

Forests or grasslands: conflicts over environmental conservation in arid and semiarid regions of China

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Abstract Behind the Chinese government’s ambition to increase its forest cover to 15 % by 2050 is the large-scale tree plantation that continues to threaten millions of hectares of grasslands in China’s arid and semiarid regions. Though the negative environmental impacts of this tree plantation in arid and semiarid regions have been identified by some studies, there has been little sign of policy change. In order to understand why, we must be aware of the political processes that have sustained China’s tree-centered conservation approach for the past decades, but these processes have been largely left unexamined in existing scholarly literature. This study examines these processes by identifying the interest groups involved in environmental conservation, and the ways they leverage scientific knowledge for specific political objectives. This study argues that improved scientific understanding of natural systems will be insufficient to bring about positive environmental changes unless institutional balance is adjusted correspondingly.

Keywords Environmental conservation · Institutional analysis · Tree plantation · Grassland management · Science–policy integration

Introduction

In terms of causing significant shifts in vegetation, human forces can be equally as powerful as climate change. In 1978, the Chinese central government initiated a large-

scale afforestation program, the Three Norths Forest Shelterbelt Program (TNFSP), which aimed to increase forest cover in northern China from 5 to 15 % by the year 2050 (Wang et al. 2010). Since its implementation, the government has claimed much success (Li 1994; Wu et al. 2009; Wang et al. 2010). Until 2008, the area that “was either artificially planted (230 million ha) or seeded by air (30.7 million ha)” amounted to 27.2 % of China’s total land area (Cao et al. 2011), and its forest cover was estimated to have increased from 5 % in 1978 to more than 10 % in 2010 (Wang et al. 2010).

Despite official claims, the results of this large-scale tree plantation program cannot be called an unequivocal environmental success, as a growing body of research into how the plantation program has affected arid and semiarid regions demonstrates. These arid and semiarid regions are located in the northwest of China (north of 35° N and west of 120° E), covering 52.5 % of China’s total land area (Ma et al. 2005; Chinese Academy of Engineering 2013). Scholars contend that the policy of tree plantation in those regions is premised on a flawed understanding of local ecosystems (Wu and Wang 2002; Cao 2008; Zhang 2008; Wang et al. 2010). As a result, planted trees have had low survival rates, and the reduced soil moisture as the result of tree plantation has led to the disappearance of grass species (Cao et al. 2007; Cao 2008).

To date, the critics of tree plantation in arid and semiarid regions have focused on plantation’s environmental impacts. However, few studies have gone further to examine the political processes that have sustained those problematic conservation projects and policies. This study examines these processes by tracing the institutional arrangements and interest groups associated with tree plantation, as well as how they use scientific knowledge to support policy decisions. I argue that China’s unbalanced

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institutional structure and the way various interest groups leverage scientific knowledge to advocate for particular environmental policy decisions have hindered policy reform and the conservation of China's grasslands. Furthermore, this study finds that the negative environmental impact of tree plantation policies in arid and semiarid regions has continued *despite* an improved scientific understanding of local ecosystems.

Institutional arrangements and the transformation of GGP

Environmental conservation in arid and semiarid regions in China involves both forest management and grassland management agencies, and the power dynamics between those agencies determine the distribution of two land covers: forests versus grasslands. The State Forestry Administration is the principal agency that takes charge of forest management. Its predecessor was The Ministry of Forestry, which was assigned the authority to oversee tree plantation across the country in 1979 (Wang et al. 2004). The Ministry went through several transformations and was restructured and renamed the State Forestry Administration in 1998. Since then, its administrative scope has been changed to forest management and conservation, the preservation of biodiversity and other forest-related values, and the enforcement of afforestation programs¹ (Wang et al. 2004).

