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DETERMINANTS OF GRASSLAND USE RIGHT TRANSFER IN INSTITUTIONAL CHANGE: EVIDENCE FROM PASTORAL CHINA

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BESTIMMUNGSFAKTOREN FÜR DIE ÜBERTRAGUNG VON NUTZUNGSRECHTEN VON GRASLAND IM LICHTE DES INSTITUTIONELLEN WANDELS: BEWEISE AUS PASTORALEN IN CHINA

DETERMINANTS OF GRASSLAND USE RIGHT TRANSFER IN INSTITUTIONAL CHANGE: EVIDENCE FROM PASTORAL CHINA

Zusammenfassung: Der Artikel befasst sich mit Einflußfaktoren des Leasings von Grasland in China und soll einen Beitrag zur Debatte über die Ausbreitung und Intensivierung von Graslandaktivitäten in weiten vulnerablen Regionen des Landes leisten. Basierend auf besondere Merkmale des institutionellen Wandels im Grasland sowie die Analyse von, in 12 Dörfern erhobenen empirischen Daten, werden bestimmten Variablen wie beispielsweise graslandbezogene Verfügungs- und Nutzungsrechte, Graslandrichtlinien, und Eigenschaften involvierter Akteuren in ihrer Wirkung auf dem Leasing von Grasland untersucht. Der Artikel lenkt eine besondere Aufmerksamkeit sowohl auf die weitverbreiteten illegalen Beweidungsaktivitäten, die Durchsetzung von beweidungsbezogenen Quoten als auch deren Einfluss auf dem Leasing sowie Gouvernance von Grasland.

Schlüsselwörter: Landnutzen, Landbesitz, Graslandleasing, China

Abstract: This paper focuses on factors influencing grassland lease, which will contribute to the heated debate about land use in China by extending to more extensive and vulnerable grassland regions. Based on review of grassland institutional change and analysis of data from 12 villages, this paper examines the impact of variables such as grassland property rights, grazing policies and physical attributes of actors on grassland lease. This paper also draws attention to widely existed illegal grazing and the implementation of grazing quota, as well as their impact on grassland lease and governance.

Keywords: Land Use, Land Ownership and Tenure, Grassland lease, China

1 Introduction

Located in the eastern Ningxia Hui Autonomous Region, Yanchi County is bounded by Shanxi province, Gansu province and Inner Mongolia Autonomous Region. It is in the transition zone from Loess Plateau to Ordos Desert, as well as the transition zone from arid steppe to semi-arid grassland. Among its total 713,000 hectares lands, 557,000 hectares is grassland. The climate in Yanchi County is continental climate, with average 272mm rainfall per year (Qi et al., 2006).Grassland not only provides irreplaceable ecological environment for local people's daily life, but is also an essential factor influencing local economic development. Although the

contribution of livestock on local Gross Domestic Product (GDP) has declined from 26.0% (2000) to 15.3% (2009), livestock kept on the grassland still constitute 31.23% of the per capita net income of farmer[1].During last decades, grassland degradation and desertification have become more and more severe in Yanchi. Before 2002, 79.3% of its total land suffered from serious desertification. In recent years, local people are frequently hit by natural disasters caused by extreme weather, such as extreme drought.

Grassland lease exists when there is a gap between the amount of grassland that actors wish to have and the amount of grassland that they owned in reality. Grassland lease appears to eliminate this gap by leasing in or leasing out grassland. In this paper, grassland lease, especially operational-level grassland lease, refers to a mechanism through which a voluntary transaction in grassland use right is leased within rural households. The term ”transaction” follows Common’s definition which treats a transaction as a unit of lease of legal control, that is, to involve the transference of property rights (Hagedorn 2008). Empirical research results show that the occurrence and forms of grassland lease varied in last decades. During certain period grassland lease declined dramatically, and it boomed in some areas while depressed in other areas in the same time. Considering institutional change during that period, this phenomenon draws our attention on the determinants of grassland lease. What is the role of institutional change on grassland lease? What is the impact of other variables such as grassland size, location, fence on grassland lease? Why did some grassland lease happen exclusively in certain situation, for example, grazing quota lease?

