

Project Update: May 2012

29 April 2011 -- The day 3 -- Snow leopard fieldtrip, Mustang, west Nepal. It was 12 noon when we returned to our temporary camp in Vrapsa – meaning, in local language, a type of soil that is used to plaster walls. Towering by Tilicho and Nilgiri peaks, both over 7,000m, this alpine grassland (4,200m to 5,000m) is a rugged U-shaped valley, almost a day of uphill climb from Thini, one of the oldest and largest Bon villages in northern Nepal. Vrapsa and its adjoining valleys -- Lubra and Mukninath -- support snow leopard *Panthera uncia*, blue sheep *Pseudois naur*, and musk deer, *Moschus chrysogaster*. Herders from Jomsom (the district hub) and Thini graze cattle, yaks, sheep and goats here in this valley. Albeit animal husbandry is gradually declining, largely because of the acute shortage of labor -- as elsewhere in northern Nepal -- livestock rearing is still a significant social and economic way of life in this ancient salt route.

We returned to our temporary camp, that day, with high spirits as we counted five groups of blue sheep, a total of 47 individuals, along the mountain slope. Blue sheep is the main local prey of the endangered snow leopard in west Nepal. [On Mt. Everest in east Nepal, Himalayan tahr constitutes snow leopard's main diet.] The kid-to-female ratio of blue sheep was encouraging, 0.6, that is 60% females had their young.

A few individual blue sheep were grazing on the slope above the trail leading to high Mesokanta pass (5,100m) bordering the adjoining district. In a high plateau in central Asia, hidden behind some of the world's tallest mountains, Dhaulagiri and Annapurna (Tilicho and Nilgiri are part of the Annapurna massif), there is a land – so unique in culture and in nature -- alternately sundrenched and snow-driven, whipped and scoured by fierce, ceaseless wind for millions of years. Welcome to Mustang! As recently as 40 million years ago Mustang was under what is called the Tethys Sea and was completely submerged under water. This ancient sea still shows itself in all the seashells and fossils that are dotted throughout the region on the valley floor as well as on the hills and ridges. Kali Gandaki -- Nepal's most holy river -- flows from the Tibetan Plateau, and cut through the Annapurna (8,091m) and Dhauligiri (8,167m) massifs creating the world's deepest gorge. Mustang, at the edge of the Tibetan plateau, is a high-altitude desert, with a landscape resembling that of the American Southwest -- the Grand Canyon. Its black, red and brown slopes are brightened at long intervals by patches of vivid green, the irrigated fields that mark the presence of a village or summer pasture such as Vrapsa.

That day, we split into two groups, after a light, dry lunch, for another round of snow leopard survey. One team followed the regular trail for some 500 m and then ascended up the slope along the livestock trail (this was our systemic transect). The other team climbed an immediate ridge standing some 1000m up and disappearing into a bowl-shaped valley up at the height of 5,500 m. This ridgeline would be our site for incidental sign search.

We had yet to discover clear snow leopard pugmarks or scrapes to affirm the local's claim that several snow leopards inhabit the upper reaches of the valley. The sheer cliff would make anyone feel dizzy and insignificant. Perhaps some blue sheep might be grazing up there! It was

