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Social-ecological transformations of Inner Mongolia: a sustainability perspective

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Abstract

Introduction: Sustainability requires the reconciling of human needs with the healthy natural ecosystem, which should be achieved within the grand course of industrialization and modernization. Systematic transitions on demography, economy, technology, and institutions are required, while different civilizations may take their respective paths. In this study, we analyze the social-ecological transitions of Inner Mongolia Autonomous Region of China during the past century, focusing on major changes in its environmental, demographic, and socioeconomic conditions.

Results: A two-level social-ecological system analysis framework was proposed, and four stages of transition were identified: traditional nomadism, primitive industrial civilization, collectivization era, and economic reform/open-door policy era. Our analysis showed that Inner Mongolia has made great achievements in its socioeconomic domains but is faced with numerous challenging environmental problems. Overconsumption of resources and failure to curtail ecological degradation may lead to a trap of unsustainability.

Conclusions: However, the slowing-down population growth, improvements of the economic structure, and many new sustainability initiatives and strong support from the central government together give hope for a sustainable future of the region.

Keywords: Sustainability transition, Inner Mongolia, Social-ecological system, Demographic transition, Modernization, Ecological trap

Introduction

Industrialization and associated technological advances have greatly increased the world's population and affluence, significantly altered global ecosystems and landscapes, and brought myriad environmental problems such as resource shortage, biodiversity loss, and climate change (Steffen et al. 2005). For the sustainability of our civilization, human demands must be reconciled with the earth's service supply capacity, necessitating a global sustainability transition (Clark 2001; Kates et al. 2001; National Research Council 1999; Parris and Kates 2003; Raskin et al. 2002; Reid et al. 2010; Schellnhuber et al. 2011; Weinstein et al. 2013). Social-ecological systems are complex adaptive systems with internal feedbacks and nonlinear dynamics, but current policies and norms, based mainly on command and control, often focus on the symptoms rather than underlying causes of unsustainability (Weinstein et al. 2013; Garmestani 2014; Holling and Meffe 1996). To increase the chance of success in sustainable transformations, it is important to examine past evolving trajectories, identify key variables and their interactions, and understand how they result in fundamental structural changes (Chapin et al. 2006; Olsson et al. 2014; Reid et al. 2010; Scheffer and Westley 2007).

From a historical point of view, human civilization is in the grand course of transition from traditional agricultural civilization to industrial and post-industrial civilizations (Boserup 1981; Cumming et al. 2014; Zeder 2008). Ancient civilizations like hunting and gathering or farming rarely ran into problems of environmental disruption, because of their limited technical capability, as well as rules and traditions that they developed to maintain their own resource bases. It is the greatly

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advanced technology and industrial power, combined with the rapidly increasing population and its ever-expanding demands for resources, that has pushed the world onto an unsustainable trajectory. However, the dynamics of complex social-ecological systems are forever irreversible and unpredictable (Holling 1973, 2001; Wu and Wu 2013). For human society to return back to the ancient state is impossible and unreasonable. Sustainability of our civilization needs to be achieved within the modernized world and coexists harmoniously with it (van den Bergh 2011).

Social-ecological transition happens when gradual or abrupt changes of external or/and internal conditions drive the system away from its initial dynamic steady state, during which the system undergoes structural changes until new feedback mechanisms are created to regain its stability (Chappin and Ligtvoet 2014; Holling 1973, 2001; Meadowcroft 2011; Rotmans et al. 2001; Scheffer et al. 2001; van den Bergh et al. 2011). The US National Research Council (NRC) addressed the goal of sustainability transition as "a stabilizing world population meets its needs and reduces hunger and poverty while maintaining the planet's life support systems and living resources" (National Research Council 1999). Towards this end, several fundamental and systemic shifts are required on the global level (Crossman et al. 2013; Gell-Mann 2010; Kates and Parris 2003), including (1) a demographic transition to low population growth rates (Caldwell et al. 2006; Notestein 1983); (2) an economic transition eliminating poverty and hunger and switching to high-level needs that are less harmful to the environment; and (3) technological and institutional transitions which allow the demographic and economic transitions to happen while protecting the environment. Thus, the human-nature relationship would outgrow the hostile stage of "conquering nature" as reflected in the philosophical and political ideologies, through cooperative coevolution and integrated landscape planning and management (Farina 2000; Naveh 2000, 2005). New equilibrium between human well-being and ecosystem integrity at global scale may be achieved, which would provide a solid foundation for sustainability (Wu 2013).

Such a transition will not be a smooth sailing. Cumming et al. (2014) provided a conceptual model of agricultural transitions, showing that the interacting processes of technological change, population growth, and urbanization may over-exploit ecosystems leading to "green" or "red" traps. A "green trap" takes place when positive feedback reinforce rural poverty and ecological degradation, while a "red trap" happens because of overconsumption and failure to maintain the integrity of ecosystems. Between these two poles of green and red traps, a continuum of combinations could be possible (Fig. 1).

Neither the developed world nor the developing world is on a path to the ultimate sustainability. Developed countries have achieved a greater success in the grand sustainability transition, but their overconsumption has contributed significantly to the world's unsustainability, usually through uneven exchanges with developing countries (Hornborg 2014). Promoting the sustainability transition in developing countries—which hold the majority of the world's population—is particularly urgent if we are to achieve global sustainability in decades to come. Studies that examine the historical transition courses in developing countries are helpful for improving our understanding and practice of sustainable development in these regions.