Grasslands, on the other hand, are managed by a network of institutions, including the Ministry of Agriculture (MOA), the State Forestry Administration (SFA), the Ministry of Environmental Protection (MEP), the Ministry of Water Resources (MWR), and the Ministry of Civil Affairs (MCA) (Brown et al. 2008; Li et al. 2014). Among all these institutions, the MOA is the major institution that takes charge of comprehensive management (Brown et al. 2008). Though the MOA has the responsibility and authority to oversee grassland management, its capacity to protect grasslands is often undermined by its tendency to impose agriculture-centered policies (Williams 2002) and by its emphasis on livestock production rather than grassland conservation. In past decades, the MOA has implemented many grassland policies, such as private land-use regimes, grassland fencing, and modernization of livestock raising (Yeh 2005; Li and Huntsinger 2011). These past policies help illustrate the priority the MOA places on production in China's grasslands.

The MOA's efforts to conserve grasslands are further compromised by its administrative overlaps with other institutions. The SFA is one of the most influential institutions competing with the MOA for national funding and political influence in the area of grassland conservation. In terms of institutional capacity, the SFA is stronger because it has more working staff than the MOA. So far, no statistics on the number of grassland-management-related staff in each institution at the national level are available, but comparison at the local level reveals this disparity. In Inner Mongolia, the provincial branch of the SFA employs 3332 staff, and the provincial branches of the MOA employ 75 staff, 52 in the Grassland Work Station and 23 in the Grassland Supervision and Management Center.²

The power dynamics between the SFA and the MOA over the gray zone of grassland conservation can be observed in the implementation of the Grain for Green Program (GGP). The GGP was initiated in 1999 as one of the largest environmental conservation programs in China, involving planting hill slopes (25 degrees or greater) and marginal farmlands with trees or grass (Delang and Yuan 2015). In the official document *Opinions on Experimental Work on Grain for Green Program*, the administrative responsibilities of the SFA, as opposed to those of the MOA, are clearly defined: The SFA is held responsible for designing, implementing, and monitoring the national plans for the GGP, whereas the MOA only takes charge of specific areas, such as the restoration of the farmed grasslands and the protection of natural grasslands (The State Council 2000). The descriptions of the administrative responsibilities of the SFA and the MOA remain the same in the Grain for Green Regulation issued in 2002 (The State Council 2002). These documents indicate the leading role played by the SFA in the GGP.

The SFA's focus on tree plantation has led to the weighted structure of GGP subsidies, which provide extra economic incentives to local households who choose to plant trees for ecological restoration. According to the Grain for Green Regulation and its established subsidy standards (from 1999 to 2007), households participating in ecological restoration are entitled to a standard subsidy of 2388 RMB per ha per year (including a grain subsidy of 2089 RMB per ha per year). Although the amount of the standard subsidy is relatively the same for all types of ecological restoration, the period of the subsidy varies among different types. For conversion to non-commercial trees, the subsidy is provided for 8 years, whereas for

¹ Regarding afforestation, the Ministry of Water Resources has also played a relatively important role, but its focus is limited to the upper and central river basins of major national rivers such as the Yellow River (Bennett 2008).

² For information on the local branches of MOA, see the official websites <http://www.nmagri.gov.cn/zwq/tsdw/191.shtml#c> and <http://www.nmagri.gov.cn/zwq/tsdw/202.shtml#c>, accessed on January 17, 2016. For information on the local branch of SFA, see the official website http://www.nmglyt.gov.cn/xxgk/cz/gk/bmysjs/201406/t20140626_70486.html, accessed on January 17, 2016.

conversion to grasslands, the period of the subsidy lasts only 2 years. Because of these different economic incentives, local households participating in the GGP tend to choose to plant trees regardless of their environmental constraints (Zhang 2008).

In the past decade, the SFA has extended its political influence into the field of grassland conservation, which is insufficiently managed as the result of the weak authority of the MOA and its overlapping institutional arrangements with the SFA. Under the guidance of the SFA, the GGP, which was originally designed to restore forests or grasslands in degraded farmlands and marginal lands, has been reshaped into a tree-centered conservation program.