disappointing that we neither encountered any fresh snow leopards' scats nor scrapes on our first systematic transects along the (sharpest) ridgeline we traversed the previous day. Unlike Mt. Everest, which is characterized by V-shaped valleys, with abundant sharp ridges, and accessible crests, Mustang is full of broad ridges and U-shaped valleys where snow leopard signs may be difficult to find. Given the rarity of signs, and the low density of snow leopards, transects are generally placed along landforms where snow leopards are considered most likely to travel. [When comparing different areas, the selection of sign-transects, and corresponding signs per unit transect length, may bias our perceptions of snow leopard distribution and abundance. For instance, in Ladakh, snow leopard signs were much predictable along sharp ridges and river confluence (Fox et al. 1991, Mallon 1991), but in Qinghai, cats marked the bases of hills flanking broad valleys where the cat's travel routes were less well defined making it difficult to locate spoors along transects (Schaller et al. 1988).] It took us one hour to reach the first ridge while meticulously searching signs along 5m stripe on either side of the trail. The ridgeline ended abruptly, so we descended 100 meters or so to climb up again to reach a bowl-shaped valley. Surrounded by eroded slopes with boulders on south facing slope and moraine on east facing slope -- this place was unexpectedly windless and soothingly warm -- a perfect site for sunbathing. Lo and behold! A very fresh scrape -- unmistakably of an adult snow leopard -- along the trail! The majestic beast had made a royal visit here the previous dawn. The depression also awarded us a pile of scats, but of red fox (perhaps shed out of fear?). There was another fresh scrape some 15m up along the base of a boulder. Excellent discovery! We put a camera trap on the base of the boulder which would be monitored for the next several months as part of the project - Assessing snow leopards and their corridor habitats in Nepal. It would also be an ideal training venue for snow leopard scouts from 6th, 7th and 8th grades to set up and learn camera traps. [The education component of snow leopard corridor project trains local school students throughout the snow leopard corridors. These snow leopard scouts would eventually become the local guardians of snow leopard.]

The aim of snow leopard corridor project's research component is to assess snow leopard corridors that lie in and outside of Nepal's protected areas. As the initial phase of the snow leopard corridor project, in 2009, we surveyed Mt. Everest National Park (source snow leopard population in "east" Nepal) and adjoining Rolwaling that falls outside of the country's protected area network. While snow leopards are declining in most range-countries, their return to Sagarmatha (Mt. Everest) National Park -- after an apparent absence of several decades' attests to country's conservation success. The discovery also raised several challenges. Will Mt. Everest be able to maintain a viable population of snow leopards? Could this re-established population serve as source for re-colonizing adjacent areas? The high valleys of Mt. Everest are connected to Rolwaling via the high Teshi Lapcha La pass (5,755m) that may serve as dispersal corridor. In 2009, we surveyed Rolwaling and found that snow leopard does inhabit its high mountains. We concluded that, despite low natural prey abundance, snow leopards survive in Rolwaling by relying on livestock which is unfortunately declining as more and more youth seek employment in lucrative trekking and climbing expeditions. We mapped seasonal livestock movements and collected biological and physical variables in addition to collecting snow leopard scats for DNA analysis --activities which are part of the agent-based corridor model which is currently under progress. The corridor project is being done in collaboration with the

leading experts in their fields -- Dr. J. Janecka (Texas A & M, USA) for genetics, Dr. R. Jackson (Snow Leopard Conservancy, USA) for ecology and field sampling, and Dr. K. Johnston (ESRI) for habitat modeling and GIS-mapping. In 2011 and 2012 -- in "west" Nepal -- we continued the snow leopard corridor field data collection from the support of Rufford's Booster grants, Snow Leopard Conservancy, and University of Illinois at Chicago, to initiate modeling corridors at the landscape level.

While the table work (modeling) is under way, we made four field trips in 2010 and 2011, including the one in the autumn of 2011 for camera-trapping snow leopard (a part of which will be repeated in 2012). In addition, we collected cursory information on livestock, culture, and people-wildlife conflict, to map "social corridors". The main objective is to educate and prepare a host of communities sharing habitats with snow leopard to establish series of "predator friendly communities". Training and educating snow leopard scouts is part of building the social corridor such that local people eventually perceive the cat as benign, not as a threat, to their livelihoods. Designing, implementing and maintaining biological corridors is only feasible in the presence of strong social corridor.

By 5:30 am we were up on the slope, the following day. We aimed for reaching a distant seemingly sharp ridgeline and placing a systematic transect out there. Snow leopards prefer sharp ridgeline as their travel lane and leave signs (scats, pugmarks, scent-marks, and scrapes). The place was surprisingly devoid of signs except for a year-old scrape on grassy ridge top. While returning, we discovered an old scat on the regular livestock- trail. "Are snow leopards in plight here in lower Mustang?" we thought aloud. A year ago, with the help local villagers, personnel from Annapurna Conservation Area Project -- the local government mandated authority to manage natural resources in Annapurna -- lifted over 70 musk deer traps from around the area. These were set-up by hunters from lower districts. [Two culprits were later prosecuted]. A few years ago, a snow leopard was found dead with its foreleg trapped on a muck deer snare, a local herdsman told us. The Buddhist inhabitants in Mustang rarely hunt wildlife like in Everest.