As the world's largest developing country, China is inhibited with roughly 20% of the world's total population, and its development is of great importance to the world's sustainability transition. Inner Mongolia is the largest pastoral area of China and also has high indigenous species diversity in its many unique landscapes (Wu et al. 2015) which has experienced multiple political regime shifts, as well as substantial changes in environmental and socioeconomic conditions during the past century (Jiang et al. 2006; Tong et al. 2004). In this study, we aimed to achieve two main objectives: (1) to examine the historical transitions of Inner Mongolia as a social-ecological system during the past century, with an emphasis on the coevolving relationship between human and nature, and (2) to assess whether Inner Mongolia has been on a path of sustainability transition based on a historical and social-ecological analysis.

Methods

Study area

Inner Mongolia is located in North China, stretching over more than 2000 km from east to west and covering a total area of 1.18 million km^2 (Fig. 2). The high latitude and altitude, as well as its distance from the ocean, result in a temperate continental monsoon dominated climate. With an average annual temperature around −2 to 6 °C, the winter is long and cold, while the summer short and hot. Annual precipitation is 50–450 mm, decreasing from east to west, and concurrently appears with temperature peak, which favors vegetation growth. Evaporation is above 1200 mm in most parts of the region, much higher than precipitation (Shi 1982; Wu et al. 2015).

About 67% of the territory (0.87 million km^2) is covered by natural grasslands (steppes); besides that, there are also 0.19 million km^2 forests and 0.07 million km^2 of cultivated land (Han et al. 2009; Kang et al. 2007; Li 1962, 1979; Wu and Loucks 1992; Wu et al. 2015). However, humus covers only 30–50 cm in most areas under the grassland, while the rest is broadly distributed sand, deficient in organic matter and mineral nutrients (Shi

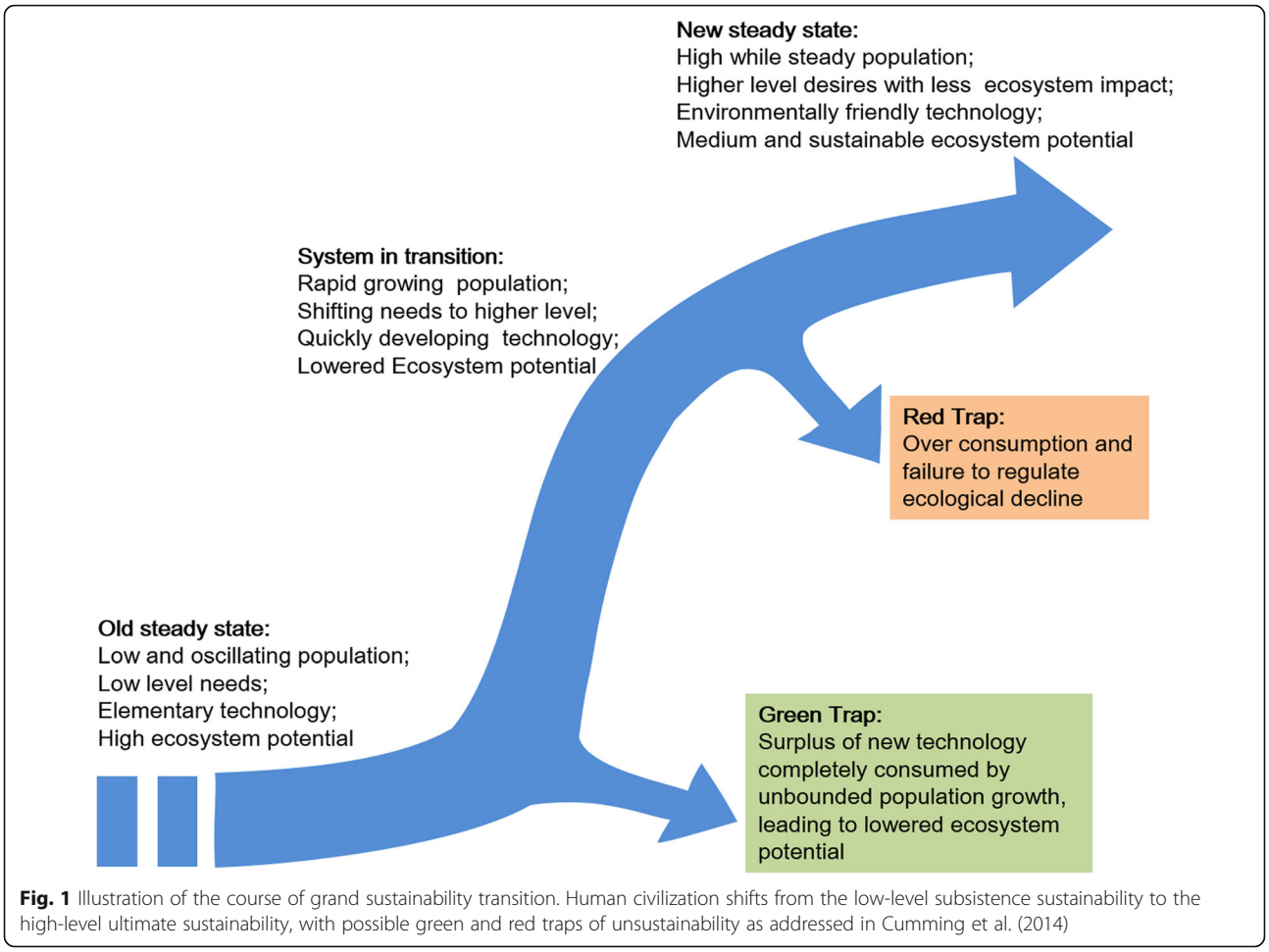

Fig. 1 Illustration of the course of grand sustainability transition. Human civilization shifts from the low-level subsistence sustainability to the high-level ultimate sustainability, with possible green and red traps of unsustainability as addressed in Cumming et al. (2014)

1982). The interdependence between organisms and environment forms a fragile balance, which is easily destroyable but hardly recoverable.

