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Topical Review

A Review of the Proposed Reintroduction Program for the Far Eastern Leopard (*Panthera pardus orientalis*) and the Role of Conservation Organizations, Veterinarians, and Zoos

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The Amur leopard is at the point of extinction. At present there are fewer than 35 in the wild. Their natural habitat ranges from China to the North Korean peninsula to Primorsky Krai in Russia. A reintroduction plan has been proposed to increase the population in the wild; however, this proposed plan still has many questions to be answered as to how effective it will be. The main objective is to reintroduce animals from a select group within the Far Eastern leopard programme or the Species Survival programme, which consist of leopards from select populations in the Northern Hemisphere.

Zoos are central to the success of this plan, providing suitable breeding pairs to breed animals for reintroduction and also raising much needed funds to finance the project. Zoos are also central in educating the public about the critical status of the Amur leopard and other endangered animals of the world.

Veterinary surgeons, by the very nature of their professional skills, are at the forefront of this seemingly endless battle against extinction of thousands of species that are critical to maintaining the balance of our fragile ecosystem. Veterinarians can analyze the health risks and health implications of reintroduction on the animals to be reintroduced and also on the native population.

A world without large cats is a world hard to imagine. If we look closer at the implications of extinction, we see the domino effect of their loss and an ecosystem out of control.

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Introduction

Imagine a world without big cats. Sadly, this is a reality that may be fast approaching. The leopard (*Panthera pardus*) has the widest distribution of all big cats in the world; however, the northern-most subspecies, known as the Amur leopard or Far Eastern leopard (*P. pardus orientalis*),[19] is the rarest of all large felids. Listed in 1996 by the International Union for Conservation of Nature (IUCN) as critically endangered,[9] the Far Eastern leopard teeters on the brink of extinction. Presently, it is estimated that there are less than 35 Far Eastern leopards living in Southwest Primorsky Krai, located in the Russian Far East.[17] A small population still remain in China; recent leopard surveys indicate that fewer than 10 remain in Jilin Province[25] and a few, if any, remain in Heilongjiang Province.[23,3]

Highlighting the gravity of the situation is the fact that a pair of these majestic cats residing in Tayto Park, Ireland, make up almost 1% of the world's population. Visitors to the park are astonished at this startling statistic. Not only is the loss of a top-order predator shrinking the Earths biodiversity, the absence of these big cats could destabilize (disrupt) the ecosystem. Far Eastern leopards occupy the highest tropic level in their ecosystem and thus act as regulators of their prey species and subsequently the lower tropic levels. Top-order predators play an important role in the regulation of prey species and thus foster and maintain the healthy balance of the ecosystem which they inhabit.[21] Biodiversity conservation cannot be effective with the absence of top-order predators.[18] The Far Eastern leopard is an indicator species for the health and integrity of the ecosystem which they inhabit[18] in Southwest Primorsky Krai, and as a result, the relevance is greater than this felid's status alone.

Although the leopards in the Tayto Park represent the dire plight of their species, they also symbolize hope and demonstrate the critical role that conservationists, veterinarians, and zoological gardens play in combating extinction. The strategies employed by these groups to preserve species include reintroduction, translocation, or in situ and ex situ conservation. To better understand these strategies, we reviewed a plan for reintroduction of the most endangered felid on the planet, the Far Eastern leopard. We describe the Amur Leopard and its relationship to its environment, the proposed reintroduction program, and the integral role of veterinarians in conservation.

Far Eastern Leopard Biology and Vulnerability

Inhabiting temperate, deciduous forests, and mountainous regions, Far Eastern leopards are nocturnal and solitary hunters that stalk or ambush their prey. The diet of the Far Eastern leopard consists of representatives of virtually all groups of vertebrates endemic to their habitat. However, medium-sized ungulates, roe deer (*Capreolus capreolus*), and sika deer (*Cervus nippon*) are the main prey species for Far Eastern leopards. Adult leopards can stay with an ungulate kill for up to a week and demonstrate arboreal behavior, protecting their kill from other predators. Of the 9 subspecies of leopards, the Far Eastern leopard is the only one adapted to a cold and snowy climate and displays the greatest

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divergence in coat pattern. Far Eastern leopards have larger, thick-rimmed, more widely spaced rosettes than other leopards.[9] Pelage length and color is variable and based on season, turning a pale yellow in the winter, reaching a length of more than 7 cm and brightening in the summer with the length reducing to 2.5 cm. The long legs of the Far Eastern leopard are another adaptation for the deep snow.

