

When protected areas prove insufficient: Cheetah and “protection-reliant” species

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An understanding of the factors that affect the distribution of species is a cornerstone of ecology; yet, two-thirds of the world’s species remain undescribed (1) and estimated rates of extinction are high, but certainty around those rates is limited (2). The International Union for Conservation of Nature (IUCN) Red List remains the “gold standard” for the analysis of extinction risk for individual species (3), but the Red Lists rely on assumptions of distribution measurement (4) and equilibrium/disequilibrium (5) that may make estimation of future extinction risk more complicated. However, these concerns do not negate the core issues central to the examination of the process of extinction for an individual species: loss of range, loss of populations, increased fragmentation, and eventual decline to a point where recovery is difficult or impossible. In PNAS, Durant et al. (6) take on these issues, bringing together a wide diversity of data across time and space on the status, distribution, and threats facing the cheetah (*Acinonyx jubatus*) to make a strong case for a change in the way that we think about the conservation of widely ranging species whose distributions occur predominantly outside of protected areas.

Cheetah face multiple threats: loss and fragmentation of habitat, loss of prey, direct persecution, and illegal trade (6). The near-extinction of cheetah in Asia [one remnant population persists in Iran (Fig. 1)] and rapid declines in cheetah populations across their range in Africa exemplify the more general phenomenon of the extinction risks faced by wide-ranging species that live at low densities. The establishment and maintenance of protected areas have been key tools for biodiversity conservation. The scale and impact of protected areas have been increasing in recent years, although they are often underfunded, and geographic coverage is still falling short of conservation targets (7). However, protected areas, although a necessary component of a global conservation strategy, are insufficient to protect species like cheetah that are wide-ranging and sparsely distributed, where the majority of individuals and populations occur on unprotected lands. Durant et al. (6) show that we tend to underestimate the threats to species where those threats occur outside protected areas, noting that



Fig. 1. Cheetah have declined across their range in Africa and are found in only one relict population in Asia, in the Islamic Republic of Iran, where this camera trap photograph was taken in the Dare-Anjir Wildlife Refuge. Photograph courtesy of Iran Department of the Environment/Conservation of the Asiatic Cheetah Project/Iranian Cheetah Society/Wildlife Conservation Society/Panthera.

such a bias can underestimate extinction risk. A recent review of large mammal declines in Kenya (8) highlights the severity of this problem at a national level, whereas, globally, Maxwell et al. (9) show that the majority of the 8,000 species evaluated as threatened by the IUCN are threatened by loss of habitat (agricultural conversion) and overharvesting, legal and illegal, precisely those threats that predominate outside protected areas. These statistics obscure the impact of conservation efforts: Of the 5,000 or so vertebrates classified as threatened, Hoffman et al. (10) estimate that a further 1,000 vertebrates would have been classified as threatened but for targeted conservation efforts.

A recent analysis shows the ecological importance of top-down ecological processes driven by carnivores, and also suggests that the cheetah is not alone among large carnivores in its declining conservation status (11). The vulnerability of large carnivores has been appreciated for decades, but the focus of risk analyses has been on populations living inside protected areas (12, 13). Recent range-wide planning (14) for both cheetah and African wild dogs (*Lycaon pictus*) suggests that for these and other wide-ranging

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species, a protected area focus will fail to reverse decadal declines in abundance and distribution. What Durant et al. (6) bring to this discussion is a flexible approach to scenario modeling for the broad array of species where conservation will require a focus on management and threat reduction outside protected areas, species they call “protection-reliant species.”

The concept of protection-reliant species is new, and differs in significant ways from the former IUCN Red List category of “conservation-dependent” (dropped in 2001 in version 3.1 of the Red List criteria). Conservation-dependent species are usually not threatened because conservation efforts have reduced, or reversed, threats. Protection-reliant species are threatened, usually have a substantial proportion of their range outside protected areas, and are disproportionately vulnerable to rapid anthropogenic change: In the extreme, the model shows that source-sink dynamics can result in population declines, even among populations that include a significant subpopulation living within protected areas. Although the focus of Durant et al. (6) is on mammals, there is good reason to believe these dynamics apply to other organisms that are thin on the ground and widely distributed inside and outside areas that are formally protected.

One must question the potential for recovering protection-reliant species, no less large carnivores, in the Anthropocene,

particularly in the tropics (10). However, there are some slim indications that conservation efforts may realize further gains. At a macrolevel, a recent revision of the Human Footprint (15) shows that in the period 1993–2009, the human population grew by 23%, the world economy grew by 153%, but the Human Footprint expanded significantly less quickly by 9%. Over the same time frame, the proportion of humans living in urban centers rose from 43 to 52% and is expected to continue to rise to 66% by 2050, leaving relatively and absolutely fewer people living in rural areas (16). Agricultural intensification, coupled with depopulation of areas where crops are marginal, offers an opportunity for wildlife recovery (17). The upward trajectory of some large carnivore populations in Europe (18) and North America (19) offers some hope: A combination of legislation, changes in attitudes, and shifting human demography and behavior has allowed large carnivore populations to show recovery in the 21st century, with most of the largest European carnivore populations, and many of North America’s carnivores, living outside protected areas. No doubt, recovery of protection-reliant species, and large carnivores in particular, will be an uphill battle, further complicated by the impacts of climate change (20), but data, analyses, and insights such as the ones provided by Durant et al. (6) for the cheetah can only improve chances for success.

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