the literature and other empirical studies on the relationship between forestry investment and tenure security (e.g. Otsuka et al., 2000; Fenske, 2011; Coulibaly-lingani et al., 2011; Thacher et al., 1996; Zbinden and Lee, 2005; Dolisca et al., 2006; FAO, 2011; Qin and Xu, 2013). Chinese forestry property rights show a trend of diversification after the devolution reform, with a majority of households still hesitating to invest, while others seem to take up the opportunity and risk for investment. Tenure insecurity leads to long-term risk and uncertainty and is therefore especially relevant in forestry because of the long gestation period of investments (Pattanayak, et al., 2003; Holden et al., 2011). On the other hand, security of forest tenure will reduce uncertainty over forest property rights and over respective investment returns for farmers. Hence, secure forest tenure is a fundamental element in achieving sustainable forest management and improved livelihoods (FAO, 2011).

6.4 Bioenergy and oil forestry program development and benefit distribution to farmers

Farm households should be crucial actors in forestry management because they are the direct practitioners on the ground. But farmers' participation is still constrained by their capacity in terms of wealth, labour endowment and education. However, for large-scale forestry projects, engaging smallholders in forestry is vital for the success of the project, with respect to a balanced socio-economic development in poor rural areas and guaranteed long-term success. Forestry development improves the livelihoods of famers by increasing their income, and poverty alleviation has always been an important objective of bioenergy and oil forestry programs. Although these programs often provide financial support and technical services, some farmers are still not able to join. For instance, the participation rate of farmers in the camellia program was only 37% (chapter 5). Moreover, the participation level varied across counties and villages (chapter 3).

Individual regime generates heterogeneity of benefit distribution among local communities (chapter 3), because large-scale and wealthy farmers are more likely to adopt camellia (Chapter 5). Forestry programs generate different benefit distribution on farm households under different forestry project implementation regimes. All villagers had access to the program and subsidies in the Collective regime. Under this regime, the distribution of final products is based on family size or is done as an average per household, which is

considered equal and fair and has been used historically in natural villages. However, Collective does not clarify the property rights of forestland to farm households. Under Collective-Individua lregime, farm households in the natural village obtain the user rights of the forestland as well as the forest products derived from it. Clarifying land tenure exists because the management 'rights' of forestland are distributed to each farm household informally. The same as Collective regime, the distribution of forestland is based on family size, as a common and equal rule. Through Company regime, farm households get access to projects and obtain benefits provided by the company. However, if the natural village leadership group is involved in the coordination between smallholders and company, the distribution of final outputs and other benefits in the natural villages might be considered as unfair, corruption is also reported by some villagers during the fieldwork. In comparison, the access to project participation in the Partnership and Individual regimes is more difficult and unequal, and benefit distribution between smallholders are more unequal. The results may confirm that Collective and Collective-Individual regimes provide more equal access to and benefits from the projects because natural villages organize the farmers together to participate in the projects. But not only companies obtain a significant proportion of the final product, also reported corruption of natural village leaders interfere in the benefit distribution between smallholders and other stakeholders. Although the discourse of national and international forestry projects is in general pro-poor, and projects are often formulated with such objectives, implementation of (inter)national projects through various levels in the local village often is quite a different story. Hence, the benefits for poor and marginal smallholders remain uncertain.

The study contributes to the discussion on benefit distribution and equity in forestry projects and management which is seldom touched upon in China. It confirms that collective-based forestry regimes sometimes perform better than individual regime in terms of social equity. Starting in the 1980s, governmental forest tenure regimes in developing countries have been increasingly devolved to community-based forest tenure institutions in many parts of Africa and Asia (Suyanto et al., 2001; Edmunds et al., 2003). The devolution of forest tenure aims at a more equitable resource management and results also in a more sustainable use of a resource (Sandbrook et al., 2010; Ambus and Hoberg, 2011). As a part of REDD+, afforestation and reforestation projects should be concerned with benefit distribution and equity issues (Brown and Corbera, 2003). Evaluation of benefit distribution is not that

easy and this study provides a preliminary approach of such an evaluation in an afforestation and reforestation program with both international and national involvement in China.

6.5 Interlinking institutions: contributions to theory

In chapter 1, Oliver Williamson's four-layer model of institutions was presented as the overarching framework to understand how multiple institutions influence bioenergy and oil forestry programs in rural China. While Williamson (1998) developed his four-layer framework initially from an institutional economics perspective, I illustrated in this thesis that the framework also has relevance for other disciplines that study institutions.

The initial rationale behind the four-layered model of institutions was that institutional economics – and also the other social sciences – have not (yet) progressed to the extent that a unified theory of institutions can be formulated and applied meaningfully; and hence that we have to accept institutional pluralism. For that reason, this thesis used different institutional theories and approaches to study the three selected institutions (property rights, governance structures, incentive structures) influencing the implementation of bioenergy and oil forestry programs, each located at a different level of Williamson's framework. However, I noted already in chapter 1 that each of these institutional analyses should be open to the linkages and interrelations between institutions at different levels, and the empirical research in Chapters 2 to 5 illustrated many examples of such interrelations and influences. Here I summarize and further conclude on these linkages between the studied institutions.

Since the founding of the People's Republic of China, many forest tenure reforms have been carried out. This is why, from an empirical perspective, it comes somewhat as a surprise that land tenure has a strong influence on structuring and conditioning governance institutions and incentive structures. However, from a theoretical perspective, land property rights and tenure regimes are expected to have such an influence as they are located at a 'higher' level of Williamson's framework. Evidence from this thesis shows that the last reform to some extent shapes human interaction and other institutions. However, as will be shown below, the institutionalization of tenure regimes is to some extent also aided by the implementation of the camellia projects. Furthermore, local governance institutions are supportive to current tenure regimes in that local actors try to overcome the difficulties that come about with these regimes: actors try to realign governance structures based on the regimes. This thesis hence shows how institutions on different levels of Williamson's

framework are mutually reinforcing. In what follows, this finding will be further elaborated along the lines of the different chapters of this thesis.

