



Snow leopard digging for water in an arid environment

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Abstract

Adaptations to arid environments, involving strategies to conserve and utilize water, are vital for wildlife. Water availability in these regions depends on seasonal rainfall, and subsequently affect species distribution and behavior. This note documents a snow leopard (*Panthera uncia*) in the Tost Mountains of southern Mongolia digging for water, a previously undocumented behavior. The first author identified evidence of snow leopards digging for water. Camera traps were then used in an attempt to document this behavior. Unique pelt patterns identified one snow leopard digging for water in the summer of 2022, with drinking observed. Other species also drank at the site, suggesting snow leopards could act as ecological engineers by providing water for other species. Four other snow leopards were observed to visit

the site in the late fall, winter, and early spring of 2022 and 2023. These snow leopards did not dig or drink, but this may largely have been related to subzero temperatures (-15°C to -30°C) and the ground being frozen for most of this period. The snow leopard digging for and exposing water may help to support biodiversity in desert ecosystems. However, further research is needed to determine its prevalence and impact. Understanding these strategies is crucial for conservation, especially with increasing droughts and extreme weather in arid landscapes.

Main text

Adaptations to arid environments among wildlife represent an evolutionary strategy aimed at water conservation and utilization (Rymer et al. 2016). These adaptations, encompassing anatomical, physiological, and behavioral facets, are crucial for survival in regions where water is a scarce and limited resource (Rymer et al. 2016; Cain et al. 2006; Gedir et al. 2020). Water availability in arid and semi-arid environments depends on rainfall, which often varies greatly among and within years, with most of the annual precipitation falling during a few months of the year (Perrin et al. 2012). Seasonal variation in rainfall determines water levels and its availability, which can shape the dynamics of communities and influence species distribution and behavior (Miranda et al. 2011, Kaczensky et al. 2010, de Boer et al. 2010).

Here we report on the observation of a snow leopard (*Panthera uncia*) digging for water in a desert ecosystem in the Tost Mountains in southern Mongolia (43.2° N, 100.7° E). Snow leopards are large carnivores adapted to the rugged terrain of High Asia (Fox et al. 2023). While much attention has been directed towards understanding their ecology and

behaviors, their strategies for coping with arid conditions is poorly described. There are also limited observations of large felids digging for water.

The first author, who was born and raised in the Tost Mountains, identified evidence of a snow leopard digging to possibly access water, by observing distinct paw marks and scrape marks at a temporary water hole near his home. We used camera traps to assess this behavior further and evaluate the potential role of snow leopards as ecological engineers.

Ecological engineers are species that directly or indirectly shape the environment in ways that impact other organisms (Hastings et al. 2007). Our study explores how snow leopards, through their digging behavior, modify the environment to access subsurface water sources, thereby possibly providing water sources for other species.

We placed two camera-traps at the site where the first author had noted evidence of snow leopards digging for water, capturing videos to ensure continuous images of any activity. This site was located in a rocky valley in the southern part of the Tost Mountains. The soil was sandy and surrounded by rocky outcrops, typical of the area. The desert here receives less than 130 mm of precipitation per year. We deployed camera traps from May 5 to July 17, 2022 and again between October 10 to March 17, 2023 to examine if the same behaviour could be observed during the autumn, winter or spring seasons. The snow leopards captured on the cameras were identified by their unique pelt pattern (Johansson et al. 2020).

In the spring and early summer of 2022, we identified two occurrences where the same snow leopard engaged in digging behavior



Figure 1. Snow leopard (top left panel) digging for water in the Tost Mountains in southern Mongolia. Also shown are other species that appeared to drink from where the snow leopard was digging for water (stone marten top right panel, chukar lower left panel, and red fox lower right panel).

(Figure 1). The snow leopard, that we identified as a male from previous camera trapping work, was photographed drinking water on both of these occasions, which suggests that the digging may have been related to accessing water or uncovering food sources beneath the surface. The observed digging behavior involved the snow leopard raising its front paws one by one. It positioned each paw on the ground and then pulled them back with sufficient force to displace the dirt beneath. This action likely aimed to create a depression for drinking or to uncover water sources hidden beneath the surface. We also observed the following species appearing to drink at the site after the snow leopard had been digging: red fox (*Vulpes vulpes*), chukar (*Alectoris chukar*) and stone marten (*Martes foina*) (Figure 1).

In the late fall, winter, and early spring of

2022 and 2023, when temperatures were mostly subzero and the ground was frozen most of the time, the cameras captured fifteen instances of four different snow leopards walking by the cameras, with one smelling the site. The snow leopards did not appear to drink during any of these fifteen visits. Other wildlife photographed during this period included red foxes, Siberian ibex (*Capra sibirica*), chukars, and hares (*Lepus sp.*). We also documented one free-ranging dog (*Canis lupus familiaris*) and one goat (*Capra aegagrus hircus*). None of these animals appeared to drink at the site.

By digging for water, the snow leopard may have provided water for other animals, potentially contributing to the maintenance of biodiversity in this desert ecosystem. However, our study is limited to one snow leopard digging for water and we do not know how

common this behavior is among snow leopards in arid landscapes or if it is a behavior learned by this specific individual. Further research is therefore needed to comprehensively assess the extent and broader implications of this behavior. In particular, investigations into the influence of water availability on the behavior and population dynamics of snow leopards and associated species would be of interest.

This observation provides a glimpse into snow leopard behaviors in arid landscapes. Droughts are common in the South Gobi of Mongolia and can occur even during the cold winter (Begzsuren et al 2004). In extreme cases, winter droughts and “dzuds” (extreme weather conditions) result in mass die-offs of livestock (Begzsuren et al 2004). Some wildlife, including the Khulan (*Equus hemionus hemionus*), cope with localized catastrophic weather events by being highly mobile, but this requires habitat connectivity at a landscape level and the protection of critical habitats that function as dispersal corridors (Kaczensky et al 2010). However, there is little knowledge on how other species, such as snow leopards, cope with droughts and other catastrophic weather events. We therefore recommend further studies to assess how common it is for snow leopards to dig for water, why they dig for water, and how this supports other species in desert ecosystems.

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