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Review

The paradox of keystone species persecuted as pests: A call for the conservation of abundant small mammals in their native range

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ABSTRACT

Small mammals, such as European rabbits (*Oryctolagus cuniculus*), plateau pikas (*Ochotona curzoniae*) and prairie dogs (*Cynomys* spp.), traditionally have been perceived as pests and targeted for control within their native ranges, where they perform essential ecosystem roles and are considered keystone species. These species can reach high densities, and have been subjected to eradication campaigns because of their putative negative impact on natural habitats and agriculture and their competition with livestock for forage. Eradication programmes have been a main factor causing sharp declines of these species in their natural ranges. Paradoxically, they are keystone species where they are abundant enough to be perceived as pests. The term "pest" is usually a social perception that is rarely supported by scientific data, whereas there is considerable scientific evidence of the key ecological roles played by these species. We call for the conservation of these species and present a conceptual model regarding the management of their populations. Where they occur at high numbers, and hence their effects on biodiversity are still of crucial importance, the persecution of these species should be avoided and their natural habitats preserved. In areas with high conservation value, but where these species occur at low densities, management efforts should aim to increase their density. In areas of high commercial value, managers ideally should consider changing prioritization of the area to high conservation value by purchasing the land or obtaining conservation easements. In situations with high commercial value and demonstrable low conservation concern, small mammals could be reduced humanely.

Contents

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1. Introduction

There is increasing evidence of a global decline in biodiversity. Although many factors are responsible for this decline, the root cause seems to be increasing pressure from human activities (Mace et al., 2005). Thus, there is a need to identify the drivers leading to conflicts between human activities and the conservation of biodiversity, and to promote the judicious management of these conflicts (Young et al., 2005; White et al., 2009; Dickman, 2010; McShane et al., 2011).

Invasive species constitute severe threats to biodiversity in many ecosystems, and these are often referred to as "pests" (Mooney and Hobbs, 2000). However, traditionally land managers and farmers have also considered several native species as pests in their native ecosystems (see below; but also Singleton et al., 1999, 2003). A crucial difference between native and invasive species is that native species may have evolved to perform key roles in ecological systems, and thus they can be important from a conservation point of view. Designating species that play major roles in ecosystems as pests frequently creates conflicts between conservationists and agriculturalists regarding the way in which the land should be managed (Smith et al., 2006; Miller et al., 2007). Several species of small mammals are especially well-known in this context. These include European rabbits (*Oryctolagus cuniculus*; Angulo and Villafuerte, 2003; Ward, 2005; Delibes-Mateos et al., 2008), plateau pikas (*Ochotona curzoniae*; Smith and Foggin, 1999) and prairie dogs (*Cynomys* spp.; Hoogland, 2006; Miller et al., 2007; Slobodchikoff et al., 2009).

Here we present a conceptual model portraying the conditions under which these species may be considered keystones or pests, the situations that lead to each designation, and the role of different management strategies (eradication programmes for pests and conservation actions for keystone species) in their respective ecosystems (Fig. 1). In addition, we identify different management models to address the conservation of these important species.

2. Methods

We focus on the well-studied cases of European rabbits, plateau pikas and prairie dogs, because they are functionally similar in

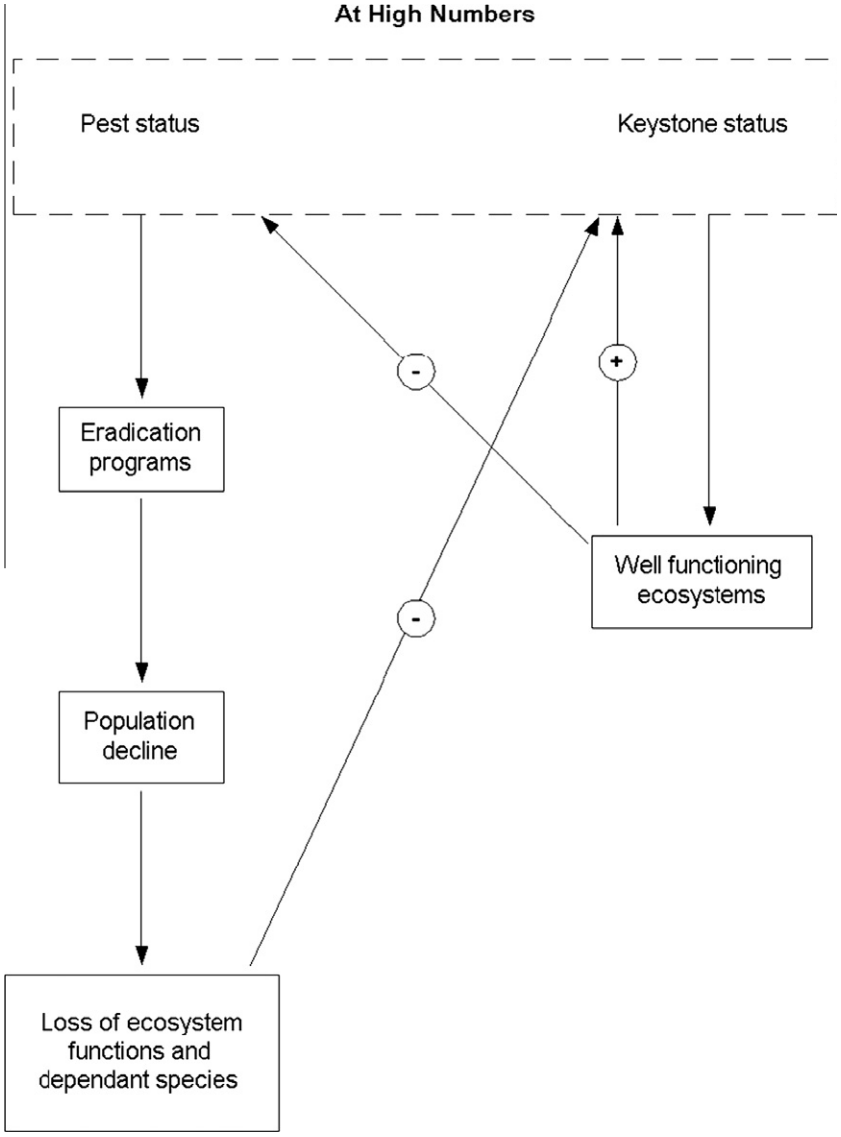

Fig. 1. A model showing the case of species of small mammals that, at high densities, can act as keystone species and simultaneously be perceived as agricultural pests. These species play major roles in the functioning of ecosystems, which provides them with keystone status but, when attributed pest status, eradication programmes have been developed, causing sharp declines of these species. Population declines of keystone species have caused the loss of ecosystem functions and dependant species, which moves these species away from the keystone status. The signs "+" and "−" indicate that keystone or pest status may be enhanced or reduced, respectively.