



Original research article

A theoretical model of community operated compensation scheme for crop damage by wild herbivores



Watve Milind*, Patel Kajol, Bayani Abhijeet, Patil Pramod

Indian Institute of Science Education and Research (IISER), Dr. Homi Bhabha Road, Pashan, Pune 411008, India

ARTICLE INFO

Article history:

Received 30 September 2015

Received in revised form 23 November 2015

Accepted 24 November 2015

Available online 10 December 2015

Keywords:

Agricultural crops

Human–wildlife conflict

Alternative model of compensation

Game theory

Behavioral economics

ABSTRACT

Damage to agricultural crops by protected species in the vicinity of wildlife parks is an important but underestimated problem. Since measures to protect crops are generally met with limited success in areas with high animal density, some form of compensation for the damage is necessary to avoid resentment of local farmers. The general method of compensation followed globally is that the victim makes a claim, which is verified or negotiated by the compensating agency and the agreed amount is paid. The major flaw in this method is that objective and realistic assessment of damage is difficult. Subjectivity in visual assessment leads to conflicts and both under and over-compensation is counterproductive in the long run. We suggest here an alternative model of compensation, which is based on the net loss in produce, rather than visual estimate of damage. In this model the average loss in net produce is estimated over a belt with comparable risk of damage. The compensation payable is calculated based on the average loss but is paid in proportion to individual farm's produce. Analysis based on principles of behavioral economics shows that this compensation scheme would facilitate good agricultural inputs and honesty in reporting the produce. It would also effectively segregate wildlife damage from other forms of agricultural loss. The theoretical foundation of the alternative model of compensation and suggestive means of implementing it are discussed.

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1. Introduction

Damage to agricultural crops by wild animals is a natural phenomenon that presumably existed since the origin of agriculture. However, it is no more possible that this loss is borne by a few farmers close to protected areas without creating resentment, which would be ultimately harmful to conservation (Tchamba, 1996; De Klemm, 1996; Brandon et al., 1998; Terborgh et al., 2002; Gureja et al., 2002; Sethi, 2003; Woodroffe et al., 2005; West et al., 2006; Ogra and Badola, 2008). What was normal, inevitable, and therefore tolerated by people for millennia has now become a source of discriminative justice since wildlife has retracted into small pockets and therefore the menace is also pocketed. Moreover, since more and more species causing crop damage are covered by legal protection, people are prohibited from using methods such as culling.

As resentment in local people is a major potential threat to conservation programs, a number of attempts have been made to mitigate the conflict (e.g. Mathur et al., 2015). Two main possible approaches are either aimed at protecting the crops from damage or to offer direct or indirect compensation for the damage. Although a number of means to repel damaging species including fences, trenches, chemical repellents or scare devices have been tried (Jayson, 1999; Delger et al., 2011), they are rarely effective on a wider scale over a long time (Thouless and Sakwa, 1995; Karanth et al., 2013a,b). Often measures

* Correspondence to: Indian Institute of Science Education and Research (IISER), Homi Bhabha Road, Pune 411008, India. Tel.: +91 20 25908093.
E-mail address: milind@iiserpune.ac.in (M. Watve).

that are found effective on a demonstration scale fail when applied landscape-wide for a perceivable reason. Models based on foraging optimization show that when a measure such as a fence or a pheromone repellent is used on a small scale, animals have a choice of avoiding the experimental protected plot and can visit neighboring farms. However, if the measure is applied everywhere, the choice is taken off and animals may start raiding indiscriminately again (Watve et al. Manuscript under review).

Since it is not possible to offer effective protection to crops in every situation, the compensation approach becomes inevitable. The nature of conflict and accordingly the concept of compensation are widespread in wildlife management. However, laws and practices of compensation vary widely across different countries and so does their effectiveness (De Klemm, 1996; Schwerdtner and Gruber, 2007; Gordon, 2009; Agarwala et al., 2010). The cultural and political background often shapes the compensation practices. People's perception and tolerance towards wildlife damage is highly variable across cultures and even locally across a small distance (Agarwala et al., 2010; Nagendra et al., 2010). It is still not a universal practice that a compensation for wildlife damage is paid by the state or public authorities but the number countries offering it appear to be growing (De Klemm, 1996). Compensation by non-governmental organizations (NGOs) with a concern for wildlife is also practiced in some areas (De Klemm, 1996). Currently practiced compensation or insurance schemes have often failed to work satisfactorily due to a variety of reasons the main concern being gross under-compensation (Chen et al., 2013; Karanth et al., 2013a,b).

