Saving Snow Leopards: Blending Biology and Social Science to Find Effective Conservation Solutions

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On a snowy night in the 1990s, a snow leopard wandered into the village of Kibber in the Indian Himalayas, one of the highest permanently occupied villages in the world. That evening it climbed into a livestock corral and killed multiple sheep and goats (see Figure 1). The villagers managed to corner and kill the snow leopard, but, as Buddhists, they felt obligated to bury the leopard in a nearby valley. For years after that, the villagers would go out and beat on the grave of the cat because they were still upset about the loss of their livestock.

Figure 1. A snow leopard with a goat kill in the Indian Himalayas. Photo credit: Karma Sonam.

Skip ahead twenty-five years to 2016, when a sickly, old snow leopard walked into the same village. Did the villagers kill this cat? No, instead they offered it meat and tried to nurse it back to health, but eventually it, too, died (see Figure 2). Moreover, they gave this cat a ceremonial burial in an honored place, which included wrapping it in a *khata*, the traditional ceremonial scarf of Tibetan Buddhism. This article will explain what transpired in those twenty-five years between the first and second incidents. I

will explain why the villagers' attitudes changed. It is an amazing conservation success story. Actually, it involves multiple conservation success stories.

Figure 2. An old, sickly snow leopard that died in the village of Kibber in the Indian Himalayas. Photo credit: Snow Leopard Trust, Nature Conservation Foundation—India.

A BRIEF BIOGRAPHICAL INTRODUCTION

Before we get deeper into this story, a brief introduction may be in order. A little more than twenty-five years ago, I was given the unique opportunity to research snow leopard ecology in Mongolia. The six-year study not only provided the basis for my Ph.D. thesis, it launched my career in the conservation of an incredible animal that is the icon of the mountain peaks of central Asia. Shortly after completing the Mongolia study, I became the Science and Conservation Director at the Seattle-based International Snow Leopard Trust (now known as Snow Leopard Trust or SLT). For more than eight years, I led the establishment of their community-based conservation program in Mongolia, China, Pakistan, India, and Kyrgyzstan. In 2008, I moved to Panthera, a conservation organization based in New York that is dedicated to saving all of the world's wild cat species. Established in 2006, Panthera already had programs focused on tigers, lions, leopards, and jaguars, and I was asked to initiate their snow leopard program. Panthera's snow leopard research and conservation efforts focus on China, India, Pakistan, Tajikistan, and Kyrgyzstan. These experiences have provided me with many insights on the conservation work undertaken by Panthera and our affiliates as well as several other conservation organizations that are active in the twelve Asian countries where snow leopards occur.

WHAT IS A SNOW LEOPARD?

Along with the other big cats, snow leopards are now classified as part of the *Panthera* genus, specifically *Panthera uncia.* They used to be categorized in their own genus as *Uncia uncia*, in part because, unlike the other big cats, they cannot roar due to differences in their throat structure. But, recent genetic work places them firmly in the *Panthera* genus, taxonomically most closely related to tigers.

Snow leopards range across more than two million square kilometers of habitat within the highest mountain ranges of Asia, including the Sayan range of southern Siberia, the Altai mountains of Mongolia, the Tien Shan mountain range of Western China and Kyrgyzstan, down through the Pamirs of Tajikistan, across the Hindu Kush in Pakistan and Afghanistan, and eastward through the Himalayas proper of India, Nepal, and Bhutan (see Figure 3). That is about two million square kilometers of habitat. Snow leopards are known to occur in twelve countries and possibly thirteen, if their occurrence in the northern corner of Myanmar is verified. That is a large range indeed!

Figure 3. The geographical range (shown in orange) of the snow leopard in Asia. Image credit: Map Design Unit, World Bank.

Snow leopards occur from about 6,000 feet elevation, as in Mongolia, up to about 17,000 feet in the Himalayas. It is a common conception that snow leopard habitat generally consists of high, rugged

mountains with ample snow (Figure 4). However, it can also include lower and less rugged areas, such as on the edge of the Great Gobi Desert in Mongolia (Figure 5). As for snow, much of the snow leopard's habitat gets very little, and, when it does snow, it sublimates quickly. Technically, a large part of the cat's range would meet the definition of a desert.


Figure 4 (left). Snow leopard habitat in the snow-covered Tien Shan mountains of Kyrgyzstan. Photo credit: Thomas McCarthy, Panthera. Figure 5 (right). Snow leopard habitat at the edge of the Great Gobi Desert in Mongolia. Photo credit: Nic Bishop.

Across snow leopards' vast range, scientists have long thought there were probably somewhere between 4,000 and 7,500 snow leopards. More recently, estimates place the population as high as 8,000 or even at 9,000, which is likely more accurate but still only a scientific 'guestimate.' They are generally solitary animals. However, a recent, long-term, radio collar study in Mongolia found that adults come together more frequently than previously thought, with males and females even sharing meals. They are very secretive animals and almost impossible to see in the wild.

Snow leopards breed from January to early March, giving birth in May through late June, usually to two to three cubs, with a total range of one to five cubs. We know very little about cub rearing although we believe that cubs stay with their mother for up to two years or more. Despite several recent radio collaring studies undertaken by Panthera and other research teams, we still know little about the basic ecology of snow leopards, such as their mortality and survival rates or recruitment rates into the adult population.

However, one aspect of snow leopard ecology that is relatively well known is their diet. They subsist primarily on large, wild ungulates, such as the mountain sheep and goats inhabiting the peaks of Central Asia. Therefore, habitats without large ungulates do not have snow leopards. The most common prey include the Markhor, argali, Himalayan tahr, and especially ibex and blue sheep. Snow leopards also prey on many small mammals, such as marmots and pikas, and occasional birds like Himalayan

snowcocks. However, the presence of snow leopards is very unlikely in the absence of the big wild sheep and goats.

