2022 LONG-TERM ECOLOGICAL STUDY ANNUAL REPORT

SNOW LEOPARD TRUST

PROTECTING
SNOW LEOPARDS
for over forty years

THANK YOU

Snow Leopard Trust extends its heartfelt thanks to you for helping us continue our Long-term Ecological Study of wild snow leopards. This study, which is taking place in southern Mongolia, is now in its 15th year.

Much of the information gathered about wild snow leopards has never been documented before. You are helping support research which is vital for evaluating the threats and conservation policies needed to ensure the snow leopard's future. Together, we are building a more complete assessment of snow leopard ecology and behavior which will help inform global conservation efforts to protect this charismatic predator.

Background

The snow leopard is a flagship species for the high mountains of south-central Asia. Snow leopards are classified as vulnerable on the IUCN Red List. Their main threats include retaliatory killing in response to livestock predation, poaching for the trade of their fur & bones, habitat degradation and fragmentation, depletion of wild prey, and climate change. New threats continue to emerge. Snow leopards are shy, elusive, and one of the least studied of the large cats. In collaboration with our Mongolia partner, Snow Leopard Conservation Foundation, we launched our long-term study of snow leopards in the Tost Mountains of the Gobi Desert to gather critical data that will help us develop an effective conservation plan.

In 2008, we chose the 1,700 km2 of South Gobi's Tost-Tosonbumba Mountains as our core study area because of its high snow leopard population -- and because it offered more accessible working conditions compared to the rugged mountains in the southern part of the snow leopard's range.

Our mission was to address critical knowledge gaps significant for snow leopard conservation, which includes basic ecology and demographic estimates (e.g., birth and survival rates) and human socio-economics. Our research also focused on analyzing the relationships between snow leopards and wildlife, livestock, humans, and abiotic factors in a changing climate.

Beginning in 2013, we expanded our snow leopard population surveys beyond Tost-Tosonbumba Mountains outwards to multiple neighboring mountain ranges, including the 27,000 km2 Gobi-Gurvansaikhan National Park and other protected and unprotected areas.

We use the data from camera surveys to determine snow leopard population density and distribution, which we analyze to observe changes over time, understand what factors may be influencing those changes, and how the data may differ between regions of snow leopard habitat. The camera surveys are important in informing the global effort to reach a reliable estimate of the world's snow leopards called **PAWS** (**P**opulation of the **W**orld's **S**now **L**eopards). This program was initiated by SLT and is implemented in collaboration with all 12 snow leopard range country governments and more than 40 research and conservation organizations, including universities.

For the last 10 years, we have monitored the abundance and distribution of ibex and argali, the two main prey species in the Tost Mountains. In 2016, we expanded the ungulate surveys to nearby surrounding mountains to gain insight into their population density and distribution and how this will affect the mapping of snow leopard activity.

We are continuing to increase our understanding of snow leopards through our comprehensive research. Some of the essential findings we have gained include:

1. The spatial ecology and predation patterns of snow leopards from GPS-collaring
2. Population dynamics of snow leopards from our research camera study
3. The abundance and distribution of snow leopard prey species from our wild prey surveys.

