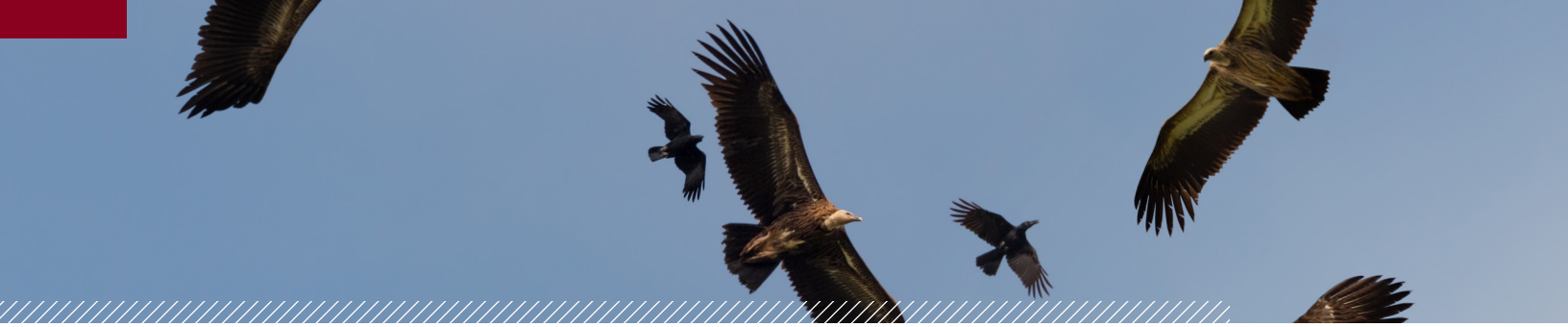

RESEARCH HIGHLIGHTS

The Social Costs of Keystone Species Collapse: Evidence From The Decline of Vultures in India

by Eyal Frank and Anant Sudarshan

How did a widespread decline in vultures in India impact human health?

Context

Scientists agree that human activity is causing the loss of animal and plant species at alarmingly high rates, making it ever important to understand how the loss of species might affect human welfare. Vultures are one example of a "keystone species" in that they provide critical environmental sanitation services for their ecosystem. They are highly efficient scavengers, and have long been relied upon by farmers to remove livestock carcasses. Once widespread in India, vultures neared extinction in the mid-1990s—where their population dropped by more than 95 percent from around 50 million over just a few years. The cause of this significant increase in vulture deaths was unintended poisoning by diclofenac, an anti-inflammatory drug that farmers used to treat their cattle. Though the drug was harmless to both cows and humans, vultures that consumed cattle treated with diclofenac suffered from kidney failure and died within weeks. The sharp collapse in the vulture population during the mid-1990s offers a natural experiment by which to study the effect on human health.

Research Design

The authors compared districts with habitats highly suitable for vultures to live and thrive to those that have historically been unsuitable, both before and after the onset of diclofenac use. They also compared human death rates in high- and low-suitability districts before and after the collapse in vulture populations. As a further check on their results, they considered whether districts had high or low livestock populations before the collapse, as well as whether an area was urban or rural. High livestock populations in urban settings meant there would be a high flow of carcasses added to animal landfills. From there, the researchers studied three main factors: the sale of rabies vaccines, feral dog counts, and concentrations of pathogens and bacteria in the water supply.

Findings

Dog populations rose in districts once highly suitable for vultures, as did the sale of rabies vaccines. With significantly less to no vultures carrying out the removal of carcasses, this attracted feral dogs. In areas that were once highly suitable for vultures, the authors found that the dog population was meaningfully higher. These dogs carried rabies and other diseases that threatened human health. The authors observed a sharp increase, of more than 20 percent, in the quantity of rabies vaccines sold during this time.

Water quality deteriorated in districts affected by the disappearance of vultures. Not only do dogs carry rabies and other diseases that threaten humans, but they are also less efficient at finishing off the carcasses. Rotting remains left behind are full of pathogens that can easily spread to drinking water due to runoff and disposal methods. The authors used data on water quality that are most directly linked to a larger presence of carcass disposal: dissolved oxygen and fecal coliform (bacteria). The authors found evidence that in urban areas, where carcass dumps occur on the outskirts of town, dissolved oxygen levels in the water dropped by 7 percent and fecal bacteria more than doubled.

In districts highly suitable for vulture habitats, more people began to die just as diclofenac sales increased. Following the onset of diclofenac use after 1993 and the first observed signs of large-scale decline of vultures in 1996, the human mortality rate rose by 4.7 percent in districts once populated by the birds. The effect was greatest in urban areas with large livestock populations. The authors estimated that, between 2000 and 2005, the loss of vultures caused an additional 100,000 human deaths per year, resulting in USD 69.4 billion per year in mortality damages.

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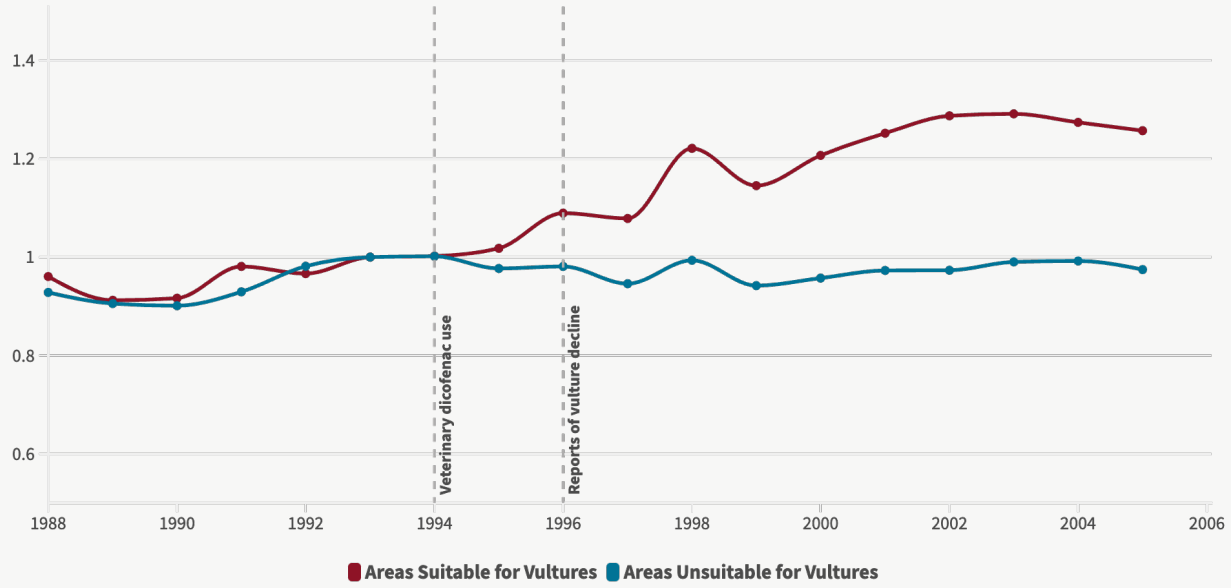
Figure 1 · Human Death Rate



Source: The Social Costs of Keystone Species Collapse: Evidence From The Decline of Vultures in India, American Economic Review, Forthcoming • Note: Death rate normalized relative to 1993 levels

CLOSING TAKE-AWAY

Human activities—from habitat loss and wildlife trade to the introduction of invasive species and human-fueled climate change—have an impact on species. This study underscores the human costs from species extinctions and points to the need for regulations and resources to conserve wildlife.