REDD+ and carbon offset projects have been criticized for creating incentives towards centralized governance, and for putting tenure rights at risk. In section 2.5.1, it has been shown that, despite the implementation of large-scale forestry projects, no re-centralization of forest tenure has taken place. Instead, forest tenure regimes affect the implementation of these projects. The findings of chapter 2 show that different tenure regimes do incite farm households' investments to different degrees. The explanation of these differences, however, needs to revert to different institutions of Williamson's categorization. For instance my findings show that farmers in a Partnership have the highest (working) capital investment. This result can be explained by reference to level 1 and 2 of Williamson's framework. Partnerships are foremost founded among friends and relatives. Their level of trust in each other and in the long-term stability of the arrangement will be high, which will have an impact on their perceived security of investment. The low investment of farm households under the Company regime, can also be explained at the level of the institutional environment. In this regime, households do not know about the long-term distribution of forestland, as the company and the village representatives hold the power to decide on future forestland redistribution. The rules of the game hence are not supportive to such a long-term investment as forestry. In conclusion, while Chapter 2 finds different tenure regimes to be having different influences on forest investment, explanations for these findings partly revert also to other levels of Williamson's framework.

Chapter 3 shows that tenure regimes shape human action as well as interaction. In this chapter, different "implementation regimes" of large-scale bioenergy and oil forestry projects are identified. The components of these regimes are local governance institutions, forest tenure and project policy. The chapter inquires in how far, under these different regimes, the distribution of benefits among stakeholders may differ. The results show that forest tenure, together with another institution on the level of the institutional environment, has a crucial effect on smallholders' access to and benefits from large-scale projects. This "other institution" is the minimum area requirement rule (participation in a project requires a minimum of 50 Mu land), set by some of the county governments. The following will focus on the cases where such a minimum requirement has been set.

In areas where the forest land use rights had already been devolved to smallholders, smallholders face difficulties in participating in the projects as they alone cannot achieve the minimum area requirement. In the survey area of this research, this low access of smallholders was overcome by realigning local governance structures (third level of the Williamson framework). One governance structure is the Partnership. As mentioned above, for setting up a Partnership, mutual trust is crucial, an institution at the first level of Williamson's framework. Hence, whether governance structures can be realigned to improve access to a project, will also depend on the first level institution "trust".

I also found that land rights institutions were influenced by governance structures, where governance arrangements of local authorities, farmers and bioenergy companies translated national and international forestry projects to the local context and by doing so, redefined land tenure rights. It seems that in the transition from a centrally planned economy to a more market oriented model, institutions at Williamson's second level are no longer stable. This appears to be rather unique and a specific characteristic of contemporary China.

From chapter 3, one may conclude that local governance plays a crucial role in intra-village benefit distribution, where access to the project is determined by forest tenure and project-related regulations by the county government such as the minimum area requirement. Whether local governance institutions can overcome smallholders' difficulty to access a project, has been found to depend also on the first level institution "trust" (in the case of Partnerships).

Chapter 5 then sheds light on the effects of different camellia project designs on incentive structures for farm households to participate in a project. It finds that international projects tend to incite participation of larger households with less migrant labour, and with household heads with a higher level of education. This is explained by the project's stricter institutional environment, requiring a feasibility and environmental impact report, loan repayment and the signature – and understanding of – a formal contract. The second level institutional environment hence directly impacts incentive alignment (level four).

Furthermore, the research on camellia plantations shows a rather smooth implementation of the projects, while jatropha biofuel projects are to some extent representative of less successful forestry project implementations. The following can be concluded for why, from an institutional perspective, large-scale forestry projects can fail. Chapter 4 focuses on the level of the alignment of governance structures. The institutional

environment, the Forestry-Oil Integration plan, is given, and so are other governmental rules and regulations, like laws and China's vertically organized administrative structure with its inherent remuneration rules. Chapter 4 shows how the institutional environment makes the governance alignment particularly difficult. In the case of the government-driven arrangement of jatropha plantations, the institutional environment does not provide incentives to governmental officials to engage in the long run. What finally led the government (and farmers) to stop their engagement in jatropha plantation, was the withdrawal of CNPC, and the resulting lack of a refinery in their vicinity. The withdrawal of CNPC is attributed to a leadership change. In a cultural environment (level 1 of Williamson) where leadership change can result in ad-hoc changes in governance structures or even in the institutional environment, long-term investments such as in forestry are particularly vulnerable to changes at this institutional level. The institutional environment furthermore does not support governance alignment in that it does not provide any legal or regulatory support in the case that one actor stops cooperating within the game. This shortcoming in the legal framework holds for both cases of market- and government-driven arrangements. In the government-driven arrangement, differences in governmental ranks made it difficult to sanction the defector. In the market-driven arrangement, the lack of the rule of law made it possible for the company to just disappear. Due to uncertainty about the long-term behaviour of participants in an institutional arrangement, their establishment is at risk.

In conclusion, this thesis started from the four-layered framework of Williamson for institutional analysis. Based on this framework, three institutions (each on a different level) were included in the analysis (property rights, governance and incentives), where the analysis of each institution separately required the operationalization of a specific theoretical framework. At the end of this thesis, two main insights stand out with respect to the Williamson framework. First, while the analysis in each chapter focused on a specific institution, it is clear from the discussion above that all levels of institutional analysis are highly interrelated and higher levels of institutions strongly affect lower levels. The analyses presented in the different chapters provide evidence of these influences. These 'top-down' effects were also indicated by Williamson (1998) but not discussed in detail. Insights from this thesis hence add to the understanding of the framework. Second, the thesis also provides evidence of what Williamson termed feedback effects, i.e. the impact of lower level institutions on higher levels such as the effect of local governance arrangements on the

definition of land property rights. Especially these feedback effects have received limited attention in the literature and the current thesis hence adds further insights and understanding.