Analytical framework

For describing the evolution of complex social-ecological systems, narrative approaches with theoretical frameworks are usually adopted (Cumming et al. 2014; Grin et al. 2010; Markard and Truffer 2008; Smith et al. 2010). Here, we developed a two-level framework modified from a multi-level perspective (Geels 2002, 2011) to describe the historical transitions of Inner Mongolia, focusing on the interactions between human and nature.

The local natural resources and ecosystems provide services (or disservices) to the society, which were made available (or alleviated) through the production activities of the people. Production activities could be divided into industry, livestock husbandry, farming, etc., which are characterized by land use, engaged population, and produced value. Along with the production activities, population is also reproduced. Up above the production level, there are related institutional arrangements, including property rights and allocation rules/regulations of resources and products, as well as the social consciousness subsystem that reflects the knowledge level and value judgment of stakeholders. Besides that, the regional social system is also strongly influenced by extrinsic factors like immigration, economic/technological innovations, and national policies (Fig. 3).

Results

We describe the historical transformations of Inner Mongolia in two different while complementary steps, i.e., a four-stage narrative of the social-ecological system, followed with an analyzing of three key variables of the Inner Mongolia (ecosystem condition, population, and economy) to provide more thorough understanding of the transition.

Different evolving stages of Inner Mongolia

The division of the four stages is based mainly on the institutional changes of the social system. Within a stage, the main feedback relationships among key variables of Inner Mongolia remained the same or similar, although

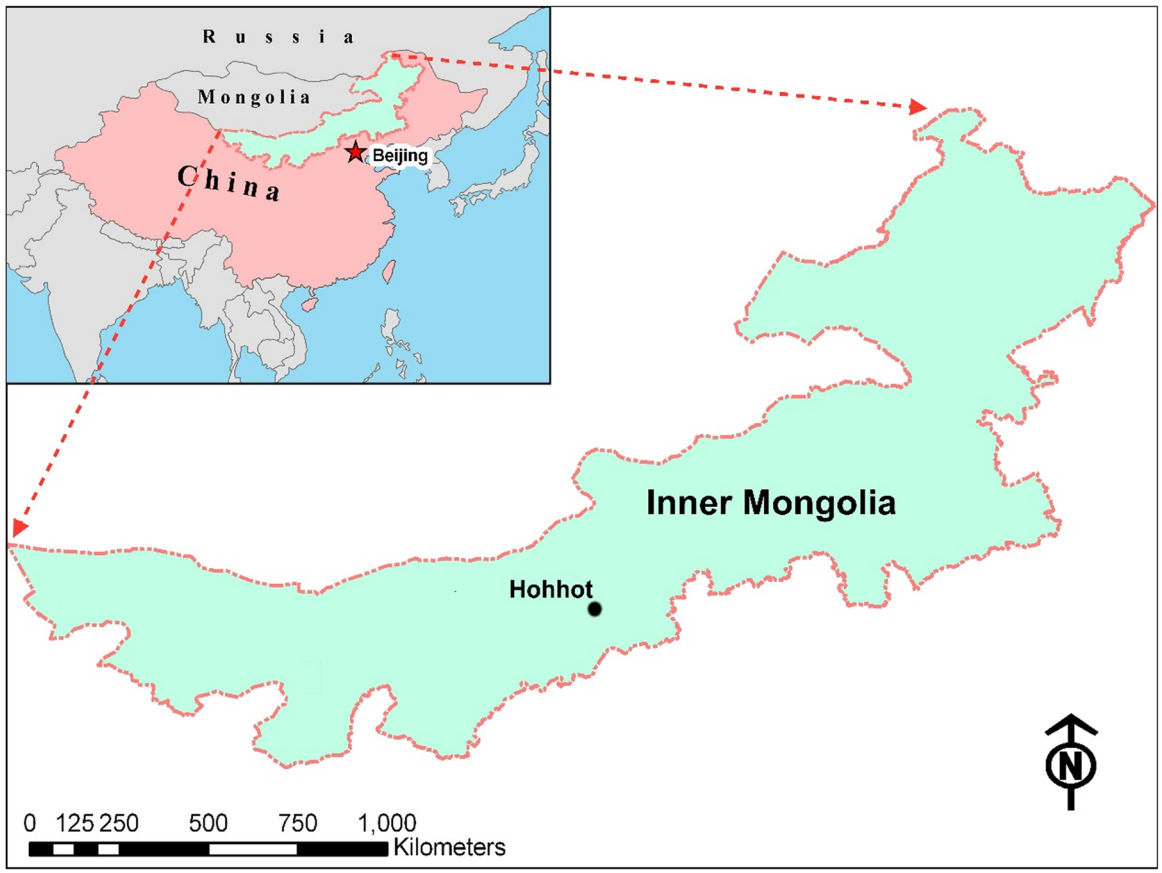

Fig. 2 Location of Inner Mongolia (modified from Wu et al. (2015)

gradual changes of some variables are possible. Between stages, however, qualitative transformation happens (Walker et al. 2004), which usually are the results of within-system processes and external influences from a broader scale (Table 1). A more detailed description of historical landscape dynamics and driving forces of Inner Mongolia is found in Wu et al. 2015.

