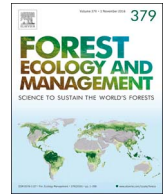




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Opportunities and challenges for the protection and ecological functions promotion of natural forests in China

Limin Dai^a, Shanlin Li^a, Wangming Zhou^a, Lin Qi^a, Li Zhou^a, Yawei Wei^b, Jiaqi Li^c, Guofan Shao^a, Dapao Yu^{a,*}

^a Key Laboratory of Forest Ecology and Management, Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang 110016, China

^b Shenyang Agricultural University, Shenyang 110866, China

^c Dalian University of Technology, Dalian 116024, China

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ABSTRACT

Excessive logging in China is the major cause of poor forest quality, degraded ecosystem functions, and near exhaustion of harvestable resources of the country's natural forests. An overall extended moratorium on logging in the country's natural forests has been launched since 2015, which is a suggested method for the gradual recovery of the structure and functions of these forests. However, the main purpose to manage the degraded natural forest after the moratorium remains not yet clear. This paper firstly reviews China's natural forest management history and clarifies the causes accounting for natural status duo, and then analyses changes in domestic natural forests and timber supply and demand in China, identifies the problems related to the sustainable operation of natural forests, especially those requiring immediate attention. Results shows that as the demand for timber continues to increase rapidly, China will experience a severe imbalance between timber supply and demand. In the long run, timber imports alone cannot meet increasing domestic demands, natural forests remain the primary source of wood products. Many issues concerning management practices and operations technology remain, including ineffective overall spatial zoning, rough operation and management of timber forests, and financial difficulties in forested areas. All of these issues have prevented natural forests from realizing both their ecological functions and timber resource potential. A moratorium on timber harvesting would offer a valuable opportunity for natural forests to recover from decades of excessive logging, as well as an exciting chance to develop sustainable operational practices, ecological functions promotion and relevant technologies. In summary, strategies for the sustainable management and ecosystem services promotion of natural forests during a harvesting moratorium are suggested.

1. Introduction

In China, 'natural forests' refer to those which have reproduced naturally, consisting of naturally immigrant or indigenous tree species and strains. Among terrestrial ecosystems, natural forests are the most important in terms of structural complexity, community stability, biomass, biodiversity, and ecological functions. They are also the primary source of forest resources in China and can be found at the head of large rivers or near agricultural areas. These forests play a unique and irreplaceable role in maintaining fresh water security, species biodiversity, climate stability, and high agricultural output (Tang and Liu, 2000). According to the 8th National Forest Inventory of China (NFI), covering the period from 2009 to 2013 (SFA, 2014), the country's natural forests cover an area of 121.84 million ha, accounting for 64% of forest land in China. The remaining forests are comprised of plantations (36%). In

terms of growing stock, natural forests account for 12,296 million m³, equivalent to 83% of the country's total growing stock. According to the forest definition in China, forest includes arboreal forests, bamboo forests and economic forests. Natural arboreal forests (trees) cover an area of 117.53 million ha or 96% of natural forests; the remaining 4% are bamboo forests and economic forests (cash trees, special economic use, timber use are excepted).

Natural forests have been the primary source of timber in China for many decades. However, unrestricted logging allowing pursuit of short-term economic benefits has taken its toll on these ecosystems. Forest management strategies focused on timber production in China have contributed to the continuous degradation of natural forests, as evidenced by the obvious decline in their ecological functions and ability to provide regional ecological security. Currently, the overall quality of natural forests in China is poor, with a growing stock of 104.6 m³/ha

* Corresponding author.

E-mail address: yudp2003@iae.ac.cn (D. Yu).

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(79.4% of the world average for all forests (including natural forests and plantations). According to the 8th NFI (SFA, 2014), covering the period of 2009–2013, the unit-area growing stock of over-mature (i.e., old-growth) natural forests (in China is 254.1 m³/ha) and on overall basis that of natural forests has been increasing at a rate of 3.71 m³/ha each year. If such a rate can be maintained over the next few decades, it is estimated that after a logging moratorium of about 40 years, the unit-area growing stock for all natural forests could be restored naturally to the same status as that of current over-mature forests, which would involve an increase of the average growing stock of natural forests from 104.6 m³/ha to 254.1 m³/ha.

China is currently the world's largest importer and second largest consumer of timber (Xie et al., 2011; Liu and Xie, 2013). Timber is also the third most exported natural resource in China, after oil and iron ore. Amid increasing protection of forest resources and restrictions on global timber exports (Chen et al., 2014), timber security is no longer a general economic issue, but an increasingly complicated national problem that requires political attention. Although the productivity of plantations has increased, the higher output provided therefore cannot erase the supply–demand gap caused by a current ban on logging in natural forests that was launched in Northeast China in 2015 (see below). Moreover, plantations are not suitable substitutes for quality timber supply. In the long run, natural forests remain the main source of timber in China. This paper discusses opportunities and challenges for the protection, functional recovery, and sustainable management of natural forests during a national logging moratorium and offers strategies for the conservation of natural forest resources in China.

