Tenure Reforms in Arable, Grass- and Forestland –

Impact on users' welfare and sustainable resource use in China

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MSc International Development Studies, Specialising in Economics of Development

MSc Thesis Development Economics DEC-80433

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Abstract

Throughout China, arable, grass- and forestland tenure have gone through a similar process of privatisation since the end of the 1970s. These reforms have had drastically different outcomes, with some areas seeing significant improvements in welfare and sustainability and others falling into degradation and poverty. The aim of this research is to improve the understanding of how and why similar land tenure reforms in China have had fundamentally different effects on these land types. This is done by comparing outcomes of reforms for levels of welfare and sustainability of resource use for each land type. Results indicate that reforms failed to take into account the various physical, social and cultural and institutional characteristics surrounding each land type. Tailor-made reforms, that take into account the socio-cultural and institutional settings, are needed for specific land types to avoid the pitfalls of implementing a one-size fits all policy.

Key words: Land Tenure, Arable land, Grassland, Forests, Welfare, China, Sustainable resource use

Contents

1. Introduction

Land is the most basic of all economic resources, pivotal in the course of economic development (Jordan & Sitwell, 2004). The manner in which land is assigned, managed and controlled determines the economic benefit with which it can provide. The assignment of land property rights and the security of land tenure therefore play a crucial role in economic growth and the lack thereof. As such, land tenure policy has always been a priority of policymakers worldwide. Land types vary significantly throughout each country, and designing the necessary tenure arrangement for each land type remains complex, takes time, and is costly. Scholars have favoured simple theoretical models investigating resource problems, such as land degradation, often prescribing universal solutions. Incidentally, due to the complex and lengthy nature of resource governance, policy makers tend to strive for a one size fits all policy (Mulan et al., 2010, Ostrom, 2009). Oftentimes governments have met limited success in designing and applying uniform rules in order to regulate the tenure of varying land types.

Land tenure is subject to frequent changes through reforms designed and applied by the ruling government. China is one such country which has gone through a series of land tenure reforms over the last decades. Tenure reform in China has been characterised in the 20th century by periods of collectivisation, followed by stepwise privatisation starting at the end of the 1970s (Du, 1998). These reforms have coincided with China's enormous economic growth and have been pivotal in its development. The Household Contract Responsibility System (HCRS) was the start to the individualisation of land tenure, targeting arable land. The HCRS was a remarkable success vastly improving China's agricultural industry and lifting millions out of poverty (Huang et al., 2012).

Tenure reforms targeting grassland and forests followed similar principles of privatisation and were modelled on the HCRS. However, the outcome of these reforms was not nearly as successful as those targeting arable land. Chinese grasslands have suffered heavily since tenure reforms and up to 90% are considered degraded (Cao, et al, 2013, Reynolds, 2001, Tan & Tan, 2015). Forest tenure reforms have had mixed results with a 1st round of reforms leading to widespread deforestation while later reforms proving more successful (Rozelle et al., 2013). Consequently, the Chinese government has had to make significant amendments and changes to grassland and forest tenure since the introduction of the reforms.

The impact on the welfare of these land actors has varied considerably. Chinese farmers have witnessed huge improvements in welfare, due to soaring agricultural production and institutional reforms. Forest actors have benefitted from more recent reforms in 2003, where timber production has increased leading to higher incomes. However, grassland inhabitants continue to see little

improvement, where poverty is still very common throughout these communities. Tenure reforms have not been nearly as effective in improving welfare for grassland inhabitants.

Studies that examined land tenure reforms in these different domains seem to indicate that it is difficult to find a one-size fits all policy for all land use types. However, in many parts of the world policymakers do install uniform regulations over large swathes of different land types. Such policies may not be appropriate in a country as large and diverse in terms of rural livelihoods as China. Currently available research in the field focuses on specific land use types (i.e. either on arable land, or grassland or forestland) and often on specific regions (Holden et al., 2011, Li and Huntsinger, 2011). To our knowledge, no efforts have been made so far to compare the impact of similar policy reforms across different land use types and draw lessons about tailor-made policies from such a comparison. As the case of China illustrates, land property rights reforms may have different effects on different land types. Therefore the aim of this research is to improve our understanding of how and why similar land tenure reforms in China have had fundamentally different effects on grasslands, forests and arable land. This will be done by investigating and comparing the outcome of those reforms for levels of welfare and sustainability of resource use for each land type across different regions in China.

To guide our research we first begin by constructing a theoretical framework where we illustrate the mechanisms through which land tenure reforms affect property rights and how this affects land and its users. We then summarise the benefits and properties of each land type followed by a brief overview of the various forms of land tenure. We then answer the four following research questions, applying our theoretical framework;

- RQ1: What are the similarities and differences in land reforms between arable land, grassland and forestland in China since the end of the 1970s?

- RQ2: What were the effects of the land reforms in arable land, grassland and forestland in China on the welfare of those who directly depend on these resources for their livelihoods?

- RQ3: What were the effects of the land reforms in arable land, grassland and forestland in China on the sustainability of resource use of each of these land use types?

- RQ4: What conclusions and policy recommendations can be derived from the answers to the foregoing four questions?

The information and data for each research question is obtained through an extensive literature analysis and is guided by our theoretical framework. The research is divided into eight chapters beginning with our introduction. This is followed by the theoretical framework, a chapter on the benefits and properties of each land type and one on the various forms of land tenure that can be found across the world. Following this, we will answer our four research questions one after another in four different chapters.

2. Theoretical Framework

Rules of land tenure define how property rights to land are allocated within society (FAO, 2016). Property rights allow individuals or groups to "lay claim to a benefit or income stream that the state will agree to protect through the assignment of duty to others who may covet, or somehow interfere with the benefit stream" (Holden et al., 2013). Land property rights are defined and regulated by the state. However, in many cases the state may not have the resources to enforce and regulate formal property rights. Oftentimes, informal rights may exist without the state's recognition and may even come into conflict with the state (Baltzer, 1998).

Property rights are comprised of three main separate rights; use rights, transfer rights, and mortgaging rights. These rights are a general representation of the bundle of rights associated with each type of land tenure. Use rights are the rights to how the land can be used, for grazing, growing crops, gathering forestry products and so on. More often than not poor communities only have use rights. Transfer rights are the rights to sell the land, to transfer land through inheritance, to transmit land to others through the community. Transfer rights may be allocated to individuals or groups, may be time limited or go into perpetuity and can be either conditional or unconditional (Baltzer, 1998, FAO, 2016, Holden et al., 2013). Mortgaging rights are the rights for the owner to use the land as collateral. Access to (formal) credit of farm households frequently depends upon the possession of land mortgage rights. Mortgage rights are conditional on transfer rights but do not necessarily follow from transfer rights.

Key avenues through which these rights affect economic outcomes are increased investment incentives through decreased risk of land loss, facilitating market transactions, and improved access to credit. The ability of a landholder to enjoy the fruits of his labour commonly encourages him to make long-term land investments and manage his land sustainably. Developing property rights increases the scope for efficiency improvements through land transfers by lowering transaction costs on land markets. Additionally, a developed market allows labour to move more freely between various types of land thus allowing these transactions at low cost and increasing productivity of land. Unclear rights can lead to high transaction costs reducing the number of transactions and driving property holders to informal markets. Asymmetric information and risk lead to uncertainty, while well-defined rights

lower information costs for banks thereby improving the likelihood that property holders can use their land as collateral to secure credit (Holden et al., 2013).

Essentially, there are three different forms in which these rights can be assigned, either to an individual, a group of people collectively and to no one. These three forms are what are known as property regimes; private property, common property and open access. Private property refers to a regime where all property rights are vested with one entity (individual, state, company). Common property rights are defined by groups of individuals collectively owning all property rights. Finally, open access is a property structure where all rights are held by no one, property rights are not defined. These regimes can be referred to as "pure forms", meaning that all elements of a property right bundle are held by the same party, and those rights are not restricted in any way. It is a purely theoretical assumption. In reality, most property regimes are restricted in some way by the state or other conventions (Baltzer, 1998). However, these property regimes provide the basis from which various land tenure structures are formed and are useful in guiding our theoretical framework.

The effect of property rights on economic behaviour can be analysed in terms of externalities and transaction costs. Through every economic transaction there is the possibility that the actions of one actor affect the welfare of another. If that actor does not take into account the effects upon the others, an externality will arise. These externalities may give rise to an inefficient allocation of resources in the economy as a whole (Baltzer, 1998). The Coase theorem states that if there are no transaction costs, an externality will be internalised by a mutually beneficial bargain between the imposer of the externality and the victim, regardless of the prevailing property structure (Baltzer, 1998, Coase, 1960). Therefore, there exists a close relationship between the level of transaction costs and externalities. Whether it takes the form of one agent imposing externalities upon others, or numerous actors imposing their externalities upon each other, economic efficiency may be enhanced if the involved agents cooperate and seek to make joint-decisions to maximise their benefits. However, cooperation between actors can be difficult as more than one actor may take advantage of a lack of information due to high transaction costs (i.e. 'information asymmetries'). As such that actor may seek to appropriate a larger share of the benefits than agreed upon. Therefore, presence of high transaction costs lead to a smaller likelihood of cooperation and a lower extent of internalised externalities (Baltzer, 1998, Holden et al., 2013).

This is where property rights become important. Property rights are the subset of institutions that serve to reduce uncertainty in economic exchange and as such, reducing transaction costs and making it easier to overcome externalities. This mechanism links property rights with the decisions on how to use natural resources. For example, if we consider a resource under open access to which no one holds the rights, resources users have no incentive to limit their use of that resource and would pose externalities on others as resource availability decreases. If resource users cooperated, they could all

stand to benefit. But due to transaction costs in initiating, enforcing and monitoring, cooperation maybe too costly. By defining appropriate property rights, “transaction costs could be lowered sufficiently to facilitate cooperation and the dissipation of resource rent could be reduced” (Baltzer, 1998).

Given the specific conditions of a certain resource, the optimal property structure is the one that most effectively lowers transaction costs thus facilitating cooperation allowing actors to internalise externalities. Transaction costs can be distinguished into three separate forms of cost; costs of internal cooperation, costs of exclusion, and costs of external cooperation.

The costs of internal cooperation refer to the costs an actor incurs when operating within a property regime. Thus a single actor within a property regime would experience low if not any costs of internal cooperation. For example, private property holds the advantage that the decision making unit is a single entity and internal cooperation is easy to accomplish (Baltzer, 1998).

Costs of exclusion refer to the costs that property rights holders incur when enforcing their property rights. An example is creating and maintaining boundaries surrounding their property to protect against others who seek to also capture the benefit stream of the resource or to interfere with it. Returning to our example of private property, a single actor may experience no costs of internal cooperation but costs of exclusion may be high and may even be too costly handle alone. These exclusion costs increase the more exclusive the property rights become. Multiple rights holders have the ability to share the cost and burden of exclusion as is the case in common property regimes. Not only are there more rights holders to bear the costs, there are also fewer duty bearers to exclude. But the joint control of the resource is subject to collective decision making, which means that there may be high costs of reaching and enforcing internal cooperation (Baltzer, 1998).

Costs of external cooperation refers to the right holders’ cost to cooperate with others and internalise externalities. Poorly defined property rights usually imply high transaction costs and may lead to actors not cooperating at all. When property rights are undefined, as is the case with open access resources, transaction costs involved in reducing resource degradation are high as there is no agreement between resource users to use the land in a sustainable way. As a result, externalities will not be internalised exacerbating the problem and possibly leading to more externalities. Similar observations can be made for arable land users who pollute waterways through the overuse of agrochemicals on their farms. If water property rights are unregulated, farmers can continue to pollute the water and thereby create externalities without fear of repercussion or fines. Under private tenure arrangements, costs of reaching external cooperation may also be high if no regulations exist. As a single entity the costs are not shared and therefore internalisation of externalities may not take place (Balzer, 1998).

Numerous factors may affect the relative costs of internal and external cooperation and the costs of exclusion. Following Baltzer (1998), these factors can be categorised into (1) physical characteristics of the resource, (2) the institutional context within which the resource use takes place and (3) the social and cultural context within which interactions occur.

The physical characteristics of the resource may make one particular property right design more effective than another. A good example are common pool resources such as pastoral lands, forestlands, fisheries, underwater basins and irrigation systems (Baltzer, 1998). These are difficult to use efficiently as the externalities present are pervasive when there are many users. They are characterised by rivalry of consumption, meaning that use by one user will subtract benefits from another user's enjoyment of the resource system (Sun, 2007). Due to their physical characteristics it is often very difficult or costly to exclude others while the benefits derived from these resources are finite; so they are often subject to degradation and overuse (Wong, 2004).

The institutional context within which the resource use takes place is a determining factor in the effectiveness of the property rights structure. A well-developed institutional framework includes state enforcement of formal property rights and thus lowers the costs of exclusion from the perspective of the rights holder. However, such formal institutions may be underdeveloped and unable to safe-guard property holder's rights. They may even be complicit in the undermining of those rights where corruption is common and institutions exploitable. When formal institutions are weak, powerful lobbyists may undermine the state placing their own needs above those of the local population, appropriating the benefits of resources. As a result, livelihoods of traditional users may become deprived, common resources enclosed and land concentrated into the hands of a select few (Baltzer, 1998, Bollier & Helfrich, 2014).

Informal institutions are socially shared rules, usually unwritten, that are created, shared and enforced outside of officially sanctioned channels (Tomiainen & Saastamoinen, 2007). Informal agreements on how specific resources should be governed exist in countless communities worldwide. They can be found in particular in poorer countries in Africa where customary rights in the form of commons in pastoral areas and lineage and chiefly control in farming areas remain common (Ensminger, 1997). These informal institutions determine and define access and management of resources and as such play a crucial role in determining the effectiveness of a property regime. Indigenous and isolated communities may have long-standing informal agreements and forms of cooperation over resources which may be the most effective way at lowering transaction costs (Tucker, 1999). Therefore it is not only important to consider the formal institutional context but also the informal context.

