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journal homepage: www.elsevier.com/locate/forpolChina's forest expansion in the last three plus decades: Why and how?[☆]

Daowei Zhang

Forest Economics and Policy, School of Forestry & Wildlife Sciences, Auburn University, USA, and Food and Agriculture Organization of the United Nations (FAO), Rome, Italy

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ABSTRACT

China's forest area and inventory have expanded greatly in the last few decades. In this paper, I explain the reasons and mechanisms for this expansion. Specifically, high demand for timber and environmental services has led to an exponential increase of government spending in forest conservation, afforestation, and reforestation, which are an expansion of extensive margin of planted forests and forestry. Furthermore, market and policy reform have increased the security of forest tenure, and tax reduction and government subsidy have given added incentive for private sectors to invest in forestry. Finally, extra-sectoral factors such as increasing agricultural productivity allow the conversion of some marginal agricultural lands to forestry uses.

1. Introduction

In 2001, I published an article in *Chinese*, which was entitled as “Why would so much forest land in China not grow trees?” (Zhang, 2001). That article used data from China's 5th National Forest Resource Survey that was published in 2000 and that covers a 5-year period from 1994 to 1998. The 5th National Survey shows that China's forest area increased 13.7 million hectares, raising its forest cover by about 1.43% from the 4th National Survey that covers the previous 5 years from 1989 to 1993 (People's Daily, 2000). Yet, some 2.81 million hectares of forest land were converted to non-forestry uses, and some 57 million hectares of land that were classified as forest land remained treeless. Noting that the loss of forest land because of conversion and the existence of large amount of treeless forestland as symptoms that forest land in China did not grow trees and grew only few trees per unit of land, I tried in that paper to explain the economic and policy reasons behind. My points were that China had adequate land, labor, capital, and entrepreneurs for increasing its forest area and inventory, but policy and institutional factors such as insecure forest tenure arrangements had hindered this development. My recommendations were to lengthen the forest tenure arrangements from 10 to 15 years to 30–50 years and to reduce taxes and transaction costs related to timber

production, thereby motivating private sectors to invest in forestry.

In 2015, China published the results of its 8th National Forest Resource Survey that covers the period between 2009 and 2013. This latest survey shows that China's forest area reached 208 million hectares, covering 21.63% of total land area, and that China's total forest inventory increased to 15.1 billion cubic meters. The former represents a 55% increase from the 5th National Survey, while the latter is an increase of nearly 50%. All these large increases happened roughly in a period of about 15 years. If one uses data back to the 2nd National Survey that covered the period between 1978 and 1981, the rates of increase would be 81% and 68%, respectively (Table 1; Fig. 1).

These numbers are impressive and require inquiries, interpretations, and explanations. It seems that there are two distinguishable periods of forest growth in the 35 years prior to 2014: a slow and steady growth period between 1981 and 1993 and an accelerated growth period between 1994 and 2013. In the steady growth period, China's forest area grew about 1.4%, and its total forest inventory grew at 1% annually. In the acceleration period, both rates doubled.¹ What happened in China's forests in about (or less than) two decades between the middle 1990s and early 2010s? How could one explain the rapid forest growth in China in this period and since 1981? Do the conclusions drew in the 2001 article remain valid or need to be revisited? And could other

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E-mail address: zhangdw@auburn.edu.

¹ Forest area was defined as land with > 30% tree cover before 1994 to land with 20% or more tree cover afterwards. Thus, the total forest area reported in the 4th and 5th National Surveys are not directly comparable. China does not report the difference in size of forest area under these two definitions. Nonetheless, Chinese media reported that forest cover increased 1.43% between the two Surveys while Table 1 shows the difference between the two Surveys was 2.63%. Thus, one can conclude that about 1.2% increase in forest coverage rate (or 11.3 of the 24.9 million ha increase in forest land) should be attributed to the change in definition. This reasoning is appropriate because one authoritative Chinese media (People's Daily, 2000) reported an increase of forestland by some 13.7 million hectares between the two survey periods (11.3 + 13.7 = 25 million hectares, which is close to 24.9 million hectares as shown in Table 1).

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Table 1
Forest Resources of China, 1977–2013.

No. of survey	Period covered	Land classified for forestry use (million ha)	Forest area (million ha)	Forest cover (%)	Forest Inventory (billion m ³)	Non-forest (million ha)	per-hectare inventory (m ³)
2nd	1977–1981	267.1	115.0	12.00	9.0	152.1	78.5
3rd	1984–1988	267.4	125.0	12.98	9.1	142.4	73.1
4th	1989–1993	262.9	134.0	13.92	10.1	128.9	75.6
5th	1994–1998	263.3	158.9	16.55	11.3	104.4	70.9
6th	1999–2003	284.9	174.9	18.21	12.5	110.0	71.2
7th	2004–2008	305.9	195.5	20.36	13.7	110.5	70.2
8th	2009–2013	312.6	207.7	21.63	15.1	104.9	72.9

Sources: Data from the China's National Forest Surveys (Ministry of Forestry, 1983, 1989, 1995, State Forestry Administration, 2000, 2005, 2009, 2014).

