

# Eco-immigration Policy for the Degraded Rangeland and Responses of Herd Family in the Source Region of Yellow River——Case Study Based on Household Investigation in Maduo County

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**Abstract:** Under the integrated influences of global climate changes and overgrazing, China rangeland has degraded over recent years. Maduo County locates in the Source Region of Yellow River and its rangeland has experienced expansive degradation. The government of Qinghai Province launched an eco-immigration policy in 2004. In order to analyze the responses of herd families to the eco-immigration and the reasons for these responses, the authors used three periods MSS and TM images for recent 25 years and interview survey data of 144 herd families in recent two years, getting the following results: (1) the rangeland had degraded extensively for recent 28 years; and (2) the immigrant families were mainly composed of the old, with little or no livestock. What's more, the percentage of immigrant households that share one rangeland certificate with parents or brothers in the immigrant family was 54.5%. Therefore, it is hard to greatly decrease the overgrazing degree through eco-immigration with those previous characteristics of eco-immigrant family structure.

**Key word:** rangeland degradation; grazing pressure; eco-immigration; responses of herd family

## 1 Introduction

Under integrated influences of global climate changes and human disturbance, rangeland had widely degraded in China<sup>[1,2]</sup> (Jiang Lipeng et al., 2007; Zhang K et al., 2007). According to statistics data, the degraded rangeland area was about 50~60 percent of total Chinese natural rangeland. The whole area of desertified and grass cover decreasing rangeland was 0.87 million km<sup>2</sup>, equal to 22 percent of total Chinese rangeland<sup>[3]</sup> (Integrated planning Department of Agricultural Ministry, 2000). Rangeland degradation not only makes vegetation cover sparse, eatable grass species decrease, soil quality worse, but also becomes the speeding area of sandy storms that has happened during the recent 10 years<sup>[4-8]</sup> (Ellis et

al., 1988; Abel et al., 1989; Su YZ, et al., 2000; Cai Xiaobu et al., 2007; Fan Yida et al., 2002). In order to improve those situations, Chinese governments have launched series of immigration projects recently. In Inner Mongolia, the immigration policy regulates: government provides houses and fodder land in the other place; grazing activities is prohibited in herds-men's original rangeland after their moving; after rangeland is restored, herd family still own its utilization rights<sup>[9,10]</sup> (Li Yan et al., 2004; Li Xiaochun et al., 2001). This policy succeeded in Aluker League but failed in Suniteyou League and rangeland even got worse after immigration in some other places<sup>[11-13]</sup> (Dong Ribu, 2000; Gegeng Gaowa, 2006; Liu Ying, 2006). So, immigration should be carefully handled.

Maudo County locates in the Source Region of

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Yellow River and supplies 4.3 billion m<sup>3</sup> water for the middle and lower reaches of Yellow River. Unfortunately, rangeland of Maduo County had degraded over the last 30 years <sup>[14,15]</sup> (Wang GX et al, 2000; Feng Jianmin et al., 2004). In order to improve these situations, the government of Qinghai province launched the eco-immigration project at this area in 2003. But, until now, there is none to study the relationship between rangeland degradation and eco-immigration, herd family's responses to immigration from the point of ecological and household. Therefore, my objectives in this article focus on those items: (1) to study the spatial pattern and trends of grassland degradation; (2) to analyze the factors that causes degradation; (3) to get herdsman responses to immigration and analyze its reasons.

## 2 Study Area

Maduo County (33°50'~35.4°N, 96°55'~99°20'E), lies in the east part of Qinghai-Tibet Plateau with total area above 25,000km<sup>2</sup> (Fig.1). Its elevation ranges between 4100~5200m. It is famous for two fresh water lakes: Zhaling and Eling. It comprises

four townships: Heihe, Huanghe, Zhalinghu and Huashixia. The climate is semi-arid. The annual mean temperature is -4℃, annual mean precipitation 321mm with a variation range between 434 to 84 mm. Zonal vegetation is Alpine meadow, steppe and swamp meadow. Alpine meadow's dominant species are *Kobresia tibetica*, *K. kansuensis*, *Bly graminifolia*. Alpine marsh meadow's dominant specie is *Carex mulliensis*. Alpine steppe's dominant specie is *Stipa purpurea* (Farming and Farrier Station of Agricultural Ministry, 1996; Editor Committee of Maduo Annals, 2001)<sup>[16,17]</sup>.