This paper would contribute to the heated debate on land use in rural China by engaging in more extensive and vulnerable grassland regions. Nowadays, more and more scholars are paying attention to arable land tenure (Guo Li, et al. 1998; Brandt et al. 2002; Kung et al.1997) and arable land lease (Li 2003; Brandt et al. 2002; Slangen et al., 2008) in rural China. Comparatively, grassland lease and its determinants is a topic under research. The situations that illegalize grassland lease or lack of protection for lease are presumed to lead to inefficiency. As Ostrom (2003) stressed that rights to their use will be leased to those who will allocate them to their highest value use. Leasing appears to be an important mechanism through which the rural economy is able to redistribute resources and improve production efficiency. In addition, in recent decades, the increasing migration causes a huge amount of abundant grassland. Grassland lease could dramatically raise land utilization ratio under such circumstance. This article also analyzes the relationship between institutions and grassland lease under certain biophysical conditions, which would shed lights on how types of property rights and related policies jointly affect grassland lease.

The rest of this paper is organized as follows. Section2 introduces institutions related to grassland governance, mainly about current grassland property rights and grazing policies. Section 3 lists the theoretical hypothesis of grassland lease. It predicts that grazing policies, *de facto* property rights of grassland, and biophysical conditions will affect grassland lease. Section 4 introduces the methodology employed in this research including research strategy and

techniques. Section 5 illustrates and interprets empirically results. Concluding remarks are contained in section 6.

2 Institutions related to grassland governance in research area

Grassland decentralization reform was implemented in 1990s in Ningxia Hui Autonomous Region, after the introduction of Household Responsibility System(HRS) for arable land (Lin 1992), which redefined farmland tenure arrangement by allocating land-use rights to individual households, despite the ongoing collective ownership of land (Banks et al, 2003). Grassland is managed under a similar HRS, albeit with slight differences due to the unique features of grassland, such as difficulties in demarcation (Banks et al.2003). The decentralization reform aimed to contract grassland use right to individual household. While the heterogeneity of villages such as grassland size, cultivation type and location promote diversified property right regime in the end. Villagers possess not the ownership but use rights. The degree of grassland allocation often varied (Ho 2000; Banks, Richard et al. 2003; Nelson 2006).Some grassland were contracted to individual household as policy encouraged, while in some areas with quite limited grassland, it was assigned to groups with several households, and some even maintain *status quo* situation (i.e., owned and managed by community). The valid time of the contract is 50 years. Until 2003, 317,000 hectares grassland, about 86.6% of its total grassland, had been contracted, among which 56,000 hectares grassland were allocated to individual households, and 261,000 hectares grassland had been contracted in the form of groups of 5-6 households.

However, the real situation is much more complicated. Property right regimes explained above were de jure rights systems since it is lawfully recognized by formal, legal instrumentalities (Schlager et al.,1992). Property rights may also originate from resource users by cooperatively define and enforce rights among themselves. This could be called *de facto* rights when they are not recognized by government authorities (Schlager et al., 1992). In Yanchi, some grassland supposed to be contracted to individuals are not realized due to the fuzzy boundary of grassland, and it is quite common that some contracted to groups in de jure property right system are still owned and managed by community.

In addition, several grazing policies were carried in last decade, responding to the increasingly severe desertification. As one of the most influential land extreme policies, grazing ban policy was issued in 2002 in Yanchi County. The grassland use right was restricted by the policy. Captive breeding was encouraged by government. Admittedly, to some extent, the policy fostered the recovery of vegetation, improved the quality of grass and stimulated the intensification of husbandry (Liu et al.2007). However, grassland desertification situation was not alleviated as expected, with about 0.297 million square kilometers (44.7% of land) in Ningxia being devoured by desertification (Qi et al. 2006). Moreover, it forced local people to abandon herding, which used to be the most important traditional livelihood. As a result, conflicts between government and local people were intensified. More importantly, grazing ban policy greatly limited alternative livelihood strategies for those who stay in villages. Increasing young rural migrants leave a huge amount of farmland uncultivated. Rural brain drain thus

caused is considered to be the bottleneck of new rural construction. Considering these problems, ten natural villages[2] were selected by local government as pilot areas for a grazing open project in 2006. Farmers in pilot villages were permitted to use grassland despite the ban grazing policy. The pilot areas were expanded to the whole town in the next year (Table1). However, this pilot project was suspended after 2008 due to extremely drought in the following years.

