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# The ecological and social effects of eco-environmental policies on grassland rehabilitation in China

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**Abstract.** Grassland degradation and desertification in China have challenged the sustainability of these invaluable natural resources. Since the beginning of 21st century, the Chinese government has set a lot of eco-environmental policies and programs to deal with these problems. To illustrate the effectiveness of these policies and programs in ecological and socio-economic dimensions, a quantitative assessment was conducted through collecting and analyzing the up-to-date information and data in this study. The results indicate that the ecological restoration projects facilitated by the grassland eco-environment policies and programs such as “Returning to Grassland by Excluding Grazing (RGEG)”, “Beijing-Tianjin Sand Source Control Engineering (BTSSCE)” and “Comprehensive Management of Karst Areas in Southwestern China (CMKASC)” have greatly improved the grassland eco-environment and promoted the local livelihood at the same time. These policies and programs should be sustained for further improvement of grassland eco-environments in China. There is the call for more fully integrated and more relevant studies to provide effective guidance to rationalize the sustainable grassland management strategies in China.

**Keywords:** Grassland policies, restoration projects, environment protection, local livelihood.

## Introduction

With a total area of 400 million ha, grasslands of 18 types cover around 41% of the China's total lands, representing the nation's largest terrestrial ecosystem and important territorial resource (Han *et al.*, 2008). Located mostly in the extreme climatic conditions with highly unpredictable environments in Northern and Western China, grasslands are often the most marginalized and inaccessible landscapes, yet they support an array of primary producers and consumers, especially herbivores. In addition, they directly provide livelihood and lifestyle to millions of people and are indirectly linked to the bureaucracy and service industries. However, grassland degradation and desertification in northern and western China are increasingly presenting serious economic, social and environmental problems (Wang and Han 2005; Lu *et al.* 2005; Han *et al.* 2008). The environmental problems of grassland degradation and desertification have severely affected not only the lives of local residents, who depend primarily on grassland resources for their livelihood and spiritual needs, but also the ecological security of the whole country (Dong *et al.* 2007).

Since the beginning of 21st century, the Chinese government has established many eco-environmental policies and programs to deal with grassland degradation and desertification. These policies and programs have primarily facilitated the ecological compensation as the important means of providing economic compensation to ecologically fragile grassland areas so as to change land use practice and make local socio-economic development sustainable (Han *et al.* 2011). After more than a decade of implementing these policies and programs, their impacts on

grassland sustainability have been increasingly assessed by both policy-makers and third parties. Although some professionals have concluded, solely through qualitative studies or perceptive observation, that these policies and programs are of vital significance in enacting sustainable grassland management in either biophysical or human dimension (Huang and Wang 2004; Bao 2006; Dong *et al.* 2007; Zhang and Liu 2010; Liu *et al.* 2010; Jia 2011), few have documented the quantitative analysis of environmental and the socio-economic implications of these programs. Therefore, up-to-date and quantitative information was collected from different sources in this study to illustrate the effectiveness of these policies and programs in the decade of implementation and to forward recommendations to overcome the policies' and programs' weakness and promote their strength in the long run.

## Data collection and processing

Statistical data were collected by searching through the public yearbook, census and government bulletins distributed by various departments including Ministry of Agriculture of the People's Republic of China (PRC), State Forestry Administration of the PRC, National Bureau of Statistics of the PRC, Ministry of Civil Affairs of the PRC, National Development and Reform Commission of the PRC as well as the provincial offices of corresponding departments in the Western and Northern China. Moreover, the literature, reports and documents related to this study are reviewed as the references to cross check the primary information and data we obtained and collected. The descriptive analysis and systematic techniques proposed by the previous researchers were applied for data and information processing.

**Table 1. Policies and programs for sustainable grassland management in China.**

Item	Date of Passing/Revision	Date of Performing
<b>Policies</b>		
Grassland Law	Jun 1985/Dec 2002	Oct 1985/Mar 2003
Management Measures for controlling the <i>Liquorice</i> and <i>Ephedra</i> collection	Sep 2001	Sep 2001
Regulations on Returning to Grassland by Excluding Grazing	Dec 2002	Jan 2003
Management Measures on Grassland and Livestock Balance	Jan 2005	Mar 2005
Notice of the State Council on Proscribing Picking and Selling <i>Nostoc Flageuiforme</i> as well as <i>Liquorice</i> root and <i>Ephedra</i>	Aug 2000	Aug 2000
Notice of the State Council on practicing Policy Measures of Development in West Region	Oct 2000	Oct 2000
Opinion of the State Council on Constructing and Protecting Grassland	Sep 2002	Sep 2002
Decision of the State Council on Combating Desertification	Sep 2005	Sep 2005
<b>Programs</b>		
Program of returning Farmland to Forestland and Grassland	Sep 1999	Sep 1999
National Ecological Environment Protection Outline	Nov 2000	Nov 2000
Program of Returning to Grassland by Excluding Grazing (also called Program of Retiring livestock, Restoring Grassland)	Jun 2001	Jun 2001