Conservation success in doubt

The heavily tree-centered conservation approach of the SFA has never failed to find supporters in the scientific community. Supporters of the SFA's approach argue for the benefits of tree plantation from different perspectives: desertification control, water and soil conservation, and farmlands and rangelands protection (Zhu et al. 2004). Large-scale tree plantation is considered to contribute to the reduced frequency of sandstorms and to help curb the trend of desertification (Yang et al. 1998; Qi et al. 2011). One study estimates that after the first phase of the program, the shelterbelts protected 2.13 million ha of farmland and 30.03 million ha of rangeland (Zhu et al. 2004). Given these results, it is not surprising that the SFA can always find scientific support for their programs.

Opponents, however, argue that tree plantation in arid and semiarid regions is environmentally inappropriate in that it ignores the fact that grasslands are complex systems affected by multiple ecological factors and that limiting ecological restoration to tree plantation can lead to both financial losses and environmental degradation (Cao et al. 2011). Cases of failed tree plantation have been reported in different regions. A 1200-km-long forest shelterbelt in the Hexi Corridor in Gansu Province showed a low survival rate because of droughts and diminished underground water, and a planted forest of 87,000 ha in Minqin County eventually shrunk to 20,000 ha because of environmental limits (Shi 2004). Considering these failures and the environmental consequences of tree plantation in arid and semiarid regions, scholars argue that tree plantation should be ended in Inner Mongolia and other northwestern areas (Wu and Wang 2002).

Future consensus is unlikely to emerge between the supporters and opponents of the SFA's approach, because at the root of the debate is the disciplinary separation of scholars, who are trained with different disciplinary foci and methodologies. Most scholars who evaluate tree plantation positively are from the fields of forestry or desertification

control, whereas their opponents tend to come from the fields of grassland ecology and grassland management. Different disciplinary foci, assumptions, and methodologies leave little room for a reconciled version of environmental conservation to develop (Li and Sakamoto 2015). The coexistence of scientific supporters and opponents helps sustain the unsolvable debate and the plantation-weighted policies of the SFA, because as long as some scientific groups continue to recognize the merits of tree plantation, the SFA can continue to cite their research findings to provide scientific justification for its conservation approach.

The SFA also has its own project evaluation system that enables the agency to assess its own conservation practices and, thus, to justify its conservation approach. The SFA first increased its estimated area of forest cover in arid and semiarid regions by redefining what counts as forests. Before 1998, vegetation covers with tree canopy above 30 % were considered as forests. After 1998, this threshold was changed to 20 %. Canopy closure is an important parameter for defining forests, as it refers to the percentage of ground area vertically covered by tree crowns (Bunnell and Vales 1990). Furthermore, starting from 2003, shrub and subshrub grasslands—traditionally considered to be categorized as grasslands—were reclassified as forests and included in the national forestry survey (State Forestry Administration 2013). Using these revised ecological concepts and statistical categories, the estimated area of forest cover in arid and semiarid regions was deemed to be continually increasing. Inner Mongolia is an example: Its official estimated forest cover increased from 14,065 million ha in 1993 to 24,879 million ha in 2013, with significant changes in the years 2003 and 2008 (see Fig. 1). The SFA's numbers demonstrating an increase in forest cover show that their conservation efforts have proved successful, but in reality an accurate estimate of forest cover attained as the result of tree plantation remains unknown.

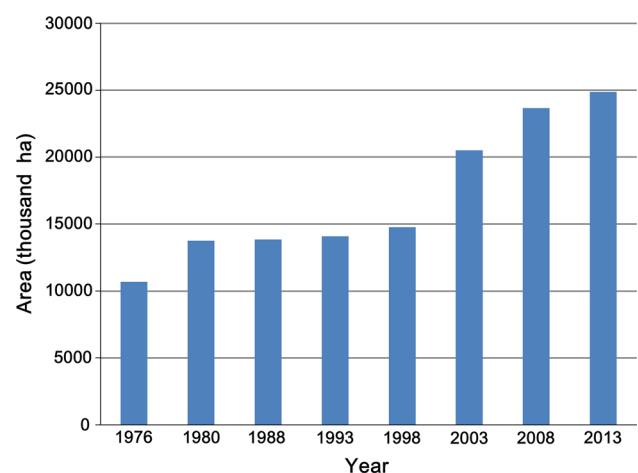


Fig. 1 Total area of forest cover in Inner Mongolia. Data cited from the eighth forest resources inventory