Snow leopards are keenly adapted to the high, rugged peaks in which they dwell, and their agility to traverse this terrain is amazing. They are adept leapers, able to cover 30 feet or more in a single jump. They are excellent climbers and can scale nearly vertical walls of stone. This is all critical in their pursuit of prey, which they stalk with stealth and end with a burst of speed to take down a large ungulate perhaps two or three times their own weight.

One feature that you notice first about snow leopards, in person or in a photo, is the size of the tail, which constitutes about half the length of the cat (see Figure 6). Snow leopards are generally about two meters long, and half of that is the tail. If you were to touch a snow leopard's tail, you would find that it is not just fluffy fur but actually a lot of muscle, allowing them to use it like a rudder or a balancing beam as they are racing through the rocks chasing big mountain goats. It is also used in winter to wrap around their muzzle to keep them warm.

Figure 6. Snow leopards have exceptionally large tails. Photo credit: Steve Winter, National Geographic.

Although they are in the big cat genus, snow leopards are the smallest of the lot. A large male might weigh ninety to one hundred pounds, whereas a large female ranges from eight-five to ninety pounds. In a zoo where snow leopards are sedentary and receive an optimal diet, they may weigh up to 120 pounds. The biggest one ever captured in the wild was a male weighing 105 pounds.

Perhaps their best adaptation is their camouflage, which makes them very difficult to see, especially if the cat is more than just a few feet away from you (see Figure 7). They blend extremely well into the dusty rocky terrain. During my Ph.D. study of snow leopards in Mongolia in the 1990s, I relied

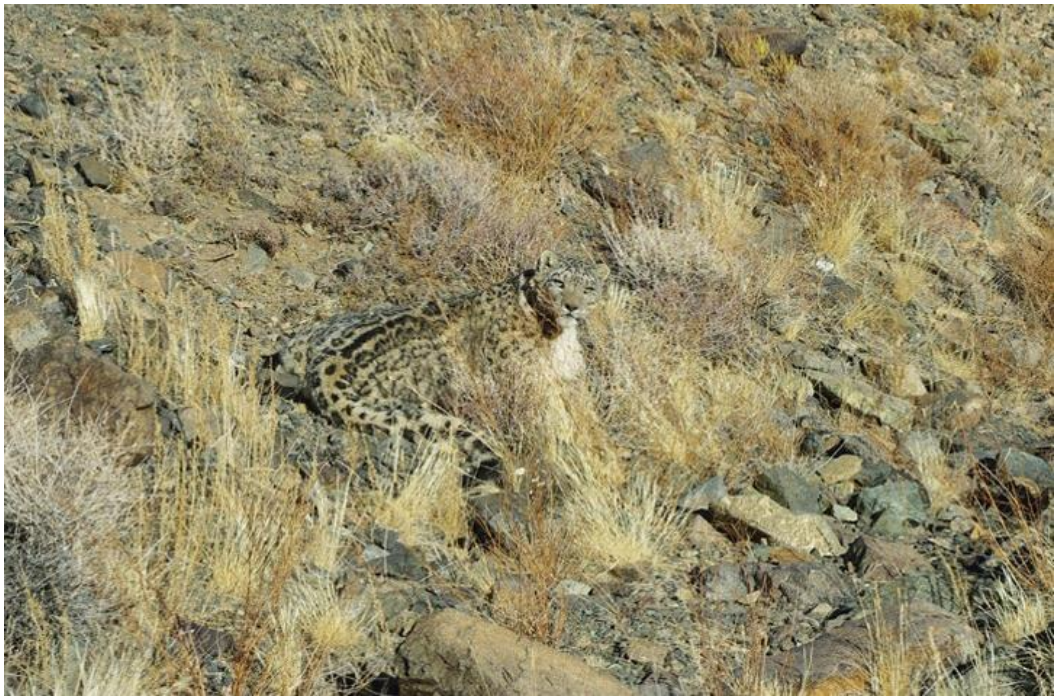

Figure 7. Snow leopards are difficult to see in the wild due to their coloration and coat pattern. Photo credit: Panthera/Snow Leopard Trust.

on VHF radio collars (I didn't have the luxury of GPS collars). VHF collars send out a radio 'ping' to a receiver that I used to determine which way to look for a cat. While sitting on a hillside, I could listen to the ping of a cat's collar as it crossed an open hillside just a hundred meters or so away. Nevertheless, despite scanning with binoculars and spotting scopes, I could not see it! During one seven-year period, I never saw a snow leopard, despite spending over six months a year in snow leopard habitat. That shows how tough they are to see.

THE BASIS OF HUMAN-SNOW LEOPARD CONFLICT

Although snow leopard habitat is very high, rugged, and extremely remote, humans live throughout the cat's vast range. This is true from crumbling old Soviet villages in Tajikistan (see Figure 8) to the edge of the Great Gobi Desert. Livestock provide food and wool that make human life in these challenging areas possible (see Figure 9). They provide milk for drinking and making cheese and wool for trading, especially cashmere wool, which is highly valuable. Villagers also use wool to make their clothing and even the felt walls of their yurts (the "mobile homes" of Central Asia). Livestock are

Figure 8 (left). Old Soviet-era village in Tajikistan. Figure 9 (right). Livestock are essential to the life of many villagers in snow leopard habitat. Photo credits: Thomas McCarthy, Panthera.

essential for human life in snow leopard habitat. They are also at the center of the conflict between humans and snow leopards that threatens the survival of these cats.