## Results and analysis

### *Policies and Programs for Sustainable Grassland Management*

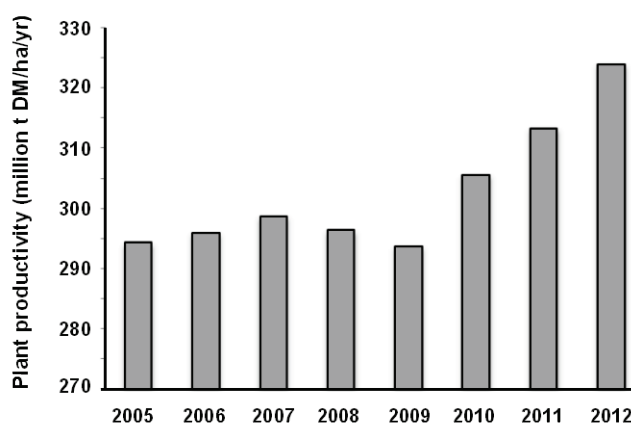
In the past decade, the Chinese government has launched a lot of grassland policies targeted at protecting, constructing and rationally utilizing grassland resources, ameliorating grassland eco-environment, maintaining the biological diversity, developing modern animal husbandry, and promoting the coordination development of economical society in pastoral areas. The Grassland Law issued by the Standing Committee of National People's Congress (SCNPC) of the PRC in 1985 and revised in 2002 provided an overarching, though somewhat ambiguous, legal and regulatory framework for rangeland management nationwide. Subsequent regulations, measures, and programs issued by the PRC's State Council (SC) or Ministry of Agriculture (MOA) have since provided more specific guidelines (Table 1).

Along with the policy implementations, the central government invested large amounts of funding to facilitate the projects for protecting the grassland ecosystems in China. The most influential ones are "Returning to Grassland by Excluding Grazing (RGEG)", "Beijing-Tianjin Sand Source Control Engineering (BTSSCE)" and "Comprehensive Management of Karst Areas in Southwestern China (CMKASC)". In the RGEG, the central government has allocated around 17.6 billion Yuan RMB (\$US2.7 billion) in eight major grassland regions since 2003 to mitigate the grassland degradation in major pastoral regions in China through fencing around 60.6 million ha of grassland and reseeding about 15.3 million ha of degraded grasslands. In the BTSSCE, the central government has allocated about 4.7 billion Yuan RMB (\$US0.73 billion) in the provinces of Shanxi, Hebei, Beijing and mid-eastern Inner Mongolia since 2000 to combat the desertification of grasslands in Northern China through reseeding and fencing about 3.9 million ha of desertified grasslands, building 5.97 million m<sup>2</sup> of livestock sheds and subsidizing the purchase of 79 000 units of forage processing equipment. In the CMKASC, the central government has allocated around 0.23 billion Yuan RMB (~\$US34.5 million) in Guizhou and Yunnan Provinces to

combat the rocky desertification in Karst areas of China since 2006. In addition, local governments, in collaboration with local communities have also launched many ecological projects for protecting and improving the grassland ecosystem.