According to the 5th population investigation of China in 2001, Maduo's total population was 10890 and 85.7% of population was Tibetan. Each township population as follows: Heihe 1642, Huanghe 1900, Zhalinghu 1564, Huashixia 3701, and county town 2083. Average birth rate was 16.52‰. Maduo Tibetan belongs to three tribes: He, Cha and Kua. Each tribe has its own temple and leader. The leader is in charge of maintaining the order of daily business. Livestock breeding of sheep and yak is the main factors for thousands of years.

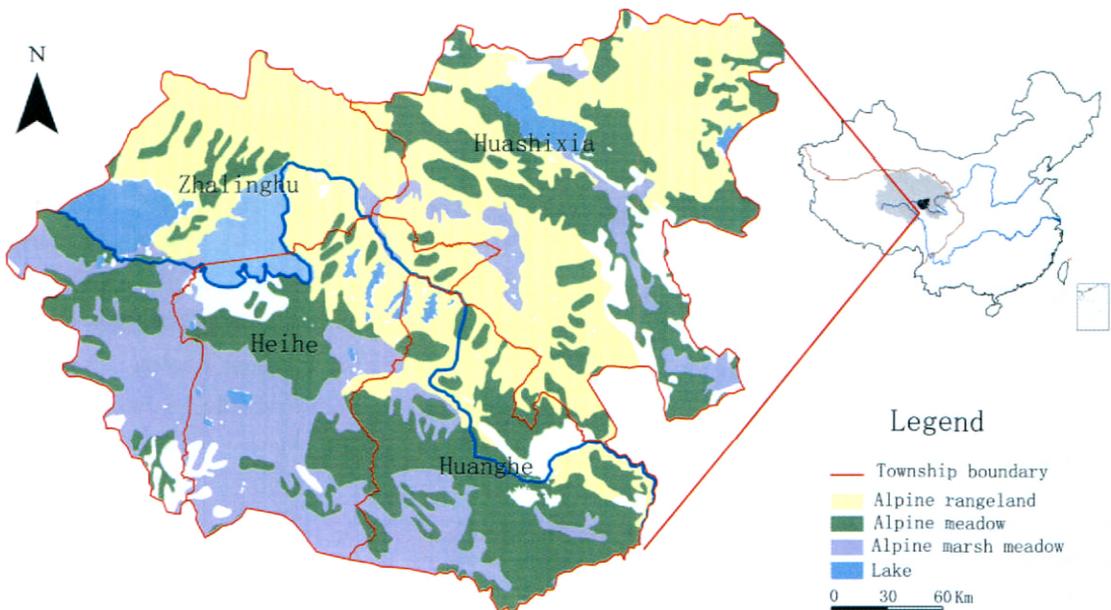


Fig.1 Township and Location of Study Area  
图 1 研究区在全国位置及其乡镇分布示意图

### 3 Data and Research Methods

Time series of images used to interpret rangeland degradation are: late 1970s, including 3 MSS images; early 1990s, including 3 scenes of TM; 2004, including 3 scenes of TM. All the images are time phase at late July or middle August that grass species are nearly at growth peak. 1 10,000 season pasture data was gotten from Maduo Grassland Station.

The classification system of degradation gotten degraded information from images was made by Liu Jiyuan(2008)<sup>[18]</sup>. Referring to State Standards of Natural Rangeland Degradation for degraded, desertified and saline types (GB19377- 2003), our classification includes 5 classes of first grade: broken steppe that is defined as more bare land than before, vegetation cover degraded steppe, compound class that is defined as both characteristics of broken and vegetation cover degraded steppe, drier alpine marsh meadow, sandy/saline steppe. Those first 5 classes were divided into 21 second grade sub- classes. In this research, we integrate those classes into 3 classes: slightly de-

graded, moderately degraded and seriously degraded rangeland. Interpretation signs were built according to field survey in summer of 2006. Then we used human-computer interview method to extract two time period information of steppe degradation from those images. The interpretation results were validated against extensive field survey and household investigation which covered 30% area of Maduo County in 2007 and its accuracy was over 90%.