6.6 Policy implications and recommendations

The planted area of jatropha is stagnating globally because many countries, companies and NGOs stepped out of jatropha plantations. Few jatropha projects obtained a net benefit, even in Africa where labour costs are low (Nielsen, et al., 2012). The bioenergy sector experienced a bubble due to the price developments for crude oil, which reached its highest point in 2007. After that, the decrease in the crude oil price made the market less promising, showing decreasing jatropha investments in South America, Africa and Asia.

After China stepped out of jatropha, it moved into camellia forestry, in its search for a promising crop to provide edible oil as well as bioenergy. Camellia gained international support. Moreover, China's recent forest tenure reform predicts a change in forestry resource management, as forestland tenure devolution aims to provide more security for and benefit to private actors (farmers and companies), who are expected to invest more in forestry. Forestry is not only important for climate change mitigation and adaptation; it also provides products and income to forest-dependent farmers. This fits into China's long-term policy agenda to improve rural livelihoods and promote agriculture and forestry development in rural China. Hence, this section contains recommendations for the further implementation of bioenergy and oil forestry programs.

First, policy inconsistency in bioenergy policies in China affected continuity. In China, state-owned companies abolished subsidies for jatropha and private companies discontinued their investment, partly because the central government subsidies for jatropha were discontinued. In addition, forest tenure policy also changed in China, which caused insecurity among stakeholders and affected their involvement in the implementation of bioenergy and oil forestry programs. In conclusion, policy consistency is crucial for long-term forestry investment.

Second, as a transition society, the role of market-based mechanisms is growing in China. Cooperation started between private actors such as companies and farmers, but due to underdeveloped monitoring programs and ill-functioning sanctioning mechanisms, the companies could easily withdraw from or abandon their contracts with farmers. As a result,

fragile and low risk tolerant farmers see their livelihoods endangered. Hence, measures should be taken to improve the institutional environment with respect to monitoring and the rule of law. Moreover, well-developed market insurance can reduce the risks brought about by natural disasters and provide stability in investment and development of forestry. Finally, providing direct cash income to stakeholders with liquidity constraints to address their short-term financial challenges, such as farmers, can be helpful.

Third, the objective of this reform is to establish a stable forest tenure system and thus to provide security to farmers and other stakeholders to improve participation of these private actors in forestry investments. Although the recent tenure reform intends to distribute tenure rights to individual farm households and increase security, land tenure security of local farmers has not been reached yet. The rapid developments in forestland tenure reform in the past create uncertainty among farmers and other stakeholders; hence it is important to improve stability of the forest tenure reform policy. Moreover, strengthening the legality and certainty of forest tenure after the reform is on its way, while effective supportive rules and market development are still required.

Fourth, although China's forestry programs are formulated centrally, their concrete design and implementation is decentralized towards local authorities and stakeholders, and thus diverse. Understanding local governance characteristics is vital to adequately design and implement forestry projects and to involve smallholders. From this study, several recommendations can be formulated for further improving the implementation of forestry projects and Chinese forest resource management. Both government-driven and market-driven projects should take local governance arrangements into account during project design and implementation. Integrating local institutions and local tenure regimes into the project setting and operation is highly recommended. International programs use international standard experiences, but especially then a pre-test regarding the local conditions is essential for the future success of the program.

Finally, large-scale forestry programs might create inequity and discriminate against fragile and marginal smallholders. Although the objectives of many forestry programs include poverty alleviation and the improvement of rural incomes, specific measures to target marginal and poor farmers are lacking. Hence, regulation on smallholders' participation should be formulated to improve and guarantee the involvement of smallholders in the design and implementation of large-scale forestry programs and to let them benefit from the program.

Moreover, as *Collective*, *Collective-Individual* and *Company* regimes perform better in smallholder involvement, developing these arrangements according to the local institutional context is recommended. In addition, as local farmers usually lack information on participation policies, procedures and the general terms of (international) projects, they lack the capacity to participate. To increase participation, education and extension to increase local farmers' knowledge on forestry projects is necessary. And, in order to reduce the transaction costs of involving a large number of smallholders, enhancing community trust and including poor farmers in existing social network is important. Finally, micro-credit provision is recommended because it helps to mitigate farmers' financial constraints and enables farmers that are short of credit to participate.

6.7 Study limitations and directions for further research

This research has analyzed bioenergy and oil forestry programs after forestland reform from an institutional perspective, focusing on program implementation and farmer investment and participation. Some limitations of this research can be formulated. First, bioenergy and oil crops are suitable to grow in sub-tropical and tropical areas and are therefore mainly observed in south China. In addition, collective forest tenure has mainly occurred in south China, hence southern provinces have been the main target of the recent reform. As a result, this research conducted case-studies only in southern provinces. Furthermore, the case-study on camellia was only implemented in one province. Hence, extending the geographical scope of research would enable to check the robustness of the research findings for other parts of rural China. For instance, the tenure regimes and their effects have been examined only for the camellia project. Similar studies in other provinces can be made to better understand forestland (re)distribution policy and measure its effects. Such comprehensive analysis will help to provide a more complete picture of forestland property rights reform in China. More specifically, of interest is whether devolution of forestland tenure provides tenure security for the private sector and farmers, and what are the effects of further forestland reform implementation on farmers' livelihood and equity.