### *Ecological effects of grassland eco-policies*

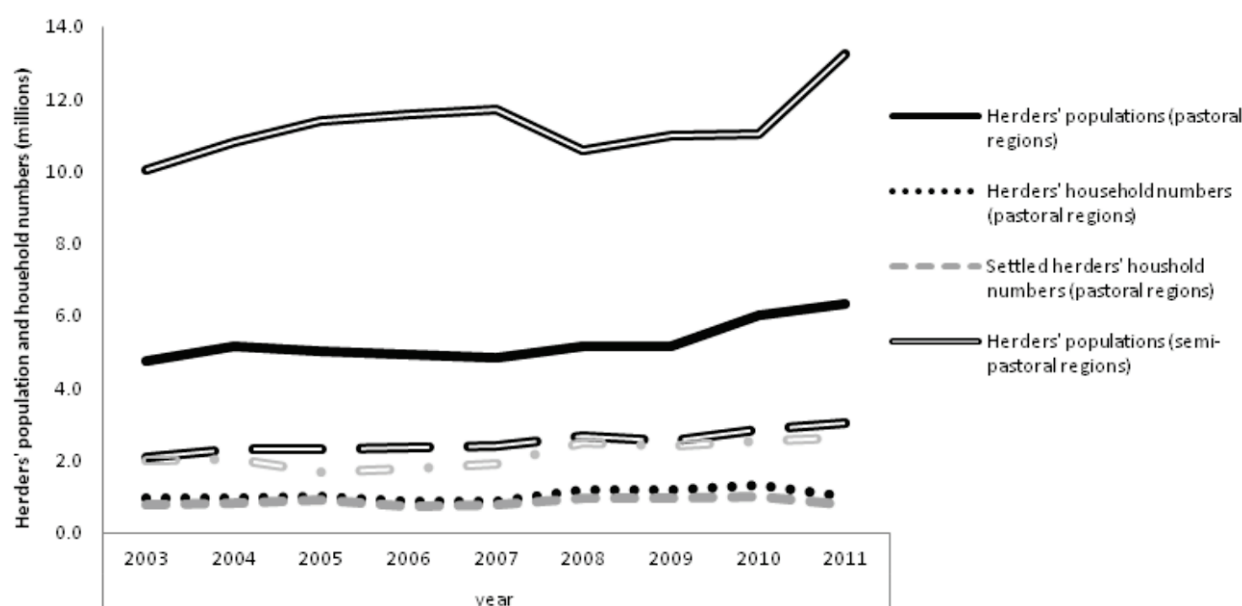
The monitoring data shows that the total grass production in China has been raised with the implementation of the eco-policies, especially in the past three years (Fig. 1). The primary production of the grasslands increased from about 295 million tons of dry matter in 2005 to 325 million tons of dry matter in 2012. The experimental results from pilot projects indicate that the plant height, coverage and aboveground biomass of major grassland communities in Northern and Western China have been greatly enhanced by the fencing and reseeding the grasslands with the implementations of Grazing Ban and Grassland Fallow projects which are associated with RGEG policy (Table 2). As a consequence of grassland community improvements, the ecological services of grasslands such as biodiversity protection, carbon sequestration, nutrients cycling, water regulation, erosion control all have been promoted in the long run.



**Figure 1. Annual plant productivity of Chinese grassland from 2005 to 2012.**

**Table 2. Changes of grassland's plant cover, height and production in pilot project sites between 2005 and 2012.**

Provinces	Counties	Increment of grassland vegetation cover (%)		Increment of grassland plant height (%)		Increment of grassland plant production (%)	
		Grazing ban	Grassland fallow	Grazing ban	Grassland fallow	Grazing ban	Grassland fallow
Xinjiang	Fuyong	3	2	12.5	18.1	11.5	20.8
	Wenquan	10	8	24.2	20.1	35.7	25.8
	Nileke	11	8	25.1	21.4	46.5	23.6
Gansu	Xiahe	3	3	17.2	24.1	9.6	4.5
	Maqu	6	4	9.5	29.1	10.5	9.9
	Tianzhu	6	3	33.7	25.6	15.8	8.6
Sichuan	Aba	16	14	27.7	35.1	7.5	14.9
	Ruoergai	10	10	46.9	26.8	6.2	6.9
	Hongyuan	9	9	28.2	17.8	9.8	10.0
	Rangtang	10	8	39.4	37.9	3.5	4.8
Yunnan	Deqin	12	2	48.7	7.7	32.3	3.8
	Shangri-la	9	7	60.6	31.3	22.9	19.7

**Figure 2. Dynamics of herders' population and households numbers since the implementation of grassland eco-policies in China.**