Data of household responses to eco-immigration projects was gotten by Participant Rural Appraisal. For non-immigrant families, the interview survey was only done in the area that automobile can reach. After one and a half month survey in recent two years, data of 36 herd families were gotten, about 5% of total non-immigrant families. For the immigrant family, one was surveyed in every 4 household as their code number. Totally, 101 households were investigated, about 31.6% of immigrant families. Besides herd family and production team basic information, the following questions were also asked (Tab.1).

Tab.1 Questions of PRA herd family interview survey

表 1 PRA 半结构式牧户访谈问题

For immigrant families	For non-immigrant families
How old are you now?	How old are you now?
Why would you like to immigrate?	What's the reason that you don't immigrate?
How many livestock do you have before immigration?	How many livestock do you have now?
How to deal with those livestock after immigration?	Was the fodder production of your family pasture enough for your livestock before 2003?
Your family pasture was shared with others or used by yourself?	How to handle if it was not enough to feed your livestock?
What's the relationship if shared?	Is the fodder production of your family pasture enough for your livestock now?
Were there rangeland certificates for each sharing family if shared?	Are there immigrant families in your production team?
How many families have immigrated if shared? How many families haven't immigrated?	How many families that the host age is above 50 in your production team if immigration exists?
How many families have immigrated if shared? How many families haven't immigrated?	How many families that the host age is between 35-49 among immigrated families in your production team if immigration exists?
How many families have immigrated among the shared families in your family rangeland?	How many families that the host age is below 35 among immigrated families in your production team if immigration exists?
How many families haven't immigrated ?	

## 4 Results and Analysis

### 4.1 Rangeland Degradation

By comprising two time period degradation data, we know that extensive degradation has taken place in this county. The percentage of degradation for the whole rangeland was over 43% in both periods. From the point of temporal trend, the ratio of degraded

rangeland speed tended to increase. For the first time period, the degraded rangeland was 896 thousand ha (Tha), 43.2% of total rangeland. And degraded area reached 1 million ha, increased by 18 Tha, 9% of total rangeland area in the second period.

### 4.2 Eco-immigration policy and objectives

Degraded rangeland was caused by overgrazing and

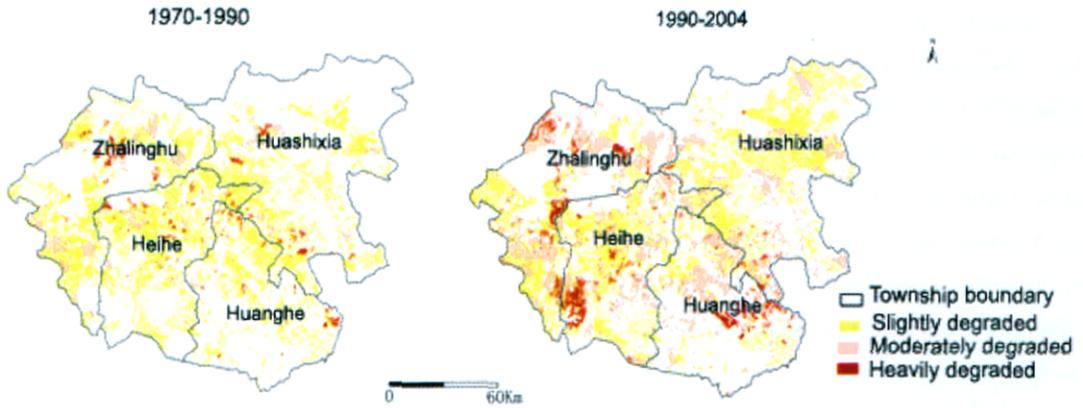


Fig.2 Spatial pattern of degraded rangeland in Maduo County, Qinghai Province\*(After J.Y.Liu, et al.)