MAJOR THREATS TO SNOW LEOPARDS

When a poor herding family wakes up in the morning and finds that a snow leopard has killed their yak (see Figure 10), it is akin to you waking up to discover somebody had emptied your bank account. This explains why retaliatory killing is the number one threat to the long-term survival of snow

Figure 10. A yak killed by a snow leopard in Ladakh, India. Photo credit: Steve Winter, National Geographic.

leopards across their geographic range. Another major threat is loss of natural prey; the wild sheep and goats that snow leopards need to survive are disappearing for various reasons, including both legal and illegal hunting. Illegal hunting of wild ungulates for subsistence use takes place across much of the snow

leopard's range. There is also legal ungulate trophy hunting, but, unfortunately, it is often poorly managed and unsustainable. To make matters worse, populations of wild ungulates that are the snow leopard's natural prey suffer from competition with several thousand head of livestock on high-elevation, low-productivity rangeland.

Another threat stems from the growing demand for snow leopard hides and bones. A single set of snow leopard bones can bring up to $10,000 on the traditional Asian medical market. When you figure a herder might make $300 or $400 a year, it is not hard to understand why they want tap into that market if given the opportunity. Hides generally go to the luxury markets across Russia, eastern European countries, and China. Demand seems to be on the increase in China, where newly wealthy people desire things like snow leopard hides to decorate their walls.

Resource extraction is, for the most part, an emerging threat. Figure 11 depicts an illegal Chinese gold mine operation just across the border in Tajikistan. Fodder and fuel wood collection, though not new examples of resource extraction, are also widespread and often unsustainable in these marginal habitats.

Figure 11. Illegal Chinese gold mine operation in Tajikistan. Photo credit: Thomas McCarthy, Panthera.

The harvesting of caterpillar fungus is yet another emerging threat, also linked to the traditional Asian medical trade (see Figure 12). Found primarily in the high Himalayas and China's Tibetan Plateau, this parasitic fungus invades the in-ground larva of the ghost moth. Each spring, tens of thousands of people look for the prominent ground shoot of the fungus. Digging out the fungus damages massive amounts of habitat, which is critical for the lambing and kidding of snow leopard prey species. Caterpillar fungus collection is driven by the fact it is more valuable per ounce than gold. There is a positive side to this, however, because many people have become so wealthy off caterpillar fungus that they have moved

out of the mountains into towns and only go back for the harvest, which may mean less livestock competing with wildlife for scarce resources in snow leopard habitat. We are not yet sure if that is a good trade-off in terms of habitat health or not.

Figure 12. A stalk-like fruiting body (mushroom) of the parasitic caterpillar fungus *Ophiocordyceps sinensis* growing out of a ghost moth larva (*Thitarodes* sp.) on the Tibetan Plateau, China. Photo credit: John Farrington.

Lack of knowledge is also a threat. As I said, there remains much about basic snow leopard ecology that we don't know. For example, in 2008 we undertook an expert knowledge process where we gathered experts on the species from every country within the geographical range of snow leopards to access what we know about the cat's distribution and population size. Despite the depth of knowledge represented, experts could not even state with certainty whether snow leopards exist within two-thirds of their suspected range.

MEETING THE THREATS TO SNOW LEOPARDS

A common objective of almost all snow leopard conservation programs is to find mutually beneficial ways to meet the needs of both the cats and the people in shared habitats. This necessitates understanding the people and their lives, including not just the hardships they face but their aspirations and needs as well as their capacities to meet them. To do so, Panthera's snow leopard conservationists use a very technical method of obtaining information: We call it listening! Simply put, snow leopard conservationists spend a lot of time sitting with people, drinking tea, and just listening, be it on the Tibetan Plateau, in Pakistan, or wherever (see Figure 13). That equates to a LOT of salty yak butter tea, but it is a very effective way to gain needed understanding. To be clear, as outsiders we should not bring our western conservation mindset with us. We must understand the local situation and from that basis

work to empower communities to devise conservation solutions that are equitable for both people and snow leopards. However, I always stress that this is not a one-size-fits-all solution. What works for people on the Tibetan plateau in China may not work for people in Kazakhstan. We have to take into account the

Figure 13. The author (second from left) speaking to local people in Chitral, Pakistan. Photo credit: Thomas McCarthy, Panthera.

culture and politics or religions present. Snow leopard habitat is very diverse in terms of human governance, religion, and culture. You have to take all of that into account when trying to work with people to develop a conservation strategy.

ORIGIN OF A NOVEL CONSERVATION INITIATIVE

Stepping back in time to when I carried out my Ph.D. research in Mongolia, a major part of my work involved traveling throughout the country to determine where snow leopards occurred and what conflicts they had with local people. What I found is that people in Mongolia generally disliked snow leopards because they killed their livestock. Consequently, snow leopards were killed with guns, traps, and poison. The end result was always the same: dead snow leopards. When traveling the country, I also noticed that many local people had a strong handicraft tradition. Being a broke graduate student, I bought many inexpensive handcrafted items as Christmas gifts for family back home. I asked the local people why they did not sell their merchandise on the market. They answered that they had no way to get their goods to market. Ulaanbaatar, the capital of Mongolia, was about a thousand miles away from these

people, and they simply couldn't get there. They would sell their wool to passing Chinese traders, usually for just pennies a pound, because of their inability to reach more lucrative markets in the capital.

Bouncing across the country in the back of a jeep, I began to think about how these two vexing problems, depredation of livestock that resulted in the killing of snow leopards and the handicraft tradition of the local people who had no access to markets, could be solved together.

As a result of an "Aha" moment that I shared with a British woman who was my interpreter, we established a new program that we called Irbis Enterprises (see Figure 14), following the Mongolian name "Irbis" for snow leopards. We talked to the local communities and asked whether, if we helped them obtain a fair market value for their handicrafts, they could, in turn, tolerate a few losses of livestock to

Figure 14. Mongolian women in the Altai Mountains making handicrafts from camel and sheep wool. Photo credit: Snow Leopard Trust.

snow leopards. They said, "We can do that!" That was the carrot, but we needed a little bit of a stick, too, which led to the 'conservation contract' that we signed with the communities. The contract said that if, at the end of each year, no one in a village had killed a snow leopard or any of their large mountain sheep and goat prey, we would give each participating artisan an extra 10% bonus on top of fair market value. The funds would be distributed by our local program director after an assessment of how well each village had done toward meeting contract terms. Additionally, we would provide a 10% bonus to support

a village conservation fund that would help meet various community needs, such as a new well or schoolbooks. The communities were more than happy with these contract terms and the benefits they would bring them.