2022 SUCCESSES

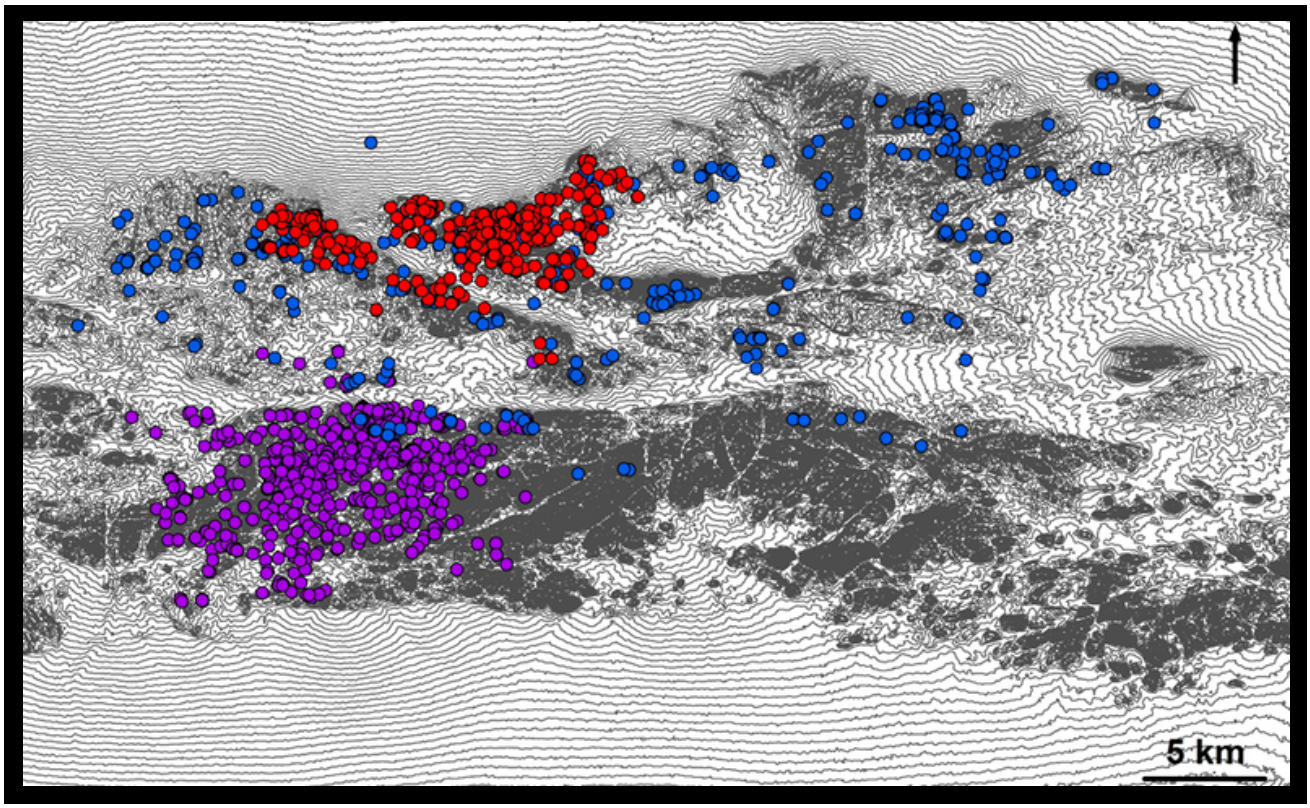
IN 2022, WE SUCCESSFULLY GPS-COLLARED THREE SNOW LEOPARDS.

- Female "Willian" (F12), first collared in 2018 and recollared in April 2022
- Female "Presnel" (F15), collared in September 2022
- Male "Kurzawa" (M19), collared in September 2022

We will track the movements of these three snow leopards for the next 20 months, at which time the collars are programmed to drop off.

Presnel and **Kurzawa** are the 15th female and 19th male snow leopards collared, for a total of *34 snow leopards*. Although Presnel and Kurzawa are new to our collaring program, we know these individuals from our ongoing research camera surveys, as well as Presnel's lineage: Tracking Four Generations of a Snow Leopard Family. **Willian** is the daughter of Anu (F5). Anu and another snow leopard we call Dagina (F8 and the mother of Presnel) are both 13 years old, the oldest wild snow leopards of known age ever recorded.

With three snow leopards currently "on air" and the collars sending locations every five hours, we can observe where the cats are ranging over a period of a couple of months. Willian patrols about 100 km2, Presnel 55 km2, and Kurzawa covers roughly 650 km2. Kurzawa overlaps much of Presnel's range, but Willian mainly patrols an area south of the other two cats.



This recent map shows **Willian's** range in purple. **Presnel** in red and **Kurzawa** in blue.

