



# Livelihood mushroomed: Examining household level impacts of non-timber forest products (NTFPs) under new management regime in China's state forests<sup>☆</sup>

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## ABSTRACT

Finding alternative livelihood possibility for state worker households is crucial for the successful implementation of Natural Forest Protection Program (NFPP) in China's key state forest regions. One local innovation to implement NFPP while allowing worker households alternative use of forestland is the “Contract Management Responsibility System (CMRS)”. Under CMRS, participating households have exclusive rights to harvest and grow non-timber forest products (NTFP) while fulfilling forest protection responsibility. Using two rounds of survey data, we evaluate the impact of CMRS on forest worker households' livelihood and the sustainability of NTFPs. We also test and correct for the bias from attrition and self-selection simultaneously. We find that CMRS leads to a significant increase in household income from NTFPs' production. We also find that increased NTFP species collected is associated with longer CMRS participation, which indicates improved sustainability.

## 1. Introduction

China launched the Natural Forest Protection Program (NFPP) in key state forest regions in 1999 to prevent its vast natural forests, mostly located in upper reaches of river basins, from depleting after nearly five decades of over-extraction (Xu et al., 2002, Xu et al., 2004; Jiang et al., 2014). Implementation of NFPP, if successful, would help restore an important part of China's forest ecosystem which provides ecological services such as carbon sequestration, water and soil conservation, and biodiversity enhancement.

The implementation of NFPP has immediate impacts on livelihoods of several million state workers and their families. Annual timber supply from the affected state forest enterprises (SFE) is cut by > 20 million cubic meters (Xu et al. 2002). Large-scale harvest reduction is observed in Northeast China Key State Forests while logging ban is installed in the rest of China's state forest regions. A direct consequence following this large cut in timber production in Northeast China is that around one-third to one-half of the SFE employees lost their jobs after being paid a lump sum settlement fee.<sup>1</sup> SFEs are forced to shift their focus from timber harvest to forest protection and restoration, under NFPP regulations. The remaining employees adjust to new

responsibilities as forest guards and afforestation workers. Very often, they find themselves working fewer days and earning less money under the new system (Wang et al., 2016a, b, c).

Another objective of NFPP is to create opportunities for SFEs to explore new schemes, which improves forest management and enhances livelihood for state worker households (Katsigris et al. 2004, Xu et al., 2004). One of the attempt by SFEs is the establishment of Contract Management Responsibility System (CMRS) for worker households. CMRS serves two purposes: one is to enforce forest protection; the other is to provide an alternative livelihood opportunity for participating households. Under CMRS, participating workers (or households) are given a contract for certain tasks of forest protection. In return, the households are granted exclusive rights to cultivating non-timber forest products (NTFPs) within the contracted forest area. The latter is believed to be an important way of providing alternative livelihood in the era of logging reduction under NFPP.

NTFPs are open access resources before CMRS. State workers and adjacent farmers are able to pick mushrooms, black fungi, wild vegetables, herbal medicines, etc. freely in state forests. Open access to NTFPs is unsustainable and has rapidly depleted some high valued species such as wild Ginseng in Northeast China. Under CMRS, workers and

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<sup>1</sup> The figure of unemployment is estimated based on survey data used in this study.

households have incentive to manage NTFPs more sustainably in order to generate stable revenue from them (Katsigris et al. 2004; Wang et al., 2016a). Moreover, households are able to use the forest environment to cultivate NTFPs through enhanced technology and productivity. Plantation of Ginseng, mushroom, black fungi, and livestock raising are more widely observed in state forests due to the movement of allowing households for contracted management (Wang et al., 2016b).

CMRS is originated in mid 1990s and is promoted as a key institutional tool for forest protection after the launching of NFPP. Currently, about 80% of forest farms under SFEs has adopted CMRS. CMRS is tried out in Yichun City, a leading forest region in Northeast China, to explore general ways of state forest reform. Success of CMRS will provide reform decision makers a major direction for designing reform policies in the region, which will affect the long term look of the state forest sector and forest ecosystem in general in China.

The importance of NTFPs for development has drawn wide attention by academia since 1980s. NTFPs have been considered as an alternative approach for income generation and economic development in rural area (WCED, 1987; Peters et al., 1989; Sayer, 1995; Belcher and Schreckenberg, 2007; Ahenkan & Boon, 2010). However, after decades of effort, NTFPs commercialization is often not successful (Rai et al., 2012; Virapongse, 2013). Viable and secure governance, access and tenure systems are identified as the key factors that influence success of NTFPs commercialization (Mayers and Vermeulen, 2002; Marshall et al., 2003; Shackleton and Pandey, 2014). Conversely, insecure property rights always lead to conflicts and competing claims (Larson et al., 2010), which would result in over extraction and wasteful exploitation (Lybbert et al., 2002; Hobley, 2007).