Initially, there were problems with the quality of certain handicraft items, such as misshapen gloves and very scratchy wool. But with some training and basic tools, that was overcome while keeping the products culturally correct. Most of their designs and local natural dyes were used to create highly marketable products. Today, nearly twenty-five years later, the project operates in thirty communities throughout the snow leopard range in Mongolia. They have hit about a million dollars in total sales. Almost all of that money goes back to the local people. That is an annual income of $150 per family. That might not seem like much, but when a family lives on $300 a year, it represents a significant increase.

Do the snow leopards still get killed? Since the inception of this program, one snow leopard and one ibex have been killed, resulting in lost bonuses. But were the participant women mad at us? No, but I would not have wanted to be the local man who killed that snow leopard when twenty irate women showed up at his front door to complain about the money that he had lost them. Peer pressure really works in this case, thus helping to sustain and expand the program.

CONSERVATION INITIATIVES PROTECTING SNOW LEOPARDS IN OTHER COUNTRIES

Next, let us look at Ladakh, India. Figure 15 depicts the type of corral that was invaded by the snow leopard I mentioned at the beginning of this article. It is not very good and does little to keep a

Figure 15. Livestock corral in Rumbak village, Hemis National Park, Ladakh, India. Photo credit: Thomas McCarthy, Panthera.

snow leopard out. The Snow Leopard Conservancy India Trust (SLC-IT), a local grassroots conservation group and affiliate of Panthera in India, came up with the idea to predator-proof the corrals, thus helping to alleviate the conflict between humans and snow leopards. They worked with local people to gain their buy-in. The locals then provided raw materials like stone and labor while SLC-IT brought in wire mesh. These newly reinforced corrals now effectively keep snow leopards and other carnivores out (see Figure 16). This new design saved livestock, but village income remained low, so there was interest in finding

Figure 16. Predator-proof livestock corral in Rumbak village, Hemis National Park, Ladakh, India. Photo credit: Steve Winter, National Geographic.

additional ways to improve livelihoods. What SLC-IT and the local people came up with is now known as The Himalayan Homestay Program. Through this initiative, local people are trained in how to host tourists, such as the many trekkers who go through this part of India. Now, foreigners can stay in a traditional Ladkhi home, see how people live, and share meals with their hosts. SLC-IT also helped build what are called 'parachute cafes' along popular trekking routes, where people stop for lunch or hot tea in the shade of an old military parachute. Thanks to the Homestays and trekking cafes, a lot of money comes into the local community.

Through their interactions with tourists, villagers came to understand that many visitors are there to see snow leopards. Knowing of places where tourists would have a decent chance of seeing snow leopards, the communities have developed snow leopard-based tourism. Hundreds of people now spend days or weeks camped in the mountains in the depth of winter, with temperatures well below 0^{o} F, in

hopes of a glimpse of the elusive feline. Tourism has brought income to the communities and, importantly, made snow leopards more valuable alive than dead. Yet tourism can be overdone, and efforts are underway to spread that out so as not to have adverse impacts on habitat and wildlife.

To summarize, at our project sites in Ladakh, there are well over one hundred of the improved livestock enclosures, and forty villages have active Himalayan Homestay programs. There is an entire network of villages that you can trek between and have a beautiful warm bed and a nice meal. The parachute cafes have expanded into a number of villages as well. That has fostered in local people an appreciation of the value of snow leopards, leading to a dramatic change in mindset. They added a handicraft program much like that of Snow Leopard Enterprises in Mongolia with products marketed at the village level to the trekkers. Previously unemployed youth are now trained as nature guides, bringing a sense of pride as well as income. And of course environmental education at the village level is part of nearly every program that Panthera and SLC-IT undertake.

A recent critical assessment of SLC-IT's snow leopard conservation initiatives in Ladakh, India, has examined their impacts on the local people's attitudes.[1] A major finding was that Ladakhi communities with homestay programs have significantly greater appreciation for wildlife. Moreover, this increased appreciation was not just because of their enhanced income but also because they now understand that the snow leopard is a national treasure that attracts people from around the world. Conversely, communities that do not have conservation interventions do not like snow leopards or wolves and generally do not appreciate wildlife. Clearly, well thought out conservation initiatives can significantly change the attitudes of people toward wildlife.

SLC-IT's work has won several awards. Jigmet Dadul, their Conservation and Livelihoods Program Manager (see Figure 17), is also one of Ladakh's best snow leopard spotters on the winter tours.

Figure 17. Jigmet Dadul scanning for snow leopards in Ladakh, India. Photo credit: Thomas McCarthy, Panthera.

This is how you usually see Jigmet, with his eye pressed against his spotting scope. He will normally be the first one to see a snow leopard – often from about two miles away with just the cat's ears sticking up from behind a rock. He received the Carl Zeiss Conservation award in 2014. SLC-IT as an organization has received a number of national awards for responsible tourism. It is an organization and team that Panthera is very proud to be affiliated with.