The historic range of the Far Eastern leopard once extended across Northeastern (Manchurian) China, the Korean peninsula, and the southern Primorsky Krai region in Russia. Genetic impoverishment of the population, overhunting of ungulates by man, destruction of habitat, poaching, man-made fires for converting forest to grassland, and blocked routes to former or potential habitat have brought this leopard to the very edge of extinction. Further adding to the plight of this felid is their low reproductive success. Research has indicated a reduction in litter size from almost 2 cubs in the 1970s to 1 cub in the 1990s.[22,16]

Reintroduction

"An attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or gone extinct."[7]

In the last 30 years, 2 of the 3 fragmented populations of Far Eastern leopards have become extinct.[15] Today, the remaining Far Eastern leopard population is limited to an isolated range bordered by North Korea, China, and the Sea of Japan and located in a region of economic importance dominated by humans in the Russian Far East.[5] Although the focus cannot be taken off the 25-34 remaining individuals in southwest Primorye, experts have concluded that reintroduction in their former range of Sikhote-Alin in Primorsky Krai may serve to save this critically endangered felid. The Far Eastern leopard's habitat and extremely low numbers inhibit their ability to successfully disperse, thus creating a second population without human intervention is not feasible.[14] Conservation experts such as the IUCN-Species Survival Commission Cat Specialist Group support the notion that to ensure a population of Far Eastern leopards remain in the wild, it is advantageous for a second population to be established within their historical range.[5,24] Reintroduction using captive-bred individuals is generally regarded as the last resort to save a critically endangered species but can result in favorable outcomes. The Association of Zoos and Aquariums (AZA) has spearheaded numerous successful reintroduction programs such as for the golden lion tamarin (*Leontopithecus rosalia*)—once critically endangered now listed as endangered; California condor (*Gymnogyps californianus*)—in the 1980s only 23 remained in the wild, now there are approximately 172; and perhaps the greatest success story, the black-footed ferret (*Mustela nigripes*)—the last 18 were put in AZA-accredited zoos, and owing to their efforts, 700 have been released into the wild.[2] The reintroduction of the Florida panther (*Puma concolor coryi*) is an example of a felid that has succeeded when reintroduced into its former range, utilizing both captive-raised and wild-caught, translocated individuals.[1] Certainly, without the benefit of reintroduction, it is highly plausible that these species would not have rebounded but rather would have been extirpated from the wild.

Although reintroduction can be a very effective strategy, it can only be achieved by navigating through a myriad of complexities, many of which come at a significant cost.[12] A few of the issues include sourcing suitable habitat for release, disease risk assessment and management of infectious and non-infectious diseases, availability of captive-bred individuals and the necessity for them to retain skills necessary for survival in the wild, local effect on citizens, and of course, the financial resources necessary to facilitate these projects.[14]

However, even with success, there is still much debate on the practicality of reintroduction. Questions continue to arise as to whether the limited resources should be spent on threatened or endangered animals that have sufficient numbers in the wild or should it be focused on critically endangered animals teetering on the brink of extinction. In the case of the Far Eastern leopard, time has run out for debate. This big cat's demise seems imminent and serves as a beacon to conservationists that Southwest Primorye is in a critical state.

The Far Eastern Leopard Proposed Reintroduction Program

The proposed reintroduction was conceptualized in 1996 at a meeting in Vladivostok, Russia, which comprised a group of cat specialists brought together to formulate a plan to prevent this critically endangered felid from going extinct.[20] The reintroduction program has been researched and prepared in accordance with the Far Eastern Leopard Conservation Strategy of the Russian Federation and the IUCN's Reintroduction Guidelines of 1998[8] by a group of international and Russian scientists.[14]

Spearheading a number of conservation initiatives while working on reintroduction planning is the Amur Leopard and Tiger Alliance, which is a coalition of 14 international and Russian nongovernmental organizations. Some of the organizations that make up this coalition include the Zoological Society of London (ZSL), World Wildlife Fund, Wildlife Conservation Society, the European Endangered Species Program (EEP), Wildlife Vets International (WVI), and the Phoenix Fund.

The main thrust of this proposed plan strives to grow the population in the Russian Far East by reintroducing leopards from a select in situ captive-breeding group to their former range. The breeding leopards or founder group would be sourced from the current Far Eastern leopard EEP and Species Survival Plan (SSP) stock, which represents the captive Far Eastern leopard population in European, Russian, and North American Zoos. Objectives of the program include constructing a reintroduction and breeding center and maintenance of the ecosystem, which will include protection of prey species, breeding and preparation of cubs for release in the wild as well as educating local communities to ease tensions and increase acceptance of the leopards.[14] An existing breeding center located on the outskirts of Ussurisk Zapovednik may also be used for the breeding and release of Far Eastern leopards, but this is yet to be confirmed.[11]

Zoos and Conservation

Modern zoos form the backbone of the reintroduction program by providing suitable breeding pairs, raising funds, and educating the public to the plight of these critically endangered animals. Zoos have evolved significantly since the early exotic collections

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