Finally, the cultural and social context within which interactions occur greatly affect the transaction costs related to human relationships. It is much easier for resource users to cooperate internally or externally if they share similar cultural and ideological characteristics such as language, religion,

tradition, norms of behaviour and a sense of social cohesion. Even the costs of exclusion may be lower, especially when those who are excluded do not share similar cultural and social characteristics. As such, the property structure that coincides the most with the social norms of individuals would be the most effective at lowering transaction costs. For example, if a community has had a longstanding internal agreement to consider land a communal resource, a change to a private property regime may cause much dissatisfaction and involve high costs due to a lack of experience in dealing with this structure. This can then lead to inefficient monitoring, lack of enforcement and non-rational behaviour (Baltzer, 1998)

The theoretical framework presented above can be visualised by means of two models. The model in Figure 1 reflects the role of transaction costs in defining the users of a resource and their property rights. As discussed above, the costs of internal and external cooperation and exclusion are affected by the physical characteristics of the resource, its institutional context, and the cultural and social context. In turn, these transaction costs affect which actors have access to a resource (and the externalities it creates on those who do not have access). The property regime can either increase or decrease the transaction costs. The property regime along wit, the actors who have access to a resource determine the actual property rights of the resource users (Baltzer, 1998, DFID, 2014, Holden et al., 2013).

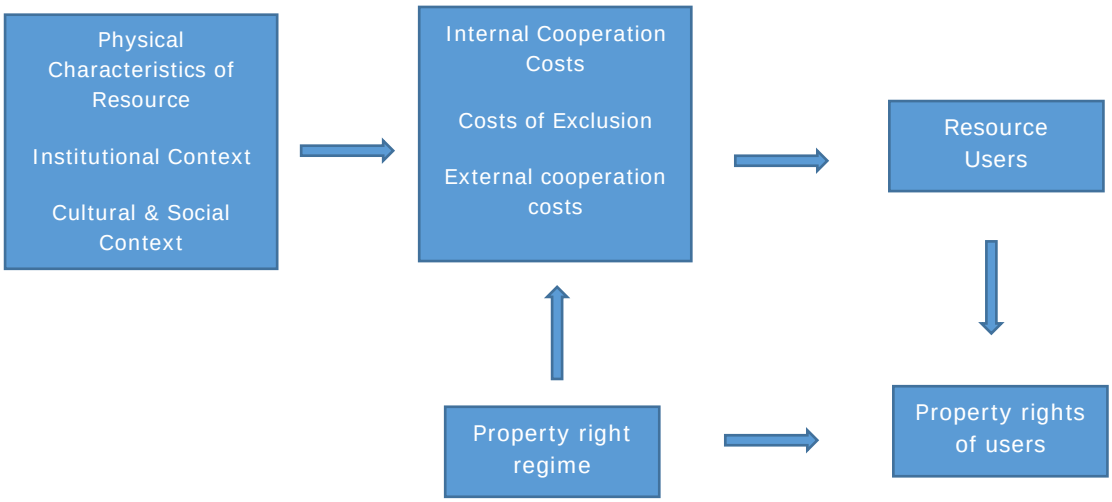

Figure 1. Determinants of transaction costs and their influence on property rights

The bundle of property rights possessed by resource users in its turn affects the production decisions of resource users and their outcomes in a way that is reflected in the model shown in Figure 2. Actors possessing property rights may have different combinations of use rights, mortgage rights and transfer rights.

Strengthening of user rights is expected to increase investment by land owners in their land by increasing their tenure security. Increased investment comes about through an assurance or security effect as secure rights incentivises farmers to make investments. They have a higher level of confidence that they are protected against expropriation and are able to recoup the fruits of their labour. Moreover, individuals, households or other users possessing use rights will need to devote less time to protecting their land and can use that time in a productive ways (Baltzer, 1998, DFID, 2014, Holden et al., 2013).

Securing transfer rights and lowering the costs of market transactions will generally increase land transfers. Having the right to transfer property can incentivise farmers to make more investments as they will be able to pass them on to the next generation or other inheritors. A well-developed market for land transfers allows actors with a competitive advantage in access to factor inputs such as labour to access more land, thus increasing efficiency and investments.

Mortgage rights allow credit-constrained farmers a better access to credit by mortgaging their land and by enhancing the credit worthiness of actors in the eyes of banks. This generally leads to higher levels of long-term investment and variable input use, increasing production and efficiency and thus increasing the welfare of land owners (Baltzer, 1998, DFID, 2014, Holden et al., 2013).

Decisions about production based on a resource depend on the users' access to credit, investments and land transfers. These production decisions in their turn affect the sustainability of resource use, the welfare level of its users and the externalities generated by them. Increased production and efficiency through investments and credit would allow actors to increase their benefit stream from the land and in turn would increase their welfare. Additionally production decisions dictate the manner in which actors manage their land. Therefore, if farmers choose to manage their land sustainably the resource can be maintained for a longer period. Otherwise, they may only look towards the short term, invest less and employ inefficient management practices thus leading to degradation (Baltzer, 1998). Resource owner production decisions can also give rise to externalities, either positive or negative. Production decisions related to forest management can give rise to a number of negative a positive externalities. For example, land owners who readily fell their tress without replanting them, exacerbate erosion and flooding. Good management practices employed by forest owners can mitigate against these events thus contributing towards positive externalities (Calder, 2007).

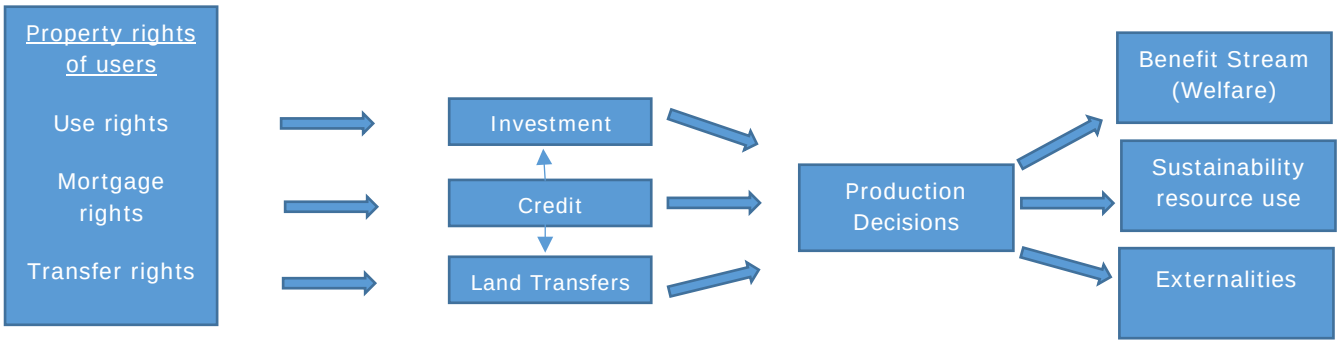

Figure 2. Property rights and their effect on production decisions.

In conclusion, our first model shows the mechanisms through which transaction costs affect the property rights of the resource users. Our 2nd model shows how property rights of resource users affect the welfare of its users, the sustainability of resource use and the externalities. Well-defined use rights, mortgage rights and transfer rights increase investment incentives and land transfers and give better access to credit. In turn this allows actors to improve efficiency and production thus affecting their production decisions.

3. Land Types and their Benefits

In the following section, each main land cover type will be introduced. The properties of each land type will be discussed focusing on the (economic and environmental) benefits each type provides. Applying our theoretical framework we will also look at the physical characteristics of each land type and discuss the affects this has on the transaction costs of cooperation and exclusion.

3.1. Arable Land

Arable land according to the FAO is the land under temporary agricultural crops, temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (FAO, 2015). Arable land per person has continuously witnessed environmental, social and economic pressures. The cause for this is the ever increasing demand for agricultural products facing finite natural resources; land, water and genetic potential. This is compounded by growing demand due to rapid urbanisation, industrialisation and biofuel production. Furthermore, with the ever more present threat of climate change renewed calls have been made to adopt more sustainable practices to preserve land for future generations (Conforti, 2011).

The area of arable land cultivated has increased over the last decades by 34 million hectares. The major contributing factors for this growth are an increasing population, growing economies, changing global diets, government policies, and developments in agricultural yield and technology. This has led to an ever increasing demand for arable land and even though efforts have been made towards crop intensification. The demand for arable land is expected to grow by 200-500 million hectares from 1990 until 2020. The FAO estimates that 20% of the extra food production will be the result of expanding arable land, 70% from increasing yield and the rest from intensifying cropping. This is ever more difficult with drastic changes in environmental suitability due to global warming. Furthermore, land under other cover types have been converted into arable land in order to keep up with growing demand. Notably in developing countries, arable land has been expanded at the expense of forests; since 1990 the global forest area has been reduced by 80 million hectares, although this is not solely due to arable land expansion (Kampman et al., 2008).

The majority of arable land is cultivated and used to grow annual and perennial crops. The main crops are food crops. No less than half of arable land is currently used for cereal production, such as wheat, maize and rice. The average yields are low in the majority of countries world-wide, with highly developed countries accounting for the largest yields. This is due to the difference in modes of production with developed countries employing advanced technologies compared to those in developing countries (Buringh & Dudal, 1987). Although cereal crops constitute a large part of arable land's products, the sheer variety of crops grown on arable land is immense. Each crop grown exhibits specific phenological behaviour meaning that arable land encompasses hugely diverse environments and climates (Zabel et al., 2010). Each crop has its specific conditions for optimal growth, although these conditions can be influenced by management technique, the ecological conditions remain different all around the world.

Although crops are used largely in consumption for either livestock or humans there is an ever growing use of arable land in the energy sector. This is largely due to increasing energy prices, concerns over petroleum supplies and increasing energy imports. Furthermore with greater scrutiny on environmental sustainability biofuels offer a cleaner alternative with far less pollutants being emitted. These factors have led to biofuel production becoming economically viable in areas around the world resulting in large areas of arable land dedicated to crops to be used as biofuel. Notably corn and soybean are the most popular crops with corn used in ethanol and soybeans in soybean diesel production. In 2011 27% of total corn harvested in the US was directed towards the production of ethanol (Hill et al., 2006, NCGA, 2013). This trend is set to increase as demand for biofuels become more viable than hydrocarbons but has also come under scrutiny as crops dedicated to energy now compete with those designated towards food consumption (Hill et al., 2006).

The majority of food production either destined for human or animal consumption comes from arable land and as such it represents one of the most significant land types. The number of crops are subject to hugely contrasting environments with arable land covering all permanently inhabited continents around the globe. However, with population pressures, industrial growth and global warming arable land faces significant constraints and threats. It is only with advancements in technology and coordinated policy will arable land be able to deal with the pressures it faces now and in the foreseeable future.

3.2. Grasslands

There are several definitions of grasslands. In the narrow sense, “grassland” may be defined as ground covered by vegetation dominated with little or no tree cover. UNESCO defines grasslands as land covered with herbaceous plants with less than 10 percent tree and shrub cover, whereas wooded grasslands range from 10-40 percent tree cover. In the wider sense grasslands are considered grazing lands although a large share of grasslands worldwide have been converted and developed into arable land (FAO, 2009). Depending on the definition of grasslands total grassland cover ranges from 25% to 40% of the world land area.

Grasslands are among the largest ecosystems in the world and contribute to the livelihoods of more than 800 million people globally. They are the source of numerous goods and services, ranging from food and forage to energy and wildlife habitat. Grasslands are also important for in situ conservation of genetic resources. They provide carbon and water storage and protection for many river basins and thus have regional and global impacts on the environment. Grasslands cover about 25% of the world surface or about 3.5 billion hectares (FAO, 2008).

Grasslands are hugely important and versatile ecosystems with far ranging benefits. Grasslands support high quality livestock produce largely through domesticated ruminants and wild herbivores (Carlier et al., 2009). Through maximising pastures as the primary diet, grasslands provide a high quality alternative to concentrate feed for animals. This can reduce inefficient use of arable land and increase the food that is directly available for consumption from cereals. Additionally, grazing animals on grasslands offers a low-cost form of production but results in higher valued meat compared to intensive livestock farming (Boval & Dixon, 2012). Pastures are the basic food resources for livestock and mixed farming systems, supplying over 90% of milk, 70% of sheep and goat meat, and 35% of beef in humid regions (FAO, 2017).

Apart from livestock products grasslands also provide a number of social and economic goods and cultural services. Grasslands provide the opportunity to produce otherwise scarce high-quality foods such as meat and milk. They provide either direct or indirect forms of employment and economic activity for disadvantaged and isolated communities. This contributes to greater household security

and a greater ability to deal with seasonal fluctuations such as crop failure, drought and other disasters. Grasslands allow for the transport of goods and people and a work force for various agricultural activities. They can be a source of fuel in the form of manure and biogas while also offering the opportunity for tourism such as hunting, fishing and ecotourism. Importantly, grasslands offer catchment areas for water supply controlling runoff and improving water quality for urban centres, estuaries and marine environments. Finally, grasslands can be a source of national identity and have important cultural and religious aspects attached to them. Throughout many countries grasslands are important for social stability and social structures (Boval & Dixon, 2012).

Another important function of grasslands is its role in offsetting greenhouse gas emissions acting as a carbon sink (Carlier et al., 2009). A large part of emissions are captured by grasslands and stored into the soils presiding underneath. The 3.5 billion hectares of grassland are estimated to contain 182 billion tons of organic carbon soil. Estimates indicate that grasslands could offset about 4% of total greenhouse gas emissions. As the carbon stored in grasslands is underground it is a more stable form of storage than aerial components of forests (Boval & Dixon, 2012). Grasslands also offer protection against erosion and provide a barrier against encroaching desserts. They are also a great source of biodiversity particularly in tropical regions. The diverse flora and rich fauna support and underpin countless ecosystems. These are being threatened by livestock grazing, land clearance, fertiliser application and the introduction of exotic species. On top of this grasslands have to contend with seasonal threats of fire and drought as well as the encroachment of deserts due to global warming (Boval & Dixon, 2012, Carlier et al., 2009, FAO, 2017).