Among various types of damages caused by wildlife, livestock killing by carnivores has received more attention; compensations schemes appear to work better for such cases since recording and assessment of damage is relatively easier and more objective (Bayani et al. Manuscript under review). Economic loss due to herbivore damage to cultivated plants is much greater in magnitude (Karanth et al., 2013a,b) in most areas but this has received less attention. Most research on crop depredation has focused on mega-herbivores such as elephants (Sukumar, 1991; Bandara and Tischell, 2003). Elephant damage is more conspicuous and therefore easier to detect and assess, whereas damage due to smaller herbivores is rather more diffused and inconspicuous in nature and therefore difficult to assess visually (Sukumar, 1990) although in the long run the losses are significant (Naughton-Treves, 1997). As a result, small herbivore damage remains uncompensated (Ogra and Badola, 2008) or grossly undercompensated (Bayani et al. Manuscript under preparation). The rate of crop loss by herbivores is commonly influenced by factors like distance of the farms from the forest border, herbivore density, cropping patterns, cropping season and other landscape variables (Jayson, 1999; Hegel et al., 2009; Retamosa et al., 2008). Therefore, the nature and extent of conflict is different in different areas (Gordon, 2009).

Compensation procedures in most countries leave the assessment of damage to the personal visual judgment of some authority or are negotiated between the victim and the compensating party. Often there is no correlation between the visible estimate of damage and the actual grain yield (Kear, 1970; Bayani et al. manuscript under review). It is also often difficult to decide whether the damage is caused by the protected species or by something else. Whether compensation will ultimately benefit the conservation cause or not is also debated. Although the general thinking supports the compensation concept (De Klemm, 1996), others think that compensation can be counterproductive in the long run. This fear is based on the assumption that it would encourage human activities in and around the protected areas (Bulte and Rondeau, 2005).

A major deficiency in the field appears to be the lack of development of a sound theoretical platform on which the questions can be addressed (Schwerdtner and Gruber, 2007; Watve et al. manuscript under review). There appear to be few attempts towards developing sound, objective, quantitative and validated methods for the assessment of damage. The social and managerial consequences of under, over or realistic compensation have not been thoroughly examined theoretically and empirically. Effective handling of the problem needs expertise from a multitude of fields including wildlife ecology, agriculture, economics, human behavior and management. A number of problems on the interface of economics and human behavior are addressed by game theory and other economic behavior theories (Neumann and Morgenstern, 1944; Aumann, 2008; Myerson, 1991; Roe, 1996; Henrich et al., 2001). It is possible that a theoretical approach based on principles of human behavior can give us a conceptual solution that can be implemented in different parts of the world appropriately modified to suit the local ecology, agricultural practices, law and culture.

2. Problems in the currently practiced compensation schemes

A universal inadequacy of all the compensation practices is that the laws and procedures all over the world provide no clear cut guidelines on how to estimate damage. Also, there are no reliable methods to differentiate wildlife damage from other sources of damage including domesticated or feral animals. Since there are no objective methods for damage assessment, the system depends upon individual judgments and therefore invites conflicts as well as corruption (Ogra and Badola, 2008; Bayani et al. manuscript under review). It is also important to realize that both under-compensation and overcompensation can have deleterious consequences for conservation. Under-compensation increases resentment and overcompensation can encourage human settlement and activities near the park (Studsrod and Wegge, 1995; Sekhar, 1998; Bulte and Rondeau, 2005). Fears are expressed that inappropriate compensation can even worsen the problem (AFESC, 2007). Therefore, a realistic assessment is extremely important in the long-term interest of conservation.

Farmers with high exposure to herbivore raiding tend to disinvest from intensive agriculture by cutting down the expenditure on quality seed, fertilizer etc. (Bayani et al.; Watve et al. manuscript under review). This decreases the produce qualitatively and quantitatively. Also, they need to spend more resources and efforts in fencing, guarding and other measures of protection. These indirect losses as well as additional costs are not covered by the compensation schemes.

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