Secondly, because the jatropha case-study is based on projects that failed, because the camellia case-study proved to be just in the initial stage, and the forest reform was only just finished, it is difficult to estimate the long-term impacts and result on farmers' participation and benefits. Hence, a new analysis after a lengthier period of implementation of the program

will provide further evidence and insights. Specifically, benefit sharing and distribution achieve significant attention in global bioenergy and oil forestry projects, including poverty alleviation and social sustainability (Duvenage et al., 2012). The social welfare and equity of bioenergy smallholder investment in developing countries are discussed widely (Hought et al., 2012). This study of smallholder bioenergy and oil forestry can only partly contribute to this debate with a preliminary appraisal due to the initial stage of the studied projects. Future research may investigate the evolution of distribution effects in the studied program and the long-term effects on smallholders' income. Future research may also widen the focus to social welfare of smallholders brought about by large-scale forestry programs.

Finally, China has been experiencing a transition to a market economy, which has consequences for its society. The implementation of large bioenergy and oil forestry programs is embedded in and part of this critical transition, where private companies and individual farmers attempt to invest in forestry. Contract farming and contract performance are now becoming standard practice for both smallholders and companies in a transitional economy (Guo et al., 2007; Zhang, 2012; Montefrio and Sonnenfeld, 2013). However, results of this study suggest that the access to these contracts may not be equal across farmers. Further research should analyse the functioning and consequences of contract farming in the bioenergy and oil forestry sector for smallholders, especially as smallholders have to deal with long-term investment and not just annual crop farming.

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Appendices

Appendix I A checklist for semi-structured interviews with stakeholders at each level of government, from provincial level to farmer representatives

1. Who decides on the jatropha and camellia projects agenda? Who participates in the policy game? Who is excluded? Who takes the decisions?

2. What are the main concepts in the policy discourses and the policy programs around jatropha and camellia projects? What do relevant policy documents related to jatropha and camellia projects contain? How do the various players in the field interpret the policy concepts?

3. Which actors are involved in the jatropha and camellia tree cultivation and promotion and how are jatropha and camellia trees promoted at the local level?

4. Whether there are any previous nationally or internationally initiated forestry projects? How were the projects implemented and do they have any impacts on the implementation of jatropha and camellia projects?

5. What are your objectives for the programs? Do you have any obligation for the implementation of the program?

6. How has the institutional arrangement been negotiated among the stakeholders?

7. Apart from the program, is there any subsidy policy for planting jatropha or camellia? May you tell me about the subsidy standard, which department offers the subsidy, the requirements for getting the subsidy and for what reason will a household be rejected for getting the subsidy?

8. What are potential risks in the program for the local government/company and farmers such as fire, pest, market risks, natural disaster etc?

9. What are the benefits of participating in the program for the government/company and farmers?

10. Whether there are any obligations in the program for the local government/company and farmers?

11. Whether there are any previous experiences of jatropha or camellia projects?

12. What is your expectation of further development of jatropha or camellia projects in the future?

13. What is the local situation of the jatropha and camellia seed processing industry and market?

Appendix II Administrative village questionnaire

The goal of this research is to try to find out the determinants of success in camellia tree cultivation. Your answer is very important for my research. All the information you offer will be kept confidential and is only used for my research.

Interviewer: _____ **Date: _____**

County: _____ Township: _____ Administrative Village name: _____

Interviewee: _____ contact Contact telephone number: _____

Distance of village to: County: ___ km, Township: ___ km

1. Characteristics of village leader

	Item	Village leader
Age	Years	
Education	Years in school	
Gender	1=male 2=female	
Whether party member	1=yes 2=no	
When s/he became village leader in this village	Year	
Procedure of obtaining the position	1=recommended by former village leader 2=recommended by administrative village 3=delegated by the township 4=villager 5=others, specify	
Whether s/he fulfills also other roles	1=farmer cooperative member 2= owner of forestry enterprise/company	

	3=owner of other enterprise 4=others, specify 5=none	

2. Village condition and labour force

2.1 Total number of natural villages _____ natural villages

2.2 Total number of households in the administrative village _____ households

2.3 Total number of villager _____ persons

2.4 Adult female labour force (16-55 years) _____ persons

2.5 Adult male labour force (16-60 years) _____ persons

2.6 Wage for employed labour _____ yuan/day

2.7 Number of farm households with access to electricity _____households

3. Forestland and forestry activities

3.1 Forestland area according to property rights

Item	Individual	Partnership	Collective	Forestland transfer within the village	Forestland leased to outsiders
Unit	Mu	Mu	Mu	Mu	Mu
2011					

3.2 Main Forestland area according to type of trees

	Economic tree						Ecological forest	Protected forest	Barren land
Name					camellia tree	Others			
Total area									
Average slop									

Land quality 1=good, 2=medium, 3=bad									

4. Tenure security

4.1 Is the forestland distributed to farm households? If yes, what are the distribution rules? If not, why not?

4.2 What is the total number of disputes in 2010? Describe the cases of who had the dispute with whom and who intervened in the dispute resolution in 2010?

Appendix III Farm household questionnaire

The goal of this research is to try to find out which factors determine farm households' camellia tree cultivation. Your answer is very important for my research. All the information you offer will be keptconfidentialand is only used for my research.

Farm household code		**Survey date**	
Name of the county		**Name of the interviewer**	
Name of the township		**Name of the interviewee**	
Name of the administrative village		**Gender of the interviewee**	
Name of the natural village		**Relation ofinterviewee and the farm household head**	
Name of the farm household head		**Contact telephone number**	

1. Household composition and family members' activities.

Series no. of household member	1.Relationship with household head 1=head 2=partner 3=child or partner of the child 4=grandchild 5=parents and parents in law 6=grandparents 7=sibling 8=other relative 9= no relative	2.Gender 1=male 2=female	3.Age	4.Education level (years in school)	Whether party member 1=yes, 2=no	Main occupation: 0=none 1=agriculture 2=forestry 3=self-employment 4= village leader 5=township cadre 6=other government employee 7= working in non-agricultural jobs 8=student 9=other	Work location if "Main occupation" = 7 1=in the village 2=other village in the town 3=outside the town within the county 4=other county within the province 5=other province 6=abroad
1 head							
2							
3							
4							
5							
6							
7							

8							
9							

2. Household land condition and activities

2.1 Arable land and forestland conditions

Item	Arable land currently in use		Arable land leased to others	Forestland currently in use				Forestland leased to others
	Own use	Leased from others		Individual	Partnership	Leased from others within the village	Leased from others outside the village	
Unit	Mu	Mu	Mu	Mu	Mu	Mu	Mu	Mu
2010								

2.2 Household farming activities

	Units	Agriculture			Husbandry			Other forestry(apart from2.3) mainly is NTPF		
Name of the crop		Rice	Maize	Other: specify	Pig	Poultry	Other: specify	Mushroom	Medicine	Other
1.Yield	Jin									
2.Market price	Yuan/Jin									
3.Total labour	Day/s									

3. Camellia plantations

3.1. Have you planted new camellia trees?

1=yes, please go to 3.2.