Grasslands occur where there is sufficient rainfall for grass growth but where environmental conditions, both climactic and anthropogenic, prevent tree growth. The better-watered parts of many of the world's grassland zones have been developed for arable farming. As such the majority of grasslands in countries are subject to frequent periods of drought and dry environments Therefore, in developing countries where water is scarce and expensive the intensity of grazing is defined by rainfall patterns.

3.3. Forests

Forests cover 31 percent of the world's land surface, around 4 billion hectares. Forests have played an important role in the development of humankind. However, forests are one of the most mismanaged resources in countries worldwide. Furthermore, forests are consistently undervalued as many of their environmental benefits are not captured by the market (World Bank, 2013). Forests are defined as land spanning more than 0.5 hectares with trees bigger than 5 meters and a canopy cover of more than

10%. Most importantly it does not include land that is predominantly under agricultural or urban use. Tree plantations with the primary purpose to produce wood or wood derived products are included as forests but trees producing other goods such as fruits is not considered a forest (FAO, 2012).

Forests have a number of values; intrinsic, economic, ecological, cultural and aesthetic. A forests economic value lies in its ability to generate welfare and its scarcity. The direct values surrounding forests involve wood production, where wood is removed for construction and energy purposes (Adger et al., 1995). Global wood removals in 2005 totalled 3 million cubic meters where 40% was destined for fuel and the remainder for industrial use and timber production represent the main economic activity surrounding forests**.** Other economic commodities found in forests include minerals, food and fodder and other non-timber products, such as fruits and nuts. Around half of the world's forests are designated for production and are thus able to supply wood and non-wood products. Other direct uses of forests include tourism and recreational activities. Protected forests represent an ever increasing destination for eco-tourism and leisure. National forest parks attract thousands of tourists yearly due their pristine habitat and biodiversity (Adger et al., 1995). In addition to commercial values of forests direct uses include non-commercial activities such as subsistence livelihoods. Many communities around the world rely on forest products for their food security and livelihoods. Human settlements have depended on medicinal plants, wild food, timber resources found in forests for millennia (UNEP, 2014).

Non-commercial uses of forests play an important role in controlling and maintaining environmental processes. Particularly, forests are able to address the impacts of climate change by reducing vulnerability and helping adaptation and mitigation techniques (World Bank, 2016). During photosynthesis forests convert carbon dioxide into oxygen as such forests are an essential form of carbon storage and the carbon sequestration benefits of benefits of forests are paramount in combatting climate change. The world's forests have absorbed as much as 30% of annual global anthropogenic CO2 emissions (Nature, 2014). Forests are also important in watershed protection and erosion control. Deforestation exposes soils which destabilises soil structure worsening erosion. This allows for greater water runoff leading to flooding, reduced hydrological cycling and recharge of groundwater reservoirs (Adger et al., 1995). Thus forests can form a suitable protective measure against river flooding and rising coastal waters. Forests are also used in maintaining water quality as they are able to purify water, invaluable in poorer regions of the world (World Bank, 2016).

Forests are present in all regions of the world and are subject to hugely varying climactic conditions. The types of trees found in each forest are dependent on the local environment. Tropical forests contain the greatest diversity of species than the others with the highest levels of rainfall, they are also subject to the highest levels of deforestation. This is due to their unique environment rainfall patterns and high levels of sunshine are suitable for agricultural cultivation. Temperate forests are found in

milder regions of the globe with rich soils and high levels of rainfall. Finally, Boreal forests are the most northern forests where cold temperatures and poor soils make for difficult growing conditions.

4. Different forms of Land Tenure

The following chapter examines the various forms of land tenure that are found throughout the world. We examine how the physical characteristics, institutional, and social and cultural context affect transaction costs and in turn the appropriate tenure regime. Applying our theoretical framework, we look at tenure regimes found throughout the world for arable land, grasslands and forests and discuss their choice based on the costs of internal and external cooperation and the costs of exclusion.

4.1. Forms of Land Tenure

Land tenure is the relationship, either legally or customarily defined, amongst people, as individuals or groups with respect to land. The four main land tenure arrangements that can be distinguished are private, communal, open access and state.

State land tenure is a specific type of private tenure (as defined by Baltzer, 1998) in which the property rights of the land are assigned to some authority in the public sector. Forests often fall under the mandate of the state, therefore the rights of those forest belong to a governmental body. Examples of open access, which has been previously discussed, include marine tenure (where access to open seas is open to anyone), rangelands and forestlands (Baltzer, 1998, FAO, 2016).

Communal land tenure systems are predominantly found in Africa and Asia. It is a tenure system which involves a large part of the community with control over land use. A right of commons exists within the community, they own the land and allocate land to members of the community. The community member's rights to that land are use rights, i.e. a long-term right for an individual or household to use land distributed by the community (Bruce, 1998). It may also include inheritance rights, but does not grant the right to sell the land. Non-members are excluded from using the resource. Examples of communal tenure systems are grasslands where community members have the right to graze cattle on a common pasture.

In private tenure, land rights can be assigned to an individual, married couple, group of people or a corporate body. Private tenure comprises use rights, mortgaging rights and transfer rights. However, in more restricted property regimes one or two may be restricted. For example, within a community,

individuals may have exclusive rights to particular parcels of land. Other members of the community can be excluded from using that land by the rights holders (FAO, 2016, Baltzer, 1998, Wong, 2004).

4.2. The most suitable form

One of the main topics of discussion amongst policymakers and academics is identifying the most appropriate form of property rights in any given situation. Based on our theoretical framework, the property rights structure that serves to lower transaction costs the most, under given physical characteristics of the resource and given institutional, cultural and social context, would be the most suitable option. However, policymakers often design and apply uniform tenure arrangements for hugely varied types of land hoping to find an easy solution to designing separate tenure arrangements (Mulan et al., 2010, Ostrom, 2009).

Mainstream economic theory postulates that collective forms of land property rights should be converted into private property because such policy eases land conflicts, enhances land markets and land use efficiency, increases tenure security and improves credit access (Lesrogol, 2005). Private property is often viewed as the optimal tenure arrangement for sustainable management of resources. Policymakers frequently follow this viewpoint and push for reforms towards privatisation, even though the advantages of communal tenure arrangements under specific physical resource characteristics and institutional, social and cultural contexts have been demonstrated by several case studies (Baltzer, 1998, Li & Huntsinger, 2011, Longsworth and Williamson, 1993, Ostrom 1990).

Development of land use and land rights usually entails the formalisation, specification and individualisation of property rights (Bollier & Helfrich, 2014). The economic rationale behind land privatisation is as follows. Privatisation enhances tenure security through the issuance of titling and strengthening of use rights, thereby actors will increase investment in their land and this will lead to enhanced productivity and efficiency. Privatisation concentrates the benefits and costs of utilisation of the resource with the owner. Therefore, this provides incentives with rights holder to use the resource efficiently and sustainably (Demsetz, 1974). Furthermore, private property has the advantage that the decision making is done by a single unit (household, cooperation, a single person, etc.) and internal cooperation is easy to accomplish (Baltzer, 1998).

Taking the case of China, arable land tenure was first individualised under the HCRS and later on followed by individualisation of grassland tenure and forest tenure. Although arable land privatisation had several positive effects (but not always on the environment), grasslands have become severely degraded under private tenure arrangements (Cao et al., 2013, Li and Huntsinger 2011, Tan and Tan

2015, Yangzong 2006). The effects on forest land have been much debated; although forest cover has increased, it has resulted in decreased diversity and damaged ecosystems (Xu and Jiang, 2009).

Traditionally the economic literature has favoured private property rights. But in recent years policymakers and researchers have begun to take notice of the merits of common property regimes (Baltzer, 1998). This is compounded by the countless private tenure regimes that have failed, leading to environmental degradation and negative welfare outcomes and prompting policymakers to find alternatives.

Referring to our theoretical framework, the difficulty in communal tenure arrangements lies with facilitating internal cooperation, as this requires interacting among a large group of people. Many case studies show that under certain conditions groups and communities can establish communal property rights which manage resources sustainably and benefit welfare (Tucker, 1999). As discussed before, the physical characteristics of the resource, its social and cultural context and its institutional context directly affect the resource users' ability to cooperate and lower transaction costs.

Communal tenure arrangements are particularly effective when a given resource is mobile or dispersed and variable such as wild animals, fish and plants. Here, a common property arrangement can provide the users with an expanded area from which to obtain the benefits and a greater chance of success than if the resource were subdivided into private parcels. With marine resources where the benefits are dispersed, such as fishing grounds there tends to be a high degree of rivalry in use and a limited ability of owners to exclude others. Therefore since exclusion costs are high, it may be most efficient to manage the resource in a large single unit under a collective of individuals. Resources may present its users with high environmental risk, this coupled with a low population density may make the benefits from private tenure arrangement not sufficiently high enough to justify the costs of exclusion. Examples include dry grasslands where persistent drought and a low population density result in herders usually forming communal tenure arrangements. A group of individuals can, however, share these costs under a communal tenure arrangement (Deninger, 2003, Baltzer, 1998).

The institutional context also has an important impact on transaction costs and the choice of tenure arrangement. Under a well-developed institutional framework the costs of exclusion will generally be lower due to the guarantee of state intervention if property rights are challenged. Communal tenure arrangements may be better suited than private property rights in cases where formal institutions are not functioning well (or absent). With the higher costs of external cooperation and enforcement a collective would be able to divide the share of the costs.

Finally the social & cultural environment greatly influences the ability of actors to cooperate and internalise externalities. Communities with long standing tenure arrangements may be unable or unwilling to adapt to a complete reversal and upheaval of these long standing traditions. This holds in

particular for the individualisation of property rights where resources have traditionally been managed as common property. This may cause dissatisfaction amongst the resource users, leading to inefficient monitoring and enforcement and to non-rational behaviour. It may also negatively affect actors in external cooperation, reducing their ability to internalise externalities (Baltzer, 1998). Furthermore, the exercise of communal property rights can be essential to the identity and livelihoods of indigenous peoples, and losing these rights threatens their cultural survival.

The fundamental condition for common property is that its users perceive its (economic and non-economic) benefits to outweigh the costs. Successful communal tenure regimes result in closed access, and thus the resource is held as shared private property. The owners draw the boundaries of the resource, restrict non-members access, define membership and install a set of rules, duties and mechanisms to govern the resource (Tucker, 1999). This being said, communal tenure arrangements do not guarantee sustainable resource use and increased welfare. Common property can result in resource degradation and it may be controlled by the wealthy by excluding the less fortunate (Balland & Platteau, 1998).

4.2. Arable land tenure

Agriculture is one of the most important industries throughout the world, especially in less-developed countries. Consequently, access to agricultural land and securing property rights is important in assuring food security. The key justification to secure property rights is that they provide incentives for investment in land and sustainable resource management. Arable land cultivation was historically undertaken in areas with low population densities. Owners would lack any incentive to invest in soil quality and would instead practice shifting cultivation. Under this system land holders would clear a plot of land. They would then cultivate that land for a number of years harvesting their crops. Once the land no longer provided the necessary nutrients, the cultivator would clear it and move on to a new plot leaving the cleared plot fallow and restore its quality (Deninger, 2003).

Where population density was low and land plentiful, the costs of internal, external cooperation and exclusion were low. Farmers did not need to worry much about delineating their boundaries nor monitoring them. Costs of reaching external cooperation were low due to the low number of external actors in the same area. Agricultural land was normally managed by a number of people, a family or small community, thus lowering internal costs of cooperation. As land was plentiful and no labour input was needed to restore fertility, tenure security was relatively unimportant. There was little incentive to claim plots of land, thus property rights were rarely enforced (Deninger, 2003).

As population increases agricultural production needs to increase as well. With increasing population density, fallow cycles become shorter and shifting cultivation is no longer appropriate. Therefore, inputs and investments; applying manure, planting trees, building terraces and irrigation systems, will need to be made to increase the productivity of land. Unless actors are able to reap benefits from these investments, they will not be undertaken voluntarily. Therefore property rights need to be defined so that actors are able to ensure their there tenure security and make the necessary investments in the land (Deninger, 2003).

This shows the evolution of arable land rights, and highlights the process of individualisation that accompanies population and economic growth. As food requirements increase, arable land productivity needs to increase. This means that investments in arable land are needed which will also increase the value of the land. Therefore adopting the most productive tenure regime involves the one which provides the most appropriate incentives for farmers to make those investments. Governments usually opt for private tenure regimes in the hope to stimulate agricultural production (Deninger, 2003).

Arable land differs substantially from other types of resources. Important characteristics of arable land is that it is an immobile resource and its value is concentrated within a small area. This means that boundary maintenance and costs of exclusion are not as high as grasslands or forests. This means actors usually opt to facilitate internal cooperation by individualising and privatising tenure. As the benefits outweigh the costs of external cooperation and exclusion due to its high concentrated value as compared to other land types. Additionally, with a growing population arable land becomes scarcer increasing its value. Therefore the costs of exclusion may be lower to that of the land itself making it economically viable for single actors to manage the land and bear the cost. Meaning that a private land tenure arrangement may be more suitable (Acheson, 2015).

However, under certain circumstances other tenure arrangements may be more suitable than private tenure. When (formal or informal) institutions are unable to enforce property rights, the costs of exclusion will be relatively large. In such cases, community management may be more suitable as it allows sharing the costs of exclusion. This is commonly found in areas with low population densities in the poorer regions of the world. Arable land is predominantly managed under customary tenure arrangements in these cases (Acheson, 2015, Deninger, 2003)

4.2. Grassland Tenure

Grasslands throughout the world find themselves under various forms of tenure arrangement. The majority of grasslands throughout the world are found on poor quality land. Grasslands with high

quality soils and abundant rainfall are largely cleared for crops in way of pastures and stock-rearing. In Central and North-America the better watered areas of grassland are dedicated to crops, under private tenure regimes. In South America, grasslands are privatised with ranching, crop production and commercial stock-rearing. The focus of our study is in China, where the majority of grasslands can be found in Inner Mongolia and Xinjiang. These grasslands are arid with poor quality with herding livestock making up the main form of income (Suttie et al., 2005).