Table 1: Information of different regulations in Yanchi County

	Grazing ban policy	Grazing open pilot project	
Time	Since Nov.1st,2002	2006	2007
place	Whole county with 8 towns, 98 administration villages, 675 natural villages	1 administration village with 10 natural villages, covering 1001.2 hectares grassland	15 administration villages with 96 natural villages, covering 54906.6 hectares grassland
Main content	All activities related to grassland were banned; captive breeding was highly recommended and subsidized.	In pilot area, local people were allowed to graze sheep on grassland. Grazing quota was assigned by county government to each household based on the quality of grassland in the village, and then allocated to each household based on grassland size household owns. Rotational grazing was encouraged by government.	

Source: data collected in empirical research (2010)

3 Literature Review and Hypothesis

Hypothesis 1 *Grassland fence is expected to exert a positive impact on grassland lease by clarifying de facto property right, decreasing the difficulty of exclusion and the transaction cost of grassland lease.*

The grassland in research area is defined as a common-pool resource, since each person's use of a resource system subtracts units of that resource from a finite total amount available for harvesting while hard to exclude other beneficiaries from benefits (Ostrom, 2005). However, common-pool resources are not automatically associated with common-property regimes, or with any other particular type of property right. It may be owed by national, regional or local governments, by communal groups or by, private individuals or corporations (ibid.). Existing literatures provide successful or unsuccessful cases for common-pool resource governance by different groups such as government, communal groups (Ostrom, 1990; Jun Li, 2007; Banks, 2003).As stated above, Yanchi grassland provides a good example of diversity of property right regimes in common-pool resource. Some grassland contracted to groups are still used and managed by community since there is no specific boundary of group grassland. Some Grassland contracted to individual households is managed by group or even community for the same reason. Without a specific and visible boundary of grassland, *de jure* grassland property rights are hard to be implemented. It is hard to distinguish the boundaries of grassland without artificial mechanism such as grassland fence building(Banks et al. 2003).It has been pointed by some scholars (Cornes et al.,1994;Ostrom, 2003) that to understand the capacity of exclusion depends both on the technology of physical exclusion devices, such as barbed wire fences, as well as the existence and enforcement of various bundles of property rights. Grassland fence is the

technology commonly used because the local government provides subsidy for fence and the cost is relatively low. Therefore, it is reasonable to define de facto grassland property right regime based on fence situation. Grassland with village fence shares the same attributes of common-property regime. Grassland with individual household fence could be classified to a quasi private-property regime. As to grassland with group fence, it is categorized to a group-property regime.

Grassland fence is believed to have positive impacts on grassland lease since it determines *de facto* grassland property rights by clarifying the boundaries of grassland, which diminishes the cost of excluding other potential beneficiaries. Even for grassland contracted to group, grassland fence is expected to exert a positive impact on grassland lease since it allows for greater external exclusion, while the cost is relatively lowered than individualized tenure case (Banks, 2003).Besides, grassland fence would contribute to grassland lease since it diminishes the transaction cost by simplifies the leasing process and in this way, grassland transferred would be less ambiguous or controversial. It also enables the formalization of grassland lease from oral agreement and produces written document feasible by defining specific and visual boundary of grassland. In the case of individual grassland fence, potential conflict between a tenant and a landowner resulted from the boundary of grassland will be solved by construction of grassland fence.

In addition, compared with grassland with fence to larger unit (i.e., fence to village), grassland with fence to smaller unit (i.e., fence to individual household) is expected to have higher probability of being leased, which means that the more decentralized property right system the actors involved, the more possible grassland would be leased. Because ambiguous rights originated from less decentralize property right system lead to inefficiency since actors cannot or have difficulty to trade their interest in such system for other goods or money. Moreover, the potential actors interested in goods with less decentralized property right are quite limited since actors involved in such system usually have to face the conflict among other owners in same system. Hypothetically, if one actor wants to rent grassland under group property right system from a group of households, the agreement has to be achieved between the actor and all households of the group. The transaction cost is much higher, compared with negotiation within two households.