[The widespread local belief, in Everest, indicates snow leopard as the dog of the mountain god, Taubuche. The act of appeasing snow leopard in ceremonies is a social norm. A thousand of years ago in the foothills of the Himalayas, Guru Rimpoche (also known as Padma Sambhava in Tibet and Nepal), the Indian yogi who brought the teachings of Buddhism from India to Tibet, plowed a series of valleys out of the mountains to serve as beyul (Shangri-La or fabled Shambala) in Nepal, Tibet and Sikkim, the refuges that were to remain hidden in a time of unprecedented religious crisis protecting dharma until the misfortune passed. Rolwaling and Khumbu where Mount Everest stands were said to be beyuls -- the fabled Shangri-la or Shambala. These valleys are protected from the world by the mountain Gods. Only the true followers, the ones who really practice Buddhist teachings, can find beyul. People with ill intentions try to follow beyul, it is believed, snow leopards will attack them at the mountain passes and drive them away. These sacred lands today maintain Buddhist bans on hunting and slaughter, elsewhere observed less scrupulously.]

No clear written accounts exist to affirm whether Mustang was a beyul, but legend says that Padma Sambhava, on his way to Tibet, stopped in Muktinath (salvation valley for Hindu at the elevation of 3,710m), meditated, and blessed the valley. [He is worshipped by Buddhists in his temple at the north end of the complex called Mharme Lha Khang or '1,000 lamps'.] The legend further says that Yogi battled and defeated the local demon while he traveled through Ghemi, a sizable village in the middle of a series of rugged mountains, on the way to Lo-Manthang, the medieval capital of ancient Kingdom of Lo. This is also the place of Nepal's longest Mhane wall (prayer wheels), 240 m long, in northern Nepal. At the demise of the demon, its intestines fell out and the place where the mhane wall was later built.

We asked a shepherd from Thini to test his mettle -- do you worship the snow leopard? Herder: Nope. Do you think snow leopards should be allowed to live? Herder: They were sent by the almighty God to live their only life, so we may not even have right to ask such questions! People have mixed feelings toward snow leopard. People-wildlife conflicts do certainly exist in Mustang as elsewhere in northern Nepal. The cursory survey on livestock depredation patterns by the snow leopard in 2010 however indicated that despite the livestock loss above the average (which is over 3% of total stock per annum) in 2010, in settlements like Lubra, people tolerate the presence of snow leopard.

Three hours north of Vrapsa is Lubra, home to the only Bon school and monasteries in Nepal. The village was Founded by Trashi Gyaltzen, in the late 12th century AD, the youngest son and spiritual heir of Sherab Gyaltzen, a Bon-Po lama, born in 1,077 AD in Tibet who was famous for his outstanding debating abilities outwitting the Buddhist monks. As Padma Shambhava eliminated most Bon followers from Tibet by the end of the 8th century, Sherab Gyaltzen in his dream was told to travel south to Lubra (Mustang) to get his ultimate teachings from a Bon teacher residing in the present-day Lubra. Today Lubra is the home to Bon's oldest monastery and Thini oldest Bon scripts. Both Bon Po and Buddhist deities, disguised as snow leopard, are believed to travel from one place to another guarding the village territories from demons and natural calamities. So, killing a snow leopard may mean harming your own ancestral spirits. While walking through these villages it is impossible not to be impressed with how people have lived with thriving cultures in this apparently barren landscape, amid snow leopards, for thousands of years.