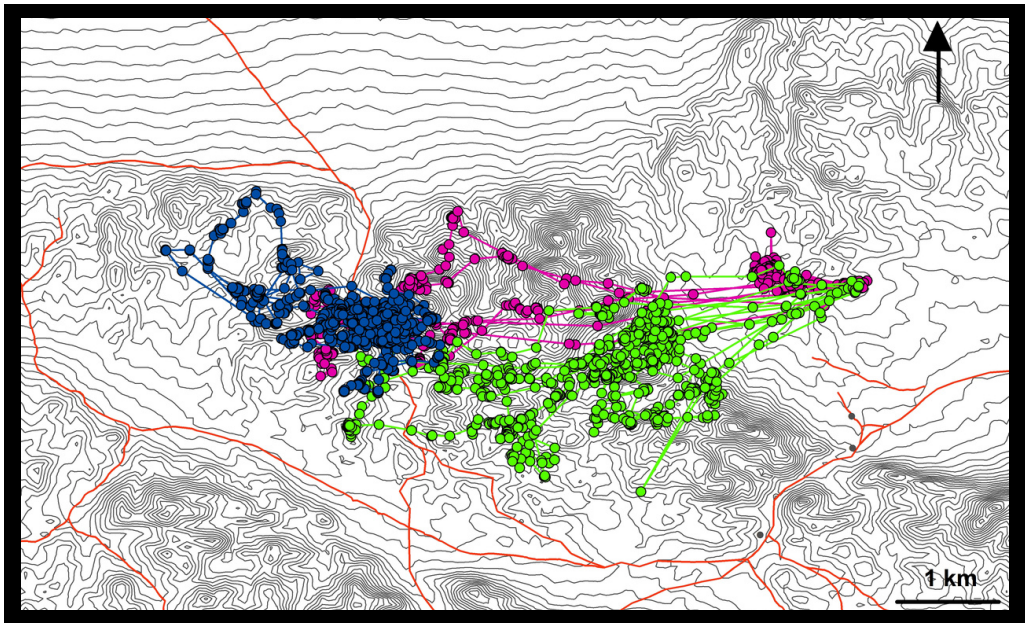
Snow leopard males have larger home ranges than females and tend to travel further on a daily basis. As females prepare to give birth, they use an increasingly smaller area around the chosen den site. Once the cubs are old enough to leave the den, the females gradually utilize a larger portion of their home ranges. We see these patterns reflected in the behavior of our currently collared cats over a period of about four months. **Willian**, who is traveling with an 18-month-old cub, and **Presnel**, who is traveling with three cubs that are about six months old, are both using much smaller areas than **Kurzawa** (male). He is utilizing an area six times larger than Willian's and 11 times larger than Presnel's current area use.

Ibex GPS-Collaring

In 2017, we began GPS-collaring ibex, the primary prey species of snow leopards in Mongolia with the goal of making recommendations on more sustainable grazing practices. We studied the distribution and habitat needs of ibex and their space use in relation to snow leopards and domestic goats. Previously, we collared eight ibex and 14 domestic goats (one goat per herd, with the cooperation of local herders). We observed that the goats and ibex were primarily separated by topography, with ibex using higher, more rugged terrain than domestic goats. By comparison, snow leopards overlapped with both ibex and goats, although the overlap was greater with ibex than with goats.

In the fall of 2022, we successfully fitted one male and two female ibex with GPS collars. The collars send GPS positions every hour, giving us detailed information about their daily movements until they drop off after 20 months.

Since October 2022, **Clifford**, **Jane**, and **Khoorhon** have traveled roughly 70, 75, and 115 kilometers, respectively. Their home ranges (areas of use) somewhat overlap, with each ibex roaming in small areas of four, 18, and 13 square kilometers, respectively. **Clifford's** home range is much smaller compared to the two females, **Jane** and **Khoorhon**. His limited movements may be due to ibex congregating in big herds during mating season (the rut) when males fight with each other. **Clifford** is about five years old and not yet old enough to participate in the rut. He may have stayed close to the periphery to avoid incidents with larger males.



Collared Ibex

Clifford (M)

Jane (F)

Khoorhon (F)

Male ibex locking horns in front of our camera

With three snow leopards and three ibex wearing GPS collars in 2022, the data provides critical information on how snow leopards and ibex move in relation to one another.

Khorhoon made the fatal mistake of visiting a water hole at the end of November when one of the two collared snow leopard females (Presnel) was nearby. Both collars sent locations from the same site for three days (indicating a snow leopard predation event), after which time Presnel left the area, but the ibex (or rather the ibex collar) remained at the site.

We will continue to collar ibex, snow leopards and domestic goats biannually over the coming years and gather more information on space use of these three species. This will lead to a much better understanding of how snow leopards and their prey are utilizing the mountains helping us develop effective conservation actions and incorporate them into the Tost Nature Reserve management plan.