2=no, please go to 3.4.

3.2. New camellia plantations on each piece of land

Variables	Unit	Plot 1	Plot 2	Plot 3	Plot4	Plot5
1. Size	Mu					
2. Average slope	Degree					
3. Soil quality	1=good 2=medium 3=bad					
4. Tenure regime	Individual, Partnership, Collective-Individual, Company					
5. Whether the plantation was done under a project?	1=yes, please specify the name 2=no, please cross the box					

6. Subsidy	Yuan					
7. Low interest loan provided by project	Yuan					
8. Cost for the first year	Yuan					
9. Labour for the first year	Day/s					
10. Cost for the second year	Yuan					
11. Labour for the second year	Day/s					

3.3. Has anyone of your household received from the forestry station any productive input/service related with camellia trees? (Multiple choice)

1=none, 2=training, 3=better seedlings, 4=technology assistance, 5=fertilizer, 6=demonstrational plots trip, 7=others, please specify: _____

Please continue with 4.

Questions for those not having planted camellia trees

3.4.Why did you not take part in the plantation? (Multiple choice)

1=no enough labour, 2=lack of investment, 3=lack of technology,4=no subsidy support,5=low economic benefits, 6=risks in the market, 7=no forestland, 8=alternative use of forestland, 9=no processing facilities accessible, 10=others, please specify: _____

Please continue with 4.

4. Institutional part

4.1. Do you know about any previous government initiated forestry programs?

1=yes, 2=no

4.2. Have you ever taken part in any local government initiated forestry project?

1=yes, 2=no

4.3. To what extent do you believe that the information on forestry projects by the local government is reliable?

1=0-20%, 2=21%-40%, 3=41%-60%, 4=61%-80%, 5=81%-100%

4.4. What is the subsidy standard for camellia plantations? _____

4.5. Are there any obligations for a farmer in the cultivation of camellia?

1=yes, list _____, 2=no obligation, 3=I do not know

4.6. Are there any sanctions if the farmers discontinue the cultivation of camellia?

1=yes, list _____, 2=no sanctions, 3=I do not know

4.7. In your opinion, what is the local government's motivation in promoting cultivation of camellia trees? (Multiple choice)

1=bring benefit for farmers, 2=political achievement, 3=international pressure, 4=economic benefit for themselves, 5=others, please specify: _____

4.8. What are the risks for a farmer in taking part in the tea oil tree cultivation? (Multiple choice)

1=lack of cash investment, 2=market risks, 3=natural disaster, 4=fire, 5=pest, 6=subsidy termination, 7=none, 8=others, please specify: _____

4.9. What is the benefit in taking part in the camellia project? (Multiple choice)

1=income increase, 2=technology training, 3=management training for the market, 4=ecological improvement, 5=none,6=other, please specify: _____

5. Household wealth

	Productive machinery				House 1=brick 2=wood	Consumerdurables						
	Tractor	Irrigation equipment	Agro-product Processing equipment	Car		Fridge	Washing machine	Television	Scooter	Computer	Air conditioner	Water heater
Original value(Yuan)	Yuan	Yuan	Yuan	Yuan	Yuan	Yuan	Yuan	Yuan	Yuan	Yuan	Yuan	Yuan
Age(year)												

6.Tenure security

6.1. Do you expect risk of expropriation (within the next 10 years)

1. Yes; 2.No

6.2. Do you know the functions of the *Forestland Title Certification*? (Multiple choice)

1=the legal contract of your user right of forestland within 70 years

2=the legal contract stipulating for which forestland you own the user rights

3=the prerequisite for the wood harvesting permit

4=the prerequisite for compensation when the land is withdrawn by the government and other sectors

5=the prerequisite for the transfer of user rights of forestland to others

6=others, _____(specify)

6.3. Do you have disputes over forestland?

1=yes, for which issues_____, 2=no

6.4. With whom do you have disputes?(Multiple choice)

1=villager in the same village, 2=village collective group, 3=villager in the neighboring village, 4=neighbor village group, 5=forestry bureau, 6=company, 7=private individual resident outside the village, 8=others

6.5. Who intervenes for resolving the disputes? (Multiple choice)

1= discussing among affected parties, 2=villager leader, 3=forestry bureau, 4=legal department, 5=other

Appendix IV Endogeneity of tenure security

Ma et al. (2013) argue that the inclusion of tenure security measures in an investment model presents a potential endogeneity problem. This endogeneity problem may have several causes. First, investments in land improvements or forestry plantations may increase the likelihood of obtaining secure land titles in the future. Incorporating tenure security as an explanatory variable in the investment model may then lead to an issue of reverse causality as tenure security may affect investment decisions but at the same time, investments can influence the level of tenure security. Consequently, coefficient estimates resulting from models that do not take account of reverse causality may be biased. The second type of endogeneity relates to unobserved household characteristics or actions that affect both tenure security and investment decisions. For example, households that invest in their land may also be more active in lobbying village leaders for protection of tenure rights. Being unable to incorporate such unobserved characteristics, may then lead to correlation between the variable tenure security and the regression model error term.