A large number of empirical studies explore the impact of property rights on sustainable forest management (Nelson et al., 2001; Agrawal and Ostrom, 2001; Araujo et al., 2009; Lambini and Nguyen, 2014), but few empirical work identifies the impacts of property rights on NTFP management. The case of China's state forest reform provides a chance to examine the impacts of forestland tenure arrangement on NTFP activities.

In this paper, we examine the contribution of improved property rights (under CMRS) on NTFP revenue and the number of NTFPs species collected in 69 forest farms within SFE system in Northeast China. These farms employ many worker households. According to our survey, approximately a third of the worker households collect NTFPs to increase their family income. Hence, the contribution of NTFPs to worker households livelihood is not negligible.

Our empirical findings show that improved property rights increase worker households' NTFP revenue by around 1000 Yuan per year (including revenue from both self-consumed and sold NTFPs) and the number of collected NTFP species by a small magnitude per year.

The remainder of this paper is structured as the following: Section 2 provides details about the policy design of the tenure reform and relevant policy context; Section 3 describes the data; Section 4 present the theoretical and empirical models; Section 5 presents empirical results and robustness tests; And lastly, Section 6 concludes.

## 2. The policy

### 2.1. Policy context

The history of the state forest in China trace back to the 1950s. After the founding of new China, tons of timber were needed for national reconstruction. The government gradually established 135 state forest enterprises (SFEs) in forest-resource-rich but always remote regions in China. Meanwhile, worker households in SFEs built their own communities near forest farms in SFEs (Xu et al., 2004). Large-scale logging started since then. After the reform and opening up in China in late 1970s, over extraction went worse. Due to the nationwide construction boom, the increasing demand for paper, and rapidly growing requirement of domestic and export packaging, the forest areas, between 1979

and 1988, were reduced by 23 percentage (Smil, 1989).

In response to deforestation, the Chinese government started to adopt a series of forest sector reforms since 1980s. In 1984, Forest Law was issued to establish forest logging quota system. Then in 1998, the Natural Forest Protection Program (NFPP) was launched. NFPP introduced severe logging restriction in state-owned natural forests in the 17 provinces bordering the two main river basins (Yangtze River basin and Yellow River basin). After the implementation of the NFPP, significant reduction in timber production from state-owned forest occurred. The proportion of timber production from state-owned forest dropped from 92% in 1980 to 33% in 2008 (Jiang et al., 2014). On the other hand, thousands of people in SFEs were threatened by potential unemployment. Under strict environmental protection policies, local policy makers and SFEs face two challenges: 1. fighting rising unemployment and finding alternative revenue source for workers in SFEs. 2. Finding new managers for protected forest. In order to cope with the challenge, local policy makers and SFEs established Contact Management Responsibility System (CMRS).

### 2.2. Policy design

CMRS uses contracted worker households as managers of the protected forest plots. In return, these households are allowed to carry out NTFPs activities on the plots (SFA, 2012).

The specific measures taken by local policy makers are the following.

- Worker households are paid to protect forests from illegal logging, forest fires and other risks in a contracted period.
- During the contract period, management rights of NTFPs (rights to collect NTFPs, rights to plant or raise NTFPs, and rights to develop forest tourism) are entitled by SFEs to worker households.
- SFEs still hold the ownership of forestland and timber (SFA, 2013).

The above contracts between SFEs and worker households follows the pattern of Contact Management Responsibility System (CMRS) from China's industrial reform (Chen, 1994). In the following sections, we named the whole system of the tenure reform in state-owned forest as Contact Management Responsibility System (CMRS). According to our survey, worker households have the option to apply for CMRS or not while SFEs have a choice to accept application or not. As a result, contracts between SFEs and worker households are two-way choices.

Under CMRS, worker households receive income from two sources: one is wage from forest protection; the other is NTFPs revenue. The wage is fixed and pre-determined by the contract. According to our survey, contracted worker households earn between 28 Yuan and 64,600 Yuan per mu per year. On the other side, NTFPs revenue relies on entrance, market, tenure, organization, individual characteristics and many other factors (Marshall et al., 2003). Before CMRS, NTFPs in state-owned forest were open access resources. After CMRS, partial property rights were established. The difference between NTFPs revenues before and after CMRS is the focus of our analysis.

## 3. Data

### 3.1. Study site

This study was conducted in the State Forest Region of northeast China, located in Heilongjiang Province, Jilin Province and Inner Mongolia Autonomous Region (roughly 120°E and 135°E longitude and 38°N and 56°N latitude, see Fig. 1). The whole forest area in these three provinces is about 38.75 million hectares, accounting for 24% of the nation's total. (SFA, 2013).

Since the founding of new China in 1949, the study area was placed under state ownership and designated as a key state forest region. Forest farms are basic organizational unit in SFEs in state forest region.

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