### *Socio-economic effects of grassland eco-policies*

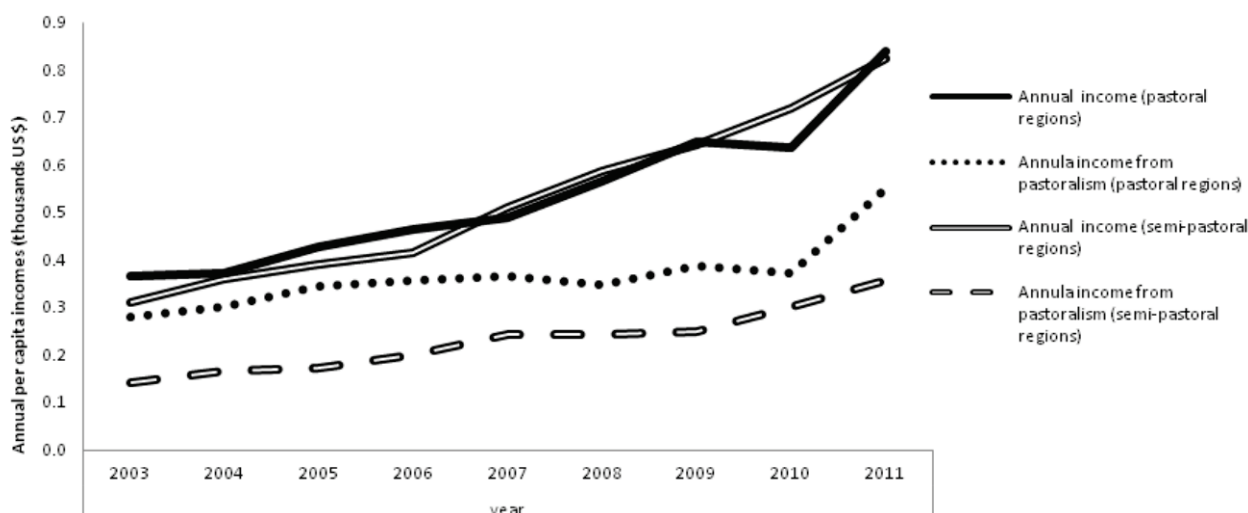
The statistical data show that from 2003 to 2011, when the eco-policies have been extensively implemented, the herders' population in both pastoral and semi-pastoral regions of China increased gradually from 2003 to 2011 (Fig. 2). The numbers of households involved in pastoral production systems increased slightly. Meanwhile, the numbers of settled herding households increased slightly. These facts imply that the pastoral production systems have been well sustained with the implementation of eco-policies in the pastoral and semi-pastoral regions of China.

The statistical data also show that the herders' total income and income from the pastoralism increased dramatically with the implementation of grassland eco-policies in both pastoral and semi-pastoral regions of China (Fig. 3). Obviously, increment of herders' annual income from pastoralism contributed a prominent proportion to the total increment of herder's annual income. Additionally, increased subsidies from grassland eco-policies and poverty alleviation programs may lead to the increment of herders' annual income. All in all, grassland eco-policies can

improve the local livelihoods through promoting pastoral production and other income sources.

### **Discussion**

As the important means of providing economic compensation to change land use practice in the fragile areas and promote local socio-economic development in a sustainable way, ecological compensation has received more and more attention in China in recent years (Bennett, 2009). The idea of eco-compensation was derived from the concept of payment for ecosystem services, which was defined as a type of voluntary transaction of well-defined ecosystem service trading between provider and buyer (Wunder 2007). Globally, many scholars have been promoting the concept of payments for ecosystem services (PES) as an innovative approach of using economic incentives to address the loss of valuable ecosystem services (Bulte *et al.* 2008; Wunder *et al.* 2008). These scholars have attempted to characterize PES programs in terms of their design, financing, environmental effectiveness, community participation, and livelihood



**Figure 3. Dynamics of annual per capita incomes in pastoral and semi-pastoral regions since implementation of eco-policies in China.**

outcomes, including effects on poverty alleviation and income distribution (Yi and Zhao 2012). In addition, some scholars have partially listed that the largest category of all the PES projects is generally the ecosystem restoration programs (ERP) in terms of financial investment and spatial coverage (Wunder *et al.* 2008). The Chinese governments have adopted this concept to facilitate the ecological restoration programs by providing the economic compensations from the governments (ecological services buyer) to local people (ecological services provider) to change the land use practices and promote the socio-economic development in grasslands areas.

Both ERP and PES, as stated by Yin and Zhao (2012), should be part of the integrated process of sustainable ecosystem management, and should use the coupled social-ecological system approach. However, in the realm of ecosystem management or ecological restoration, restoration ecologists have generally focused on issues of the biophysical side, socioeconomic scholars have concentrated on problems of the human dimension (Yin and Zhao 2012). In this study, we assessed the effects of grassland eco-environment policies and programs through quantitatively analyzing the long-term monitoring data in both ecological and socio-economic dimensions. Our results indicated that the ecological restoration projects facilitated by the grassland eco-environment policies and programs such as “Returning to Grassland by Excluding Grazing”, “Balancing Grassland and Livestock”, “Beijing-Tianjin Sand Source Control Engineering” and “Comprehensive Management of Karst Areas in Southwestern China” have greatly improved the grassland eco-environment and promoted the local livelihood at the same time. In this sense, these policies and programs should be sustained for further improvement of grassland eco-environments in China. However, the flexibility of eco-compensation mechanism should be further examined, as the competitive selection processes (such as auctions) would improve the cost effectiveness of the programs (Uchida *et al.* 2005; Yin and Yin 2010). Therefore, there is the call for more fully integrated and more relevant studies to provide effective guidance to ecological restoration and

ecosystem management facilitated by grassland eco-policies in China.

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