Across the border in Pakistan, Panthera is also part of a trilateral partnership with the Snow Leopard Foundation (SLF) and the US-based Snow Leopard Trust. In northern Pakistan, snow leopard conservation takes a slightly different form than what I have thus far described in other countries. Several years ago, SLF recognized that villagers in snow leopard habitat lost far more livestock to disease than to predation by the big cat. They proposed a program to help people vaccinate their livestock and reduce disease loss in exchange for villagers tolerating the normally few losses to snow leopards. Similar to our initiatives elsewhere, the concept evolved after much listening and with the community taking an active role in program design. In the end, they were happy to accept a few depredation losses with the promise of far fewer disease-related mortalities. They deemed that a more than fair trade-off.

Since 2002, when the program was initiated, SLF has trained more than 200 environmental health workers, essentially para-veterinarians. They include several women, which is an important fact, considering that in Pakistan you rarely even see women outside the house in tribal areas because of Muslim restrictions. Trainees learn about livestock disease and how to handle the vaccinations, nutrition, and data management. More than 100,000 livestock are now vaccinated twice a year for several common diseases, and many more livestock are surviving. However, we do not want increased herd size, which puts pressure on fragile rangelands. Therefore, a condition of the program is that they have to sell excess animals, which increases income. It also allowed us to build an exit strategy. After five years, the program is self-sustaining, with proceeds from the selling of excess animals funding the vaccinations. That is a benefit for me because I do not have to keep going back to the same donor asking for more money for a vaccination program in the same village. Now I can ask them to help fund the expansion of such a successful project to a new valley!

Looking at attitudes, 90% of people benefiting from the Pakistan vaccination initiative now believe snow leopards should remain on the local landscape or even increase in abundance. The amount of habitat now protected through this program has increased from just a few hundred square kilometers in the early years to over 22,000 square kilometers today. That constitutes about 25% of snow leopard range in the country. The government is highly appreciative of the program, which is critical because we require their permission to continue and expand. There are so many communities asking us to initiate the program in their valley that we cannot expand fast enough.

Another useful snow leopard conservation undertaking in Pakistan is livestock insurance. This is not to be confused with livestock compensation, where the government hands people money if they lose livestock to predators. That is a black hole, an approach that never works because the government will simply run out of money. Furthermore, why would anyone go to the effort to practice responsible animal husbandry if somebody will just pay them if they lose an animal? Dr. Shafqat Hussain (see Figure 18), who is now a Professor of Anthropology at Yale University, conceived of a true livestock insurance program for his home country, which he initiated about two decades ago in the Skardu district of Giligit-Baltistan.

Figure 18. Dr. Shafqat Hussain (right) talking with villagers in Pakistan. Photo credit: Thierry Grobet, Rolex.

Everybody pays a premium based on the number of their livestock. Shafqat calls it "building landscapes of coexistence, bringing tolerance through compensating for losses." I do not like the word "compensation" because of its normal use to describe the aforementioned ill-fated government handouts. However, in this case, people are getting their own money back from an insurance program for loss of livestock, and it is administered at the village level. It is working well, and the program has spread to over twenty-six villages, covering about $20,000 in compensation loss claims. As for the impact on snow leopards, surveys indicate the snow leopard population in areas served by the insurance program has been stable since this program started.

Next I will discuss snow leopard conservation in Tibet, where the Buddhist religion preaches a great reverence for all life. Buddhist monasteries are prevalent throughout snow leopard habitat on the Tibetan Plateau, and associated with every monastery is a sacred mountain. The monks patrol these

sacred mountains and protect them from poachers. A recent study by a graduate student at Peking University found that these sacred landscapes currently protect more snow leopard habitat on the Tibetan plateau than the national protected areas do.[2] Hence, it was not a difficult decision for Panthera's associates at the Chinese conservation organization Shan Shui to establish a working relationship with the Buddhist monasteries in snow leopard habitat and add a little more scientific support for the monks' conservation efforts. Shan Shui provided them literature in the Tibetan language on snow leopard ecology (see Figure 19) so that they could understand the relationship between snow leopards and their prey. They trained the monks in the use of camera traps and GPS (Global Positioning System), which allow them to

Figure 19. Buddhist monks reading about the ecology of snow leopards and their prey. Photo credit: Thomas McCarthy, Panthera.

understand where snow leopards roam in their sacred landscapes (see Figure 20). Today they are scientifically monitoring the snow leopards on their sacred mountains. And they take great pride in "their" snow leopards, many of which they have named after capturing their images on cameras.

Figure 20. Author (on the left) and Chinese associate Yin Hang (second from right) helping Buddhist monks learn about how to use GPS to monitor snow leopards. Photo credit: Thomas McCarthy, Panthera.

Their admonitions to local people to protect snow leopards are now more easily understood when each cat is a known entity. On a larger scale, at annual Buddhist festivals, Shan Shui provides pamphlets and calendars depicting snow leopards and urging their protection. Their message is amplified when senior monks stand before 50,000 or more attendees and ask how many people will pledge to protect snow leopards for the rest of their lives and 50,000 hands go up (see Figure 21). That kind of commitment to save snow leopards is humbling. It is quite impressive how the Buddhist religion has done so much to foster conservation on China's Tibetan Plateau.

Figure 21. A Buddhist festival on the Tibetan Plateau in Qinghai Province, China. Photo credit: Shan Shui Conservation Center, Beijing, China.

In Tajikistan, Panthera participated in developing the National Snow Leopard Action Plan in 2010, which pointed out loss of natural prey as one of the most critical threats to the species. Being well aware of a very successful and longstanding program just across the border in Pakistan that dealt with a similar issue, Panthera suggested it as a model for Tajikistan to emulate. In Pakistan, a consortium of national and international conservation groups had created community-based conservancies to manage local natural resources. The conservation organizations helped village conservancies build the governance structures necessary to petition the government to be able to manage their own wildlife, in particular the Markhor goats that are highly sought after by trophy hunters. Today in Pakistan, village conservancies market trophy hunts themselves, and 80% of the proceeds goes to the local people instead of the coffers of the far-away central government. Local people now take pride in managing their own wildlife, including Markhor, which had been in rapid decline and listed as "Endangered" when this program started over twenty years ago. As a result of this program, there are now over 1,700 Markhor in the country, and they were recently downlisted from "Endangered" to "Near Threatened" on the International Union for Conservation of Nature's (IUCN) Red List.