In the Chinese context, the reverse causality effect of tenure security and investments may be minimal. The reason for this is that land redistribution or expropriation are usually decided at the village level and are therefore independent of land management and investments decisions taken by households (Brandt et al., 2004; Liu et al., 1998; Ma et al., 2013; Qin and Xu, 2013). Furthermore, this chapter discusses (marginal) labour and working capital investments rather than investments in forest plantation which also lowers the risk of reverse causality. The second type of endogeneity – unobserved variables that can affect both tenure security and investments decisions – may however be relevant also in my analysis. I therefore applied econometric techniques to correct for endogeneity arising from a binary endogenous variable based on Heckman (1974) and Heckman and Navarro-Lozano (2005). This apporach is also referred to as the control function approach and solves the endogeneity problem based on a two-step procedure that is estimated by Stata's *treatreg* command (Wooldridge, 2012). As compared to the results in table 2.5, tenure insecurity is no longer significant in the labout investment model and the collective tenure regime has no significant effect on capital investments. Other results remain largely the same.[26]

[26] Remark that the results in table 2.5 are based on a tobit estimation model and the coefficients in tables 2.5 and A.2.1 can therefore not be directly compared.

Table A.2.1 Treatment effects model regression results

	LABOUR			CAPITAL		
	Coefficient	z-statistic	sig.	Coefficient	z-statistic	sig.
partnership	-0.6	-0.5		61.0	3.7	***
collective	-4.0	-2.6	***	-31.1	-1.3	
company	-2.5	-2.4	**	-35.7	-2.3	**
tenure_insecurity	3.0	0.7		-6.8	-0.1	
size	0.0	-2.6	***	0.4	1.9	**
distance	-0.4	-1.1		1.8	0.4	
slope	1.2	1.9	*	-4.1	-0.5	
soilquality	-0.3	-0.4		-1.7	-0.2	
headgender	-2.5	-1.4		54.3	2.1	**
headage	0.1	1.7	*	0.3	0.7	
headeducation	0.0	-0.3		-2.7	-2.0	**
householdsize	-0.5	-3.5	***	3.0	1.6	
valueofhouse	0.0	-1.3		0.0	0.2	
_cons	6.4	2.3	**	-18.4	-0.5	
	TENURE INSECURITY			TENURE INSECURITY		
partnership	-0.3	-0.8		-0.3	-0.8	
collective	1.3	4.2	***	1.3	4.2	***
company	0.5	1.6		0.5	1.6	
size	0.0	1.5		0.0	1.5	
distance	0.2	1.6		0.2	1.6	
slope	0.2	0.7		0.2	0.7	
soilquality	-0.2	-0.5		-0.2	-0.5	
headgender	0.3	0.5		0.3	0.5	
headage	0.0	1.0		0.0	1.0	
headeducation	0.0	0.1		0.0	0.1	
householdsize	0.0	-0.6		0.0	-0.6	
valueofhouse	0.0	-0.4		0.0	-0.4	
_cons	-0.8	-0.7		-0.8	-0.7	
Number of obs	182			Number of obs	182	
Wald chi2(25)	85.75			Wald chi2(25)	109.55	
Prob > chi2	0			Prob > chi2	0	

* Significant at 10% level, ** Significant at 5% level, and *** Significant at 1%.

Summary

Climate change, as a result of greenhouse gas emissions and ecosystem deterioration, is currently one of the planet's main challenges. The forestry sector can play an important role in addressing this challenge because forests absorb large quantities of CO_2. In addition, forests also provide economic, environmental, and sociocultural benefits. Several important international schemes are being implemented in developing countries to initiate afforestation and reforestation projects. The Chinese government is paying great attention to climate change and to green and sustainable economic development strategies. The forestry sector is a key focus in these strategies.

However, China has experienced a number of difficulties in the implementation of national forestry programs. These include the "top-down" administrative approach, the lack of interagency cooperation and long-term planning, and poorly functioning market-based approaches. Furthermore, the government has neglected to engage local people in program implementation. Moreover, since 2003, China experienced a reform of forestland rights, where user rights of collective forestland are redistributed to individual households. As a result, understanding the interests and incentives of smallholders in forestry conservation programs is crucial to achieve the government's pro-poor targets and to ensure benefits of these programs for the local population.

This research focuses on the institutional aspects of large-scale bioenergy and oil forestry programs and gives special attention to the smallholder implications. The general objective of this research is to investigate how the three institutions of property rights, the governance structure and farmer incentives affect the implementation of large-scale bioenergy and oil forestry programs, and whether and how these institutions determine farmers' participation and benefits in these programs.

The research question has been investigated for two influential large-scale bioenergy and oil forestry programs in China (Jatropha and Camellia). Data was collected through secondary data collection, in-depth interviews with stakeholders, and farm household surveys. Through these methods, information and data were gathered about bioenergy and oil forestry policies, implementation and performance of the programs and the forest tenure reform process at different administrative levels. Farm household data was collected through questionnaires. The fieldwork on jatropha was carried out in Sichuan Province and Guangxi Province in 2010. The camellia fieldwork was undertaken in Jiangxi province in 2011. A valid sample of 308 households from 30 villages was collected. The study has led to a number of interesting insights related to each of the three institutional aspects.

First, good governance, which includes stakeholder participation, plays a crucial role in the success of large-scale forestry programs. As forestry entails a long-term investment, how to set-up good and sustainable governance architecture is very important, but also challenging. The research shows that large-scale bioenergy and oil forestry programs in China are moving from government-organized, centralized, top-down governance architectures to multi-level and multi-actor governance arrangements, which involve market-based mechanisms and private actors such as private companies, NGOs, international agencies, communities and individual farmers. Large bioenergy and oil forestry programs in China can be distinguished as those driven and implemented by the government and those driven and implemented by market arrangements. As such, this structure confirms that new roles and interaction patterns between government and markets are present in contemporary transitional China. Another finding is that jatropha's failure in China can be attributed to the institutional environment, such as poor implementation and enforcement of monitoring and sanctioning rules. Rules to prevent the withdrawal of a company and executing such rules are crucial to keep companies committed. Finally, convergent "time perspectives" of different actors in forestry institutional arrangements is important in the success of large-scale forestry programs.