Due to the physical, cultural and social, and institutional characteristics of arid grasslands, costs of exclusion and external cooperation are high. Arid grasslands are fragile ecosystems, characterised by long periods of drought, thin top soils, low population density and low land productivity. Furthermore grassland inhabitants are vulnerable groups, usually isolated from institutions and exposed to the harsh environmental conditions (Tan & Tan, 2015). These factors have led to development of the various grassland tenure systems found worldwide.

Grasslands are isolated areas where historically inhabitants have led semi-nomadic lifestyle, depending on the resource for their livelihoods. The isolated nature of grasslands also means that weaker formal institutions are commonplace. In many places communities have developed extensive customary systems collaborating with themselves and self-governing the resource. The established tenure mechanisms allow for resolving internal conflict and dictate the rules governing the resource. This facilitates internal cooperation due to the level of trust shared between individuals within the community. It also lowers both the costs of exclusion and the costs of external cooperation as individuals are able to share the burden (Acheson, 2015).

Grasslands are predominantly used for livestock herding. This represents a mobile resource which is grazed over large swathes of land. This leads to high costs of exclusion due to the sheer size of boundaries which need to be monitored. Due to the natural conditions of grasslands, actors frequently confront natural disasters like hail, snowstorms, animal diseases, drought and strong winds. Herders are constantly moving their herds across rangelands, in search of forage and water during different seasons and to evade bad weather. This also leads to a high cost of external cooperation as actors need to be able to move across grasslands, cooperating with others, without hindrance (Tan & Tan, 2015).Therefore, due to the high costs of exclusion and external cooperation communal tenure arrangements are usually the choice of tenure arrangement.

Policies promoting individualisation of grassland tenure in order to increase investment and promote sustainable management practices have been met with mixed results. Grasslands communities predominantly rely on the ability to move freely in search of forage and water. When individuals are the sole owner of allocated patches, boundaries are drawn and fences erected. This leads to the fragmentation of grasslands and often contributes to resource degradation as livestock has a smaller area to graze. When this is not (sufficiently) compensated by feed purchases, a greater strain is placed

on already fragile ecosystems. Individualisation has also been found to lead to a breakdown of social capital amongst herders. Herders have to contend for scarce resources, individualisation leads them to reinforce their plots with fences and restrict other herders from freely moving their livestock (Tan & Tan, 2015).

4.3. Forest Tenure

Forest tenure has been subject to all four major forms of property structure, state, open-access, private and communal with each tenure arrangement found in various parts of the world. The most common form of tenure surrounding forests is state tenure with 80 percent of global forests being under public control. In all regions across the world public ownership of forests is dominant apart from Europe (FAO, 2011) Nationalisation of forests, in third world countries is advocated on the grounds that local individuals and communities are unable to manage forests sustainably (Ostrom, 1990). The theory behind this is that a lack of formal institutions, common in third world countries, results in reduced tenure security. Unsecured tenure means that villagers lack the incentive to make long term investments as they have no means of protecting them. Therefore they would either cut down the trees for a quick source of income or wouldn't soil fertility leading to degradation.

In countries such as Thailand, Niger, Nepal, India and China, forests have been nationalised on the pretence that local villagers couldn't manage forests sustainably in order to sustain their productivity (Ostrom, 1990). Several cases from the nationalisation of forests in these countries show the pitfalls of state forest tenure. Oftentimes, prior to nationalisation many villages had owned and regulated their local forests communally. Villagers restrained themselves considerably over harvesting forest products. Under public ownership, these new public forests were subject to elaborate regulations with multiple actors that needed to be considered. Additionally, the state often employed an insufficient number of foresters, thus they were unable to enforce any of these regulations. Commonly, the majority of foresters were underpaid making them easier to bribe (Dasgupta & Symlieh, 2006, Ostrom, 1990, Feeny, 1984). Nationalisation transformed previously common-property resources into open-access resources. These pitfalls of nationalising forests is well documented, proving the importance of appropriate institutions in forest governance (Ostrom, 1990).

Forests often have a significant cultural and social value. For many indigenous communities, forests are an object of social identification and culture, as they are normally isolated. It can be an important economic and cultural source which communities have relied on for generations. Many forests have important religious meaning for communities and are closely guarded and monitored. Frequently these forests come under customary communal tenure arrangements, where the state does not regulate

or intervene in forest management. Communities in the area have a shared understanding of local rules and regulations on harvesting and managing the forest. (Anderson, 2011).

The physical characteristics of forests make exclusion and enforcement of property rights often difficult. Forests usually extend over large areas of land with a high density of trees making it difficult to traverse quickly. Therefore it is commonplace for individuals to cut down trees without fear of being found. Even though forests may fall under a particular property structure, many have become open access resources, and the unconstrained exploitation has been a pivotal factor in deforestation (Tucker, 1999). Most trees also require two or more decades to mature before they can be felled and sold for income. This makes it relatively expensive to invest in exclusion measures. It also encourages farmers to go for short-term profits (instead of sustainable management) and to convert their land into other forms, mainly arable land, when feasible. Given these physical characteristics, the appropriate property structure should in many cases facilitate internal cooperation and incentivise farmers to manage their land more sustainably (Sun, 2007).

Due to the physical nature of forests the transaction costs of exclusion are much higher with costs of external cooperation. Forests are normally considered common-pool resources due to their large area and difficulty to enforce boundaries. As such it makes it very difficult to control access and joint-use due to the sheer size and costs of monitoring (Baltzer, 1998). Timber is a valuable commodity and individuals will constantly be seeking to cut down trees for a quick and easy source of income. Under private tenure internal cooperation would be easier to achieve but the costs to delineate boundaries and enforce them may be too costly.

Therefore the most appropriate property structure must delineate boundaries and limit exploitation in such a way that it is sustainable but remains economically beneficial. It must not estrange existing communities living within the forests and incorporate some of their social and cultural values. However, this is not to say that forests should always be managed communally. Communally managed forests per se do not guarantee wise resource management or sustainability (Tucker, 1999).

During the past two decades forest tenure is transitioning from that of public ownership to more individualised tenure arrangements. Although the majority of forests still remains under the state, decentralisation is occurring with forest tenure becoming more diversified (FAO, 2011). Consequently, there is no reason to believe that a forest policy based on the structure of private, common or public leads to good forest management. They are all viable options for sustainable management but not guarantees. Instead, outcomes will be determined by the actors, their preferences, and the institutions operating on the ground (Gibson et al., 2002, Tucker, 1999).

4.4. Divisions of land types and costs

When choosing the appropriate tenure regime it is important to consider how various characteristics of each land type affect transaction costs. Based upon our theoretical framework, Table 1 provides an overview of how changes in certain economic and social conditions lead to differences in transaction costs and how these changes in costs may affect the choice of the most appropriate tenure regime.

Market factors are also important in defining the optimal tenure arrangements. For example, improvements in infrastructure, diffusion of technology and the liberalisations of products can increase incentives for defining property rights. These factors can increase the output and value of the agricultural product which lead to a higher land value. As land values increase, property rights will become more defined inducing higher levels of investment, eventually leading to individualised forms of tenure. For example the transportation revolution caused by steamships led to an enormous increase in global trade but also an increase in the demand for individualised tenure (Deninger, 2003).

Population pressure has played an important role in determining arable land tenure throughout history High population density results in the value of land increasing. This leads to high costs of internal cooperation. Costs of external cooperation and exclusion may also increase with a rising population density, but usually not as fast as the value of the land. Hence, costs of internal cooperation increase most. Therefore, when externalities are absent or insignificant, the most appropriate tenure arrangement is private property as it is has the lowest costs of internal cooperation (Deininger, 2003).

Observing the case of grasslands, when the price of meat is high due to high demand, the value and size of a herder's livestock will increase. As the land available is finite, the value of grasslands which support high value livestock will also increase. High meat prices will increase competition amongst farmers and drive up prices of land. Therefore, actors will have to compete with increasingly more actors, leading to costs of exclusion. Due to the physical characteristics of grasslands, particularly the relatively large stretches of land needed per animal and the need for seasonal herd migration in certain regions, it is not easy to exclude others from using the land. Herders therefore face relatively high costs of exclusion and external cooperation. However, if the price of meat is high enough the value of the grassland and the livestock will outweigh those of external cooperation and exclusion. If this is the case, a private property regime may be most suitable as has the lowest costs of internal cooperation (Tan & Tan, 2015).

Forests main value usually comes from timber, although non-timber forest products may also provide important livelihoods in some regions. Therefore, the demand for timber is a major factor in the choice of the most appropriate tenure regime. The physical characteristics of forests, particularly the relatively long growing periods of trees and the corresponding low annual benefits per unit area, result in relatively high costs of exclusion with low costs of external cooperation. With an increase in timber demand, the value of trees will increase. This will provide incentives for farmers to invest more in their boundaries as a way to exclude other actors from harvesting their timber. Furthermore, with a

higher value of timber actors will be willing to invest more in the planting and maintenance of trees. The value of the forest may exceed that of excluding others, meaning a private tenure regime may be the most suitable (Rozelle et al., 2014).

Table 1: Factors effects on transaction costs

Land	Characteristics	Costs of internal cooperation	Costs of External Cooperation	Costs of Exclusion	Appropriate tenure regime
Arable Land	High Population Density	High	High	Medium	Private
	Low Population Density	Low	Low	Low	Communal
Grassland	High meat demand	High	Medium	High	Private
	Low meat demand	Low	High	High	Communal
Forests	High timber demand	High	Low	High	Private
	Low timber demand	Low	Low	High	Communal

5. What are the similarities and differences in land reforms between arable land, grassland and forestland in China since the end of the 1970s?

Since the 1970s the world has stood by and marvelled at China's miraculous economic growth, propelling it into an economic powerhouse that dominates the current global economy. Between 1978 and 2007, China's GDP increased from US $214.2 billion to US $3,400.4 billion, with GDP per capita increasing from US $224 to US $2,604 (Zhang & Liu, 2009). Since the 1970s China has undergone a rapid transformation of its economy, remodelling it from a centrally planned economy into a market oriented one.

The start of these economic reforms can be found with the policies addressing rural areas of China aimed at increasing agricultural productivity. These changes were characterised by changes in the rural political structure and the national resource management regimes. They replaced the archaic soviet style policies, deposing the People's communes, brigades and production teams and replacing them with townships, towns, administrative villages and natural villages. Communal production systems in rural China collapsed during the years 1980-82 and were replaced by the Household Contract Responsibility System (HCRS) (Sun, 2007).

The introduction of the HCRS had immediate consequences for the management of arable land, shaping famers' behaviours and practices in the management. The introduction of the HCRS led to a sharp increase in agricultural productivity. Following the HCRS's success, the Grassland Law and Forestry law were adopted following the same process of individualisation. However, these led to

severe degradation of both grasslands and forests with subsequent aimed at addressing these problems (Nelson, 2007, Sun, 2007).

These strategies include revising laws, developing natural resource protection regulations and establishing natural reserves (Sun, 2007). Market reforms have also played a significant role in shaping land tenure outcomes, for example the liberalisation of timber was one of the reasons which led to a reversal of forest individualisation. Since 1970s the central government has passed numerous policies and reforms addressing the management of arable, grass and forest land resources.

These reforms have been similar in design but had contrasting effects on their designated resources. A summary of can be found in Table 2, where a timeline dates important tenure reforms for each land type. It is important to highlight their similarities and analyse their differences as it would provide an appropriate background for analysing why these reforms have had varying welfare and sustainability outcomes.

5.1. Arable Land Reforms

Prior to the introduction of the HCRS, the majority of China's land was managed under a three-level ownership scheme. The three levels referred to the commune, production brigades and production teams. Under this scheme the 'production assets' (arable land, grassland, forestland) could be under the jurisdiction of either of the commune, brigades or team. However, under this scheme it was never clear who fully owned the resource and whose responsibility it was to manage the resources. The commune was responsible for the coordination of all production activities. Furthermore, it was under the jurisdiction of higher levels of government but in the eye of the farmer the commune was a symbol of state power. The individuals who worked the land were known as 'Sheyuan' and they formed the collective. Under the commune system these individuals were only allowed limited assets for basic living and were not allowed to undertake any income generation schemes. Consequently, the 'Sheyuan' had little incentive to work harder for higher productivity or to manage the land properly; therefore rural land throughout China was managed inefficiently and unsustainably (Sun, 2007). After the death of Chairman Mao and the chaos of the Cultural Revolution, China's moderate elite decided that reforms needed to be implemented in order to modernise the country's economy.

This begun with the introduction of the HCRS towards the end of the 1970s, which was fully recognised by the central government in 1981 (Lin, 1998). Arable land in rural areas was the designated target of these reforms, with the intended goal of increasing productivity and efficiency. With these reforms, arable land in a village was equally contracted to the individual farmer household depending on the number of family members and/or labour force members at the time. Formally, the land still remained owned by the Collective. Farmers were now being granted use rights, the right to

make decisions on how to manage the land, rights on agricultural production and the products themselves. However, farmers were not allowed to change the purpose of the land (for example building a house on arable land) without government permission (Sun, 2007).

The HCRS started in Xiaogang Village, in Anhui province in the spring of 1979. Here, collective land was allocated to individual farmers based upon egalitarian principles. Farmers were given land use rights and right to obtain a portion of income derived from the land. This initial trial received approval from the central government and by 1981 was expanded to cover the rest of the country under the name of the Household Contract Responsibility System. By the end of 1984 the HCRS had been adopted by the whole country and was formally recognised by the central government with 'The Land Administration Law' (LAL) in 1986 (Ma et al., 2015, Tilt, 2008, Sun, 2007).

These initial reforms increased farmer's incentives to increase productivity through linking production to benefits. Under the HCRS, new agricultural taxes were imposed and a quota system was created. Under the quota system farmers were required to deliver a certain quantity of given output to the government with the remaining produce the property of the farmer's household and they had the right to do what they wished with it. The quota was abolished in 2002 and the agricultural tax was abolished from 2004-2006. In order to encourage farmers to manage their land sustainably and guarantee access to basic living assets, the contract for the land was extended to 15 years around 1984 and to 30 years in 1993 but not formalised until 1998 (Tilt, 2008, Sun, 2007). Farmers now had the right to sublease the land within the collective for agricultural purposes. However farmers were not allowed the right to mortgage the land or sublease the land to individuals or units outside the village collective (Ma et al., 2015).