Panthera sought to emulate that program in Tajikistan, but there was initial skepticism by local people regarding the government agreeing to hand over wildlife management, much less share in the revenue from hunting. To alleviate that concern, Panthera went to the government, worked with them, and made it possible for community conservancies to manage their local wildlife. That step accomplished,

local village organizations became very excited about what they could do. They mapped local wildlife resources, including huntable populations of ibex and Marco Polo sheep (see Figure 22). Panthera helped them conduct surveys so that they could determine a sustainable annual harvest. We provided basic training in hospitality, helped them build sanitary facilities (see Figure 23), and even brought in international hunting guides who helped prepare them to cater to foreign hunters. In 2012, they hosted their first successful ibex hunt. An all-night community party ensued (see Figure 24). They had great pride in their accomplishments, and they saw a good future in it for them.

Figure 22. Villagers in Tajikistan's Pamir Mountains mapping the location of local resources, including snow leopard prey (ibex and Marco Polo sheep). Photo credit: Thomas McCarthy, Panthera.

Figure 23. A solar powered shower and washroom for tourists visiting the Pamir region of Tajikistan. Photo credit: Thomas McCarthy, Panthera.

Figure 24. Villagers celebrate hosting the first successful trophy hunt as part of a community-managed wildlife program in Tajikistan. Photo credit: Thomas McCarthy, Panthera.

An ibex hunt sells for about $5,000. About $4,000 of that goes to the community, and the balance pays for government permits and fees. Since the first hunt in 2012, the program has been quite successful and expanded to several new locations. However, the local people recognized that they could host only a few hunters each year, and, therefore, sought additional non-consumptive tourism opportunities. Now they have started doing popular winter yak treks into the mountains that are marketed in Europe. There is a strong demand to expand both the hunting and non-consumptive initiatives in other parts of Tajikistan's snow leopard habitat. Importantly, snow leopard prey numbers have stabilized or increased in most areas where the program operates.

Although the hunting program brought much needed income to people in snow leopard habitat in Tajikistan, local people continued to lose livestock to the big cat. Panthera discussed India's predator-proof corral program with the communities, and they were willing to give that a try. As I said before, one size does not fit all, but in some cases, a specific kind of initiative is replicable across borders. Many livestock corrals in the Tajik Pamirs were broken down and thus unable to protect sheep and goats from

predators (see Figure 25). However, with Panthera support, villagers have transformed them into sturdy effective structures (see Figure 26), some of which can hold up to 400 head of sheep and goats. At last count, more than 250 corrals have been rebuilt in this fashion, and demand remains high for additional ones.

Figure 25. A broken-down livestock corral in Tajikistan. Photo credit: Panthera.

Figure 26. The same corral after being refurbished. Photo credit: Panthera.

Most of what I have described thus far has been community-based conservation programs, but other issues require different tactics. In neighboring Kyrgyzstan, for instance, Panthera has been working with the government's Customs Service to provide trained wildlife detection dogs (see Figure 27). To date we have trained and placed six detection dogs at critical border crossings. The dogs are trained to detect not only snow leopard parts but those of prey animals as well. Last year, they intercepted snow leopard hides and several illegally harvested Marco Polo sheep on their way from Tajikistan to Russia.

Figure 27. A wildlife detection dog in Kyrgyzstan. Photo credit: Panthera.

This effective program is helping to identify and intercept illegal trade in wildlife parts. To better detect the origin of such trade, the community conservancies that Panthera helped establish have formed an informant network. Recognizing that losses to poachers can impact the ability of communities to benefit from managing their own wildlife, conservancy members now use cell phones to contact law enforcement officials anytime a poacher is detected. We believe that border detection dogs and the conservancy-based informant network are both helping to reduce poaching and illegal trade of snow leopards and their prey.

MEASURES OF SUCCESSES

In this essay, I have described multiple examples of successful conservation initiatives. One can measure success in many ways. Several innovative conservation initiatives have enhanced the livelihoods of people living with snow leopards through more marketable handicrafts sales, homestay programs, and reduction in loss of livestock or payments when losses do occur. We have seen the attitudes of local communities toward snow leopards change in positive ways (see Figure 28). No longer do herders in snow leopard habitat ask me why I would bother to save such a nuisance animal that has caused them so much harm. More commonly today, when our teams visit villages, we are thanked for our efforts and for the benefits that our programs provide. People are genuinely interested in how snow leopards near them are doing, hoping they are not still at risk of declining. These are huge changes and very gratifying to see.

Figure 28. A local herdsman in Ladakh, India, who is pleased with our wildlife conservation program. Photo credit: Thomas McCarthy, Panthera.

Although enhanced livelihoods and wildlife appreciation of local villagers are positive measures of success, as a conservationist, my ultimate goal is saving snow leopards. So we must ask: How much difference are we making for the cats? Are their populations stable or increasing due to our interventions?

Given how cryptic, shy, and elusive snow leopards are, they have been notoriously difficult to survey. For years, we conducted counts of snow leopard sign (pugmarks, scrapes, etc.) along set transects, hoping it was an indicator of snow leopard numbers that could be monitored over time. It was not! Fortunately, we have come a long way since the days I crawled over miles of transects sniffing for snow leopard urine and looking for their paw prints. Today we have a number of more accurate means to count snow leopards, including camera traps and noninvasive fecal genetics (see Figure 29). These methods have allowed us to document that our efforts are paying off and that snow leopard numbers are stable or increasing in most places where we have long-standing programs. We are confident this will be true in most areas where we work, but it can take several years for the data to show clear trends.