Besides redefining what counts as forests, the SFA deploys an ambiguous statistical category in its national forestry survey: the total area of tree plantation on *barren mountains and lands*. The word “barren” denotes an absence of vegetation cover. However, in reality those mountains and lands deemed “barren” are primarily covered by shrubs, subshrubs, and grass. Planting trees in these areas, therefore, results in a dramatic transformation of local ecosystems. To date, however, in official documents no clear ecological definition of *barren mountains and lands* can be found. According to Article No. 26 of the Forest Law of the People’s Republic of China (1998), two types of *barren mountains and lands* are suitable for tree plantation: (1) lands owned by the nation and put under the administration of the SFA and other associated institutions and (2) lands owned and managed by collectives and communes. According to this description, *barren mountains and lands* are defined mainly by their property rights rather than their ecological characteristics. In the *Guidelines for Ecologically-Beneficial Forests*, the term “Four Barrens” (*sihuang*) is used to specify four types of lands—barren mountains, barren gullies, barren hills, and barren sand lands (Tree Plantation Department of State Forestry Administration 2001). Still, what the word “barren” actually means is left unclarified. Without clear classification standards, many lands have been arbitrarily deemed “barren” and included in tree plantation zones.

Discussion and conclusion

Over the years, the number of tree plantation programs in China has increased. In the National Plan for Ecological Conservation and Construction (2013–2020), the country’s conservation and afforestation efforts are summarized into nine major programs, which include the Natural Forest Protection Program, the GGP, the TNFSP (Three Norths Forest Shelterbelt Program), and other forest-shelter construction programs (The State Council 2013). Though the administrative power of the SFA was significantly affected by institutional reform in 1998 (Wang et al. 2004), its focus on planting trees remains the same. Even though new conservation programs have been initiated, these programs are more likely to be integrated into existing policies and programs, which explains why the GGP in arid and semi-arid regions has adopted a subsidy scheme weighted in favor of tree plantation.

The tree-centered approach of the SFA is supported by some in the scientific community, whose studies help to sustain the SFA’s political legitimacy in leading conservation efforts. The central role of the SFA in planning the GGP and other tree plantation projects, in turn, helps enhance the voices of its scientific supporters (primarily

foresters and ecological engineers) while weakening those of others (primarily grassland ecologists). Supporters of the SFA may be more likely to be included in the conservation program and receive research funding from the SFA, whereas the critics, especially grassland ecologists, may have limited political backing because of the weak capacity of the MOA and the absence of other institutions that can counterbalance the SFA’s institutional power. Therefore, this unbalanced political system has led to a highly politicized leveraging of scientific knowledge.

Under pressure from increasing academic criticism, limited policy adjustments have been made. A new subsidy plan for the GGP was unveiled in 2014: Households participating in tree plantation can receive a subsidy of 22,388 RMB per ha within a time span of 5 years, whereas households participating in grassland restoration can receive 11,940 RMB per ha within a span of 3 years (Bureau and of National Development and Reform Commission 2014). Though the central government argued that it has adjusted its subsidy to more strongly incentivize grassland restoration with this new plan, differences in economic incentives for planting trees and restoring grasslands remain salient.

This study reveals that an improved scientific understanding of ecosystems is insufficient to bring about positive change. The predominant authority of the SFA in planning and implementing the GGP and other projects in China would have to be counterbalanced by other agencies in order to facilitate a shift in conservation policy in arid and semiarid regions. One way to break out of the current political inertia would be to carry out institutional reform in tandem with progress in scientific understanding. The institutional capacity of the MOA should be strengthened, and other major, non-sector-based government agencies such as the National Development and Reform Commission and the Ministry of Land Resources should play a more important role as coordinators of grassland management in order to facilitate the emergence of a balanced conservation approach. To achieve science–policy integration in a real sense, the coevolution of scientific knowledge and political institutions is crucial.

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