Hypothesis2 *Grazing policies have profound influence on grassland lease, and grazing ban policy is expected to have a negative impact on it.*

As Ostrom (2005) asserts, “rules affect the types of actions that individuals can take the benefits and costs of those actions and potential outcomes and the likely outcomes achieved”. When grazing policy is implemented to regularize the use of grassland, it does impose a constraint on grassland use and change the incentives actors face. On the one hand, as transactions are institutionalized, actors will adjust their choices to the new rules and enforcement mechanism (Hagedorn 2008). We assume that when grassland use is institutionalized by a grazing ban policy, it is probable that the actors will adjust their choices to

reduce grassland use which inevitably decreases incentive to lease grassland use rights. With a grazing ban policy, grassland is enclosed for vegetation recovery and not for grazing. Villagers are required to change the pattern of raising livestock from grazing to captive breeding. Therefore the incentives for grassland lease are reduced. The lease probability will drop dramatically under such circumstance, in particular in the first a few years when official monitoring of illegal grazing was extremely intensive and restrict. Illegal grazing happened frequently in recent year since the official monitoring was much looser especially in evening. Accordingly, we assume that the incentive of leasing grassland use rights gradually increased due to lower transaction cost. The economic value of grassland increases since the risk of being sanctioned fori llegal grazing by government decreased. In addition, we also consider the impact of grazing open pilot project on grassland lease. It is reasonable to consider that the open grazing policy will stimulate grassland lease. The grazing open policy provides a formally recognized and authorized arena for grassland use right lease by legalizing grazing activity. Hence the transaction cost reduced greatly.

Hypothesis 3 *Physical attributes of the community will also influence individual's decision-making on grassland lease.*

Evidence from existing research shows that the same policy may yields entirely different actions because of the various characteristics of actors. Individuals' incentives are also affected by attributes of the biophysical and material condition. As Ostrom (2005) stressed that human actions are also affected by other attributes that how institutions combine with biophysical conditions to generate positive or negative incentives. What actions are physically possible, what outcomes can be produced… are affected by the world being acted upon in a situation. This is also supported by Hagedorn (2008) that physical world (and related physical properties of a transaction) is as important as the social world (and the related physical characteristics of actors). For institutional analysis, in the case of grassland lease, Banks et al. (2003) identified several physical attributes of grassland, including ecological fragility, remoteness from residential quarters, difficulties in demarcation and heavy reliance on group enforcement of any policy and legal measures. The model Bliss et al., (1981) developed implies that leasing decisions are closely related to the bullock, family worker, and land endowments of rural household in India, which was then proved again by Taslim (1992).

The size of grassland might affect actors' incentives. The size of the resource could cause different consequences of institutions. The larger the grassland individual household possess, the more benefit the grassland originated, therefore higher incentives actors have for grassland utilization, either through grazing sheep or leasing to others.

The location of grassland would also influence grassland lease. In the studied region, grassland location can be divided into two parts, in hill or in plain. As Ostrom (2003) stated whether it is difficult or costly to develop physical or institutional means to exclude non-beneficiaries depends both on the availability and cost of relevant technologies... and the relationship of cost of these solutions to the expected benefits of achieving exclusion. Generally,

it is costly and more difficult to build grassland fence in hills than in plain. Besides, the geography attributes of grassland in hilly areas could reduce the incentive of grassland lease, not only because it is hard to graze in those places due to its complicated geography but also because transportation cost is high. Usually the hilly areas are remote and hard to reach from the residential areas.

Irrigated farmland is expected to have a positive impact on grassland lease. As stated above, grassland is usually leased as an appendage to irrigation farmland. It is reasonable to assume that the type of farmland would be a determinant of decision on grassland lease. In addition, farmers will spread the risk of production in order to smooth their income (Ellis, 2000).