图 2 青海省玛多县两期草地退化空间分布(据刘纪远等)

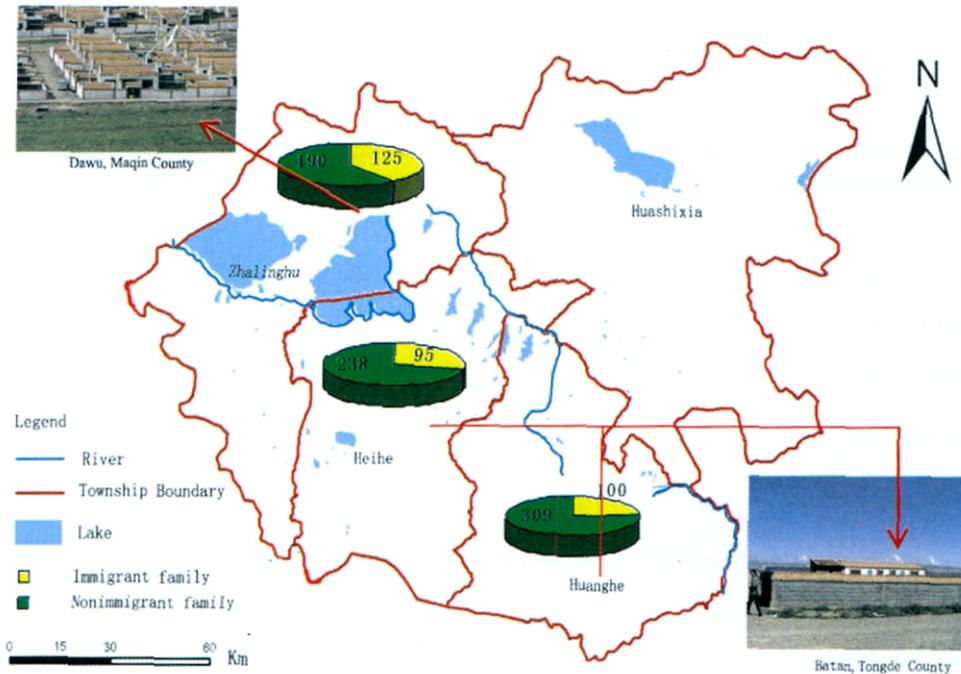


Fig.3 General information of immigrant and non-immigrant families in Maduo County, Qinghai Province

图 3 青海省玛多县移民和非移民情况示意图

\* LIU J.Y., et al. Integrated assessment reports of ecological system at the Head Region of Yellow, Yangtz and Lancang Rivers, Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, 2007.

climate changes (Wan qi Bai (2002)<sup>[19]</sup>, Huakun Zhou (2003)<sup>[20]</sup>). In order to alleviate rangeland degradation and protect the source region of Yellow River, Qinghai Province governments set up two reserves that one was around Zhaling and Eling lakes and another was Yueguzonglie in 2003. Then eco-immigration was initiated within reserve area in 2004. The government of Maduo County planed to move out all the herds that live in the Zhalinghu Township according to Eco-protection and Construction Planning of Sanjiangyuan Natural Reserve of Qinghai Province (Fig. 3). The immigration was completely voluntary and local government provided help to immigrate. The government provided houses and RMB 8000 yuan as immigration compensation for each immigrant family. The compensation will last 10 years. The moved-in place is in Dawu Twonship, where the Gueluo state government is located. During the 10 year period, herd family still owned their family pasture and grazing was prohibited. So, government leaders and staffs from county, township and production team introduced rangeland degradation knowledge and immi-

gration policy tent by tent. As a result, only 125 families agreed to immigrate and the rest of them refused to move out. After a careful research, the Maduo local government extended immigration area to the other two townships: Heihe and Huanghe. The move-in place is in Batan, a place that is 10 km near to the County Town of Tongde. Until now, 189 herd families decided to move out and 535 families refused to immigrate after local governments persuading house by house. For non-immigration families, local governments limited their livestock number and prohibited overgrazing. Governments supplied 10000 to build an enclosure and 3000 RMB yuan for each family.

#### 4.3 Responses of herd family to Eco-immigration police

##### (i) Herd family with different livestock number

According to our investigation, the percentage of herd family without livestock and with little number of livestock was higher in the immigrated families than before immigration (Tab. 2). The percentage of herd families without livestock and little number a-

Tab.2 Household information of immigration with different livestock

表 2 不同牲畜量的牧户移民情况

Type	Heihe	Huanghe	Zhalinghu	Total	Percentage (%)
Household without livestock	17	12	9	38	37.6
Household with few livestock	8	11	13	32	31.7
Household with many livestock	7	8	16	31	30.7
Total	32	31	38	101	

Notice: Household with few livestock refers to the family with livestock below 20 sheep unit per person, household with many livestock refers to the family with livestock above 20 sheep unit per person.

mong county total family was 21.9% before immigration in 2002. But in the investigated herd families, the percentage of herd family without livestock was 37.6%, family with few livestock 31.7%. The total percentage of them in the investigated family was 68.3%. And the percentage of herd family with more livestock was only 30.7%. This situation is closely related with herdsman tradition.

