Searching for the ghost of the mountains

Report of a camera trapping study of the snow leopard and other mammals in the Altai Mountains of NW Mongolia

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Introduction and aims of the study

In 2014, the Mongolian Conservation NGO Green Initiative, based on a desire from the Mongolian Altai Range Protected Areas Authority, contacted MUSE - Museo delle Scienze (Trento, Italy) to propose a study on the snow leopard (*Panthera uncia*) and other mammals of a remote and poorly known areas of the Altai Mountains in NW Mongolia, known to be within the snow leopard range.

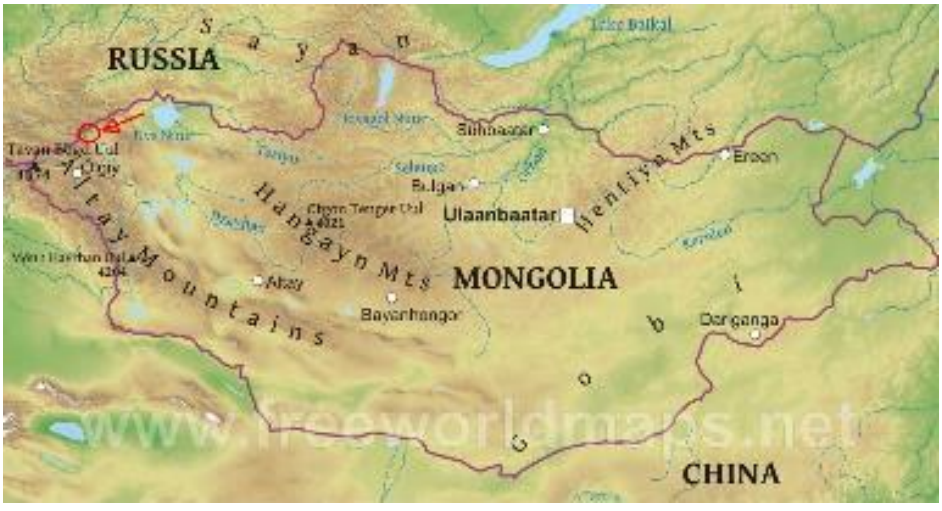
MUSE has a well established experience in the study of elusive mammals using camera trapping and therefore the ensuing discussions led to a study being conducted in March-July 2015. The study was conducted as a partnership between MUSE, the Natural History Museum of Denmark, Green Initiative and the Mongolian Altai Range Protected Areas Authority. In the course of the study, Dr. Zimmermann of KORA (Swiss organization for carnivore ecology and wildlife management) joined the partnership.

The main aim of the study was to confirm and assess the presence of snow leopard in the proposed area, trying to establish its population density through systematic use of camera trapping and capture-recapture analysis. Secondarily, the study aimed to report on the presence of all medium-to-large bodied mammals in the area, as well as assessing the general conservation status of the area and its fauna.

This is a report that presents the main results from the study. Only qualitative results are reported here; detailed analysis of results are in progress by MUSE scientists and partners, with a view of publishing them in scientific journals.