4 Methodology

According to research questions, a combination of qualitative and quantitative methods has been employed during the empirical research and data analysis. Participatory rural appraisal was employed in each village to get the general information of village, including geography information, population, self-governing organizations and so on. Village-level data was collected by key informant interviews.

4.1 Sampling procedure

Twelve villages were selected along with the poverty alleviation offices and a local NGO to take into consideration of more diversified physical attributes influencing grazing activities. The criteria to be considered included the average grassland in a village, fence situation, and arable land situation. We took average grassland per person in a village as an indicator. The sample covered four villages with more than 100 mu3 grassland size per person, 4 villages with less than 100 while more than 50 per person and four villages with less than 50 mu per person. Fence situation of grassland is included as an indicator of de facto management units: fence to village, fence to groups and fence to individual households. Grazing policies implementation is also considered during case selection. Four pilot villages with an open grazing policy implemented since 2007 and 8 villages with a grazing ban policy since 2002 have been selected in village sample selection.

At household level, a random sample selection has been conducted. According to research plan, 10 questionnaires should be collected in each of the 12 village. While due to increasing migration, it is hard to find 10 household who raise sheep in some villages. Therefore, we modify the number of questionnaires for each village according to village population in the process of data collection. In the end, 111 questionnaires have been collected by face to face interview directly conducted by the project team, which ensures high accuracy of data. Fourty-two households are located in four natural villages with open grazing policy, and 69 are from the eight natural villages with ban grazing policy. In order to test the impact of grazing policies on grassland lease, we used questionnaire to trace back the situations of grassland and grassland lease in three periods including the implementation of grazing ban policy (2003), the enforcement of open grazing policy (2007), and recent years (2009).

Tabel2: Attributes of selected villages

	The scale of grassland (unit: mu/person)			Fence situation			location		Cultivation type	
	Less than 50	51-100	More than 100	Village	Group	Household	In hills	In plain	Without irrigated lands	With irrigated lands
observation	4	4	4	2	6	4	3	9	5	7
Percentage (%)	33.3	33.3	33.3	16.7	50.0	33.3	33.3	66.7	41.7	58.3

4.2 Multivariable Analysis

The probit model is employed to analyze determinants of grassland lease. The ordinal regression model is a nonlinear model in which the magnitude of change in the outcome probability for a given change in one of the independent variables depends on the levels of all of the independent variables (Long et al., 2001). The likelihood of grassland lease is treated in the modal as an ordinal dependent variable (P). It represents the probability that a household makes the decision to lease grassland. Otherwise, 1-P represents the likelihood that a household decides not to lease. Although the villagers only possess nominal grassland use right, they still can lease it to others. In order to avoid double counting, we only count the number of the households who lease in grassland, instead of the figure of leasing out. We calculate two types of grassland lease. One is directly renting the grassland, and the other is renting grazing quota, as the amount of sheep that can be grazed in grassland of individual household is regulated. From primary statistics, we notice that the latter type of lease mainly took place in village implementing grazing open pilot project in 2006 and 2007.

The hypothesis formulated in Section 3 pointed out that, variables including irrigated land size (ir), dry land size (dr), grassland per household (gr), fence unit (fence), location of village (l) and types of grazing policy (policy) will influence grassland use right lease. Accordingly, such variables are included into the model to explore their impact on the probability of grassland lease:

$$\mathrm{P} = \Phi\ (\beta_0 + \beta_1 ir + \beta_2 dr + \beta_3 gr + \beta_4 fence + \beta_5 l + \beta_6 policy)$$

The amount of irrigated land (ir), dry land (dr) and grassland (gr) each household has are measured in unit of mu. The dummy variable l refers to the location of grassland as a control variable to reflect whether grassland is located in a hilly (0) or plain area (1). The dummy variable policy represents grazing policies. When policy=1, it means an open grazing policy. When policy=0, it refers to a ban grazing policy. The categorical variable fence refers to de facto property rights regimes of grassland in natural villages. In reality, de jure property rights regimes hardly function without clear boundaries defined by grassland fence. In the surveyed area, even if grassland is allocated to households, it might be managed at collective, group or household level depending on fence situation. Therefore we use the situation of fence as a proxy for de facto property rights regimes of grassland which takes the value of 0 and 1, meaning non-private property right (i.e., collective and group property right) and private property right respectively.