Therefore, we also analyze herd family tradition

and customs. Tibetan livelihood depends on the livestock. For instance, their clothes, food, tent, fuel and so on, come from livestock. The herd family without livestock or with little livestock hadn't enough livestock to satisfy their living. At the same time, they had no other techniques to make living and only can depend on government's supplies. If they choose to immigrate, they will get immigration compensation at least for 10 years. Therefore, 100% of them decided

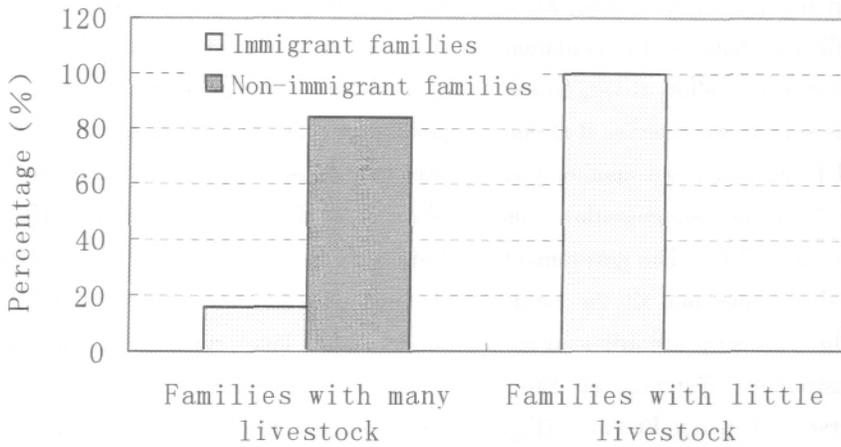


Fig.4 Percentage of Immigrant and non-immigrant families in families with many livestock and little livestock

图 4 少畜户和多畜户中移民和不移民比较

to move out (Fig.4). For the herd family with more livestock, their life level is relatively higher and sustainable. If they immigrate, their family can only get 8000 RMB yuan each year. This living compensation only equals to the prices of 2 or 3 yaks and makes their life at a relatively low level. What's more, the compensation only lasts for 10 years. Ten years later, there is no guarantee for their living. However, if they choose to stay in their family pasture, they can get new born livestock every year and can freely use immigrate family pasture to increase their livestock. So their lives will become better. After a careful comparison between immigration and stay, 83.9% of herd family with more livestock was unwilling to move out.

Therefore, the immigration trends of herd family with different livestock will result in an increasing grazing intensity and make degradation heavier.

(ii) Hosts of herd family at different ages

According to our investigation, the immigration trends varied with family host ages (Fig.5). The percentage of family with host ages above 50 was 32.9% at Maduo County before immigration in 2002. But for the investigated immigrate families, the percentage of herd family with host age above 50 was 48.5%. This showed that herd families with old hosts was at higher ratio. This trend was closely related with grazing activities. The elevation of Maduo County is above 4100 m, annual mean temperature - 4 , month mean tem-

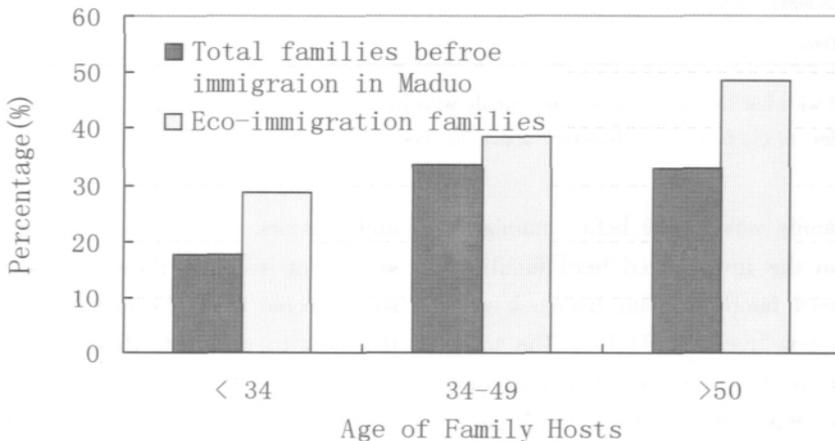


Fig.5 Percentage of Family Host in Immigrant Families and Maduo County, Qinghai Province