Figure 29. The author (on the right) and Mongolian biologist Nadia Mijiddorj (on the left) collecting snow leopard feces in the Altai Mountains for genetic analyses. Photo credit: Nic Bishop.

These same survey methods have allowed us to start improving our understanding of snow leopard distribution and numbers across larger parts of their range than just our project sites. We are still only scratching the surface, and perhaps no more than a few percent of the cat's vast suspected range has been adequately surveyed. Yet we have documented that snow leopard numbers have rebounded in some places where we saw large declines in the mid-1990s due to the collapse of the Soviet system and resultant turmoil in newly independent Central Asian states. Simply put, the more places that we survey using scientifically sound methods, the more snow leopards that we find. That fact is having ramifications on how biologists view the species conservation status of snow leopards and, in particular, how they are listed in the International Union for Conservation of Nature (IUCN) Red List of Species.[3]

The IUCN Red List provides a measure of extinction risk for each of the more than 116,000 species of animals that have been assessed. Space does not allow me to elaborate on the Red List process

or the myriad categories and criteria involved in assessing any given species.[4] For our purposes here, we need only understand that there are multiple IUCN categories, including the "Threatened Categories" grouping that encompasses "Vulnerable," "Endangered," and "Critically Endangered" species (see Figure

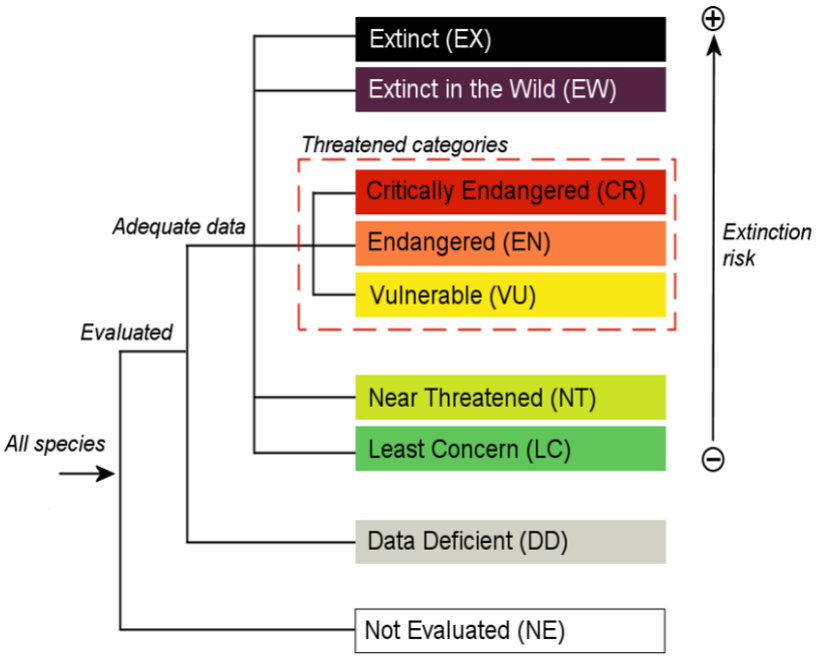

Figure 30. Categories used in the International Union for Conservation of Nature (IUCN) Red List of Species. Source: IUCN.[5]

30). One of five conditions must be exhibited for a species to be placed into one of the "Threatened Categories." At the risk of oversimplification, they include the following:

- Rapidly declining population
- Small population and fragmented range
- Small population size and in decline
- Very small population size and restricted distribution
- Viability analysis suggesting a high likelihood of extinction

Snow leopards were assessed as "Endangered" in 2002 and then again in 2008 because it was assumed that there were fewer than 2,500 mature individuals and they had experienced a 20% decline over two generations (a generation being about eight years in the case of snow leopards). A 20% decline over the sixteen years prior to the assessments of 2002 to 2008 was related to the aforementioned collapse of the Soviet Union during the mid-1990s. For several years after that event, people in the Central Asian republics who had been rangers or managers of protected areas became poachers and sold wildlife on the

black market to provide for their families. They drove snow leopards and the other big mammal populations in those protected areas to near extirpation.

By the time of the 2014 snow leopard Red List assessment (species are re-assessed every six years), it was a different story. The two-generation timespan since the collapse of the Soviet system and resultant loss of wildlife was past. For that reason and other considerations, several members of the IUCN assessment team believed snow leopards no longer met the criteria for "Endangered" status. Others on the team had very different viewpoints, believing the species still qualified as "Endangered." There were heated debates over such things as rate of decline and what actually constitutes a mature individual. Some argued that inadequate data existed to conduct an assessment since only 2% of the cat's range had ever been adequately surveyed. Others said that if the cat were downlisted, it would send the wrong message to governments of countries where the species occurs. There was concern that downlisting would result in the loss of funding for snow leopard conservation since some grants apply only to "Endangered" species. While valid in a general sense, most of these arguments could not be considered under IUCN assessment guidelines. IUCN assessments essentially rely only on the rate of decline and how many mature animals there are in the population (again, an oversimplification, but, for our purposes here, it explains how things turned out).

Since the expert group could not come to an agreement, in a rare move the IUCN allowed the team to split into two groups, both of which would conduct an assessment. One team completed an assessment with a finding of "Endangered," and the other found the cat only met the criteria for "Vulnerable." After multiple internal and external reviews, the "Vulnerable" finding was found to be most appropriate.

The people advocating for continuation of the "Endangered" designation, including the governments of most snow leopard range states, were not pleased by the result. For context, consider the controversy concerning the downlisting of the Giant Panda from "Endangered" to "Threatened." The Chinese government was not happy about it and fought against the change. They said pandas must be listed as "Endangered" since it was their flagship species. It was a long and difficult conflict, but the new designation stood. In that case, there was only one range country where pandas occurred. All twelve countries where snow leopards are found signed a petition to the IUCN demanding snow leopards remain listed as "Endangered." The IUCN, to its credit, said it is a scientific process, not a political process. They stated that the assessment was done correctly, following IUCN guidelines, and they were standing by it.