5 Empirical Results

5.1Attributes of dependent variables

Lease contract provides a physical area for grassland use right lease. It defines the boundaries of a transaction: what is leased during the transaction, how long is this transaction valid, and what are the responsibilities of tenants and landowner. We found that there are different types of grassland leasing, and the commonly existing practice works by oral agreement instead of written document within a short period, usually one or two years, between two households living in same village. Landowners usually lease out all his or her grassland to one tenant. Only 22% households leased grassland by written agreement. However, all of these agreements only consist of lease time, lease price, and contractors, having no specific terms on responsibility of contractors and rules about violation of the contract. Mutual trustworthy based on past life experience is one of the essential factors influencing contractors' decision making. Another type of grassland lease is to rent both the grassland and farmland instead of renting grassland separately. It does happen in villages with irrigation farmland. Due to severe scarcity of farmland, the comparatively higher economic value of farmland generates farmland leasing market before the appearance of grassland lease. Under such circumstance, in villages with irrigation farmland, sometimes grassland is taken as a bundled product of farmland lease, and this kind of lease contract tends to be more formal than usual one (i.e., signed by contractors in written agreement).

In field research, there are 23 cases of grassland lease in 2007, among which 10 were in villages under grazing open policy. Additionally, grazing quota lease become quite popular in these villages. Since quota system allocates grazing quota based on household's grassland size, quota lease is also included in grassland lease in this research. In a village with group grassland fence, the village leader told us that about 60% household leased in or leased out grassland during the implementation of grazing open project. Six cases of grazing quota lease were found in field research. In in-depth examining, we found out that these four households were located in the village with group management unit of grassland. For these people, what they lease in was not grassland but grazing quota. It is easier to lease the quota instead of leasing the grassland in villages with group property. Grazing quota provides a well arena for grassland lease.

In village without specific fence, the probability of grassland lease (0) is lower than that in village with group fence (12.9%) or household fence (34.2%). It supports the Hypothesis 1, which proposes that the probability of grassland lease is expected to be higher in grassland with fence to smaller unit than in grassland with fence to larger unit. The result also reveals a positive correlation between grassland size and grassland lease. The percentage of grassland lease in area of per capita average grassland less than 50 mu is 11.1%, from 50 to 100 mu is 17.6%, and more than 100 mu is 28%.

5.2 Primary statistic description of independent variables

The distribution of households and some of their characteristics are shown in Table 3. It is interesting to notice that there are still 13 households leasing the grassland in villages with the

ban grazing policy, which is out of our expectation that no grassland lease would exist under the constraint of the grazing ban policy. This might be caused by cases of grassland leasing in villages with grazing ban policy. According to our assumption, considering the compulsory constraint originated from grazing ban policy, no grassland leasing should exist in these villages. However, the appearance of illegal grazing totally changes the assumption. With the gradual improvement of environment, conflicts between herders and government occurred frequently in monitoring. Because of high financial and labor cost for monitoring, policy implementation tends to be loose in recent years. In field research, we found that illegal grazing was popular despite of the implementation of the grazing ban policy. More than 54% people admit that they were grazing every day in 2010. Usually, illegal grazing happens in mid-night since the monitoring becomes loose during that time. Moreover herders are familiar with local geography while the governmental monitoring committee usually doesn't, so it is easy for herders to avoid monitoring in the evening. The cost of grazing is much lower than captive breeding (Qi et al. 2006). This is the main reason for the frequent occurrence of illegal grazing. Apparently, the possibility of grazing illegally increases the economic value of grassland; therefore it enhances the incentives for grassland leasing.

Table3: Features of the households and villages

Variable	Obs	Mean	Std.Dev.	Min	Max
The amount of grassland leased	111	0.207	0.407	0	1
Irrigated land	111	7.910	12.00	0	50
Dry land	111	30.15	24.34	0	90
Grassland	111	346.0	243.3	0	1080
The location of grassland	111	0.793	0.407	0	1
De facto property rights regimes	111	0.333	0.474	0	1
The grazing policy	111	0.378	0.487	0	1

Households in our sample have grassland use rights since the establishment of the HRS. As mentioned above, more than 86% grassland has been formally allocated to groups or individual households in 2002. While de facto grassland property rights regimes instead of de jure regimes are measured by this model in which fence is an indicator. The result is consistent with the situation of HRS in Yanchi County that grassland is most commonly allocated to the group.