图 5 青海省玛多县移民户户主年龄情况

perature in January -16.8 , -26.6 in 1978, daily lowest temperature was -48.1 . The days of precipitation are about 120 each year. The male adults of each family must graze livestock every day no matter what the whether is. The shepherd has to move with their livestock group according to season changes. But the shepherd has only some food and Tibetan robes to resist the hard whether. So, many of them lose their ability of grazing due to arthritis when they are over 50.

Due to the character of nomadism, it is very hard to use machine in Qinghai-Tibetan Plateau. Every day, the female adults of each family must pick up cow dung, grind naked barley, made Tibetan butter and so on. When getting old, they are unable to work, either. Therefore, the men and women over 50

years old, distribute their livestock to their children. And their children support their living. The old man and women take care of their grandchildren. The move-in place lies in or near the county government location and is convenient for children to go to school. Besides the governments provide compensation each year for immigrate. Therefore, 43.4% family with host age above 50 was willing to immigrate (Fig.6).

As Fig.5 shows, the percentage of immigrating family with host age below 50 was relatively lower in the total immigrating family than before immigration. The percentage of family with host ages between 34 and 49 was 38.6% in 2002 before immigration. However, the percentage of them in our investigated data was 33.7%. For the family with host age below 35,

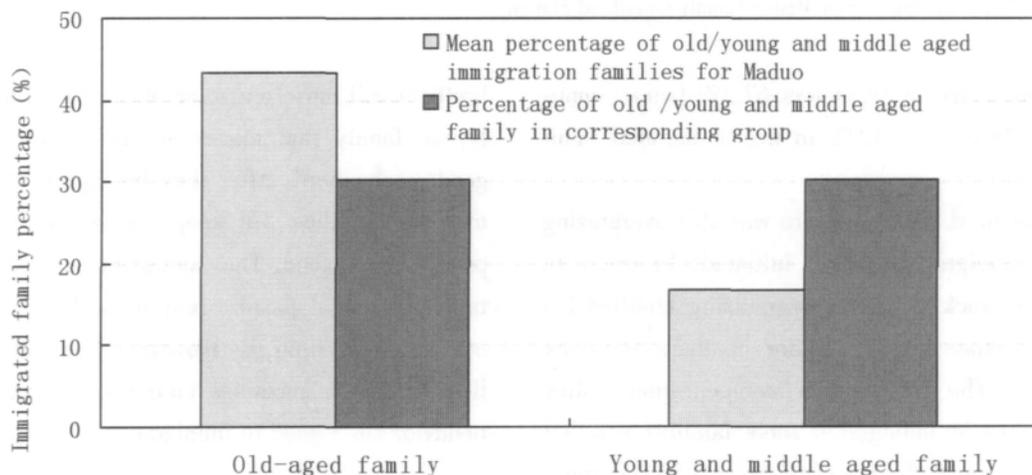


Fig.6 The percentage of immigrant family host ages in their corresponding groups

图 6 各年龄段牧户在移民前相应群体中比重

the percentage was 28.6% before immigration in 2002 and 17.8% in our investigated immigrating family. Those families normally have children in school and this would cost lots of money. Besides, they also need to support their parent lives. Although they wanted to immigrate, the immigration compensation isn't enough to support those things. So, the percentage of them was 16.7% in the immigrating families (Fig.6).

### (iii) Family pasture certificate

The grassland law was executive at Maduo County in 1994. This law regulates that: the new formed

family after 1994 can't get their own family pastures from the production team; they only can share with their parents or brothers. With the population increase, many families began to share a common family pasture and certificate. This resulted in the different trends of immigration between one family with one certificate of family pasture(OCO) and many families sharing one certificate of family pasture(OCM). According to Table 3-4, the percentage of OCM was 32.7% before immigration in 2002 and 45.5% in the immigrated families according to our investigated da-