Traditional nomadism (before the 1900s)

In the vast arid and semiarid regions of the Mongolian Plateau, harsh natural conditions could barely support large-scale farming systems, and a nomadic lifestyle became the choice of history (Bao 2005; Tian and Ma 2008). This land use form made good use of the mobility and feeding habits of herbivores to suit the changing dryland environment, converting the primary productivity of grassland into meat, milk, fur, and other necessities (Wang 2008; Xi 2010). Through moving around broad areas seasonally and annually, livestock had diverse forages, saline and mineral supplements, and a reduced risk of spreading diseases, while grasslands were fertilized relatively evenly with livestock manure (Bao 2015). As a way of human adaption to the natural environment, the nomadic land use reconciled the relationship between people, livestock, forage, and pasture, resulting in a culture that includes its unique production style, social system, and customs, for example, the selection of appropriate breeds, suitable grazing stations and nomadic routes, and social cooperative organizations to resist natural disasters (Liu 2005). In addition, people also created political organizations and paramilitary system (Uretogtohu 2006). Such technological measures and institutional arrangements enhanced adaptability, which maintained the relative stability of the grass-livestock-herder system for over 2000 years (Wang 2006; Wu et al. 2015).

However, the nomadic economy was also fragile (Hu 2002; Lu 2005), and wealth accumulation and population growth were very slow (Jia 2011; Shen 1986). The military advantages of nomadic economy enabled it to partly compensate for its vulnerability through plundering adjacent agricultural societies, which was indeed a main theme of the ancient history of China (Barfield 1989; Lattimore 1988; Tian and Ma 2008).

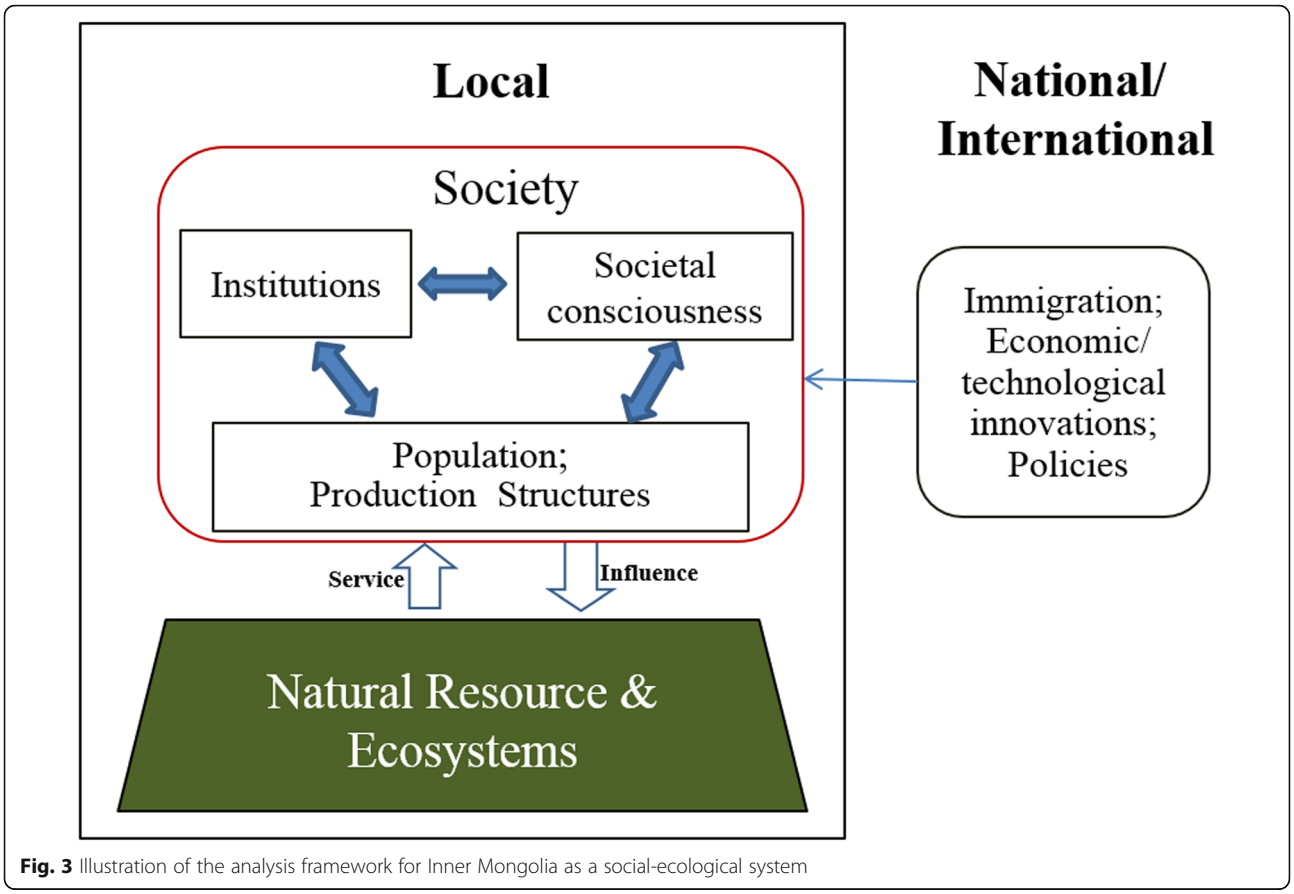

Fig. 3 Illustration of the analysis framework for Inner Mongolia as a social-ecological system