SNOW LEOPARD POPULATION SURVEYS

We have been conducting snow leopard abundance surveys using camera traps since 2009 in partnership with local protected-area staff and community rangers. Our surveys provide vital information for Mongolia's contribution to **PAWS** (**P**opulation **A**ssessment of the **W**orld's **S**now Leopards). **Researchers have reached a preliminary estimate of Mongolia's snow leopards of 953.** Final estimate is pending, but this is a huge step in understanding the baseline for the snow leopard population in Mongolia.

Our ongoing surveys of several important regions in southern Mongolia will help identify abundance and distribution of cats. As we continue to follow individual snow leopards over time, we can estimate survival and various reproductive parameters such as litter size and breeding intervals.

In 2022, our camera trap surveys captured data from 8000 km2 of the Tost Mountains and surrounding areas. (Those 2022 images are not yet available for review but will be analyzed in 2023)

A THRIVING SNOW LEOPARD POPULATION IN TOST

Last year, we analyzed images from 43 camera traps deployed during our 2021 survey of the Tost Mountains. They revealed 239 photo capture events of snow leopards. This is the **highest number of snow leopard photo capture events for this area so far** compared to 44-190 in 2009-2020.

A capture event is the set of images captured when an animal triggers a camera, not the actual number of snow leopards.

Highlights

- A total of **21 adult snow leopards categorized as resident animals were observed**, including 13 females and eight males. Three of the females had a total of six first-year cubs and another three females had a total of four sub-adult/second-year cubs. **Total cubs: 10.**
- The majority of resident adults from 2020 survived and were observed again in 2021. Only two adults from 2020 were not photographed in 2021. This could indicate they moved to another area, died or were still in Tost but not detected by our cameras.
- A total of seven adult snow leopards categorized as "floaters" were observed in 2021. Floaters are non-residential animals that cover large areas and don't have well-defined home ranges.
- **Total resident snow leopards and floaters recorded by our cameras in the Tost Mountains was 28 individuals**.
- Pallas's cats were detected on two different camera traps (one cat on each occasion). Our senior scientists work directly with the Pallas's Cat International Conservation Alliance (PICA), developing strategy and sharing data on Pallas's cats' occurrence. We collaborated with PICA to develop the first global action plan for the species published in a special issue of Cat News.
- The oldest females are Anu (F5) and Dagina (F8), both 13 years old in 2021. Dagina had three first-year cubs—making her the oldest breeding female in our study.
- The oldest male in our Tost long-term study was Nachin Devekh (M13), who is estimated to be about 12 years old. He has changed his home range several times.

This is a good sign for snow leopard abundance in the Tost-Tosonbumba Nature Reserve (hereafter called the Tost Nature Reserve), which has been under direct protection since it officially became a protected nature reserve in 2016. Data from our long-term study helped gain federal support for the reserve's creation and is being provided regularly to the Tost Nature Reserve Administration for their long-term conservation planning.

Snow leopard cub captured on camera in Tost Nature Reserve

In 2022, we surveyed the Nemegt and Gurvansaikhan Mountains in the Gobi-Gurvansaikhan National Park and the Noyon Mountains, an unprotected area to the east of Tost. Between 32 to 38 cameras were set out in each of these mountains for three to four months. Our team is currently in the time-consuming process of identifying individual cats by comparing all images against each other and cats from different mountains. This work will build on earlier multi-year estimates.

Our cameras captured the following over multiple years:

- **12-20 adult snow leopards annually in Nemegt between 2013-2021 covering an area of 1700 km2**
- **14-17 adult snow leopards annually in Noyon between 2015-2019 covering an area of 1440 km2**
- **21-27 adult snow leopards annually in Gurvansaikhan between 2013-2018 covering an area of 2500 km2**

These numbers represent the minimum number of snow leopards in the area and are not equivalent to the total snow leopard population in each area.