Social media became the next attack point, and not only was the new assessment called "unscientific," there was concern that it would risk conservation efforts for snow leopards. Selecting a more appropriate venue for having this discussion than social media, those opposing the assessment published pieces in the highly respected journals *Science* and *Nature*, labeling the assessment

"questionable."[6] Those supporting the new assessment replied with a letter in the journal *Oryx* asking why some people seem to cling to the "Endangered" status as if it were a desired status for a species.[7] They wondered if those opposed to the new designation believed that "Vulnerable" meant snow leopards were now well situated to survive. By definition, "Vulnerable" species are at a "high risk of extinction." Clearly, "Vulnerable" is not a good category for a species, and the new assessment does not suggest that snow leopards are doing well. Moving from "Endangered" to "Vulnerable" only indicates snow leopards are not doing as badly as before and have rebounded from the post-Soviet Union population decline. Nevertheless, all sides agree that conservation efforts are still needed and should be maintained and even increased.

Even though there was a rift in the snow leopard community over the latest Red List assessment, we all remain committed to the cat's conservation. Indeed, when I was preparing this talk, I asked all the people that were on the other side of the debate from me for slides and data. Within twenty-four hours, I had everything I had asked for. We remain a tightknit community within the snow leopard conservation world. We all understand what is at stake for the cat that we have dedicated our careers and lives to protect.

If you want to learn more about snow leopards, you should visit Panthera's website (https://www.panthera.org) or obtain a copy of the book *Snow Leopards*, published in 2016 (see Figure 31).[8] This book, which I co-edited, has a description of every conservation story that I shared here and much more. It remains the most complete and authoritative examination of the species and its conservation status to date.

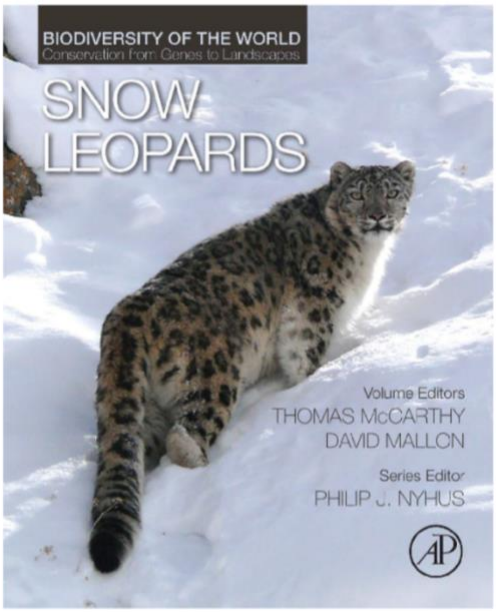

Figure 31. Cover of a book on snow leopards co-edited by the author. Photo credit: Elsevier, Inc.

DISCUSSION

Audience Member: Is there a concerted effort to assess the status of snow leopards across a much larger part of their range? Would that perhaps settle the population question that was part of the Red List debate?

Thomas McCarthy: Yes, there is, and I think you are going to see that work finalized, or at least be far enough along to give us a better grip on snow leopard numbers, before the next Red List assessment. There is an initiative called Population Assessment of the World's Snow Leopards (PAWS) underway now. Little new data is available yet, but I do not believe the species will go back to "Endangered" because I really think that there are a lot more snow leopards than we previously thought. Consider that two million square kilometers of habitat, and imagine spreading out fewer than 2,500 cats (the benchmark number for "Endangered") across that vast area. They would struggle to find each other to breed. To me, it is inconceivable that we could have fewer than 2,500 breeding cats. Therefore, I do not think it's going to go back to "Endangered" unless something more serious happens to drive numbers down. Climate change, of course, is a serious concern. But if we factored climate change into all Red List assessments, we would probably just assess every species as Critically Endangered.

Audience Member: How large is a typical snow leopard's home range, and do home ranges often overlap?

McCarthy: The typical home range for a snow leopard runs anywhere from fifty to sixty square kilometers in good habitat where food is abundant to over 400 square kilometers in areas where prey is scarcer. Big males do have distinct home ranges that don't overlap, at least not by much. They patrol the edges of it, and they scent mark and scrape to signal to others they have claimed an area. So they provide both an olfactory and a visual cue to help them stay away from each other. But females seem to overlap a lot, and they move around each other. When mothers give birth to females, the offspring often take over or stay in their mother's home range, whereas males are pushed out or leave of their own accord after about two years to set up their own home range.

Audience Member: What kinds of impacts on snow leopards might we see from climate change?

McCarthy: We see dramatic shifts already in glaciation, especially in the Himalayas, and that will change the whole ecology of the area. Tree lines will move higher, and snow leopards generally occur above the tree line. You are going to have many small isolated massifs, pockets of useable habitat, instead of the broad conductivity across snow leopard range we see today. Climate impact modeling that has been done recently is suggesting that snow leopard habitat in the southern portion of their range, including the Tibetan Plateau and Himalayas, is going to decline. Conversely, we're actually going to see an increase in

suitable snow leopard habitat in the north and west portion the range, such as in Siberia, Kazakhstan, and parts of Mongolia. Much of this will be driven by changes in habitat availability for snow leopard prey species and general snow leopard habitat connectivity. We're not seeing a lot of changes yet, but we're seeing the indicators of what is to come, such as loss of glaciers. I don't think it's going to take very long before we see changes in human use of high elevation areas in the region as well.

NOTES

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8. Thomas M. McCarthy and David P. Mallon, *Snow Leopards* (Amsterdam: Academic Press, 2016).