Primitive industrial civilization (1900s–1949)

In the beginning of the twentieth century, when industrial civilization dominated the western world, China was in a chaotic state characterized by repeated invasions and exploitation by imperialist countries, endless military conflicts between warlords, and a lack of governmental control. The long-term dominance of nomadic pastoralism in sInner Mongolia was also challenged by episodic but large-scale grassland-to-farmland conversion events in the last decades of the Qing Dynasty and during the era of the Republic of China (Wu et al. 2015). A key driver for such land

Table 1 Summary of different evolving stages of Inner Mongolia as a social-ecological system and their major characteristics

Major characteristics	Evolving stages			
	Traditional nomadism (before the 1900s)	Primitive industrialization (1900s–1949)	Collectivization (1949–1978)	Economic reform (1978–present)
Natural resource and ecosystems	Natural grasslands	Localized cultivation and land degradation	Large-scale cultivation and increasing land degradation	Serious degradation due to overgrazing, cultivation, mining, etc.
Production structure	Primitive nomadism	Traditional nomadism, with limited sedentary pastoralism and cultivation	Sedentary pastoralism, with increasing cultivation	Privatized sedentary pastoralism, with cultivation, mining, tourism, etc.
Population	Very low and sparsely distributed	Episodic immigration waves	Rapid growth, large-scale immigration	Steadily increasing, with low immigration rate
Institution	Tribes, clans, and feudalistic empires	Tribes, subordination to centralized government	Communes, collectivism	Privatization, property rights, marketization
Social consciousness	Reverence for nature, lamaism (since 16th century)	Lamaism and various other trends of thought	Socialism, conquering nature	Mixture of nature exploitation for profits and nature conservation for sustainability
National/ international influence	War, commercial trading	Immigration, capital	Immigration, technology, land use policy	Land use policy, common markets

conversion was the enormous pressure put on China by imperialist aggressions, which further impacted the pastoral areas of Inner Mongolia (Lattimore 1988). Large areas of natural grasslands were converted to farmland because of governmental policies for reclamation in order to pay for foreign indemnities or because of the lawless behavior of warlords often in the name of feeding their armies to resist imperialist aggressions (Lattimore 1988; Wu et al. 2015). Also, the Japanese imperialist turned vast areas of natural grasslands into farmland and looted a great deal of natural resources from Inner Mongolia to support their military aggressions against China and humanity (An 1995).

Warlords, local landlords, and foreign powers exploited the grasslands and the local herdsmen, devastating the socioeconomic development of the region (Da and Zheng 2010). Meanwhile, massive hungry inland farmers entered the grassland area to seek a new livelihood. Areas with best natural conditions and vegetation were converted into farmland, forming an expanding pastoral-agricultural transitional zone (Yan 2004). Farming in drylands of Inner Mongolia where precipitation is quite limited often led to the loss of soil fertility and consequently land degradation. The traditional nomadic pastoralism could no longer sustain itself under such conditions, and many herders had to settle down. When the People's Republic of China was founded in 1949, the sedentary herders reached 50% of the total pastoral population (Historiography Committee of Inner Mongolia Animal Husbandry Department 2000).

The collectivization era (1949–1978)

The newly established People's Republic of China adopted the socialistic system to achieve industrialization. Livestock herding in Inner Mongolia was incorporated into pastoral communes through the process of collectivization. Individual herdsmen were transferred into members of the people's commune who own the grassland, herds, and other production tools (Da and Zheng 2010). Pastoral and agricultural products were produced at low costs, and a gradual modernization of animal husbandry took place. During this period, there were frequent reciprocal socioeconomic interactions between Inner Mongolia and inland China.

The nomadic mode of production underwent a series of changes, including specialization, sedentarization, and the introduction of new technologies, which improved the productivity of both animal and people. Sedentarization facilitated government service delivery, such as postal services, business services, education, and health care, which greatly improved the resilience of the herding community (Wang 2006). By 1965, traditional nomadism was largely abandoned (Xu 1999). Then, a pastoral system based on seasonal rotational grazing within a production unit was formed (Wang 2006, 2013). Meanwhile, the introduction of machinery like harvesters and wind generators, as well as breeding stations, greatly promoted the efficiency of animal husbandry (Lin and Zheng 1990). The efficiency of livestock raising was high, while its impacts on the environment were relatively low.

As the further expanding of animal husbandry, the grassland began to feel the pressure exerted by the rapidly increasing livestock and human populations. In particular, higher birth rate and lower mortality rate, plus increasing immigration influx, resulted in fast increasing human population (except the period 1960–1962). To feed the nationally growing population, the government expanded cultivated in several grassland areas across Inner Mongolia, substantially altered the structure and function of Inner Mongolia as a social-ecological system (Su et al. 2005; Wu et al. 2015).