The second set of results relates to the role of property rights and property rights reform. Since 2003, there is a new trend of devolution in forest tenure in China. Five different forest tenure regimes have been identified in this research: Collective, Collective-Individual, Company, Partnership, and Individual. The study indicates that the devolution process in tenure reform redistributed the user rights to local stakeholders. It also confirms that the de-collectivization process and the tenure reform have resulted in a diversification of management forms. Based on the New Property Rights Theory, it is hypothesized that the five forest tenure regimes differ in terms of residual control and income rights, implying different degrees of tenure security for farm households. The research findings confirm that in general tenure regimes with higher degrees of tenure security trigger higher household investment. Furthermore, the risk of future expropriation negatively affects farmers' participation in forestry projects.

Finally, the study addresses the question of farmer incentives and benefits. For large-scale forestry projects engaging smallholders in forestry is vital for the success of the project, with respect to a balanced socio-economic development in poor rural areas and guaranteed long-term success. Forestry development potentially improves the livelihoods of famers by increasing their income, and poverty alleviation has always been an important objective of bioenergy and oil forestry programs. Although these programs often provide financial support and technical services, some farmers are still not able to join. For instance, the participation rate of farmers in the camellia program was only 37%. Moreover, the participation level varied among counties and villages, because farmers' participation is still constrained by their capacity in terms of wealth, labour endowment and education. Finally, forestry programs generate different benefit distribution impacts on farm households under different forest project implementation regimes. Results show that five implementation regimes of camellia plantations can be distinguished, i.e. Individual, Partnership, Collective-Individual, Collective, Company, each having their own specifics of project access and benefit distribution among smallholders. Collective-individual, Collective, and Company forest implementation regimes

perform better in terms of program access and equal benefit distribution than Individual and Partnership regimes. But also for the former three regimes, village leaders and companies may seize substantial project benefit reducing the benefits to and marginal smallholders.

Samenvatting

Klimaatsverandering, ten gevolge van de uitstoot van broeikasgassen en de schade aan ecosystemen, vormt momenteel een van de grootste uitdagingen voor onze planeet. De bosbouwsector kan een belangrijke bijdrage leveren om tegemoet te komen aan deze uitdaging omdat bossen grote hoeveelheden koolstofdioxide absorberen. Daarbovenop bieden bossen ook economische, ecologische en socio-culturele voordelen. In ontwikkelingslanden zijn verscheidene internationale programma's opgezet om de aanbouw en heropbouw van bossen te stimuleren. Ook de Chinese overheid heeft het tegengaan van de klimaatsverandering en het opzetten van groene, duurzame ontwikkelingsstrategieën als prioriteit. De bosbouwsector speelt binnen deze strategieën een centrale rol.

Een aantal factoren bemoeilijken echter de uitvoering van de nationale bosbouwprogramma's in China, zoals de top-down administratieve aanpak, het gebrek aan samenwerking tussen agentschappen, het ontbreken van een lange-termijn planning, slechtfunctionerende marktmechanismen en een beperkte betrokkenheid van de lokale bevolking in de uitvoering van de programma's. Een bijkomend element is de fundamentele landhervorming die sinds 2003 is doorgevoerd in China en waarbij collectieve gebruiksrechten van de grond herverdeeld zijn naar individuele huishoudens. Mede hierom is het cruciaal om een beter inzicht te krijgen in de rol, de motivatie en dus de voordelen van kleinschalige grondgebruikers in bosbouwprogramma's om de doelstellingen van de overheid met betrekking tot armoedebestrijding te kunnen verwezenlijken.

Dit onderzoek richt zich op de institutionele aspecten van grootschalige bosbouwprojecten voor bio-energie en -olie waarbij speciale aandacht wordt besteed aan de gevolgen voor kleinschalige grondgebruikers. De doelstelling van het onderzoek is om na te gaan hoe de drie instituties eigendomsrechten, governance en motivatie van landbouwers een invloed hebben op de uitvoering van grootschalige bosbouwprojecten voor bio-energie en -olie en met name hoe bepalend deze

instituties zijn voor de deelname aan en voordelen uit deze programma's voor kleinschalige boeren.

Deze onderzoeksvragen zijn onderzocht voor twee invloedrijke grootschalige bosbouwprojecten voor bio-energie en -olie in China (jatrophaen camellia). De onderzoeksmethodologie omvatte secundaire gegevensverzameling, interviews met stakeholders en een survey van landbouwhuishoudens. Door middel van deze methodes is op verschillende administratieve niveaus informatie verzameld over het beleid in de bosbouwsector voor bio-energie en olie, de uitvoering en resultaten van de programma's en het landhervormingsproces. Landbouwhuishoudens werden persoonlijk bevraagd met behulp van vragenlijsten. Het veldonderzoek voor jatropha werd in 2010 uitgevoerd in de provincies Sichuan en Guangxi.Het camellia veldonderzoek werd uitgevoerd in de provincie Jiangxi in 2011. In totaal werden 308 huishoudens bevraagd in 30 verschillende dorpen. Het onderzoek resulteerde in een aantal interessante bevindingen voor elk van de drie institutionale aspecten.