Study area and methods

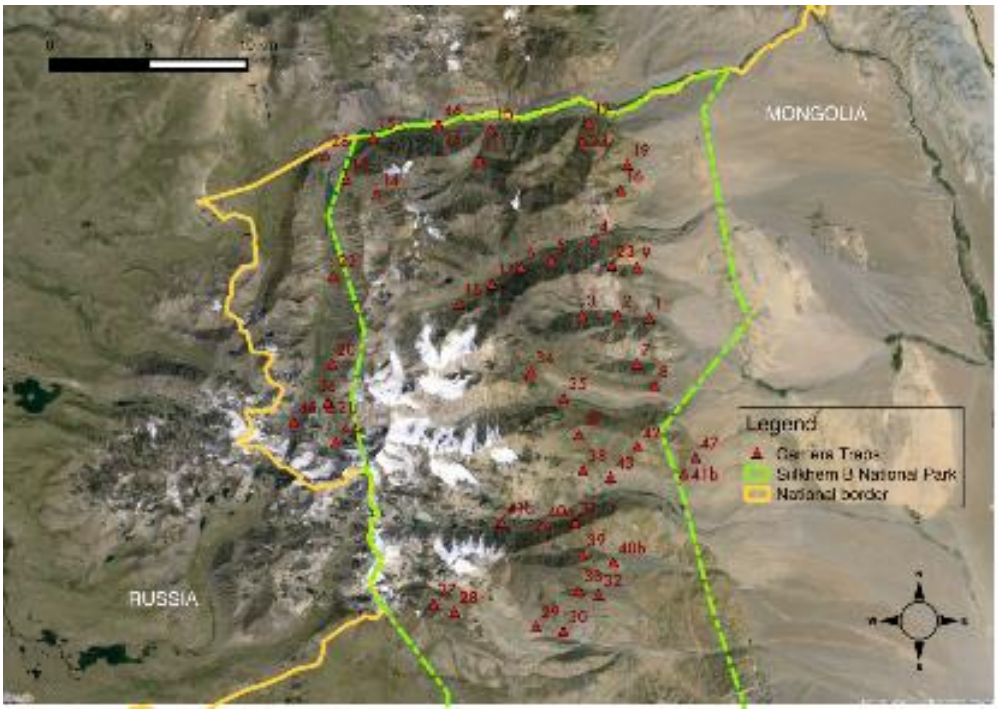
The study was conducted in the 'Siilkhem B' National Park (49 49 21.42N 89 44 56.84E; area approximately 1400 km^2 (http://www.infomongolia.com, see aslo http://whc.unesco.org/en/tentativelists/5955/), located in NW Mongolia bordering Russia, with highest elevation up to 3900 m a.s.l. The park covers a portion of steep, rocky and dry habitat within the Altai Mountain range, and is mainly covered in grassland with valley bottom sparsely covered by scattered larches.



Map of Mongolia with the study area to the NW

A view of the study area

Within the central-to-northern portion of the National Park, and the western valley running N-S which is outside the park and borders Russia, we sampled a focal study area of approximately 950 km^2 where we set 49 camera trap stations (2219-3126 m a.s.l.). Each 'station' consisted in a pair of camera traps set on a presumed point of passage of snow leopards, with one camera each side of the trail so to photograph both flanks of the animals.



Map of the study area with the 49 camera trap stations set

This is needed to identify individual leopard from the spots on their coats and allow identifying the individuals repeatedly and at different locations. The map of the camera trap array is shown below. Spacing and location of camera trap stations was based on a sampling design decided before the study and based on the literature and available information on the site.

We set a first array of 26 camera trap stations in March 2015 in the northern portion of the focal area, and a second array of 23 stations in May 2015 in an adjacent, southern portion of the focal area. Using the pre-determined scheme of sampling as a reference, we set camera traps on suitable sites maintaining a minimum distance of 1.5-2 km between contiguous camera traps. We used digital camera traps: the majority were Cuddeback Ambush mounting a white flash, with a subset of 10 UV565HD (IR+) camera traps that mount an infra-red LED flash and can record video at nights. Hence, 40 sites were made of coupled Cuddeback and 10 sites had a Cuddeback and an IR+ camera. The white flash allows for clear colour images at night that help identifying animals, while the infrared flash allows to record black and white video at night. We set camera traps on rocks at a distance of approx. 4-5 m from the target trail. We used alkaline batteries that proved to work in freezing temperatures (down to -20° in March). Date and time of image was stamped in the images themselves. We left camera traps unattended for a minimum of 40-45 days (see Results). Camera traps saved images on SD cards.

We recorded by using GPSs the location of the camera trap sites, and we also recorded day and time of start and end of sampling.

Setting camera traps

Images were retrieved from SD cards and sent to MUSE by Green Initiative. We analysed images entering species identification and metadata using dedicated, open-access software (WildID, see https://www.wildlifeinsights.org/WMS/#/shareData). The software allows to export a database (.csv format) that we used for further analysis. In particular, images of snow leopard were analysed for individual identification.

