Rodent outbreaks and extreme weather events: a southeast Asian perspective

Singleton, G.R., Htwe, N.M., Nelson, A.D.
International Rice Research Institute, DAPO Box 7777, Metro Manila, Philippines, g.singleton@cgiar.org

DOI: 10.5073/jka.2011.432.093

Abstract

In recent reviews of rodent outbreaks (Singleton et al., 2010a,b), three general systems were identified that influence the food supply of rodents in significantly different ways. One is life-cycle- or evolution-driven in the form of plant masting events. Outbreaks triggered by masting, including bamboo and beech forests, are examples of this system. The second is climatic; these include outbreaks driven by changes in abiotic conditions alone (aseasonal or unusual rainfall events, or major climatic events such as El Niño or La Niña). These are irregular and rodent populations respond rapidly to the peaks in increased food availability. The third is anthropogenic responses associated with extreme climate events or market forces with outbreaks driven by changes in cropping systems. These are driven directly by anthropogenic responses to calamitous events such as cyclones, high rainfall, and drought, or responses to shortfalls of production of staple crops.

In Southeast Asia a massive outbreak of rodents in the Ayeyarwaddy delta in 2009 and 2010 was associated with a calamitous weather event, cyclone Nargis, which occurred 15 months prior to the outbreak. We present findings that support the association between the effects of cyclone Nargis and the subsequent rodent outbreaks. These rodent populations response appeared to be associated with an extended period of available high quality food, which was caused by asynchronous and aseasonal planting of rice during the 2008 monsoon season. We contend that climate change and extreme climatic events will increase the impacts of rodents on agricultural production in coming years.

Keywords: extreme climatic events, Outbreaks, Rodents, Southeast Asia

Introduction

Since 2007, rodent outbreaks in Asia, from bamboo masting, have led to severe food shortages in Mizoram (India), Chin State (Myanmar), Chittagong Hill Tracts (Bangladesh), and upland provinces of Lao PDR. In Laos, emergency food assistance was required for 85,000-145,000 people. These outbreaks have affected highly vulnerable and food insecure families. In 2009-2011, high rodent losses also occurred in lowland irrigated rice-based systems in the Philippines, Myanmar and Indonesia, not related to bamboo masting (Singleton et al., 2010a). In 2009 in the Ayeyarwaddy delta, a major outbreak of rodent populations occurred in the monsoon rice season 15 months after cyclone Nargis, a calamitous event that led to the death of 140,000 people and destroyed more than 450,000 houses. This paper will examine the hypothesis that the outbreak of rodents in the Ayeyarwaddy delta was driven by asynchronous and aseasonal planting of rice post-Nargis, which extended the period when high quality food (rice from the booting to ripening stage) was available for rodents.

Methods

In July 2010, a household survey was conducted of 103 farmers from 5 village tracts in Bogale Township in the Ayeyarwaddy delta. The survey focused on the main production constraints, the cropping systems, the time of planting and the yields obtained during 2007 to 2009.

A two-stage remote sensing analysis was performed to derive an independent estimate of the rice planting dates for each year. The first stage identified the area planted to rice in each monsoon season; pixels were classified as rice or non-rice using a slightly modified version of the rice paddy detection algorithm by Xiao et al. (2006). The second stage estimated the date of the start of the season for each rice pixel using the approach developed by Jönsson and Eklundh (2004). Moderate Resolution Imaging Spectroradiometer (MODIS) Surface Reflectance was used to estimate planting dates. An 8-day composite (MOD09A1) provided the best observations to create a high quality composite image. This method enabled compilation of rice area maps, which were then used to select the rice pixels for the detection of the 'start of season' using the TIMESAT software (Jönsson and Eklundh, 2004).

Data on the numbers of rats in the Bogale Township in 2008 and 2009 were obtained from local government agencies which conducted bounty campaigns; 50 Kyatt were paid per rat tail (900 Kyatt=1USD).

Results

In the 2008 monsoon season, the major constraints for farmers for rice production were lack of money for inputs (12.4%), and limited time for cultivation due mainly to lack of labour (34.4%); rats were ranked as the major pest by 6.7% of farmers. In the 2009 monsoon season, rats were ranked by 19.1% of farmers as their major constraint.

In 2009, in the Ayeyarwaddy delta, 2.6 million rats were collected in 3 months through community action in five townships.

In Bogale Township, the TIMESAT analysis indicated that the time of planting of the monsoon rice crop in 2008 was extended by on average 24-32 days compared to the 2007 and 2009 monsoon seasons. This pattern was confirmed by the data collected from the households' surveys.

Discussion

In Southeast Asia a massive outbreak of rodents in the Ayeyarwaddy delta in 2009 and 2010 was associated with a calamitous weather event, cyclone Nargis, which occurred 15 months prior to the outbreak. Our findings support the association between the effects of cyclone Nargis and the subsequent rodent outbreaks. The extended planting season in the 2008 monsoon season would have led to an extension of the main breeding season by around 4 weeks. The main rodent pest species have a peak in breeding activity from the booting stage of rice through to its harvest (Sudarmaji et al., 2010). The first litter of the main breeding season does not usually breed during that crop. However, an extension of the breeding season by 3-4 weeks would enable them to breed and provide a platform for an exponential increase in the rodent population. Because the rodent population would be at a low density following the 3-5 m tidal surges associated with cyclone Nargis, it would take at least two seasons for the rodents to build up to high densities. We contend that climate change and extreme climatic events will increase the impacts of rodents on agricultural production in coming years. The delays between these events and population outbreaks of rodents may be greater than 1 year.

References

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