In recent decades the central government has pursued a series of market-oriented land tenure reforms in order to encourage land rental markets and contribute to efficiency gains in agricultural production (Ma et al., 2015). The central government aimed to achieve these goals through increasing tenure security amongst farmers. In 1993, the central government pledged that the lease period of farmland would be extended from 15 years to 30 by the end of the 1990s and in 1997 announced that village land reallocations (that correct for demographic changes that occurred in a village) would be strictly limited. These pledges were formalised with a revision of the LAL in 1998, stipulating that land use rights would be extended by another 30 years, use rights were protected by law and certificates would be issued to protect farmers' land use rights. Furthermore land reallocations within villages now needed to be accepted by at least two-thirds of villagers' representatives and approved by higher levels of government.

Further changes to land tenure were stipulated with the Rural Land Contract Law (RLCL) in 2002 and the Property Law (PL) in 2007 (Ma et al., 2015). The RLCL reaffirmed that contracts would be maintained for at least 30 years. Land reallocations would only be allowed in case of a natural

disaster, land expropriation or some other special circumstance. Even then land reallocation would still need to be approved by two-thirds of village representatives and higher level authorities such as the township. Farmers were now entitled to compensation if the collective retook land from them. Furthermore, farm households now had the right to subcontract land to other households within the same village, lease out contracted land to individuals or units outside their own village, exchange land with other households within the same village and transfer land use rights to other households within or outside the same village (Ma et al., 2015).

Although the RLCL made important steps towards increasing transferability and securing property rights, some issues still remained unclear, particularly rules on land inheritance. Therefore the PL in 2007 further increased legal land tenure security. It reaffirmed that land reallocation should only be allowed in light of special circumstances. It granted farmers with perpetual rights, stating that farmers should retain and inherit their rights when the initial 30 years had passed. Finally, further legal support of farmers' interests was supported by the Mediation and Arbitration of Rural Land Disputes contract law passed in 2009 (Ma et al., 2015) Reforms have since focused on increasing rural farmer's welfare, income distribution, raising production capabilities, maintaining food security and improving environmental sustainability (Zhang & Brummer, 2011).

5.2. Grassland Reforms

Throughout China's history there has been no comprehensive long-term policy regarding the governance of Chinese grasslands (Liu, 2017). With the abolition of the people's commune livestock became privatised, this increased livestock production dramatically but led to grassland degradation (Liu, 2017, Sun, 2007, Nelson, 2006). Prior to the 1980s grasslands were managed under the commune system, whereby communities usually comprising of local herders would manage the land. Grassland reforms can be highlighted with two major policies. The first being the grassland tenure reforms during 1980-1990 followed by Ecological Construction Programmes (ECP) after 2000. Throughout 1980-1990 reforms were aimed at privatising use rights of grasslands to individual households and abolishing traditional communal use. The ECPs were designed for grassland conservation and maintenance of local household livelihoods (Liu, 2017).

Grassland reforms begun with the introduction of the Grassland law, which introduced the Pasture Contract System (PCS) an extension of the HCRS (Nelson, 2006). This policy clarified the rules for issuing grazing contracts to households in grasslands. Households were given secure, exclusive access to specific areas of rangelands for grazing livestock. The ownership of livestock was assigned to households depending on its size and number of labourers. The use rights were informally allocated to small groups of households. Livestock was privately owned and the grasslands collectively belonged

to the villages. Furthermore the marketing system for the majority of livestock products was liberalised (Liu, 2017, Sun, 2007).

These reforms were primarily based on the rationale of giving households more incentives to increase production. The duration of grassland contracts was not clear at the start and this led to farmers intensifying grassland use for short term income. With these reforms a new set of problems began to emerge; the lack of clarity in the tenure system led to overgrazing and degradation. (Wang et al., 2010). Therefore the government responded to these problems with the passing of the Grassland Law in 1985.

The Grassland Law is the primary law regulating land tenure in grasslands, introducing the PCS. The PCS granted ownership of grasslands to the state or collectives but the use rights of the grasslands could be assigned to households or collectives. These use rights could be contracted out 30 years, which was extended to 50 years after 1996. These rights set out household or collective boundaries, seasonal pasture allocations, stocking rates, and a duty to sustain rangeland productivity. Furthermore, the law also prohibited activities that led to grassland degradation such as felling trees and crop cultivation. Departments were set up to monitor these regulations and enforce the Grassland Law (Liu, 2017, Nelson, 2006, Wang et al., 2010).Throughout the 1990s, grassland use rights to individual households were further strengthened through a series of reforms. These reforms signalled the further privatisation of grasslands. Property rights were individualised, made exclusive and transferable in order to encourage individuals to see land as a production factor, not as a free resource and promote sustainable management practices and access to credit (Nelson, 2006). In 2002, the Grassland Law was revised with reforms cementing the shift from state and collective land use rights to individual households.

During the 1990s the central government implemented a number of programmes, ECPs, to protect grasslands. The ‘Conversion of Cropland to Forest and Grasslands Programme (CCFGP) was one such reform. The CCFGP was also the response to a series of natural disasters that had hit China, particularly flooding. The CCFGP’s main goal was to stimulate water and soil conservation by encouraging farmers to convert sloping cropland into forest and grassland in order to alleviate poverty and achieve sustainable development (Wang et al., 2010). Another such programme is the Returning Grazing to Grassland, launched in 2010. It aimed at conserving grasslands by sowing grass onto grasslands experiencing severe degradation, restricting grazing in targeted areas, setting a stocking rate, and implementing grazing bans in specific areas. The Programme to Combat Desertification was launched to protect against encroaching deserts around the cities of Beijing and Tianjin. From 2011, the Subsidy and Incentive System for Grassland Conservation, has been running in eight pastoral provinces of China. This programme aims to improve local herders’ welfare and livestock production through intensification while conserving the condition of the grasslands (Liu, 2017).

5.3. Forest Reforms

China's forests have frequently come under different forms of ownership since the start of 1950s. China has a total forest area of around 175 million hectares, making up 18% of its total land area. China's forest industry has grown over the last decades with timber production being the most valuable sector (FAO, 2009). The north-eastern regions of China contain the richest timber resources making up approximately 40% of China's timber area. These include Heilongjiang, Inner Mongolia, and Jilin. Important forested areas can also be found in the south of China in the regions of Fuijian, Jiangxi and Yunnan. Reforms throughout the decades have attempted both to deal with degradation, and improve productivity of the forest industry. They have been met with varying degrees of success. Public programs aimed at afforestation and combatting deforestation have been largely successful, with forest cover in China increasing steadily since the 2000s (Rozelle et al., 2014).

Prior to the 1980s, China's forests were organised under the commune system and centrally managed. Following the success of the HCRS in arable land, forest tenure was to follow the same process of individualisation (Yin et al., 2013). However, the central government was initially quite sceptical at initiating sweeping reforms, and in 1984 70% of forests still remained under collective ownership. This reluctance was based on the concern of excessive logging if land use rights were assigned to households and the presumption that small-scale family logging activities would be unsustainable. After a couple years the central government gave way and by 1986 over 70% of collectively owned forest now belonged to households. Following these policies, forest tenure has been subject to more reforms throughout the 1990s and earlier 2000s aimed at further individualised rights and promoting conservation efforts (Xu, 2010).

Forest reforms begun with the adoption of the 'Three fixes policy' issued by the State in 1981. This policy aimed to transfer management responsibilities of forests to farmers, helping them generate sufficient and sustained forest-derived incomes (Chen & Innes, 2013). The 'Three fixes' were to (1) fix the contract responsibility system for forest production, (2) fix property rights of village collectives by issuing property certificates and (3) fix the use and management rights for the farm households for family forestland. The primary objective behind this policy was to legally recognise the farmer household as a basic management unit for forestlands under collective ownership.

Under this formal recognition two types of forest management existed, responsibility forestland and family forestland. Family forestland referred to forests that were allocated to individual farmer households for free and without a contract with the village. Responsibility forestland were forestlands that were contracted to an individual household or a group of households. These contracts were signed with the village and specified clearly defined rights, responsibilities and shared benefits. Shortly after tenure reform was initiated the government liberalised the timber market that was heavily regulated

until then. By 1986, when the 'Three fixes policy' was considered fully implemented, over 70% of collectively owned forest had been transferred to household management (Sun, 2007, Xu, 2010, Yin et al., 2013)

These early reforms had failed to promote sustainable management practices and led to major deforestation, particularly in Southern China (Holden et al., 2014, Sun, 2007). During the period 1989-1993 an estimated 7.6 million hectares of forestland was removed or degraded through illegal logging, forest fires, or bad management practices. Following this, many villages tried to retake responsibility of forestlands and revert to management systems that had been effective during the commune era. In response to the deforestation, the government restricted the timber trade and slowed the pace of forest tenure reform (Xu, 2010). Future government reforms made several changes to ameliorate the situation. Programmes for reforestation were initiated, quotas were implemented for tree felling, natural forest protection at regions of large rivers, logging bans, conversion of sloping farmland to forest and establishment of natural reserves and national parks (Sun, 2007).

With these problems it was clear that there needed to be a modern forestry strategy. The central government understood that addressing all prevailing issues would be almost impossible. Foretsry policies needed to promote healthy forest ecosystems, a sustainable and efficient but profitable forest industry, and protect multiple use forests, paying particular attention to the cultural and spiritual needs of forest dependent communities. These issues were compounded by the linkages with the forest sector and poverty, especially in rural areas. Many forest-dependent communities survive on income generated from unsustainable, short-term forest activities which have negative impacts on the surrounding environment (Chen & Inners, 2013).

A new set of reforms were launched at the start of the millennia. These new set of policies were aimed at strengthening land use rights and tenure security. Forest tenure reforms also hoped to encourage farmers to operate and manage their lands responsibly and sustainably through issuing forest tenure certificates and the introduction of forestry property markets. Another driving force behind these set of reforms was the government's understanding that existing tenure arrangements and regulations in forestlands were major hurdles to rural development. Furthermore the government had launched the New Rural Development Initiative (NRDI), a policy aimed at assisting rural development and poverty eradication. In order to successfully implement the NRDI, the government understood the need to further decentralise forest management by strengthening use rights for farmers and reforming forest tenure (Chen & Innes, 2013, Yin et al., 2013).

In 2003, resolutions were passed by the central government which reiterated their commitments of devolving village owned forests to individual villagers. Now, decisions on how to pursue devolution were taken by a village representative committee, which was elected by villagers via a 2/3 majority vote. This individualisation of forest management was accompanied by signing legal contracts and

issuing certificates, differentiating it from the reforms passed in the 1980s. Land use rights were also expanded to include transferring, inheriting and mortgaging forestland. Logging controls were relaxed and taxes on sales reduced. Additionally, the contract period was extended to 30 or 70 years. One of the first provinces in China to follow the steps of individualisation was Fujian, this came as quite a shock as Fujian was once extremely resistant to tenure reforms and by mid-2006, 99% of the villages in Fujian had moved towards decentralisation. By the end of 2007 more than 10 provinces throughout China had announced plans for collective forest tenure reform (Xu, 2010, Yin et al., 2013)

In 2008, the Chinese government released statements indicating that over the following five years it would be committed to continued reforms targeted at raising forest productivity, investment and resource growth. It would continue to allocate collective forestland to households for management, assigning land rights and tree ownership to families via formal contracts that clearly define boundaries and protect land rights. New regulations included private plots which now belonged to individual households for permanent use and which could not be reverted back to the collective or divided amongst the villagers. All forests should be classified into commercial or ecological forests, with clearly defined boundaries. To encourage private interests into the forestry sector, the government took steps to reduce or eliminate taxes and fees. Harvesting regulations have been relaxed so that farmers have more freedom to decide which timbers to be harvested. The financial system was reformed, allowing farmers to use their timber as collateral, allowing them to obtain loans and thus increase their investments. Local centres have been set up to facilitate the sale and transfer of timber (Yin et al., 2013). By 2011, the use rights of over 162 million hectares of forestland (92 percent) have been devolved to households. Certificates have been issued for over 144 million hectares with about 82 million households having received forestland certificates (FAO, 2013).

Table 2. Overview of Tenure Reforms

	Arable Land	Grassland	Forest
1979	HCRS trials held in Xiaogang Village		
1981	HCRS fully recognised by the central government	PCS grants informal use rights to hhs, livestock privately owned.	Three Fixes policy introduced, management rights given to hhs
1984	Contract for land extended to 15 years, HCRS now countrywide		
1985		Grassland Law Passed, use rights formalised and granted to hhs or collectives for 30 years	
1986			

	HCRS formally recognised under LAL		70% of forests now under hh management
1990		Property rights further individualised, made exclusive, transferable, and promotion of sustainable management practices. Contract extended to 50 years. Ecological programmes initiated to protect against grassland degradation	Government initiates reforestation programmes, quotas, logging bans, conversion of farmland to forestland.
1993	Contract for land extended to 30 years		
1997	Village land reallocations strictly limited		
1998	Revision and formalisation of LAL		
2000			
2002	RLCL confirms restriction of land reallocations, farmers entitled to compensation, sub-contracting allowed	Grassland Law revised confirming shift from collective land use rights to individual.	
2003			Use rights expanded to include transferring, inheriting and mortgaging rights, contract duration extended 70 years
2007	Farmers granted perpetual rights after 30 years had passed.		
2008-2015	Legal support provided to farmers, reforms focus on welfare and sustainability	Ecological conservation programmes initiated to combat degradation and desertification.	Forest continued to be allocated to hhs, individualisation of land rights, certificates issued

5.4. Similarities and differences between reforms.

Arable land, forests and grassland each went through numerous reforms spanning a number of decades. First and foremost the main similarity between these tenure reforms is that they follow the same trajectory of individualisation of property rights albeit at a different pace and with significant differences in policy. The HCRS marks the starting reform that bounds all land tenure forms together. Its introduction towards the end of the 1970s marked the beginning of privatisation of property rights in land tenure. At the start each land tenure reform was initiated to increase productivity and efficiency through improving the incentives of farmers. This was done through the individualisation of property rights and the gradual liberalisation of land markets for arable land, grassland and forests.