2. Natural forest management history and status quo

The history of natural forest management in the People's Republic of China (PRC) can be described in terms of four stages (Deng, 2008; Yu et al., 2011): (1) Forest management targeted at timber production (1950–1966). Without relevant research and policy regulation, theories and management strategies that integrated harvesting and cultivation on the basis of “forest culture and management” were suggested but never realized. (2) Major destruction of forest resources (1966–1978). During this period, forest management fell into disorder, with a sharp decrease in area and growing stock of natural forests (Fig. 1a). (3) Timber utilization and the birth of ecological construction (1978–1998). China launched large-scale forest planting initiatives to assign equal importance to timber production and ecological construction. In 1987, a harvest quota system was introduced, which contributed to an increase in the growing stock in natural forests (Fig. 1a). However, the pursuit of economic benefit combined with slack policy regulation led to illegal logging, causing state-owned forest

areas to become stagnated in a resource and economic crisis. After this stage, China shifted its priorities from a principal emphasis on long-term timber utilization to forest management focused on multiple benefits. (4) Forest resource recovery and development oriented towards ecological construction (1998–present). Since 1998, China has launched the Natural Forest Protection Program (NFPP) to promote natural forest restoration. NFPP encompasses the upper reaches of the Yangtze and Yellow Rivers as well as a large portion of forests in Northeast China (Zhang et al., 2000). Its focus is on the restoration of natural forests and critical watershed protection areas via a combination of prohibitions and/or restrictions on logging with intensive reforestation efforts. Since the initiation of the NFPP, China has introduced classification-based forest management to protect 50.2% of natural forests nationwide by reducing the volume of harvested timber. In 2015, more strict protective measurements for natural forests were launched. Logging has been prohibited in all natural forests in Northeast China, and in 2017 this restriction will be extended to the entire country. At present, no specific time period over which this national logging ban is to extend has been specified. During this fourth historical stage, the area, growing stock and forest quality of natural forests has increased markedly (Fig. 1b).

Since the NFPP was initiated in 1998, China has added an additional 1,165,000 ha of natural forests each year, with an annual increase in growing stock of 215 million m³ (growing stock per hectare = 0.93 m³). The overall forest quality is improving, with a current growing stock per hectare of natural forests of 104.6 m³ (Fig. 1b). However, this figure still falls far behind the average for world forest of 131 m³/ha. Furthermore, forest productivity in China, based on an average diameter at breast height of 14.1 cm and an annual timber output of 3.71 m³/ha, is low.

Natural forests in China are distributed mainly throughout seven provinces including Heilongjiang, Inner Mongolia, Yunnan, Sichuan, Tibet, Jiangxi, and Jilin. Among these, Tibet (267.8 m³/ha), Sichuan (173.1 m³/ha), Jilin (136.2 m³/ha), and Yunnan (118.9 m³/ha) are classified as key eco-functional regions, with a growing stock per hectare greater than 104.6 m³. Due to long-term excessive logging, the remaining natural forests in China are mainly young or middle-aged, accounting for 64.8% and 36.2% of natural arboreal forests in area and growing stock, respectively (Fig. 2a). The growing stock of middle-aged forests is only 83.7 m³/ha, and that of mature and over-mature forests is only 184.8 m³/ha and 254.1 m³/ha, respectively, lagging far behind the primary forests – i.e., old growth natural forests and others never disturbed by humans.

In terms of overall uses and management goals, China's forests may be divided into five categories: (a) protective forests; (b) special-purpose forests; (c) timber forests; (d) fuel-wood forests; and (e) economic

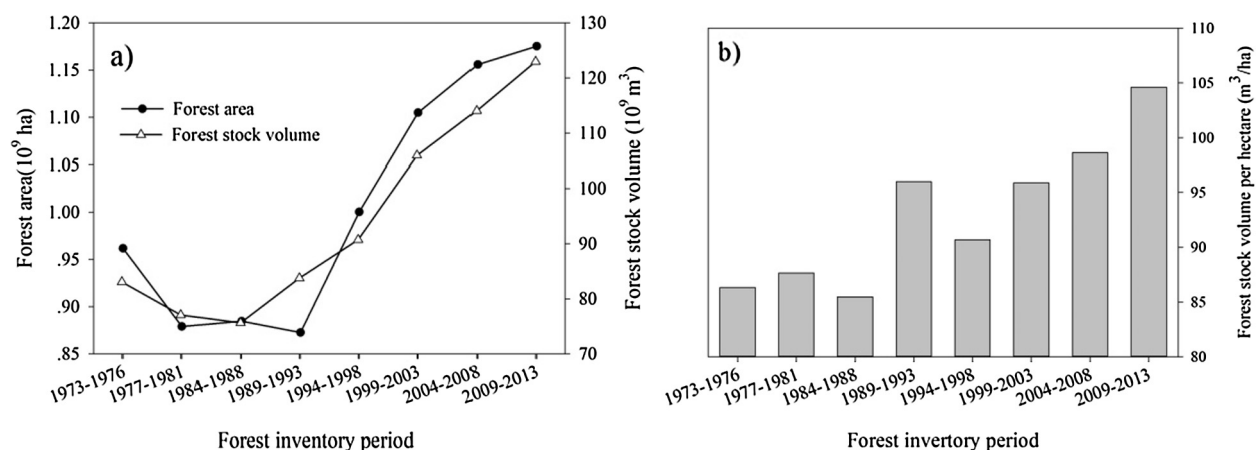


Fig. 1. Area and stock volume trajectory (a) and average growing stock of natural forests (b) in China during different inventory periods. *Source: The 1st–8th National Forest Inventories of China (SFA, 1977, 1982, 1989, 1994, 1999, 2004, 2009, 2014).

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