



Review paper

Under what circumstances can wildlife farming benefit species conservation?



Laura Tensen*

Molecular Zoology Laboratory, Department of Zoology, University of Johannesburg, Johannesburg, South Africa

HIGHLIGHTS

- Farmed wildlife products should be considered equal in quality, taste, and status.
- The demand for wildlife products cannot increase due to the legalized market.
- Wildlife farming should be more cost-efficient than poaching.
- Wildlife farms should not depend on wild populations for restocking.
- Laundering of illegal wildlife products into the commercial trade should be absent.

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ABSTRACT

Wild animals and their derivatives are traded worldwide. Consequent poaching has been a main threat to species conservation. As current interventions and law enforcement cannot circumvent the resulting extinction of species, an alternative approach must be considered. It has been suggested that commercial breeding can keep the pressure off wild populations, referred to as wildlife farming. During this review, it is argued that wildlife farming can benefit species conservation only if the following criteria are met: (i) the legal products will form a substitute, and consumers show no preference for wild-caught animals; (ii) a substantial part of the demand is met, and the demand does not increase due to the legalized market; (iii) the legal products will be more cost-efficient, in order to combat the black market prices; (iv) wildlife farming does not rely on wild populations for restocking; (v) laundering of illegal products into the commercial trade is absent. For most species encountered in the wildlife trade, these criteria are unlikely to be met in reality and commercial breeding has the potential to have the opposite effect to what is desired for conservation. For some species, however, none of the criteria are violated, and wildlife farming can be considered a possible conservation tool as it may help to take the pressure off wild populations. For these species, future research should focus on the impact of legal products on the market dynamics, effective law enforcement that can prevent corruption, and wildlife forensics that enable the distinction between captive-bred and wild-caught species.

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* Tel.: +27 74 6225598.

E-mail address: tensen.laura@gmail.com.

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1. Introduction

1.1. Illegal wildlife trade

Wild animals, plants and their derivatives are traded worldwide to meet demands for food, clothing, decorative items, traditional medicines, and pets (Challander et al., 2015; TRAFFIC, 2008). Although the trade in some wildlife products is regulated (CITES, 2014), the industry remains largely illicit (Rosen and Smith, 2010). The illegal trade in wildlife is estimated to value over 20 billion USD per year (South and Wyatt, 2011), making it the second-largest illegal business in the world (Wylor and Sheikh, 2008). Skins, pelts and fur are the main traded animal products, followed by elephant ivory, meat and other body parts, bones and teeth, and horns (Rosen and Smith, 2010). The high demand for these products and subsequent wildlife poaching has been one of the main threats to the conservation of species (Challander et al., 2015; Dinerstein et al., 2007; Naylor, 2005).

The scope of animal species involved in wildlife trading is large and covers most taxonomic groups (Rosen and Smith, 2010). For many of these species, illegal harvesting has had a catastrophic impact on their population numbers. To give an illustration, the demand for tiger skins and bones for traditional medicines has led to a total population decline of 97% in one century and local extinctions (Check, 2006). Pangolins are caught for their meat and scales, and poaching has led to a population decline of 94% in China and surrounding countries (Pietersen et al., 2014; Wu et al., 2004). Asiatic black bears (*Ursus thibetanus*), sun bears (*Helarctos malayanus*) and sloth bears (*Melursus ursinus*) are threatened by the demand for bile, which is used in Chinese and Southeast-Asian medicines, and which led to a global population decline of 49% and local extinctions (Foley et al., 2011; Servheen, 1994). Rhino horns are also in high demand for their use in Asian traditional medicines (Biggs et al., 2013; Milliken and Shaw, 2012), and subsequent poaching led to a global population decline of 85% in only 17 years (Ayling, 2012). In South Africa, home to 90% of the world's white rhinos (*Ceratotherium simum*), poaching has been doubling each year over the past five years (Biggs et al., 2013). Elephants are being poached for their ivory, which is used for decorative purposes (Stiles, 2004). Even though the international trade in ivory was banned in 1989, poaching has increased persistently (Underwood et al., 2013). Tanzania alone has lost 60% of its elephant population (65 000 individuals) in only 5 years due to poaching (Mathiesen, 2015).

1.2. Regulations and law enforcement

The market for wildlife products is of high value, which makes illegal trade difficult to combat. The International Convention on Trade in Endangered Species of Wild Flora and Fauna (CITES) is an international agreement among countries to regulate the trade in animal products. Additionally, the wildlife trade monitoring network (TRAFFIC) investigates the extent and impact of illegal wildlife trade on wild populations. Both organizations aim to ensure that wildlife harvesting and trade does not threaten the survival of wild species. CITES has divided circa 35 000 species over three appendices, which determine the degree to which trade is prohibited (CITES, 2014). Appendix I is for endangered species and allows no trade. Conservation efforts have been aimed to seize illegal wildlife resources, activate anti-poaching patrols, and raise awareness by community-based education. Some governments have responded to illegal poaching by increasingly severe law enforcement and militarization for wildlife-protection (Ayling, 2012). As for rhino poaching, a shoot-on-sight policy

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