Based on a first review of snow leopard captures from the 2022 cameras in the Gurvansaikhan, Nemegt and Noyon Mountains, snow leopards were detected on 83 of a total of 108 cameras. **In all three regions, we have observed multiple females with young.**

Female snow leopard and three cubs

We also observed the same tailless male snow leopard seen in three earlier years. Clearly, this cat continues to hunt successfully without the stabilizing help of a tail. Gustaf Samelius, Assistant Director of Science and the long-term study director, says, *"Every year, I am amazed to see this cat continue to do well and look healthy. Snow leopards never fail to amaze us."*

Tailless snow leopard, May 2022

WILD PREY SURVEYS

Knowledge of the abundance and distribution of prey populations is important for our understanding of snow leopard ecology. We have been monitoring ibex and argali in the Tost Mountains since 2012 (except for 2015 and 2021) using a method called double-observer surveys. The surveys are done in collaboration with Tost community rangers and Tost Nature Reserve rangers. They are conducted in late fall when ibex and argali mate and are easier to detect.

Ibex and Argali

The surveys were completed over 24 days in October and November, with 12 people participating. Analysis of the results is underway at this time.

Goitered Gazelles

While conducting our long-term study in the Tost-Tosonbumba Mountains, there has been an increase in Goitered gazelle (Gazella subgutturosa) sightings by both herders and researchers.

This and recent evidence that a snow leopard killed two gazelles a few years ago (our first documentation of snow leopards killing this species) led us to launch the study. We are interested to understand if there are changes in the goitered gazelle area use.

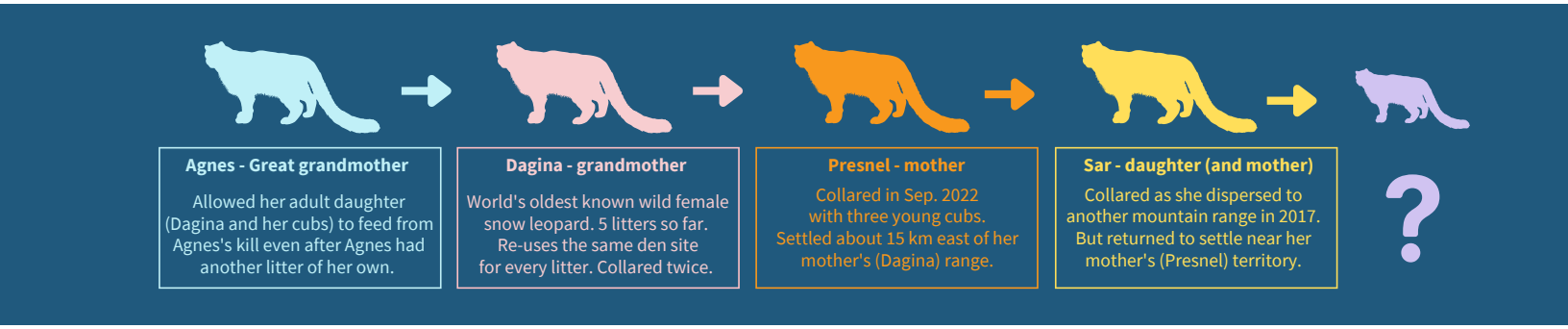
Goitered Gazelle in Tost Nature Reserve

Goitered gazelles, listed as vulnerable by IUCN, are typically found in Mongolia's more open, steppe habitat rather than in mountainous terrain. We conducted surveys in 2022 (in both mountains and steppes) to examine the threats (interview-based survey) and the abundance and distribution of goitered gazelles in Tost Nature Reserve (using a method called distance sampling). These surveys will help us better understand the conservation status of the goitered gazelle and its role in the Tost-Tosonbumba Mountain ecosystem.

- In April, community rangers from the Tost Nature Reserve interviewed a total of 49 Tost herders (20 women and 29 men) who have lived in the region for decades and seen changes in wildlife occurrence and abundance. The seven rangers interviewed herders in all seven of the Tost Community Responsible Areas about their perceptions of goitered gazelle presence over the years, thus ensuring the sampling was geographically representative. From the interviews, we were able to map the gazelle occupancy, distribution data and population trends.
- In September, we trained four of the Tost community rangers and four Tost Nature Reserve rangers/specialists to conduct the first distance sampling survey of gazelles, a common technique used to survey animals in open flat terrain. A total of 120 gazelle groups were detected, with a total of ~600 gazelles. This gives us solid baseline information on the abundance and distribution of gazelles in the nature reserve that we will share with the Tost Nature Reserve Administration for inclusion in their management plan.

