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A New Snow Leopard Record Reflects the Value of Remote Protected Areas for Connectivity

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A new snow leopard record reflects the value of remote protected areas for connectivity

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Abstract As wildlife becomes more isolated in human-dominated and rapidly changing environments, species conservation requires investment in landscape connectivity. Identifying stepping stones (discrete areas of suitable habitat that facilitate the movement of dispersing individuals) can help meet connectivity goals. We report the occurrence of the snow leopard *Panthera uncia* in Ikh Nart Nature Reserve, Mongolia, over 250 km from the nearest known population, one of the easternmost records for the species. Ikh Nart Nature Reserve lies within a region considered highly resistant to movement but harbours high densities of argali sheep *Ovis ammon* and Siberian ibexes *Capra sibirica*, both important prey items for snow leopards. This occurrence reveals a new distribution record for the species, the capacity of the species to move across low-quality environments, the value of investment in community conservation and collaborative park management, and the role of remote protected areas such as Ikh Nart Nature Reserve as stepping stones for facilitating population expansion and broader connectivity to other potentially suitable but unoccupied areas.

Keywords Connectivity, distribution, Mongolia, *Panthera uncia*, protected area, snow leopard, stepping stone

Landscape connectivity allows individuals to move between populations, limiting the effects of isolation (Rudnick et al., 2012). For large carnivores that often have a fragmented distribution, population connectivity facilitates gene flow, reduces inbreeding and can lead to larger, more stable populations (Crooks et al., 2011). Efforts to maintain or increase connectivity typically focus on areas within the current distribution of a species and often seek to identify stepping stones: discrete stop-over areas for dispersing or migrating individuals (Saura et al., 2014). Stepping stones that provide refuge and suitable habitat are especially important for large carnivores vulnerable to habitat loss and human persecution.

The snow leopard *Panthera uncia* is categorized as Vulnerable on the IUCN Red List because of habitat degradation, illegal trade and depleted prey populations, often leading to livestock depredation and conflict with people (McCarthy et al., 2017). The species occupies 12 countries and c. 2.8 million km², with the largest populations being in China and Mongolia (McCarthy et al., 2017). The snow leopard distribution is fragmented because of the patchwork of its favoured habitat, including rugged mountainous terrain, and patterns of human activities that impede movement (Jackson et al., 2010). In an increasingly variable and human-dominated landscape, identifying stepping stones of suitable and safe habitat is key to conserving snow leopards (Riordan et al., 2016).

We report a new snow leopard record in Mongolia that is 266 km from the nearest known population and represents one of the easternmost observations of the species. We believe the record has significant implications for understanding the ecology of the species and improving conservation planning. On 10 December 2021 herders reported seeing a snow leopard in Ikh Nart Nature Reserve (Dornogovi Province). The Reserve covers 666 km² of arid, semi-desert and steppe environments with unique rocky outcroppings (Fig. 1; Reading et al., 2011). It is a multi-use area with c. 110 families (c. 500 people) living in the region, where they herd livestock (Davie et al., 2014b).

Shortly after the report, we set 10 camera traps within a 1-km radius of the observation site, a rugged rocky area near a spring. One of the camera traps recorded the snow leopard on 9 January 2022 at approximately 45.72°N/108.64°E (Plate 1). We then set a square grid of 40 camera traps (500 m spacing) centred on the observation. We identified the individual based on its coat pattern, and it was detected by three of the camera traps, all in a dry drainage valley within a 2-km radius of the initial observation. Camera data, tracks and scats indicated the presence of a snow leopard in the area for at least another 7 months. Rangers documented predation of two Siberian ibexes *Capra sibirica* and one argali

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FIG. 1 Location of Ikh Nart Nature Reserve, Mongolia, relative to the range of the snow leopard *Panthera uncia*. Extant and possibly extant ranges are from the IUCN Red List species assessment (McCarthy et al., 2017).

PLATE 1 A snow leopard *Panthera uncia* captured by a camera trap in Ikh Nart Nature Reserve, Mongolia (Fig. 1), in January 2022.

sheep *Ovis ammon* based on tracks and injuries consistent with a single predator. Such kills can be distinguished from those of wolves *Canis lupus* using tracks, bite marks and feeding patterns (Davie et al., 2014a). Lynxes *Lynx lynx* were not detected by the camera traps. The rangers received no reports of livestock predation.