Economic reform and open-door policy era (1978–present)

People's communes were disbanded in the early 1980s, together with the centralized government-planned economy. Production materials including herds, farmlands, and grasslands were gradually separated and distributed to households (Wang 2013). With the changes of the property right system, market mechanism was introduced in and gradually took dominance.

The downsizing of grassland livestock husbandry through privatization upsets the traditional way of livestock herding, causing numerous impacts on production structure and the environment. Constrained by the small and fragmented grassland size of individual owners, rotational grazing became less applicable and degradation is more possible (Zhang and Li 2008). The pastoral management system changed fundamentally; herdsmen's consciousness of grassland ownership right was motivated and began to invest on construction, especially fences. Pastoral culture of mutual support within the community began to disintegrate, while market mechanisms began to penetrate into labor force (Da and Zheng 2010). As a side effect, grasslands were divided into pieces and livestock mobility was further lost (Williams et al. 2008).

In 2001, the Chinese central government initiated a national program to promote the economic development in its western regions (the "Western Development Drive"), which encouraged the flows of capital and technology from developed countries as well as China's eastern regions to its resourceful but economically less developed western regions. Industries of coal mining and electricity generation, among others, began to grow

quickly and soon became the main driving force of economic development of Inner Mongolia. However, proper institutions of profit distribution and ecological compensation were not in place timely, resulting in soaring wealth inequality and large-scale land degradation (Da and Yu 2015; Wang 2010).

Rising human and livestock populations, changing pastoral systems and grazing patterns, grassland-to-farmland conversion, and industrial activities together caused considerable damages to the grasslands of Inner Mongolia (Li et al. 2016; Su et al. 2005; Wu et al. 2015). According to the third national survey of grassland resources, about 57% of the total available grassland area in Inner Mongolia suffered moderate or more serious deterioration and desertification, with only 30–70% of natural grassland productivity (Joint Investigation Team of Grassland Ecological Research 2003). A recent study by Li et al. (2016) showed that the ecological footprint of the drylands of northern China increased from 30 million global hectares in 1990 to 170 million global hectares in 2010, with a total deficit of 100 million global hectares. Ecological problems in Inner Mongolia have had impacts on the environmental quality of surrounding regions (e.g., dust storms and reduced carbon sequestration capacities).

In order to restore the degraded grasslands, the Chinese government has enacted laws and regulations to protect the grasslands and curb land-conversion activities since the 1980s (Squires and Yang 2008a; Wu et al. 2015). Since the beginning of the new century, several large-scale national programs have been implemented, with billions of yuan invested by the government to achieve the following goals: (1) balance grassland herbage production and livestock population; (2) regulate grazing activities and restore grazing lands to natural grasslands; and (3) design proper ecological migration strategies (Da and Zheng 2010; Qi et al. 2012; Yin and Yin 2010).

Changes of key environmental and socioeconomic variables

Ecosystem conditions

The ecosystems of Inner Mongolia experienced continuous degradation (Fig. 4). After a series of reclaiming actives, cultivated land increased to 82,000 km^2 in 1996, accounting for 9.4% of the total pastoral area (Bayaer et al. 2005a). Studies based on remote sensing showed a decreasing trend of grassland and water surface, coupled with degradation and desertification, as well as the growth of farmland and urban since 1970s to 2000s (Bayaer et al. 2005b; Shi et al. 2013). However, the deterioration trend slowed down and even reversed in some cases during the recent decades (Chen et al. 2014).

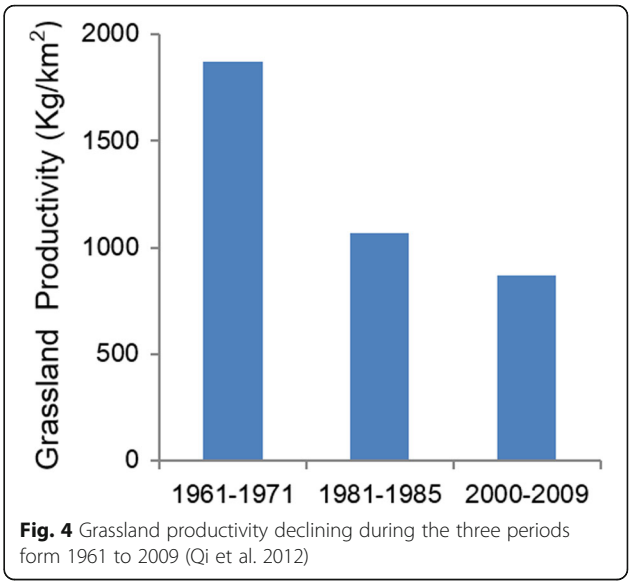

Fig. 4 Grassland productivity declining during the three periods form 1961 to 2009 (Qi et al. 2012)

Population

The total population of Inner Mongolia was 1.75 million in 2 AD, reached 2.15 million in the early nineteenth century, and increased from about six million in 1949 to 18.2 million in 1978 mainly because of immigrants from other places in China (Wu et al. 2015). Since the mid-1970s, the natural population growth rate dropped rapidly and immigration rate also declined, both due largely to the implementation of family planning policy (Wang and Chog 2009) (Fig. 5). Besides, education level greatly elevated (Cui 2014; Su et al. 2002) (Fig. 6), which also shifted societal consciousness from the traditional state of seeking a livelihood to a modern state of seeking a higher living standard and self-development.