In 2010 and 2011, in Vrapsa (Thini/Jomsom), Lubra, Muktinath and Chhuksang valleys, we randomly laid out 27 transects of various lengths, and walked along them covering a total 19.4 km of linear distance, following standard SLIMS procedures (Jackson and Hunter 1996). We detected several scrapes, scats, and pugmarks [3.6 all signs per km (1.9 scrapes per km, Appendix I-Table 1)]. Our "random" sign search (that is, recording signs that we encountered while walking between transects or while searching other wildlife) revealed 46 signs in 35 full search-days from 7 to 16 November 2010, 1-10 May 2011, and from 12 to 27 July 2011. The likelihood of encountering signs was greatest in autumn (7.6 signs/km) and least in summer (1.9 signs/km). If we consider only autumn season, then snow leopard sign density in Mustang was much higher than that in Mt. Everest (Ale 2007) and Rolwaling (Ale et al. 2010), both below 4 sign items per kilometer. Mt. Everest revealed two resident cats (Loavri et al. 2009) while in

Rolwaling snow leopards were transient (Ale et al. 2010). To take an extreme case, Langu in west Nepal, with a snow leopard density of 8-10 cats/100 square km, revealed 36 signs per km (Jackson 1996).

We also surveyed blue sheep, opportunistically, to understand its population structure and composition (Appendix I-Table 2). The kid to female ratio of blue sheep in Mustang is within a normal range. The proportion of females seen with a calf at the end of birth season is used as a proxy of birth rate in ungulates (e.g. elk *Cervus elaphus* L.: Eberhardt et al. 1996; White-eared kob *Kobus kob leucotis* A. Smith: Fryxell 1987; moose *Alces alces* L.: Laurian et al. 2000; Himalayan tahr *Hemitragus jemlahicus*: Scahller 1973, 1977; Lovari 1992; Ale 2007) -- a quick, easy-to-use method in open habitats. A normal range for kid to female ratio for ungulate is c. 0.6 for stable populations and c. 0.7 for a growing population.

Despite barren landscape with patchy vegetation, Mustang supports a healthy population of blue sheep and a good number of snow leopards [the camera-trap analysis, which is currently underway, may reveal an index of relative abundance to Mustang]. Perhaps a combination of local people's religious attitude toward wildlife added by over two decades of conservation activities initiated by the Annapurna Conservation Area Project may be credited for this. In settlements in and around Lo-Manthang, lying further up from Chhuksang and Ghami, as recent as in 2007, the 15th-century Buddhist and pre-Buddhist religious texts and wall paintings were found in series of man-made caves carved into sheer cliffs. Few have been able to explore the mysterious caves, since the place was long closed to outsiders. A team of researchers and mountaineers scaled the crumbling cliffs on a mission to explore the caves where they even discovered ancient Tibetan Buddhist shrines decorated with exquisitely painted murals, including several 600-year-old human skeletons. The National Geographic team and locals even christened one of the caves "the snow leopard cave" as the elusive animal's footprints were found inside!

We will be placing camera traps in strategic locations in and around Lo-Manthang, in 2012, and collect additional information on snow leopard signs. With Everest and Annapurna snow leopard data, the snow leopard corridor project will culminate into a map that stretches from Everest to Annapurna showing the best snow leopard locales linking these two protected areas. At one level of analysis (the agent-based model is another); we will be using principle component analysis and discriminant function analysis to sort out best snow leopard habitat variables to know the habitat preference of snow leopards. Based on these, we will then predict snow leopard habitat along the corridor areas.

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Richard

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Appendix I: Abundance of snow leopard signs and blue sheep in Mustang

Table 1: Snow leopard sign abundance in Mustang, Annapurna

	Feces	Pugmarks	Scrapes	Total	Transect length (km)	Transect No.	Signs/km	Scrapes/km
Autumn 2010	18	10	27	55	7.2	9	7.6	3.8
Spring 2011	11	5	34	50	11	15	4.5	3.1
Summer 2011	19	3	10	32	19.4	27	1.6	1.9
Total	48	18	71	137	37.6		3.6	1.9

Table 2: Blue sheep structure and composition in Mustang, Annapurna

								Ratio of		
	Male	Female	Yearling	Kid	Unidentified	Small male	Large male	Male/female	Kid/female	Small/large male
Autumn 2010	31	63	16	35	3	16	16	0.5	0.5	1
Spring 2011	97	78	32	43	44	43	41	1.2	0.6	1