With the introduction of the HCRS in arable land, use rights were now granted to farmers. Farmers were now also allowed to sell some of their produce at market prices no longer having to sell all their product to the government at fixed prices. Contracts of 15 years was established in 1984, increasing farmer's tenure security and giving them access to basic living assets, with these being extended to 30 years in 1994. Markets were gradually liberalised and the procurement system relaxed.

Grassland transition followed a similar path of individualisation at the start. Grazing contracts were established with farmers being assigned plots of grassland to raise their livestock. Use rights were at first informally granted to households with formal rights being established with the Grassland Law, introduced in 1985. This law also defined contracts of up to 30 years later extended to 50 years in 1996. Furthermore, the marketing system to livestock products was gradually liberalised.

Throughout the 1980s forest experienced a similar process of individualisation with the 'Three fixes policy'. Forests were contracted to individual households or to a group of households. Rights were clearly defined and formalised through contracts; additionally the timber market was liberalised with wood prices soaring.

Hence, the first decade of reforms targeted at arable land, grassland and forests was aimed at increasing production through improving incentives amongst farmers. Following the first decade of individualisation several problems arose in all three types of land. The subsequent round of reforms, throughout the 1990s and 2000s, tried rectify these. Additionally new problems presented themselves with reforms also targeted at these. Land tenure reforms during 1990-2000 for arable land and grassland continued the process of individualisation with farmers being granted further rights. Property rights for grassland owners were made more exclusive and transferable. In the domain of arable land, grain markets were further liberalised with government decentralising responsibilities to provincial governments.

Throughout the 1990s land reforms were also targeted at improving the environment. Grassland degradation had led the government to implement a series of ecological reconstruction and protective measures. Similarly, forests had suffered heavily after reforms throughout the 80s and protective measures were also implemented both to restore forests and protect against further exploitation. Therefore policies throughout the 1990s for forests and grasslands were largely aimed at sustainability as individualisation of property rights had led to widespread degradation in both land types.

Subsequent reforms from the late 90s into the 2000s furthered the process of greater environmental sustainability and increasing welfare. For arable land, a free grain market was finally introduced accompanied with the abolition of the procurement system and further liberalisation of markets. Regarding grassland tenure, government policies continued to target degradation with the launching of further environmental programmes. With forests reforms, after holding back on further

privatisation throughout the 90s due to deforestation the government began the process of decentralising forest management towards households. Furthermore initiatives were set up to target rural poverty and the bettering welfare for forest dependent communities. Therefore, tenure reforms after the 2000s were largely targeted at improving the environment and welfare of land owners. This was done through environmental reconstruction projects, subsides, tax breaks and strengthening land rights thus improving tenure security.

Major differences between land tenure reforms can be found in the timeframe through which they were implemented (see Table 2). Originally, the main reason for implementing reforms was to increase production and efficiency. A large part of these reforms was successful in increasing production albeit at the cost of the environment. Therefore, following reforms in the 1990s tried to refine the process of individualisation but in the case of forests this was put on hold due to rapid deforestation. Policies in arable land continued to decentralise but with grassland and forests this process was not as quick. Policies for grassland and forestland focused more on the immediate problem, the environment. Massive flooding had been partly blamed on the degradation of forests and grasslands, this combined with mounting environmental scrutiny led to the implementation of policies designed to protect the environment. Post-2000s, the central government largely pursued similar policies with further decentralisation, policies targeted at welfare and the environment.

6. What were the effects of the land reforms in arable land, grassland and forestland in China on the sustainability of resource use of each of these land use types?

Chinese land tenure policy has dramatically changed over the last decades. Tenure reforms aimed at privatisation have contributed to the fast growth in the economy over the last 30 years. But the land tenure reforms have not come without their problems. Environmental and social concerns have led to much concern about potential negative effects of the tenure reforms carried out by the central government, particularly with regard to the degradation for arable land, grassland and forests. By applying our theoretical framework we will deduce the mechanisms through which land tenure reforms have affected the sustainability of our land types paying attention to transaction costs and the characteristics of each land type. As shown in Chapter 5, Chinese land tenure policy has dramatically changed over the last decades. These reforms have contributed to the fast growth in the economy over the last 30 years, but have not come without their problems. Potential negative effects of the tenure reforms include the degradation of arable land, grassland and forests, which may affect their future productivity and thereby the livelihoods of those who depend on these resources for making a living.

Using the theoretical framework presented in Chapter 2, we will try to identify mechanisms through which land tenure reforms have affected the sustainability of arable land, grassland and forestland. The focus will be in particular on the role of transaction costs and the characteristics of each land type.

6.1. Arable Land

As of 2014, 40% of China's arable land is said to be degraded to a certain degree. From 1978 to 2007 the area of arable land decreased by 15.3 million hectare, i.e. by 11% (Qu et al., 2011). Degraded land includes reduced soil fertility, erosion, changes in acidity, damage from pollutants and the effects of climate change. Years of overexploitation and rapid industrialisation have contributed to these problems (Patton, 2014). Although arable land tenure reforms cannot account for the pollution caused by industrial and urban centres. Tenure reforms have dramatically increased the use of chemicals in agricultural production such as pesticides and fertilizers. Chemical pesticides have polluted some 13-16 million hectares of farmlands, with 20 million hectares of farmland contaminated by heavy metals from industrial use. Estimates indicate that over 12 million tons of grain is contaminated and harmful for human consumption (Wen, 2006).

China's total land area has seen a steady decline since the onset of tenure reforms, to a level of 121.7 million hectares in 2007. Ecological recovery programmes are the main contributor to this decline in and to a smaller extent urbanisation. Furthermore, the amount of water available for agricultural production has steadily been declining due to rising competition. Water quality has also declined due to rising pollution of irrigation systems. Polluted water is increasingly being used for irrigation purposes, leading to contaminated soils and produce. Agricultural runoff only exacerbates these problems, being the main source of pollution of river waters and lakes throughout China. Despite these problems, grain production has increased sufficiently to keep up with China's growing production. Increases in yields per hectare of land and per cubic meter of water have been high enough to offset land degradation, water quantity and water quality (Qu et al., 2011).

The privatisation of arable land resulted in unprecedented growth. With the individualisation of tenure, the costs of internal cooperation were lowered considerably but also led to increased costs of exclusion and external cooperation. These reforms resulted in the increase in the use of production inputs leading to serious environmental consequences. As tenure became more individualised, farmers rapidly increased the use of chemical inputs. Initial reforms led to massive increase in use of chemical fertilizers, pesticides and hybrid seeds; from 1978 to 1984 fertiliser usage more than doubled. Initially, these new inputs worked on increasing agricultural production, but led had serious consequences on the environment (Wen, 2006).

Years of farming practice has exposed the HCRS's weaknesses and limitations and the consequences this has had on the environment. Firstly, the HCRS resulted in the fragmentation of farmland into smaller units which were distributed to individual units who farm it independently. Farmland in a village was owned by all members collectively, therefore every individual had equal claim on land property rights. Given the abundant population and limited land the amount distributed was very small. Each parcel of land was different in location, fertility and access to water. Therefore, not only was the farm size usually very small but it was also fragmented and scattered around villages. This led to significant areas of cultivated land being wasted in the form of paths and boundaries separating household's holdings (Chen, 1998).

The individualisation of tenure led to the increase in costs of exclusion. Previously farmer's boundaries were fewer as land was not fragmented. With fragmentation each farmer needed to demarcate their plot of land which led to both higher costs of exclusion and external cooperation. What arose from this, was that the land was wasted in the form of paths and boundaries. With fragmentation of land farmers also had to contend with a higher number of rights holders in neighbouring farms, which further increased transaction costs. However, costs of exclusion and external cooperation were lower compared to the increased value of investing in arable land and its products. This meant that it was economically viable for farmers to exclude others, thereby further cementing the adoption of privatised tenure.

Another problem of the HCRS was the distribution of farmland. Due to the population increase, land was regularly reallocated to deal with changing household sizes and new households in the villages. This led to even more fragmentation resulting in more boundaries meaning more land was being wasted. Initially, farmers were worried about losing their land and investments. Therefore, they had no incentives to invest in land conservation and agricultural infrastructure, with irrigated land one of the most important components of agriculture remaining largely unchanged throughout the 1980s. Furthermore, farmers often overexploited their land in order to pursue short term returns, reducing the quality of soil (Chen, 1998).

Land fragmentation accounted for the majority of arable land decrease during the initial reform period. More recently the majority of cultivated land loss is through its conversion into other uses in the form of ecological restoration programmes such as the Sloping Land Conversion Programme (SLCP). This programme contributed to 67% of the 9.3 million decline in arable land between the years 2000-2005. With an increasing population, cities have expanded with urbanisation accounting for 14% of the decrease in arable land. The SLCP was conceived in 1999 to combat increasing wind and water erosion caused by expanding cultivated land. Natural forests and grasslands had been converted to make way for expanding arable land following the HCRS. This lead to increased water

and wind erosion and contributed to a severe drought in 1997 and devastating floods in 1998 (Qu et al., 2011).

Soil contamination with heavy metals is another cause for concern in cultivate land. Wastewater irrigation zones have expanded throughout China and account for over 4 million hectares of arable land. Produce from these lands is contaminated with heavy metals such as mercury, copper, chromium and arsenic. Estimates suggest that over 10 million hectares of arable land is polluted, of which 2.2 million hectares were irrigated with water contaminated with heavy metals. The reason behind the use of polluted wastewater as irrigation is the increasing scarcity of water throughout China (Qu et al., 2011).

Our theoretical framework indicates that increased pollution could be a direct consequence of the privatisation of land tenure. Under a private tenure regime, external cooperation is a lot more costly for the individual land owner, because it becomes more costly to reduce and internalise externalities. The high amount of pollution caused by crop farming is a clear example of such an externality. As farmers have gradually seen the tenure become more and more individualised, the externalities affected a higher number of actors throughout China. A larger number of actors results in higher costs of external cooperation. This coupled with the rapid increase in chemical inputs has resulted in rapidly increasing off-farm pollution.

6.2. Grasslands

Over 84% of grasslands are located in Western China, with the main grassland regions of China located in the arid and semi-arid north-western, northern and southwestern regions around the waters of major rivers such as the Yellow and Yangtze (Cao et al., 2013). Major pastoral areas are found in Tibet, Inner Mongolia, Xinjiang, Qinghai, Sichuan and Gansu. The grasslands of these areas account for over 75% of the national total and for 70% of the grazing livestock (Hu & Zhang, 2001). According to recent estimates, over 90% of China's grasslands are considered 'degraded', with 34% considered moderately to severely degraded (Cao, et al, 2013, Reynolds, 2001, Tan & Tan, 2015). This is compounded by the fact that degradation is said to be expanding at a rate of 2 million hectares per year; compared to 1983, the productivity of degraded grasslands has decreased by 20-50% (Cao et al., 2013, Tan & Tan, 2015).

Several scholars and scientists argue that the decline in grasslands is the result of the grassland property reforms that started in the 1980s. These reforms transformed traditional forms of grassland management, leading to reduced mobility amongst pastoralists and to fragmentation of grasslands.

Additionally it has led to a decline in pastoralist's adaptive capacity to cope with climate change, an important skill in the harsh and fragile environments surrounding grasslands (Sneath 2000, Ho 2001, Williams 2002, Cao et al., 2013). The Grassland Law passed in 1985 marks the start of these changes, having dramatic effects on both the inhabitants of grasslands and grasslands themselves. The Grassland Law borrowed its ideas and objectives from the HCRS for arable land that was adopted in 1981. The grassland tenure reform followed the same process of individualisation of property rights, contracting grasslands to households thereby decreasing costs of internal cooperation but increasing costs of exclusion and external cooperation.

Arid grasslands are extremely sensitive ecosystems susceptible to long periods of drought, dry environment, storms and other adverse weather patterns. Grasslands areas fit for grazing in China have largely been determined by the amount of rainfall throughout the year. Pastoralists have always depended on the ability to freely roam grasslands in search of water, forage and to allow grasses to regrow after grazing. These physical characteristics of grasslands mean that external cooperation amongst actors is extremely important and has played an integral part in grassland management throughout the decades.

Prior to reforms grasslands and livestock were owned by the collective. The collective had the right to use and manage the grassland and exclude users from it. However, the right to exclusion was rarely exercised. Excluding herders from other grasslands was rare, as other collectives understood the difficulties which pastoralists could face during storms or periods of drought. Thus costs of exclusion were almost non-existent under this form of communal tenure. During adverse weather, food could become scarce and herders would need to move their livestock to other collectives in search of forage. This movement of livestock to other grasslands was common practice as storms and droughts were frequent; thus boundaries were not enforced (Li & Huntsinger 2011). Therefore, a well-established pastoral community operated over a large swathe of rangeland similar to rotational grazing, relying on locally developed social rules (Cao et al., 2013).

Throughout the first round of reforms, the use rights shared between collective were distributed to households. Households were allowed to use the resources within the parcel of grassland that had been allocated to them, but gave up the rights to resources outside of those boundaries. Therefore the size of the rangeland available for foraging and water reduced significantly in size.

Single household units now possessed the right to exclude outsiders, use rights and management rights. This greatly increased and the costs of exclusion and also the costs of external cooperation, hampering their ability to internalise externalities. Therefore, when a snowstorm or drought hit households they would no longer have the right to access necessary resources outside the household rangeland. Pastoralists attempting to move their livestock would now have to pay rent to the owner of the destined grassland in advance (Li & Huntsinger, 2011).

With privatisation and individualisation of land tenure, local governments throughout China encouraged fencing of boundaries, digging wells and constructing pens for livestock (Cao et al., 2015). Freely moving livestock has become less and less common due to the extensive barriers and enclosures bounding grasslands reducing the likelihood for actors to cooperate. Trampling increased as herds were enclosed on smaller plots contributing to grassland degradation.

