

CASE STUDY Snow Leopard Study in the Tost Mountains of Southern Mongolia



Introduction

Snow leopards are an endangered species found in the rugged mountains of Central Asia. They have a beautiful fur coat and are perfectly adapted to the cold, barren landscape in high-altitude mountains. The snow leopard is a top predator with a habitat range of over 2 million km², but scientists estimate there may only be about 3,900 to 6,400 snow leopards left in the wild. Much of the species' biology is still unknown because of their elusive nature and the remoteness of their habitat. However, with new technology, the tools needed to study snow leopards are now available, such as remotely

triggered cameras and GPS-collars. The Snow Leopard Trust started the first long-term study of snow leopards living in the Tost Mountains in southern Mongolia in 2008 (Fig. 1). The principal goal of their program is to learn more about snow leopard ecology, such as how the cats use the mountains, to help guide the conservation of the species.

For wildlife researchers, detailed maps are an essential tool. Researchers use maps to navigate in their study areas and, more importantly, interpret how the animals utilize their landscapes and prioritize between resources. When the Tost Mountain study began, the only map available was a satellite image with a coarse resolution of 50 x 50 meter pixels, where the only discernable information was elevation. The study area was explored using the satellite image and dirt bikes. Navigation was difficult because a valley bottom that looked completely flat on the low-resolution map could, in reality, be crossed by a 20-meter vertical wall. The lack of a coordinate grid on the map also made it challenging to determine exact locations. While more detailed maps are available today (i.e., 30 x 30 meter), which include car and bike trails, water holes, herder camps and landmarks, they are still coarse and unsuitable for scientific analyses in such wildly rugged terrain.



Figure 1: The Tost Mountain study area in southern Mongolia.



The rugged terrain in the Tost Mountains.

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The Problem

The Snow Leopard Trust needed access to high-resolution elevation data for the Tost Mountains to confidently move throughout their study area and to accurately examine snow leopard movement patterns and how they are affected by mountainous terrain.

One of the hypotheses the researchers are exploring is whether snow leopards stay longer at kill sites (i.e., where they have made their kills) in more rugged terrain, which offers better escape routes and hiding places. In other words, more rugged terrain may be less risky for snow leopards, and that might allow them to stay longer at their kill sites.

However, there are a variety of other factors that might simultaneously influence how long snow leopards stay at their kill. Take prey weight, for example. Researchers might expect snow leopards to stay longer at their kills when the prey weigh more, simply because there is more food to eat there. Risk from humans may change how they use their kills as well. Large predators like the snow leopards are often at risk of retaliatory killing by humans when they prey on local livestock. Thus, researchers at the Snow Leopard Trust also think that prey type (i.e., whether the prey are wild or domesticated) might play a role in snow leopard behavior at their kill sites. Understanding how all these factors, including terrain, affect snow leopard behavior around kill sites is important because it can be used to make recommendations to herders to avoid such

Ibex in the wild.

We are very excited about this collaboration! Having access to these maps will be a revolution for what we can learn about the snow leopard and for the conservation of the species."



Gustaf Samelius Assistant Director of Science The Snow Leopard Trust

areas, thereby reducing the risk of snow leopards killing domestic prey.

To explore this question, researchers at the Snow Leopard Trust used long-term GPS location data of snow leopards and the locations of known kill sites to examine how risk affected prey 'handling time.' They expected that snow leopards would spend less time handling domestic compared to wild prey, because staying at domestic kills would be more risky. Due to the generally cryptic nature of snow leopards, they predicted that handling time would increase with terrain ruggedness, as rugged terrain provides better escape routes and more hiding places than flat terrain. The Snow Leopard Trust originally used a 30-meter resolution digital elevation model (DEM) for this study. Because the

Mother and cub playing.

resolution of the map was so coarse, it was unclear if terrain ruggedness affected snow leopard behavior, as the map was not detailed enough to capture features such as cliffs and terrain ruggedness. Now, using Intermap's NEXTMap 6-meter resolution DEM, which is much finer in scale, researchers can confidently test whether there is a link between terrain ruggedness and prey type (wild or domestic) and the amount of time snow leopards spend near their kills.





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Preliminary Results

The preliminary results suggest that both prey type (wild or domestic) and terrain did indeed affect snow leopard behavior around their kill sites, after controlling for other important factors, such as prey size, season, and leopard sex and reproductive status.

The researchers found that snow leopards stayed longer at the kill sites of their largest prey when the kills were made in more rugged terrain (Fig. 2, red line). They also found an increase in time spent near the kill site as terrain ruggedness increased with medium sized prey (Fig. 2, blue line). With their smallest prey, however, terrain ruggedness seemed not to affect how long they stayed (Fig. 2, gray line). This is likely because handling



Researcher examining snow leopard kill.

time was comparatively short with smaller prey. They also found that snow leopards stayed longer at the kill sites of wild prey, compared with domestic prey, when the prey were larger in size (Fig. 3).

All together, these results suggest that potential risk from humans changed how snow leopards behave at their kill sites in the Tost Mountain region. For example, snow leopards are likely more at risk from retaliatory killing when they are at the kill sites of domestic livestock and when they are out in open, flat, less rugged terrain that offers fewer hiding places. This is important because the longer a leopard is able to stay at their kill, the more food they can take from it. Furthermore, when snow leopards stay longer at kills it means they reduce their kill rate, meaning they kill fewer prey, both wild and domestic, which could reduce conflict with local livestock herders.





Figure 2: The relationship between terrain ruggedness and snow leopard handling time for different sized prey (small, medium, and large).

Figure 3: The relationship between prey type (wild vs. domestic) and snow leopard handling time.





Conclusion

With access to new fine-scale maps through collaboration with Intermap, researchers at the Snow Leopard Trust are now able to do deeper analysis of how the snow leopards use the mountainous terrain and to understand how they go about their daily travels and where they make their kills. The results of this type of research will help The Snow Leopard Trust gain insight into snow leopard behaviors that will be useful to help conserve the species. Better understanding of how snow leopards use the mountains, how different landscape features affect where they make their kills, and how they spend their time at the kills can inform recommendations to livestock herders that can help reduce the risk of livestock depredation. Reducing livestock depredation is one of the central conservation challenges for snow leopards, as it can result in retaliation killing, which is one of the main threats to snow leopards throughout their range.



Sandstone formations in the southern part of the Tost Mountains.

Snow leopard caught on animal camera.



Herd of ibex.



A wide valley cutting through the Tost Mountains.



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