Local economy

Economy in Inner Mongolia has developed quickly with tremendous changes in its structure, especially since the reform and open-door policy in the early 1980s. Primary industry has shrunk greatly, while the secondary and

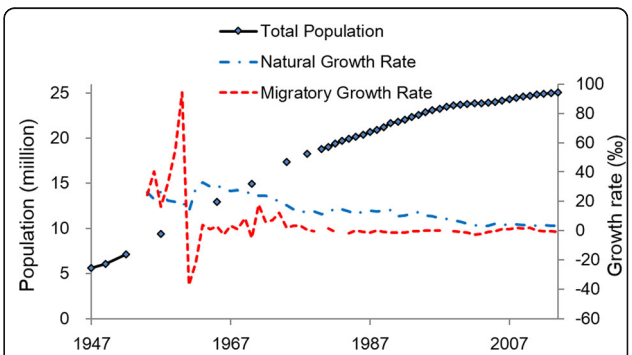

Fig. 5 Historical changes in human population and natural growth and immigration rates in Inner Mongolia. Data source: Inner Mongolia Yearbook (2015)

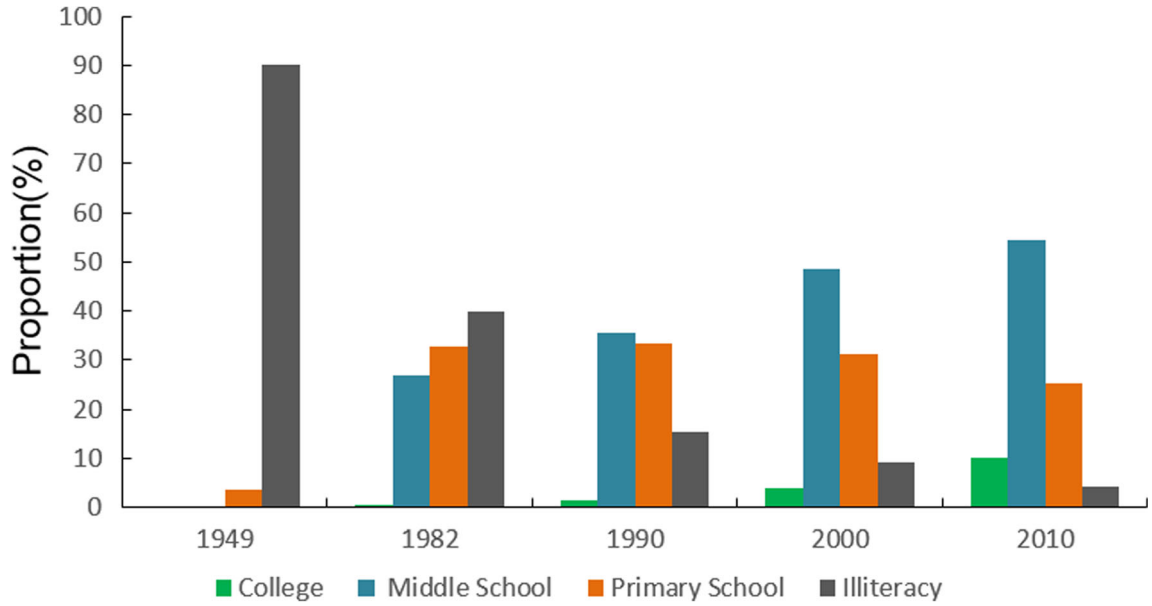

Fig. 6 Education level of Inner Mongolia. Note that the primary school of 1949 means total students at school. Data are obtained from Cui 2014; Su et al. 2002; and Inner Mongolia Yearbook (1991–2015)

tertiary industries have taken an increasingly larger share of the local economy (Chen et al. 2015a, 2015b). The grassland scenery and nomadic culture have also become key resources for tourism enterprises in the recent decades (Figs. 7 and 8).

Discussion

The past century witnessed dramatic socioeconomic and environmental transitions in Inner Mongolia. The traditional nomadic lifestyle, which maintained a fragile balance between the harsh environmental conditions and a vulnerable society, was forced to change when the industrial revolution spread to China. Since 1949, the People's Republic of China has initiated a process of industrialization and modernization. The economic reform and open-door policy in 1978 marked a new era of privatization and marketization in Inner Mongolia, elevating local people's aspirations for an affluent life beyond meeting the basic survival needs.

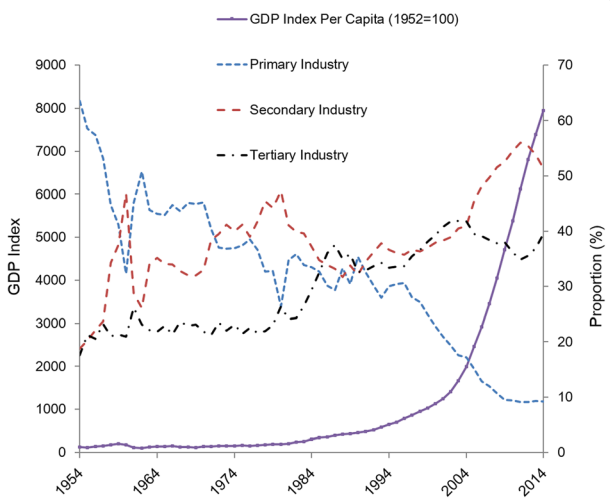

Fig. 7 Composition of GDP and per capita value. Data source: Inner Mongolia Statistical Yearbook (2015)

The socioeconomic development of Inner Mongolia has long depended on the natural resources in the region, which has resulted in a cascade of environmental changes. Our analysis suggests that Inner Mongolia now is faced with a development trap that may prevent it from achieving regional sustainability. The demands for mutton, beef, and cashmere from people and industries in different parts of China and the world have already exceeded the capacity of the grasslands. Intensified land use activities have profoundly transformed the landscapes of the plateau. The wide-spreading surface mining not only has torn up the face and destroyed the beauty of the grasslands but also is radically changing the identity and function of the Inner Mongolia social-ecological system. While Inner Mongolia once led all other provinces of China in GDP in recent decades, its enormous economic growth dug a huge hole into its fragile environment (Wu et al. 2015), which is the primary root cause of this potential development trap.

