



# Wildlife damage and cultivated land abandonment: Findings from the mountainous areas of Chongqing, China



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## ABSTRACT

Human-wildlife conflict (HWC) is a growing global issue that seriously threatens agricultural production and livelihoods. Studying the relationship between wildlife damage, land use, and livelihood enables us to understand the dilemma facing current wildlife protection and ecological restoration policies and to amend existing policies effectively. Using participatory rural appraisal (PRA), quantitative analysis, and a Multilevel Logit regression model, this paper analyzed land use and livelihoods among 160 households subject to wild boar (*Sus scrofa*) damage in four villages within Youyang County in the poor mountainous areas of Chongqing, China. The findings showed the following: (i) wild boars in Youyang County were responsible for large-scale crop and property damage; (ii) cultivated land abandonment has become a significant trend in land use, and the most important perceived driver for abandoning farmland is the land plot's vulnerability to wild boar damage; (iii) when protecting cultivated land plots, households tend to protect those plots that are close to the road, have larger land area, and have a slight or abrupt slope; however, households with more members working in non-farm labor, more female agricultural workers, and/or higher non-farm income are more inclined to abandon protection of their plots. This paper discusses seven main measures that are frequently adopted by farmers to protect their crops and livestock and are perceived by these farmers as the most effective and sensible countermeasures.

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## 1. Introduction

Human-wildlife conflict (HWC) has increased in recent years, becoming a major worldwide concern (Distefano, 2005; Madden, 2004; Messmer, 2000; Osborn and Parker, 2002; Thapa, 2010). HWC has significant impacts on land use practices and agricultural production. For example, in Asia, snow leopards (*Uncia uncia*), lions (*Panthera leo*), leopards (*Panthera pardus*), tigers (*Panthera tigris*), wild boars (*Sus scrofa*), and elephants (*Elephas maximus*) are often regarded as destroyers of livestock and crops. Local farmers have suffered major financial losses annually due to crop damage by wildlife (Distefano, 2005; Madhusudan, 2003; Sekhar, 1998; Sreekar et al., 2013; Yu et al., 2009). Inhabitants who suffer from wildlife damage around the world often take measures, using both indigenous knowledge and modern technology, to protect local farming (Hartter et al., 2011; Hough, 1993; Thapa, 2010).

In the context of HWC, numerous studies attempt to better understand the relationship between wildlife and livelihood security. The themes of these studies can be generally divided into two important categories: (i) the damages to crops and loss of livestock caused by wildlife and the effectiveness of countermeasures taken by individuals or households (Hough, 1993; Messmer, 2000; Thapa, 2010; Wang et al., 2006); (ii) the gap between wildlife protection policies and livelihood, and how to design compensation schemes to protect farmers' rights of development (Madhusudan, 2003; Rondeau and Bulte, 2007). However, very little research has been done on the connections among wildlife damage, cultivated land use, and household livelihood that could contribute to further thinking on current wildlife protection policies and ecological restoration policies.

Although the causes of the wild boar problem in China are still unknown, wild boar populations are now overly abundant in several provinces, resulting in damage to agricultural crops and local livelihoods, and raising concerns among agricultural producers, wildlife managers, and natural resource professionals (Cai et al., 2008; Li et al., 2010a, 2010b; Zhou et al., 2008). Restricted

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by wildlife protection policy, limited technology and knowledge, and the lack of a compensation scheme, farmers find themselves in a vulnerable position with regard to wild boars. For instance, in China, the State Forestry Administration (SFA) has published two documents—*Wildlife Conservation Law* and *Lists of State-Protected Terrestrial Species That Are Beneficial and of Important Economic and Scientific Research Value* in 1988 (first amended in 2004 and again in 2009) and 2000, respectively (Li, 2007). In this context, killing and injuring of wild animals listed in the protection index is prohibited. Furthermore, there is no compensation policy with respect to HWC in rural China, where small-scale farming plays a significant economic role. Just as in other countries, Chinese farmers protect their crops using indigenous knowledge and methods; for example, increasing the number of people patrolling a field has reduced the incidence of wild boar damage around a giant panda nature reserve in the Qinling Mountains in Shaanxi Province, China (Cai et al., 2008). In Eastern Liaoning Province, farmers there use traditional, non-lethal measures to prevent wild boar damage, such as setting off firecrackers and patrolling at night (Yu et al., 2009). However, other traditional methods, such as lethal hunting methods, are banned by wildlife conservation guidelines inside a nature reserve, though local people lack broad knowledge, technology, and equipment needed to deal with wild boar in alternative ways (Cai et al., 2008; Dickman, 2010; Osborn and Parker, 2002; Thapa, 2010).