This record is significant for several reasons. Firstly, the observation represents a new distributional record (Fig. 1; Clark et al., 2006). Archives and questioning of local herders and officials have not provided any historical evidence of the snow leopard occurring in this region. The record is far from the nearest edge of the known extant population and is the easternmost location for snow leopards in Mongolia and possibly range-wide, although the species has been identified as possibly extant in some areas further east in Mongolia and China (McCarthy et al., 2017).

Secondly, the observation reveals the movement capacity of snow leopards. Ikh Nart Nature Reserve is surrounded by low-quality habitat for the species and connectivity assessments indicate that it is situated within a region that is highly resistant to snow leopard movement (Riordan et al., 2016; Li et al., 2020). We presume the individual travelled hundreds of kilometres through this highly resistant landscape to reach Ikh Nart Nature Reserve. Snow leopards are known to travel across low-quality regions but usually over shorter distances (Sharma et al., 2014).

Thirdly, we believe the arrival of this snow leopard reflects in part the benefits of long-term investment in community conservation. When it was founded, Ikh Nart Nature Reserve was in reality a so-called paper park, but a conservation initiative began in the early 2000s and led to its recognition as a model protected area (Reading et al., 2016). In collaboration with local communities, most initial conservation efforts focused on restoring populations of argali sheep and ibex. This led to the near cessation of poaching of both species, which now occur in Ikh Nart Nature Reserve at some of the highest densities in Mongolia, which in turn resulted in investment in sustainable tourism driven by interest in seeing these species (Wingard et al., 2011; Murdoch et al., 2017). The arrival and persistence of the snow leopard is probably in part because of the restoration and protection of these ungulate prey populations.

Conservation management at Ikh Nart Nature Reserve over the last c. 20 years has focused on building positive relationships and ensuring active local engagement in planning and decision-making. Multi-use areas present conservation challenges, especially for large carnivores, because of potential conflict with livestock farming and other human activities. In particular, killing of wolves has been a conservation challenge historically but has declined substantially since community management efforts began. We are encouraged by local reactions to the snow leopard, which have been positive and may reflect changing attitudes towards large carnivores in the region. Efforts to manage wildlife in close partnership with local communities have been successful for several species, including wolves, and we believe that continued investment in this approach

will be key to the long-term persistence of snow leopards. Community engagement in developing a plan for snow leopard conservation will be important for mitigating potential livestock depredation.

Lastly, this snow leopard occurrence indicates the importance of areas such as Ikh Nart Nature Reserve as stepping stones for animal movement and potential population expansion. The Reserve is probably too small to support a significant population of snow leopards despite its high prey densities, but it seems that the species can live there for short periods. Ikh Nart Nature Reserve is an improbable place for snow leopards to appear, given the surrounding low-quality habitat and distance from the species' current range. However, areas in northern Mongolia (north of Ikh Nart Nature Reserve by c. 290 km in Töv and c. 375 km in Onon Balj) have been identified previously that could support snow leopards (McCarthy et al., 2017). These areas are most probably too far from the known snow leopard range for individuals to reach them without effective stepping stones that can support dispersing individuals and small itinerant populations. Ikh Nart Nature Reserve is surrounded by several other multi-use reserves that could serve in this capacity, such as Ikh Gazriin Chuluu, Arvan Naimyn Bogd Uul and Choiriin Bogd Uul, which also support ungulate populations but have little formal management or funding. These areas, together with Ikh Nart Nature Reserve, could form a network of sufficient size to support a small population and facilitate connections to areas in the north as well as to priority snow leopard conservation areas in central Mongolia (Li et al., 2020).

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Author contributions Conceptualization: GW, JDM; data collection: RO, AT, BO, BN; writing: GW, JZ, RR, EG, JDM.

Conflicts of interest None.

Ethical standards This research was conducted with permission from the Ikh Nart Nature Reserve Management Office and abided by the *Oryx* guidelines on ethical standards.

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