Nevertheless, there are also reasons to believe that such traps can be overcome through institutional changes and stakeholder engagements following the principles of the place-based science of sustainability (Kates et al. 2001; Kates and Parris 2003; Wu 2013; Wu

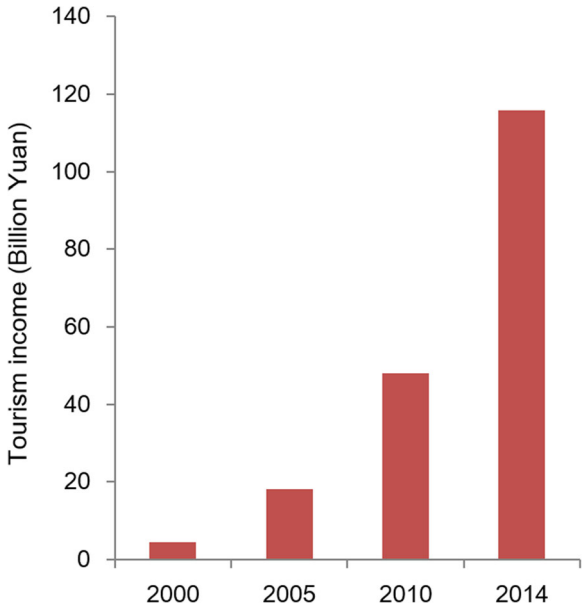

Fig. 8 Tourism income. Constant price of the year 2000 was used. Data source: Inner Mongolia Statistical Yearbook (2000–2015)

et al. 2014, 2015). There are already several encouraging signs emerging. First, the population of Inner Mongolia, as well as the population of China as a whole, seems close to reaching a steady state in the near future, so do the total demands for food, water, and other essential life-supporting materials. Second, new policies from the central government and local governments have increasingly emphasized the "quality" (environmental impacts), instead of the "quantity" (GDP), of economic development. This is particularly evident in China's 13th Five-Year Plan, approved by China's National People's Congress in March of 2016, which provides the blueprint for the economic and social development of the country from 2016 to 2020. Third, as China's socioeconomic development puts more emphasis on "quality," people's awareness and participation of protecting the environment are also increasing. These positive signs of government policy and stakeholders' attitude towards nature are essential for a sustainable future of Inner Mongolia.

To avoid the trap and achieve sustainability, however, both institutional reforms and technological innovations will be needed (Wu et al. 2015). There has been a wealth of research on the ecology, conservation, and management of the dryland systems of Inner Mongolia, which provides a valuable scientific basis for guiding the region's sustainable development in the future (Fang et al. 2015; Han et al. 2009; Kang et al. 2007; Wu and Loucks 1992). A number of suggestions have been made for making the region more environmentally sustainable, economically viable, and socially equitable (see Wu et al. (2015) for a summary). Such suggestions include to develop a semi-nomadic system to increase mobility (Squires and Yang 2008b; Williams et al. 2008); to improve degraded natural grasslands and to establish artificial grasslands in appropriate locations (Hou 2015; Jia et al. 2015; Jiang et al. 2016); to establish mechanisms for forage reservation (Jia et al. 2015); and to develop an ecological pratacultural production system composed of pastures, meat, dairy and poultry production chains, bioindustry, ecological tourism, and a joint venture of grass-paturage-research-industry-commerce (Jiang et al. 2016). In addition, Wu et al. (2015) proposed a multiscale, transdisciplinary approach for future development of Inner Mongolia, guided by landscape sustainability science and land system design.

Conclusions

In this study, we examined the historical transformations of Inner Mongolia, as a coupled social-ecological system, from a traditional nomadic society to an increasingly industrialized and modernized society during the past century. Then, we discussed the challenges for achieving sustainability in this region. Inner Mongolia has made great achievements in its socioeconomic domains, but its environmental problems are mounting, possibly leading to a potential "red trap" (sensu Cumming et al. (2014)). Some additional challenges, such as climate change, were not considered here, but will likely worsen the situation (Fang et al. 2015; Qi et al. 2012; Xu et al. 2010). However, we argue that several reasons give us hope for a sustainable future. Towards this end, both research and actions are imperative. Better understanding of the coupled social-ecological system of Inner Mongolia needs to integrate biodiversity, ecosystem function, ecosystem services, and human well-being. Achieving sustainability in this region needs to maintain both ecosystem and cultural diversity and requires innovative land system design and planning directly linked to institutional changes (Wu 2013; Wu et al. 2015).

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Author's contributions
Both JW and GX contributed to the conceptual framework. GX wrote the manuscript, and JW revised it. Both authors read and approved the final manuscript.

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Competing interests
The authors declare that they have no competing interests.

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