In China, dominant off-farm earnings and lower profits in agricultural production make farming unattractive to most farmers. Nowadays, more and more agricultural laborers migrate to seek off-farm employment, which has resulted in a labor shortage in rural China (Knight et al., 2011; Zhang et al., 2011), and cultivated lands, forming the basic cultivation for food-subsistence, are left to women and elderly people (Chang et al., 2011; Lichtenberg and Ding, 2008). From 2008, the wages for off-farm employment increased quickly, which has even attracted women and elderly people to seek off-farm employment. The farmers now face the choice between protecting cropland from wild boars and seeking off-farm employment. If they choose the latter, they are inclined to abandon croplands.

There are numerous reports on the theme of “wild boar invasion and human retreat” (Cai et al., 2008; Li et al., 2010a, 2010b); however, there is a lack of empirical information and research on the connection between HWC and land abandonment at the micro-level. The goal of this study is to present an empirical study of how increasing opportunities within the labor force will drive local farmers to stop protecting their crops and abandon their cultivated land that has been damaged by wildlife.

## 2. Materials and methods

### 2.1. Study area selection

Youyang is a National Key Poverty Alleviation County and belongs to an ecologically fragile zone (Chen, 2009; Editorial Committee of Chorography of Youyang County, 2002; Editorial Committee of Overview of Youyang County, 2008; Hua et al., 2013, 2014). Youyang County lies in Southeastern Chongqing (Fig. 1). Its geographic coordinates are 108°18'25"–109°19'02" E, 28°19'28"–29°24'18" N, and it has a total area of 5159.3 square kilometers. There are three types of landforms within the county: middle mountain (800–1895 m), low mountain (600–800 m), and trough valley (263–600 m), each accounting for approximately 54.86%, 21.14%, and 24% of the total land area, respectively. Youyang has a four-season humid monsoon subtropical climate. Topoclimate is quite prominent in this area. The annual average temperature decreases from 17.1 °C in the lowlands (263 m) to 8.1 °C at the

highest point (1895 m). The county has jurisdiction over 38 towns and 278 administrative villages, and the county seat is located in the town of Zhongduo.

We chose two townships—Maoba and Muye—as the study area due to their severe crop loss, such as maize, damaged by wild boar, based on an early household survey (Li et al., 2014). Maoba Township is located to the North of Youyang County. The township is 38 km away from the county seat, with an elevation of 703–1540 m and a total area of 143 square kilometers. We selected Tiancang Village and Shuanglong Village as sampled villages in Maoba Township. Muye Township is located to the northeast of Youyang County. The township is 61 km away from the county seat, with an average elevation of 850 m and a total area of 130 square kilometers. We selected Li'er Village and Dabanying Village as sampled villages in Muye Township.

### 2.2. Data collection

We carried out a tracking survey in August 2013 based on a household survey conducted in Youyang County in July 2012 (Li et al., 2014). In the previous survey, we found that human-wild boar conflicts perceived by farmers were very serious in the sampled villages (Li et al., 2014). Hence, we designed and conducted the supplementary investigation. Our study adopted participatory rural appraisal (PRA) tools including in-depth interviews, focus group discussions, and questionnaires. First, we performed in-depth interviews with some informants, including heads of administrative villages and natural villages, elderly persons, and township officials. These in-depth interviews mainly focused on the overall conditions as well as changes of livelihood activities, cultivated land use, and the main crops damaged by wild boar in the areas. In addition, we gleaned some information about the amount of residents who suffered great loss by wild boar damage in the study areas in 2012. Second, we conducted focus group discussions to obtain information such as socioeconomic conditions and institutional backgrounds, farmers' perceptions on the crop damage, cultivated land abandonment caused by wild boars, and the means of protection taken by local farmers. Based on these two methods, we obtained a general understanding of our targets at the village level, which was helpful in conducting household surveys. Third, we developed a detailed quantitative questionnaire using preliminary information gathered during the first two stages to obtain information on the following two topics: (i) crop damage and cultivated land abandonment, and (ii) the means taken by farmers to protect their crops. The survey contents included basic information of investigated households, such as family size, education level, and allocation of labor force; land use, including land area, type, and grade, as well as cultivated land abandonment and “Grain for Green”; and crop damage and land abandonment caused by wildlife, and the means taken by households to protect their crops. The main respondent was the head of each household, with other family members providing supplementary information. The interview time for each household was 1–2 h. We performed the interviews separately by two interviewers. In total, we selected 160 households randomly from four administrative villages (37 in Tiancang, 40 in Shuanglong, 39 in Li'er, and 44 in Dabanying).

### 2.3. Statistical analysis

Wild boar, showing remarkable flexibility in its ecological and behavioral traits, almost always are active at night when human presence is low (Li et al., 2013; Ohashi et al., 2013). Therefore, we presume that all cultivated land plots are faced with wild boar damage during the overnight hours. When analyzing the cultivated

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