Previously households would coordinate amongst themselves on herding livestock. A cooperating group of herders could allocate labour to each type and class of animal, so that the specific requirements of each species could be met. As such costs were reduced significantly and multiple households could rear varying species of livestock i.e. cow, sheep, horse and goat, where a single household could not adequately care for multiple species (Li & Huntsinger, 2011). When households have to graze animals independently, it becomes increasingly difficult to rear more than one type of species. Thus individualisation of tenure led to households simplifying their herds to the point that a majority of households raised only one species. When this happens, grasslands are used less efficiently as species have different grazing patterns and diets. If only sheep are raised they will eat plants palatable to them leading to a less efficient and unbalanced use of plant species (Li & Huntsinger, 2011).

The establishment of boundaries has led to increased trampling which is twice as damaging to grassland than overgrazing. Moreover, herders have been forced to graze land inappropriately, i.e. undergraze more productive areas and overgraze less productive areas (Yang, 2007, Zhang & Li, 2008).

Furthermore, in the region of Xilingol, Inner Mongolia, policies have led to a reduction in livestock population decreasing from 18 million in 1999 to 6.7 million in 2005. However, this has done little to improve the environment with grassland degradation is still considered severe. Other rangelands throughout China have also shown that even with the decrease of the livestock population degradation has continued (Cao et al., 2013).

It can be concluded that the increase in enclosures and boundaries is a major cause of the high rate of degradation through trampling, decreased flexibility to respond to climatic events, decreased mobility and mismatches between plant growth and livestock access to forage (Cao et al., 2013, Wu & Du 2008, Xie & Li, 2008). This is a result of the individualisation of grassland rights following tenure reforms. Negative externalities arose through the high costs and breakdown of external cooperation between actors. Overgrazing and environmental changes do cause degradation of Chinese grasslands. However, these are less important driver in degradation that the effect of enclosures and boundaries which dominate Chinese grasslands since the start of the tenure reform.

6.3. Forests

Forest cover has changed significantly throughout China's reform period commencing from the 1980s. However the pace at which forests have grown has differed throughout the decades. Throughout the initial reform period, China's forest cover has increased from 12% in 1980 to 13.9% in 1993. Forest volume experienced slower rates of growth, albeit positive. Growth varied with each region in China, with north-eastern and southern forests witnessing a fall while southwestern and central regions seeing rapid growth. In total China's forest cover has increased by 18 million hectares during the first reform period from 1980 to 1993. It is important to distinguish between the different forms of forest management. Collectively owned forests at the start of reforms represented 80% of China's total forests whereas state run forests accounted for 20% but controlled the vast majority of high quality timber reserves (Rozelle et al., 2014). State managed forests are disregarded in this study, as they have not been subjected to tenure reforms.

Although Chinese forest volume and cover did increase throughout the reform period, there is still a great deal of disagreement about the successfulness of the tenure reforms. Total forest cover may have increased, but a large part of those forests represent commercial plantations (Ho, 2006). The rise of commercial plantations coupled with deforestation in old and natural forests has led to an increase in homogenous forest species. This has had an impact on forest biodiversity, as old and natural forests rich in diverse flora and fauna have witnessed the largest share of deforestation (Rozelle et al., 2003). Forest cover has increased rapidly during the reform period, forest volume increased at a much slower rate. This was in part due to the felling of old and natural forests where volume is much larger, with the rise in forest cover supplemented by expanding plantations (Rozelle et al., 2014, Ho, 2006).

1st Period

The start to China's forest tenure reforms begun with the implementation of the "three fixes policy" in 1981. Forest management was decentralised from the central government to local governments. Management and use rights now belonged to households, who had the right to exclude outsiders from their forest plots (Delang & Wang, 2012, Sun, 2007). Following these reforms, forest use no longer came under the jurisdiction of local leaders but the household. The local government still controlled local administration but they no longer controlled farmer's actions such as when to plant and harvest their trees. The benefits of the trees belonged to the farmers and they were allowed to derive income from it (Delang & Wang, 2012).

Many observers believed that the three fixes policy worsened degradation and did not benefit the forestry sector (Delang & Wang, 2012, He & Zhu, 2010). With the reforms policymakers distributed forest equally amongst villagers. Therefore, small parcels of land were distributed to many households

with some owning two to three parcels, normally located at a great distance from the village. Due to the size and distance of the plots, few households were willing to maintain or invest in their plots, thus the land value increase was relatively small. In other words, the individualisation of forest tenure did not take into account the physical characteristics of forests. Therefore costs of exclusion increased as individuals had to bear the full burden of the costs.

Additionally, the reforms were carried out very fast, with the government failing to delineate boundaries in many rural areas, leading to frequent disputes between farmers. This further increased the costs of external cooperation between farmers. The responsibilities, rights and obligations of farmers within the three fixes policy was never fully understood, thus these various issues with the three fixes policy had several consequences on forest management. This led to a decreased effectiveness of the property structure in place, resulting in persistent externalities such as forest fires which increased throughout the reform period (Chen & Innes, 2013, Delang & Wang, 2012).

In response to deforestation the central government enacted the Forest Law in 1984 further individualising forest management. The law formally recognised the use rights of households, the existence of collectives and the guaranteeing contracts between collectives and households. This allowed for larger units to manage forests instead of single households (Delang & Wang, 2012). Actors would now be able to better share the costs of exclusion and external cooperation between themselves. However, these reforms did not have the desired consequence.

Under these tenure reforms, forests suffered heavily. Additionally, the timber market was liberalised the following year in 1985. Combined with the relatively high tenure insecurity, this served to encourage more deforestation (Chen & Innes, 2013). Instead of engaging in sustainable forest management, farmers opted for a quick source of income and would fell the trees on their respective plots. Farmers lacked confidence in the long term stability of the policy; this further increased the rate of deforestation, as actors decided to get a return through logging before the system would collapse (Delang & Wang, 2012, Ma, 1991).

The formal and informal institutional environment failed to guarantee farmer's tenure security. This led to low levels of trust, resulting in farmers felling their trees. Farmer's remained insecure with regard to the government's commitment to maintaining private tenure for forests. This discouraged many farmers from investing in their plots and increasing its productivity, and induced them to quickly harvest the timber for income or allowing their forests to degrade (Deland & Wang, 2012). Thus the first phase of forest tenure reform led to massive deforestation and forest quality decline throughout China (Delang & Wang, 2012, Sun, 2007)

With these regulations, farmers' use rights were severely restricted fostering a great deal of resentment between farmers and the central government (Sun, 2007). Therefore Chinese farmer's past

scepticism that the central government would not continue the individualisation of forest tenure was proven true. Consequently, this dissuaded farmers from investing in forests and leading to forest degradation (Delang & Wang, 2012). Deforestation persisted during this period, but was offset by growth of large scale state run plantations. The reforms continued to lack the necessary regulation to halt logging, while enforcement remained difficult. As a result, deforestation continued.

2nd Period

Following this period of deforestation some government villagers tried to take back management responsibility and the government slowed down the process of individualisation, furthermore the timber market was again restricted (Chen & Innes, 2013). However deforestation and degradation persisted in forests as the institutional framework continued to lack the necessary incentives for farmers to manage their forests sustainably. Tenure security continued to remain low amongst actors thereby reducing investments.

Total forest cover may have increased throughout the period 1988 to 1993, however the replanted forests mainly comprised of single tree species. Single tree species replaced natural trees in major forested areas of China. This was in part due to the rapid increase in commercial plantations and shelterbelts. Commercial plantations are trees used in agriculture consisting of oil bearing trees, fruit and nut orchards and other cash-producing, non-timber-tree species, under the FAO definition these should not be included as forests. This changed the makeup of Chinese forest affecting the environmental services that had been previously provided by the natural forests. For example, plantations do not act as repositories for forest plant and wildlife diversity. (Rozelle et al., 2014).

The sharp decline in quantity and quality of natural forests resulted in in the loss and fragmentation of countless natural habitats, with 200 plant species extinct and 61% of wildlife suffering severe habitat loss since the 1950s. It is estimated that since 1950 natural forest cover throughout China has decreased to make up only 30% of total forest area in 2004. According to the FAOs definition of forests, commercial plantations cannot be categorised as forest. Therefore, tenure reforms throughout this period did little to protect natural forests and protect against degradation (Wenhua, 2004).

The changes in forest composition also led to severe ecological and environmental problems. Insect infestations increased leading to more than 9.3 hectares of forest damaged annually, and causing the loss of 10 million m^3 of timber. Furthermore, the change in composition coupled with expanding cultivated land contributed to the devastating floods that struck China in 1998. Previously, forests had acted as natural defences against rising waters, but this disappeared after they had been chopped down (Wenhua, 2004).

These externalities were the result of tenure policy which had failed to promote sound forest management. A lack of incentive amongst farmers persisted due to the new restrictions emplace on the timber industry leading to low investment and maintenance contributing to degradation. Discontent with Chinese tenure reforms led to an unstable institutional framework which manifested itself in increased transaction costs. Furthermore, individualisation had failed to take into account the large size and difficult terrain forests and the resulting high costs on exclusion.

3rd Period

Reforms begun in 2003 aimed at addressing the prevailing issue of tenure security. It also involved issuing certificates and opening up the market for forest transfers. This provided the necessary incentives for farmers to invest into the forests. The new institutional framework allowed for the private tenure regime to lower the costs of internal cooperation in the hope to stimulate investment. Furthermore, as power was devolved to local levels of government costs of external cooperation were also lowered as local actors were now able to cooperate on conservation, boundaries and fire prevention (Xu & Jiang, 2009).

Lower costs of internal cooperation and higher tenure security have promoted more sustainable management of forests. Farmers increasingly make the necessary investments to maintain their forests in the long term thus reducing degradation. Externalities such as forest fires have reduced due to higher cooperation between actors, as costs of external cooperation have reduced (Chen & Innes, 2013).

7. What were the effects of the land reforms in arable land, grassland and forestland in China on the welfare of those who directly depend on these resources for their livelihoods?

Since its introduction, the HCRS has paved the way for land tenure reforms throughout China. Its introduction had a profound effect on varying land types. The effects on the sustainability of land use have been discussed in the previous chapter. However, the HCRS brought about fundamental economic and social change. Its introduction is one of the factors for China's extraordinary economic growth over the last decades. With its implementation, agricultural production soared and lifted millions of farmers out of poverty and increased their welfare (Huang et al., 2012). Reforms targeting collective forests and grasslands have not had the same degree of success. Economic and social issues persist with the users of these land types, and tenure policies have been further reformed to deal with adverse effects. In this chapter, we will apply our theoretical framework to examine the mechanisms through which tenure reforms have affected the welfare of the users of different land types.

7.1. Arable Land

The amount of literature discussing welfare outcomes for arable land reforms is limited. Overall, rural welfare has increased significantly with the HCRS. Research carried out has focused on the general outcomes of policy reforms on welfare. Little has been done to investigate the specific impact on incomes and social relationships of farmers resulting from tenure reforms. Furthermore, China's diversity means that welfare outcomes are different with regard to each area. However, that is not to say nothing can be said regarding welfare outcomes, our research highlights the general welfare outcomes of arable tenure reforms throughout China.

With a growing population and the need to increase efficiency and investments in agricultural production, the process of privatisation of tenure through the introduction of the HCRS transformed Chinese agriculture and led to large gains in production. This gain can be attributed to an increase in input use, technological change and institutional reform. Income of farmers throughout China increased as production increased, contributing to gains in welfare. Particularly rural areas benefited from the HCRS, as a means of guaranteeing food security and increasing income. Rural industries grew and this diversified income generating activities, further contributing to poverty alleviation and gains in welfare (Yuan, 2010). The HCRS led to profound economic and social changes throughout China, with issues continuing to emerge and shape China today.

Internal costs of cooperation decreased with the individualisation of arable land tenure. As such management decisions now fell upon individual households. This led to an increase in the use of inputs and investments which increased agricultural production. Output of the three main crops, grain, cotton and oil bearing crops increased at annual rates of 5%, 7.7% and 14% from 1978 to 1984. Per capita farm income grew by 17% throughout the same period. Grain production, which was the most valued commodity for the government, saw a net increase of 100 million tonnes in just 6 years (Davis et al., 2001, Atinc, 1997). Rural areas witnessed a huge reduction in poverty as incomes grew. As millions were lifted out of poverty, overall welfare increased (Atinc, 1997).

As tenure was decentralised from the collectives to individual households, farmland now emerged as small fragmented plots. Land was distributed by village leaders on an egalitarian principle where each household's land size was based upon the number of the household members and/or labourers in a household. Previous forms of management had involved high levels of cooperation between households where costs of labour and capital had been shared. Following reforms, the prioritising of internal cooperation had disregarded the benefits of shared costs, such as sharing machinery and labour. Previously, irrigation system had been collectively maintained and individualisation may have given rise to increase pollution as costs of external cooperation increased.

The diversity of circumstances for each farm and the variation in technological farming systems resulted in large differences in production capabilities between households. As a result large social and economic differences between rural communities appeared. Rural inequality has steadily been rising since reforms begun. This has increased as rural actors have diversified their income generating activities, with mainly richer households benefitting from off-farm employment opportunities (Atinc, 1997).

This has led to larger socio-economic differences between households. There is an increasing difference between rural households, both in economic and political power. Individualisation of tenure led to shifting power dynamics where households became more independent. Village leaders have lost part of their authority and power after the introduction of the HCRS. Social relationships have changed, as migration has accelerated a steady decline of rural populations. The increasing allure of the burgeoning cities on China's coast have led to a mass outflow of labourers of young labourers from rural areas of China. Rural society is now mostly composed of women, elderly people and children (Sun, 2007, Attinc, 1997).

The LAL established in 1998 and the RLCL in 2002 brought land transfers and reallocations under stricter regulation. The HCRS had led to frequent land reallocations based on household size or composition. Households would not receive compensation for the investments they made into their land and this lead to a great deal of tenure insecurity. Furthermore, if a household moved out of their village, their land use rights could be taken by the village. Thus farmers risked losing their land rights when they left for off-farm work. The LAL and the RLCL, restricted these land reallocations and land transfer rights were allowed outside village collectives. These policies strengthened tenure security amongst farmers and lead to increased investments into their land (Ma et al., 2013).