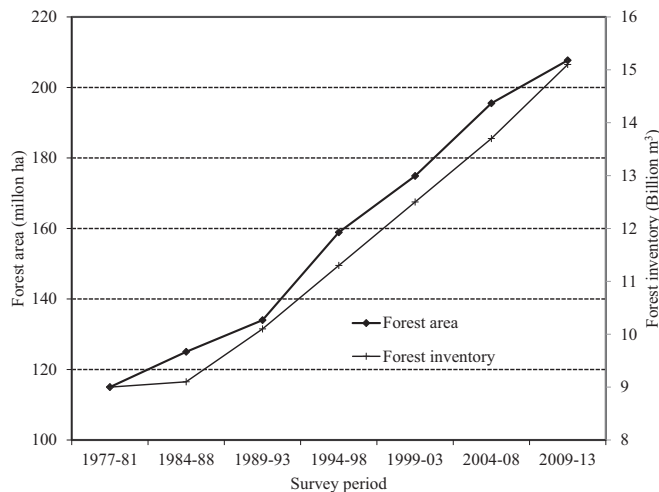


Fig. 1. Change of China's Forest Resources, 1977–2013.
Data sources: See Table 1.

countries learn from China's experience?

The purpose of this paper is to explain China's rapid development in its forest sector—exemplified by the rapid growth in forest area and inventory—in the last few decades. I reason that China's forest growth mainly comes from an expansion of extensive margin of forestry and planted forests and is influenced by three main factors: (1) a drastically increase in government spending in forestry activities, (2) reforms in land and forest tenure arrangements that attract private investment in forestry, and (3) extra sectoral factors. The latter include industrialization and infrastructure development that drive up the demand for timber; rising income and standard of living that increase the demand for forest-based environmental services, which in turn leads to an increase in protective forest areas as well as other forest areas whose main purposes are for environmental services; and rising agricultural productivity that allows some marginal agricultural lands to return for forestry uses. The next section starts with a brief description of China's forest ownerships, market and policy reform, and forest growth in terms of forestry extensive margin expansion in the last three plus decades. This is followed by a quantitative analysis of forest growth and an example of market and policy reform that have reduced the transaction costs of private forestry investments in the country. The final section presents some conclusions and discussion.

2. China's forest growth: an expansion of forestry extensive margin

In 1981, China's forestland and forests are owned by the central government and local communities. State-owned forests, which are managed by 131 state forest bureaus, accounted for 54% of forest area and 70% of forest inventory. The remaining parts are called collective forests. At that time, China had 115 million hectares of forests, and

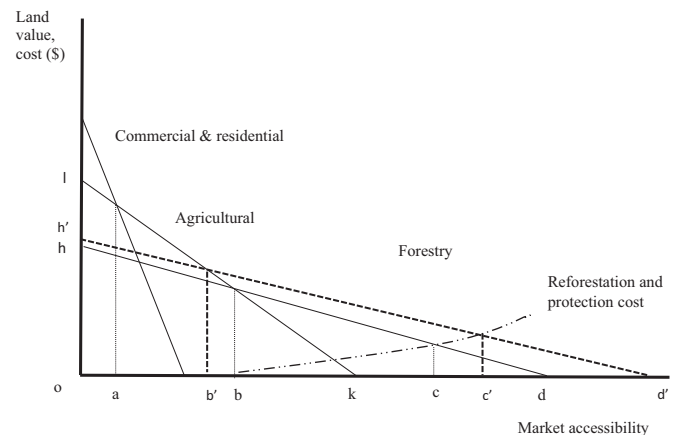


Fig. 2. The relationship between land value under alternative uses and market accessibility.

another 152 million hectares of land that are classified for forestry uses, but without the sufficient tree cover to be counted as forests (Table 1). Clearly China did not have a lot of forests then. Consequently, the primary focus of the government was to afforest lands without trees while ensuring all cutover forest lands being reforested. Both afforestation and reforestation lead to planted forest developments and forest expansion.

Fig. 2 illustrates forestry among competing uses considering one characteristic of land in isolation—market accessibility (von Thunen, 1966; Hyde, 2012). Assuming all other characteristics of land are identical, Fig. 2 shows how land value under various uses declines as progressively less market accessibility, meaning greater distance from market or an urban center. Commercial and residential uses yield a higher return than all others close to the urban center (point “o”). This return declines relatively quickly farther away from the urban center. Because it does not make economic sense to build a shopping mall far away from the people who ordinarily might patronize it, at distance greater than point “a” from the urban center the land value from using the land for residential/commercial development drops below the value for using the land in some other capacity, for example, growing agricultural crops. Since food is perishable and needs to be transported at a cost, the land value from farming also declines when moving farther away from the urban center where those crops are consumed. At distance from the urban center greater than point “b,” the land value for using the land to grow crops falls below that for timber production. Thus, point “b”—a turning point from agriculture to forestry operations—is the extensive margin of agriculture, marking the beginning of the intensive margin of forestry.

Two extensive margins of forestry operations are relevant. One identifies the extent of the forest land base which will be managed for continuous timber production (i.e., planted forests). The other defines that part of the original stock of timber (sometimes referred to as old growth forests) which may be merchantable, but whose owners

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