Tab.3 Data of immigrant families with different situations of certificates

表 3 一证多户中部分迁移牧户和一证一户移民户调查情况

Township	Total number of investigated household	Partially Immigrant families with one certificate on many families		Immigrant families with one certificate on one family	
		Household	Percentage(%)	Household	Percentage(%)
Heihe	32	22	68.8	10	31.3
Huanghe	31	16	51.6	15	48.4
Zhalinghu	38	8	21.1	30	78.9
Total	101	46	45.5	55	54.5

Tab.4 Data of certificate and households in 2002

表 4 玛多县 2001 年草原证和户数情况

Township	Total households	One household with one certificate	Percentage (%)	Household without certificate	
				Household	Percentage
Heihe	333	210	63.1	123	36.9
Huanghe	409	259	63.3	150	36.7
Zhalinghu	315	242	76.8	73	23.2
Total	1057	711	67.3	346	32.7

Notice: this data comes from Maduo County Grassland Station

ta. The percentage of OCO was 67.3% before immigration in 2002 and 54.5% in the immigrated families.

60% of herd family pasture was still overgrazing when the immigration policy initiated. In order to maintain livestock numbers, overgrazing families began to rent other family pasture or their livestock would die. The immigration compensation policy made some OCM immigrated some families and left others to maximize their profits. So, 45.5% of immigrant families are OCM (Table3). Tibetan has a tradition of helping each other among their relatives and family members. During the season of new livestock born, several families would form a union to emasculate male lambs or calves house by house. In August, the union works again to cut wool or cow hair in the same manner. Each family will provide food for the union members by killing sheep or yak. When the festival comes, they will also send gifts each other. Especially when some families are in difficulty, other relatives will give them a hand. The immigration policy regulates that the compensation is distributed by the basic unit of family. So, families that share the certificate of family pasture with their parents or

brothers will move out some of their families. Normally, the family that moves out is the one that isn't good at shepherd. After they immigrate, the non-immigrated families still keep immigrant livestock and provide them food. The immigrants can also go back to their original pasture helping with cutting wool or cow hair and so on. By moving out part of such families, herdsman maximize their profit. Therefore, such behavior isn't good to immigration objectives.

## 5 Conclusion

Source regions of Yellow River in the east part of Qinghai Tibetan Plateau, degraded seriously by the climate changes and human activities. The research about rangeland degradation, driving factors and herd family responses to eco-immigration could provide valuable advices for ecology recovery. According our analysis, the following results was formed:

(1) The rangeland had degraded extensively in recent 28 years, the percentage of degraded area in all rangeland was over 43% and degradation showed an increasing trend.

(2) The immigrant family was mainly composed by the old aged, little or no livestock family, the percentage was 48.5% and 68.3 separately, due to the profit difference between the eco-immigration and social-economic situations of herd family.

(3) The percentage of immigrant households that shared one rangeland certificate with parents or brothers in the immigrant family was higher than with one rangeland certificate with one family.

Therefore, it is hard to greatly decrease the overgrazing degree through eco-immigration with those previous characteristics of eco-immigrant family structure.

## Acknowledge

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## 黄河源区应对草地退化的生态移民政策以及牧户响应分析 ——基于玛多县的牧户调查

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**摘 要:** 在全球气候变化和人类干扰的综合作用下,中国草地出现大范围的退化,退化的草地造成了严重的生态问题。玛多县位于青海省三江源区的黄河源区,草地也出现了严重退化,因此,青海省政府于2004年在该地区实行了生态移民政策。为了分析牧户对生态移民的响应差异,作者从牧户角度,通过牧户调查,遥感数据、自然要素和社会经济要素综合分析,研究生态移民政策和牧户的响应情况及原因,对以后的人地和谐共处具有借鉴作用。本文利用近25年的三期MSS和TM影像、两年的PRA牧户访谈共144户的资料,通过综合分析,得出以下结果:(1)草地退化主要是由气候干暖化和草地载畜超载造成的。(2)移民政策和牧户社会经济情况的对比利益差异,导致移出的牧户以老年牧户、无畜/少畜户为主,牲畜多的、中青年牧户普遍不愿移民。而且,移民户中,一证多户中的部分户移民占有所有移民户54.5%。移民牧户结构的上述特征导致通过移民实现草地载畜量明显减少的目标不易实现。

**关 键 词:** 草地退化; 放牧压力; 生态移民; 牧户响应