Overall, rural villagers now enjoy better living conditions, increased wealth throughout rural areas has led to improvements education, health overall welfare. Income sources are diversifying, with agriculture no longer the main source of income. More money is being made through migrants working in cities, animal husbandry and other resources. The majority of agricultural production within rural households is now used as a form of security. Households primarily rely on production to meet their food needs, with a greater share of households now working in other areas for larger incomes (Davis et al., 2001).

7.2. Grasslands

Grassland inhabitants throughout China are extremely vulnerable to shocks due to the tough natural conditions and poor socio-economic environment. Pastoralist communities are often isolated due to

their remoteness, lack of infrastructure and low access to public services such as education, healthcare, and credit. Consequently, the welfare level of most pastoralist households is low. More than 50% of pastoralists in major pastoral areas in China live in poverty. In some regions such as Inner Mongolia more than a quarter (26.36%) of households experienced negative income during 2012 (Tan & Tan, 2015).

Livestock production has increased significantly in China throughout the reform period. However, these increases are predominantly associated with industrialised, rather than traditional grazing systems. The majority of this production does not take place on natural pastures. Rather, industrial livestock production primarily relies on crop stalks, bran and other grain by products. Thus actors engaged in livestock production have seen significant welfare gains since the 1980s, China is now a major player in the international livestock sector (Liu, 2017).

The livelihoods and welfare of grassland inhabitants is constantly under threat from a myriad of problems, and tenure reforms have done little to improve pastoralists' welfare and resilience. The two rounds of grassland tenure reforms have gradually led to the individualisation of property rights of pastoralists. This individualisation has led to increased fragmentation of grasslands which resulted in higher costs of external cooperation and exclusion. This increase had important impacts on social and economic interactions between grassland herders and their welfare (Tan & Tan, 2015).

Firstly, the HCRS increased the number of households herding single species of livestock. Similar to the cultivation of mono-cultures, single species herds are more vulnerable to diseases, pests and changes in market price. This increased household's vulnerability to environmental and economic shocks. Once tenure was individualised, households became subject to the general conditions of labour limitations, markets and capital availability (Li & Huntsinger, 2011). As such, households with small number of livestock found it increasingly difficult to be competitive. Maintenance costs and investments could no longer be shared and became the sole burden of the household. Furthermore, due to limited capital and technology, it proved extremely difficult for poorer households to participate in industrial meat and dairy production, constraining them further (Tan & Tan, 2015, Li & Huntsinger, 2011).

The individualisation of grassland changed formerly cooperative relationships between farmers into competitive ones as communal tenure regimes became individualised (Li & Huntsinger, 2011). This lowered costs of internal cooperation of farmers but increased the costs of exclusion as herders in previously cooperative communities were encouraged by the state to fence their land and focus solely on their own parcel of land. This also led to increased costs in external cooperation as herders needed to negotiate about the use of pasture, use of wells and the right to travel through (Cao et al., 2015).

As the HCRS was introduced, tenure became individualised and costs of internal cooperation decreased. According to our theoretical framework, costs of exclusion and external cooperation will increase as single entities will have to bear the full and these costs cannot be shared. Sharing the costs of fencing, shed construction and pest control for example. This is common throughout many grassland communities, with individuals spending a lot more on inputs and investments compared to cooperatives (Tan & Tan, 2015).

However, costs of exclusion may not always increase. An important example can be found throughout the grasslands of the Inner Mongolia region. These grasslands cover an area of over 87 million hectares. These grasslands are significantly degraded resulting in socioeconomic problems throughout the region (Han et al., 2009. Government incentive programmes provided investments for herders to set up boundaries and fences and this meant investments in fencing was lower (Tan & Tan, 2015, Li & Huntsinger, 2011). Therefore, costs of exclusion were much lower for individual households leading to more boundaries between herders and further increasing costs of external cooperation (Tan & Tan, 2015).

This increase in costs of external cooperation and individualisation of tenure has been described as a form of community failure throughout grassland communities in China (Li & Huntsinger, 2011). Prior to this, grassland communities maintained strong social bonds. These reciprocal bonds were based on an expectation and degree of trust amongst herders that each herder would allow access to their pasture for other herders in need. In turn they could expect help of others when environmental conditions were poor. This allowed a great deal of flexibility in adjusting grassland boundaries when needed (Tan & Tan, 2015, Li & Huntsinger, 2011). As such, costs of exclusion and external cooperation were low.

Higher transaction costs led to a breakdown of communication between herders and a host of externalities. Prior to individual tenure, during severe weather conditions, information could be communicated quickly between collectives, which is essential when moving livestock. However, with individualisation households now had to single-handedly search for and evaluate possible destinations for moving their livestock to. Higher costs of external cooperation limited access to information and knowledge. This led to delayed decisions or poor information which resulted in livestock losses (Li & Huntsinger, 2011).

Livestock losses resulting from miscommunication and misinformation were common throughout pastoralist regions, particularly in Inner Mongolia (Li & Huntsinger, 2011). During droughts large number of livestock would die, and the remaining ones were weakened. Farmers would see their herd size reduced daily before they could move them to another parcel of grassland. The weakened livestock would be less valuable and farmers would sell them below market price which further

restricted capital to herders, increasing their vulnerability and worsening welfare (Tan & Tan, 2015, Li & Huntsinger, 2011).

Higher costs of external cooperation and individualisation contributed to less communication, reduced cooperation and high land fragmentation. Previously reciprocal bonds, based upon trust and friendship between herders, were fractured which has made costs of external cooperation high. Moving livestock between grasslands is now based upon market mechanisms, herders have to pay fees to move their livestock from grassland plot to grassland plot. This has further exacerbated social and economic woes. Often herders are unable to afford the fees, particularly during crisis periods, and rely on high interest illegal loans (Li & Huntsinger, 2011). This leads to heavier burdens and increased vulnerability of herders and reduced welfare.

7.3. Forests

Chinese forest tenure reform has had a turbulent history, with forest actors witnessing several changes in policy throughout the last decades. Initial collective forest tenure reforms provided households with use rights in order to stimulate productivity and incomes. However, these reforms proved unsuccessful primarily leading to deforestation and negative welfare outcomes. Forest tenure reforms since 2003 have strengthened tenure security and improved incentives. These reforms have had a profound impact on forest management and its inhabitants' livelihoods (Chen & Innes, 2013).

Initial forest individualisation came with the three fixes policy and led to the decentralisation of forest management from collectives to households. These reforms had little positive outcome on forest actors. High costs of external cooperation, exclusion, low tenure security and low investments led to rampant deforestation. Reforms did little to improve rural incomes and continued to remain negligible for its inhabitants. Cooperation in forest conservation and fire prevention broke down due to rising costs of external cooperation, leading to poor conservation efforts and increased forest fires. Poverty did not decrease significantly throughout this period as reforms did little to increase revenue and productivity (Chen & Innes, 2013).

Renewed efforts to improve forest tenure reforms begun in 2003. These reforms strengthened tenure security, improved incentives and facilitated cooperation. Timber harvests increased substantially in provinces that initiated reform. Costs of internal cooperation decreased as property rights became more secure through the issuance of certificates to forest actors. This lead to more investments into forests by the users as the institutional environment was much more stable. The central government decentralised enforcement and monitoring responsibilities to local governments, strengthening the

institutional framework, increasing tenure security further. Higher investments led to increased productivity which resulted in increased timber harvests (Xu & Jiang, 2009)

Reforms were far more successful than previous attempts at privatisation and this has largely been credited with the introduction of certificates guaranteeing forest owners' rights and the extension of contracts from 30 to 70 years. Forest reallocations were now only allowed by a majority of 2/3 of village representatives. This further strengthened tenure security and improved incentives amongst farmers (Xu & Jian, 2009).

Compared to the previous period of reform, costs of external cooperation decreased as reforms facilitated partnerships between foresters allowing them to share costs (Xu & Jiang, 2009). This resulted in farmers cooperating more which led to increased income, and also decreased externalities such as forest fires. This ties in line with our theoretical framework, as costs decreased, cooperation increased which allowed actors to internalise externalities (Baltzer, 1998).

However, several problems persist with forest tenure. Limits on timber harvesting are still in place in certain regions. The rising number of small holder forest owners has made it increasingly difficult for authorities to regulate harvests subject to quotas. Furthermore, the responsibilities over managing quotas has been decentralised to local authorities, making it increasingly difficult and costly to implement key forest policies (Xu & Jiang, 2009).

Finally, forest tenure reforms have led to many new partnerships and contracts. Increasing incomes has had profound social and economic impacts and this has resulted in many actors renegotiating their contracts in search of new possibilities with forestland possibly being redistributed. Management and use rights will be renegotiated and both the state, tenure regimes and rights holders will need to be able to adapt and enforce these changes (Chen & Innes, 2013). Forest conflicts may arise if the appropriate legal tenure framework does not exist. This can lead to increased costs of external cooperation which may cause shifts in the tenure system (Chen & Innes, 2013, Xu & Jiang, 2009, Baltzer, 1998).

8. Discussion

The argument for land privatisation is that the exclusive use of land by private users will lead to long-term investments, increasing productivity and encouraging the land user to manage it sustainably (Demsetz, 1974). Although private land tenure regimes have met with success in different parts of the world, there are many cases where privatisation of land has been less successful and even led to negative outcomes. Furthermore, there are many cases of successful communally managed resources worldwide. As such, these regimes should not be overlooked.

Our theoretical framework suggests a multitude of factors that affect the effectiveness of different property regimes and how different bundles of property rights assigned to (groups of) users affect the production decisions made by land users. These production decisions affect the welfare of its users, dictate the sustainable use of the land and may cause externalities. Considering the complexity of these interactions it is important to formulate land tenure regimes specific to each context, i.e. physical characteristics of the resource and its institutional, cultural and social context..

There are many cases where these contexts are overlooked by policy makers and, as a result, land tenure policies may fall short of their intended goals. The case of China highlights this, with grassland and forestland reforms following the same course of privatisation as arable land, but with very different outcomes. Privatisation of grassland has accelerated degradation and led to a breakdown of social relationships between herders. Grassland inhabitants have seen little increase in income with poverty prevalent. Forests initially suffered heavily as tenure was individualised but more recent reforms have led to higher productivity with improved management and increased incomes.

The introduction of the HCRS signalled the beginning of individualised land tenure and led to numerous problems that continue to affect grasslands and forests today. The causes of the aforementioned unintended outcomes are several. Firstly, privatisation ignored the physical differences between arable land, grassland and forests. The individualisation of tenure lowered costs of internal cooperation and prioritised single household management. However grasslands and forests cannot be easily managed by a household due to their inherent physical traits, they're susceptible to environmental shocks, they span large continuous areas, and are isolated regions. These physical characteristics mean that exclusion and restricting use difficult and costly for an individual alone. External cooperation between actors is often necessary to overcome difficult environmental conditions which individualised tenure has put into jeopardy. These rising costs reduced actor's ability to internalise externalities.

Second, the grassland and forests reforms often lacked the ability to safeguard, enforce and effectively manage property holders rights, because reforms changed regularly and often lacked clarity with a multitude of external bodies presiding over the enforcement of rights (Sun, 2007). Additionally, property holder's rights were not clearly defined during some of the reforms, as was the case with the three fixes policy in forestland. This lack of clarity restricts farmer investments in the land and undermines the tenure regime in place by increasing transaction costs involved in internal and external cooperation. Farmers would also lack the incentive to maintain their land and prevent it from degrading.

Third, the HCRS did not take into account the social and cultural context which had existed under previous traditional forms of management. This was especially true in ethnic minority areas within forests and grassland areas where resources had been communally managed. First, the disappearance

of these traditional forms of management had detrimental impacts on actors' social relationships. As seen with the case of grasslands, relationships among herders changed significantly as privatisation encouraged exclusion and land fragmentation. This led to higher costs of external cooperation, hindering income growth and sustainable resource management. Additionally, the disappearance of traditional local management systems made forest and grassland users reliant on government agencies to enforce and maintain their rights. As formal institutional arrangements were often poorly developed, for example the three fixes policy which improperly assigned forest plots and reduced tenure security (Delang & Wang, 2012). Therefore, farmers had little sense of ownership and often lacked responsibility to manage the resource sustainably (Sun, 2007).

Chinese land tenure has gone through major changes in recent decades. The success of the HCRS at increasing agricultural productivity on arable land cannot go unmentioned. Its results transformed rural China and lifted millions out of poverty. Livestock production also increased significantly, but did little to benefit pastoralists in grassland areas. Actors engaged in industrial livestock production have seen significant welfare gains, but these improvements have not been felt by the majority of pastoralist communities.

Nevertheless, reforms aimed at grassland and forest could not emulate the same degree of success. China's case, highlights the potential shortfalls in implementing a one-size fits all policy to different types of natural sources in different socio-cultural and institutional environments. Subsequent reforms in China, particularly in grassland and forestland have aimed to rectify and alleviate these problems. They recently met with considerable success in forests, while grasslands users continue to face significant problems.

Our study on the individualisation of Chinese land tenure and its outcomes has highlighted the need for tailor-made policies for specific land types. Each land tenure arrangement should take into account the various characteristics surrounding it, from its physical characteristics down to its traditional forms of management, as these factors influence transaction costs and thus the effectiveness of the property structure in place.

Understandably, tailoring tenure to specific land types may take longer and cost more than a one size fits all policy as more specific information needs to be collected and analysed. However, the long-term consequences of implementing improper tenure regimes are often worse, and can have a serious negative impact on the welfare of the resource users and sustainability of the resource use. China's case highlights the problems of implementing a one-size fits all policy to different land resources. Tenure reforms are difficult to design and implement, given the specific resource characteristics and contextual factors that need to be taken into account. But if done appropriately, the economic benefits can be huge. Arable land tenure reform in China illustrates this, as it was pivotal in China's unprecedented economic success since the end of the 1970s.

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