From the tabulation of grazing policy and number of grassland leased, we can see that in villages with open grazing policy, the percentage is 23.81%, higher than that in villages with ban grazing policy (18.84%). We also tabulate grassland fence situation and grassland leased, and find out that the percentage of leased grassland with household grassland fence is 37.84%, higher than that with group grassland fence (14.29 %).The overall p value is less than 0.05($p = 0.004$), which implies that there is significant difference in the mean of grassland leased in different grassland fence situations. There is perfect multi-colinearity between household fence and group fence when we use dummy variables including household fence, group fence, and collective fence, which might be resulted from only 11 observations of collective management units. In the

following regression analysis, only one dummy of household level fence non-household fence is employed.

5.3Regression results

The impact of institutions in grazing policies, de facto grassland property rights and physical attributes of grassland on grassland lease are estimated by a probit model. Table 4 presents the results of Probit estimation. Probit 1 only examines the impact of treatment variables. In Probit 2 and Probit 3, we include control variables measuring a household's capital and physical attributes of grassland, such as location. The standard errors in Probit 1 and Probit 2 are measured by robust error estimation, and the standard deviations in Probit 3 are robust and clustered on the village level. The advantage is that it allows correlation between independent variables in the same cluster, which is quite common in reality. Based on probit estimation, we find out that property rights regimes and the grazing policy have significant impact on grassland lease, while the location of grassland and household characteristics are not as significant as we expected.

Table4: Linear probability estimates of grassland lease decision

Dependent variable: Rent grassland (0,1)	Mean of X	Probit 1	Probit 2	Probit 3
De facto property rights regimes#	0.3333	0.3165**	0.3279**	0.3279*
		(0.1043)	(0.1236)	(0.1334)
Grazing policies#	0.3784	0.1075	0.2502*	0.2502**
		(0.08261)	(0.1052)	(0.1023)
The location of grassland#	0.7928	-0.08068	-0.2143	-0.2143
		(0.1126)	(0 .1404)	(0 .1660)
Grassland area per household	346.0		-0.00001	-0.00001
			(0.0002)	(0.0002)
Irrigated land area per household	7.910		0.0039	0.0039
			(0.0038)	(0.0021)
Dry land area per household	30.15		-0.0029	-0.0029
			(0.0037)	(0.0027)
Pseudo R^2		0.1049	0.1490	0.1490
observations		111	111	111
chi square		9.7686	16.81	32.15
Log pseudo likelihood		-50.69	-48.19	-48.19

Note: * p<0.05, ** p<0.01, *** p<0.001. Coefficients refer to marginal effect of mean of independent variables. (#)The coefficient is for discrete change of dummy variable from 0 to 1. The standard errors in Probit 1 and Probit 2 are measured by robust error estimation. The standard errors in Probit 3 are robust and cluster on the village level.

De facto property rights regimes have significantly positive impact on the probability of grassland lease. The probability of grassland lease will increase by 32.79% when grassland is managed by individual households, compared with the grassland managed by groups of households. This support Hypothesis 1, namely, small scale of management unit has positive impact on the probability of grassland lease, since small management unit with more explicitly fenced boundaries needs less labor to manage. In field research, we found out that in some