Results

All 49 camera trap stations set worked successfully, and only 1 camera trap out of 98 originally set was lost due to ice melting causing over-flooding at the camera trap site. We cumulated an effort of 2225 camera days (mean 45.4 per camera trap station) in the overall sampling period of 17 March to 29 June 2015. We obtained 669 images of wild animals and 1880 images of domestic animals and people. We filtered images for independent detection 'events', i.e. images of the same species taken within a span of 15 minutes were scored as a single event. This avoids multiple scoring of the same individuals that in fact represents a single, detection event. We used the events as an index of relative abundance for each species, by normalizing events for the sampling effort. We also calculated naïve occupancy as the number of sites positive to species' presence to the total number of sites, which is a complementary index of abundance to the event rate.

We recorded 11 species of medium-to-large mammals (Table 1), as well as people and livestock.

Table 1. Checklist of species, with the number of detection events

Common name	**Latin name**	**Events**
Wolf	*Canis lupus*	10
Siberian ibex	*Capra sibirica*	33
Wolverine	*Gulo gulo*	6
Arctic hare	*Lepus timidus*	18
Siberian marmot	*Marmota sibirica*	276
Beech marten	*Martes foina*	10
Steppe polecat	*Mustela eversmanii*	25
Pallas' cat ('Manul')	*Otocolobus manul*	11
Snow leopard	*Panthera uncia*	14
Red squirrel	*Sciurus vulgaris*	1
Red fox	*Vulpes vulpes*	81
People and domestic animals:		
Humans		105
Cows and yaks		163
Camels		11
Goats		138
Horses		50
Sheeps		50
Dogs		28

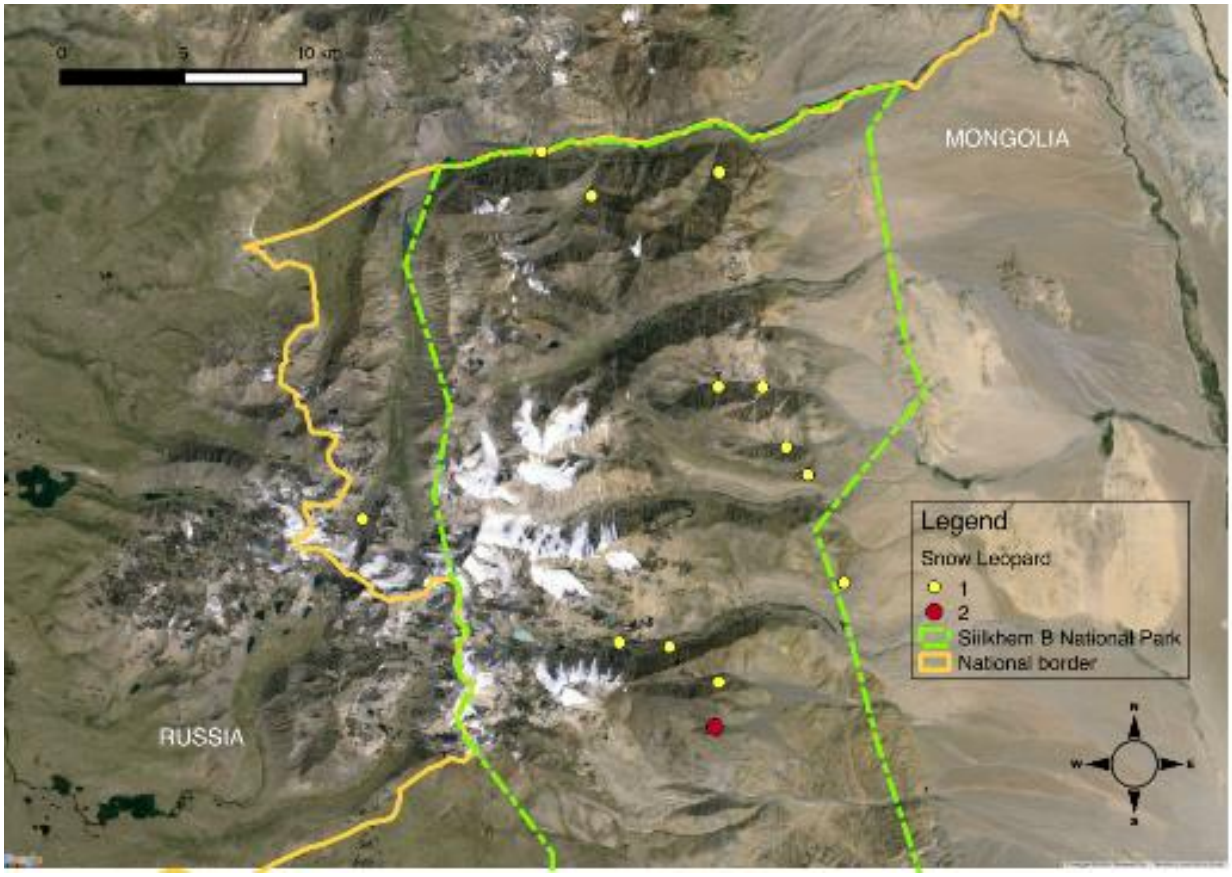
The 14 detection events of the snow leopard belonged to only 3 individuals. One individual was only captured once, along the northern valley of the study area, and the other 2 individuals were captured at multiple sites across the study area. One of these, in particular, used an area of approximately 20x25 km. Pending statistical analysis these data suggest a very low density of this IUCN Endangered large felid in the study area (see Discussion). We found fresh tracks on snow of leopards at two sites only, in the centre and the north of focal area, with a track of three individuals walking together along a narrow, lateral valley of the