Allereerst speelt een goede governance, waarbij stakeholders betrokken worden, een cruciale rol voor het succes van grootschalige bosbouwprojecten. Omdat bosbouw een lange-termijninvestering inhoudt, is het belangrijk – maar eveneens ook een uitdaging – om het beheer op een duurzame manier op te zetten. Het onderzoek toont aan dat grootschalige bosbouwprojecten in China evolueren van overheidsgestuurde, gecentralizeerde, top-down beheersstructuren naar governance structuren die meerdere niveaus en meerdere actoren omvatten, die meer door marktmechanismen gestuurd worden en waarin private actoren zoals bedrijven, NGOs, internationale organisaties, gemeenschappen en individuele boeren betrokken zijn. Grootschalige bosbouwprogramma's voor bio-energie en -olie in China kunnen onderscheiden worden als deze die gestuurd en uitgevoerd worden door de overheid en deze gestuurd en uitgevoerd door marktmechanismen. Dit toont aan dat nieuwe patronen en vormen van interactie tussen overheid en markt ontstaan in het hedendaagse China. Een ander resultaat is dat het mislukken van de jatropha projecten in China in verband kan worden gebracht met de institutionele omgeving,

met name de gebrekkige uitvoering en opvolging van supervisie- en bestraffingsregels. Regels die het terugtrekken van een bedrijf moeten voorkomen en de uitvoering van dergelijke regels zijn belangrijk om de toewijding van bedrijven te garanderen. Tenslotte onderstreept deze studie ook het belang van een samenhang in de tijdsperspectieven van de verschillende actoren in een grootschalig bosbouwproject.

Een tweede reeks van resultaten behandelt de eigendomsrechten met betrekking tot grond en met name de hervorming van deze eigendomsrechten. Het eigendomsrecht betreffende bosbouwgrond is drastisch hervormd in China sinds 2003. In dit onderzoek werden vijf verschillende grondeigendomsregimes geïdentificeerd: collectief, collectief-individueel, bedrijfs, partnerschap en individueel. Met de de-collectivisering van eigendomsrechten zijn gebruiksrechten toegekend aan lokale stakeholders. Dit proces heeft geleid tot diversificatie in de beheersvormen. In navolging van de Nieuwe Eigendomsrechtentheorie, verschillen de vijf beheersvormen in residuele inkomens- en controlerechten watresulteert in verschillen in eigendomszekerheid voor landbouwhuishoudens. Het onderzoek bevestigt deze hypothese en vindt verder dat landbouwhuishoudens met een hogere eigendomszekerheid meer geneigd zijn tot investeren. Eigendomsonzekerheid, gemeten door het risico op onteigening, weerhoudt boeren er overigens van om deel te nemen aan de bosbouwprojecten die worden opgezet.

Tenslotte kijkt deze studie ook naar de motivatie van landbouwers en de voordelen die zij uit de bosbouwprojecten halen. Het betrekken van kleinschalige grondgebruikers in bosbouwprojecten is cruciaal voor het succes van de projecten, met het oog op een evenwichtige socio-economische ontwikkeling in achtergestelde gebieden. De ontwikkeling van de bosbouwsector heeft potentieel positieve gevolgen voor de leefbaarheid van de rurale gebieden door het verhogen van de inkomens van landbouwhuishoudens. Armoedebestrijding is dan ook een belangrijke doelstelling in bosbouwprojecten voor bio-energie en -olie. Hoewel deze programma's vaak financiële en technische steun bieden, blijkt de deelname van kleinschalige

grondgebruikers soms beperkt. Zo zijn slechts 37% van de ondervraagde huishoudens betrokken bij het camellia project. Deelname verschilt ook sterk tussen regio's en dorpen omdat boeren beperkt worden door hun lage welvaartsniveau, beschikbare arbeid en opleiding. Een andere bevinding is dat bosbouwprogramma's verschillende effecten hebben op huishoudens afhankelijk van het grondeigendomsregime. Eigendomsregimes verschillen in de mogelijkheden die huishoudens hebben om deel te nemen aan de programma's maar ze verschillen ook op vlak van de verdeling van de voordelen. De collectieve, collectief-individuele en bedrijfsregimes bieden een gemakkelijkere toegang tot de projecten.Echter, in gevallen waar de hoofden van de gemeenschap betrokken zijn in de coördinatie tussen huishoudens en bedrijven, wordt de verdeling van voordelen soms als oneerlijk ervaren ten gevolge van corruptie. Deelname aan de bosbouwprojecten is moeilijker bij de grondeigendomsregimes partnerschap of individueel maar de verdeling van de voordelen wordt wel als transparant en eerlijkgezien.

About the author

Jia Li was born on 11 June 1984 in Anren, Hunan, China. She obtained her Bachelor degree in Economics from Nanjing University in 2006. In the same year she started her Master studies in Nanjing University. In January 2009, she graduated with the MSc degree in Political Economics from Nanjing University. Then, she continued to pursue her Doctoral Degree in Wageningen University, The Netherlands.

Jia Li
Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Name of the activity	Department/Institute	Year	ECTS (1 = 28 hrs)
A) Project related competences			
The Economic Institutions of Agriculture, Food & Rural Areas: institutional Dynamics, Organizations and Governance	Mansholt Graduate School	2009	1.5
Techniques for literature search and argumentation building for SURE PHD students	SURE course	2009	1.8
Institutional Economics Advanced Environmental Economics and Policy (ENP 322306)	WUR	2009	6
Biodiversity and Ecosystem Services	Fourth ALTER-Net Summer School	2009	6
Writing Research Proposal	WASS	2009	6
Theories and Models in Environmental Economics (ENR 30306)	WUR	2009	6
B) General research related competences			
Mansholt Introduction course	Mansholt Graduate School	2009	1.5
Mansholt Multidisciplinary Seminar	Mansholt Graduate School	2009	1
'Biofuel from forestry: Promising or Disappointing? The case of Jatropha in China'	Tropentag	2011	1
'International Conference: Smallholder, local governance, and benefit distribution in large-scale forestry projects - camellia case in rural China'	The Scandinavian Society of Forest Economics (SSFE)	2012	1
Questionnaire Construction (YRM 65300)	WUR	2009	1.5
Total			**33.3**