villages with household grassland fence, traditional grazing (i.e., supervising the sheep through the whole night) has been substituted by a new way: Sheep are sent to farmers' own grassland in the evening and are left with no inspection during night. Then farmers return home and herd sheep back in early morning. As one herder said, this way of grazing reduces the working hour and workload. In this way, herders can take other jobs during the day. He also admitted that sometimes they were caught by monitoring committee and fined for illegal grazing, but they continued to do so. Small management unit has positive impact on grassland lease. It might solve difficulties in demarcation and lower the cost of monitoring, bargaining and decision-making. The impact of grazing policies on grassland lease is significant and positive in both estimations, which is consistent with Hypothesis 2. With change from grazing ban policy to grazing open policy, the likelihood of grassland lease will increase by 25.02%. Admittedly, widely existing illegal grazing greatly challenge the assumption that no grassland lease should be appear in villages with grazing ban policy. With Compared with farmers in villages with grazing ban policy, farmers in villages with grazing open policy are endowed with recognized and assured grassland use rights. Additionally, the grassland quota system further provides farmers with incentives to lease grassland, because it avoids conflicts caused by fuzzy boundaries and property rights of grassland.

6 Conclusions and discussions

This paper examines the impact of formal institutions as well as biophysical and material conditions on the probability of grassland lease decision made by households in Yanchi County in the Ningxia Hui Autonomous Region, China. According to the model, grazing open policy has positive effects on grassland lease. Farmers responded to institutional environment. It implies that famers in villages with grazing ban policy have low willingness to lease grassland. Albeit there are illegal grazing, famers are not long-term engaged with these activities. On the other hand, farmers in villages with grazing open policy are endowed with high willingness with grassland lease, especially with support of grassland quota system. This paper examines the impact of de facto rights, which relates to the problem of difficulties in demarcation in grassland. It is evidenced that grassland fence has positive and significant effect on the probability of grassland lease, and clear boundaries are important to grassland governance. As Wade (1987) points out, boundaries of common-pool resources matter for self-governance. Property rights with clear boundary overcome the difficulties in demarcation and reduce the transaction cost. According to our research, a village with more than 100 mu grassland per person usually has fenced grassland to individually household. Accordingly, grassland is a 'quasi private goods' which can be managed individually. While in other villages with quite limited grassland size, in particular in villages with less than 50 mu grassland per person, fence is built in group level or village level, which means that it is difficult or even impossible to lease grassland in some circumstances. As to these villages, we propose community based grassland lease in the form of grazing quota lease, which solves the problem of fuzzy boundaries and diminishes the possibility of conflict result from lease. The community based grassland lease refers to grassland use rights

leasing within a community. As to the term 'community', it is not equivalent to administrative level community. An area could be a "community" as long as the people live within it shares the same informal institutions such as norms. Accordingly, a community might be a natural village or a group of people with the same religion.

We need to be aware of the potential bias resulted from the lack of information about household income. Local people are quite sensitive to topics about income. In the first village survey, the data we collected about income are hardly convincing since interviewees either refused to answer our questions or gave us a false reply. Therefore, instead of income, we asked them the percentage of income changed in last few years, which is less sensitive, but it is hard to integrate this variable into our modeling. In our analysis, we use the amount of arable land, sheep and grassland land to represent the household income. We could only count the number of households leasing in grassland to minimize the effect of migration. We assume that the determinants of land leased in are determined by the same coefficients that determine the amount of land leased out. This may be equivalent to the average level of the figures in reality. Additionally, it is hard to collect information about grassland leased out. This might be caused by increasing migration in rural China. Most of households leasing out grassland have migrated to cities to work. People living in rural areas are mainly the old and the poor who live on grazing. In addition, we have not solved the potential endogeneity problem which might result from the correlation between the amount of grassland lease and the fence situation, due to lack of strong evidence to find a reliable instrumental variable. Last but not least, as a snap-shot, the disadvantage of a cross section analysis is that we cannot correct the bias resulted from the selection of villages for open grassland policy. However, in order to reduce or eliminate all the limitation, we combine multivariable analysis with reliable qualitative analysis, and the results are convincing. The future research will improve the data and explore more information about the topic of grassland property rights lease which is under research at present.

Note

1. Calculated based on data from Ningxia Hui Autonomous Region Bureau of Statistics, National Bureau of Investigation Corps Ningxia (2010), Statistical Yearbook of Ningxia Hui Autonomous Region. Beijing: China Statistics Press.
2. Natural villages refer to the settlements which constitute an administrative village. The number of households in natural village can range from 1 to 100.
3. In research area, the usual unit used in describing grassland size is mu. 1 hectare equals to 15 mu.

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