large northern valley bordering the study area. We also found a number of possible snow leopards' markings on rocks and of defecations sites across the study area.

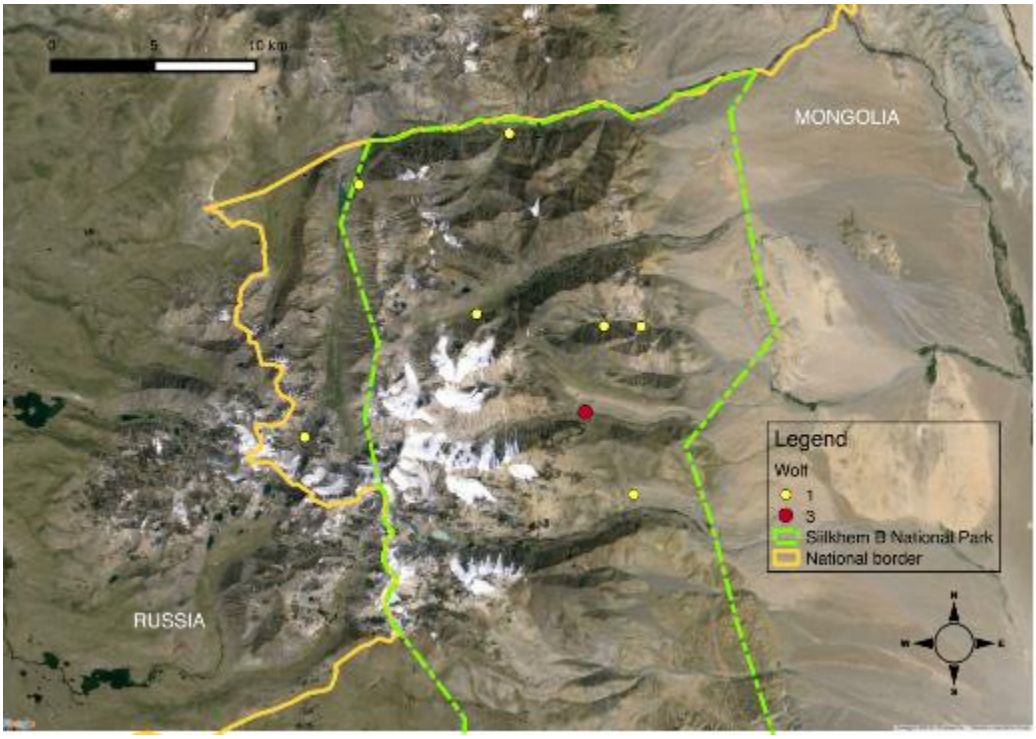
A selection of snow leopard images from camera trapping