LONG-TERM FINDINGS

- In the Tost Mountains, 21 resident snow leopards were recorded by our cameras in 2022.
- Nachim Devekh (M13) is estimated to be 12 years old and is the oldest documented male in our study.
- Our research cameras captured images of 13-year-old Dagina (F8) with three young cubs in 2021. This provides critical new information on snow leopard reproduction age - as Dagina is the oldest documented wild snow leopard to give birth. Dagina is part of an unprecedented four generations of wild female snow leopards in our study.



OUR STUDY DATA INFORM CONSERVATION

In addition to gaining a better understanding of the snow leopard population in our surveys of Nemegt, we also conducted threat assessment surveys. We learned that retaliatory killing for livestock predation is the biggest threat to snow leopards in Nemegt as the local community often loses livestock to both snow leopards and wolves.

To address this challenge for herders and the risk to snow leopards, we met with Nemegt herders to brainstorm and develop solutions. We are pleased to report that in 2022 the Nemegt community chose to engage in our Snow Leopard Enterprises handicrafts program. Fifteen women completed training and have begun making handspun camel wool yarn for the domestic market in Mongolia. **They will earn extra income for their families to help mitigate some of the economic costs of livestock losses. This community will soon develop and sign a Snow Leopard Enterprises Conservation Contract that protects snow leopards and other wildlife within Nemegt's community responsible area.**

Nemegt women refining their spinning skills, November 2022

Snow Leopard Trust has partnered with local and indigenous communities for decades to create conservation solutions that protect habitat, improve livelihoods and foster coexistence with snow leopards. Very early in our study, we learned that the land used by snow leopards, other wildlife and the herding community in Tost Mountains was under threat from the mining industry. Our data demonstrating snow leopard distribution in the region and support of the Tost community's actions led to the successful creation of the Tost Nature Reserve, which encompasses 8,965 km2 of mountains and surrounding steppes. The federal government subsequently revoked all exploratory mining licenses.

Thanks to your support, the commitment of our community-based partners and our long-term ecological study data, this valuable habitat and the iconic cats who call it home are protected.

SCIENTIFIC PAPERS

Snow Leopard Trust researchers published 28 papers in international peer-reviewed journals in 2022, of which five are based on findings from or related to the work done through our long-term snow leopard study in southern Mongolia, bringing the total of papers published to 33 since our research began in 2008. Our publications are providing the scientific world with new insights on snow leopard ecology and behavior and best practices for snow leopard research and conservation and human/nature relationships. We could not contribute in such a powerful way to the global conservation of snow leopards without your support. Thank you!

Johansson Ö., Mishra C., Chapron G., Samelius G., Lkhagvajav P., McCarthy T. and Low. M. 2022. **Seasonal variation in daily activity patterns of snow leopards and their prey.** Scientific Reports 12: 21681.

Johansson Ö, Agvaantseren B., Jackson R., Kachel S., Kubanychbekov Z., McCarthy T., Mishra C., Ostrowski S.,Johansson Ö, Kachel S., and Weckworth B. 2022. **Guidelines for telemetry studies on snow leopards.** Animals 12: 1663. http://doi.org/10.3390/ani12131663

Johansson Ö, Agvaantseren B., Jackson R., Kachel S., Kubanychbekov Z., McCarthy T. Mishra C., Ostrowski S., Kulenbekov R., Rajabi A.M. and Subba S. **Body measurements of free-ranging snow leopards across their range.** Snow Leopard Reports 1: 1-6.

Mishra C., Samelius G., Khanyari M., Srinivas P.N., Low M., Esson C., Venkatachalam S. and Johansson Ö. 2022. **Increasing risks for emerging infectious diseases within a rapidly changing High Asia.** Ambio 51: 494-507.

Samelius G., Xiao L., Li J., Lkhagvajav P. and Johansson Ö. **Risky business: red foxes killed when scavenging from snow leopard kills.** Snow Leopard Reports 1: 7-10.

Acknowledgment

Thank you for your support of our research efforts in Mongolia. Together, we are helping to protect the threatened snow leopard and its habitat.

If you have any questions about our Long-Term Ecological Study, please contact:

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