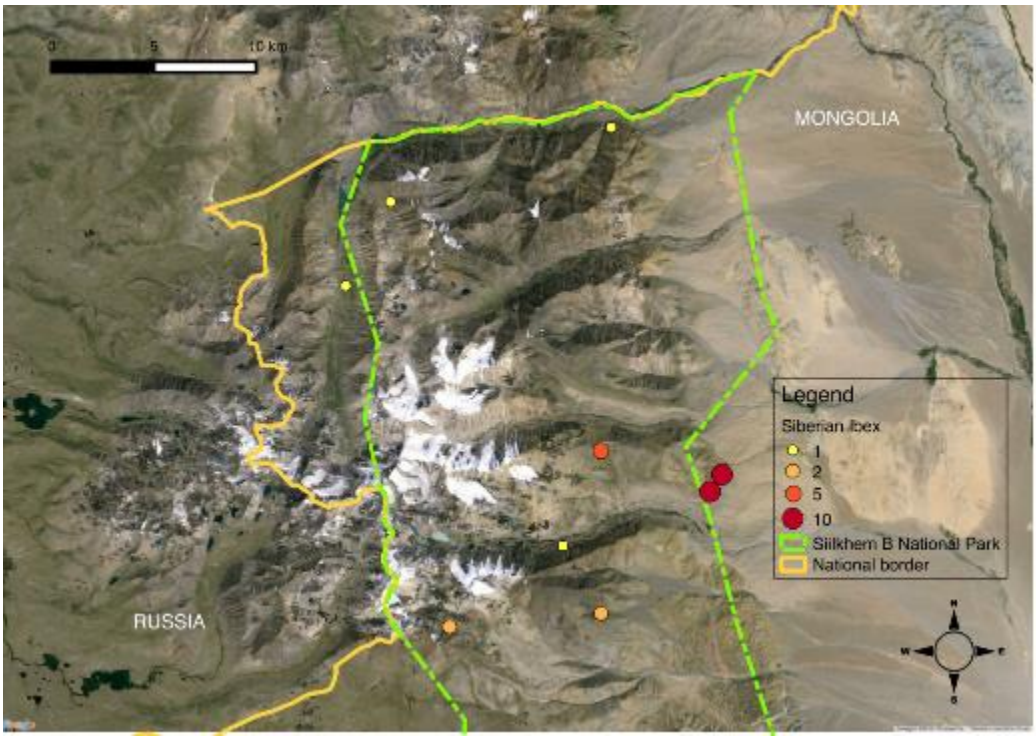
A selection of other species detected by camera trapping, from top to down and left to right: Pallas' cat, Siberian ibex, wolf, wolverine, Siberian marmot, red fox, beech marten and steppe polecat

Among the other wild species recorded it is remarkable the presence of the Pallas' cat (*Otocolobus manul*), a IUCN Near Threatened small cat that has a poorly known and fragmented range in central Asia. It is also relevant to show the distribution map for the records of the Siberian ibex (*Capra sibirica*) which is likely the main wild prey of snow leopards in the area. This species was found at only 9 of the 49 camera trap stations. However, livestock (primarily goats) were by far the most recorded group of animals, with 545 events altogether, recorded at 20 camera trap stations. Interestingly, detections of ibexes and livestock overlapped at only 1 camera trap site. The wolf (*Canis lupus*) was captured at 8 sites (10 events). Below are shown the maps of detection events for a selection of species (and of livestock), in the following order (see legend for species name): snow leopard, wolf, ibex, Pallas' cat, and livestock.



Map of distribution of snow leopard detections


0
5
10 km
MONGOLIA
RUSSIA
Legend
Wolf
1
3
Silkhem B National Park
National border
N
W
E
S


0
5
10 km
MONGOLIA
RUSSIA
Legend
Siberian ibex
1
2
5
10
Silkhem B National Park
National border
N
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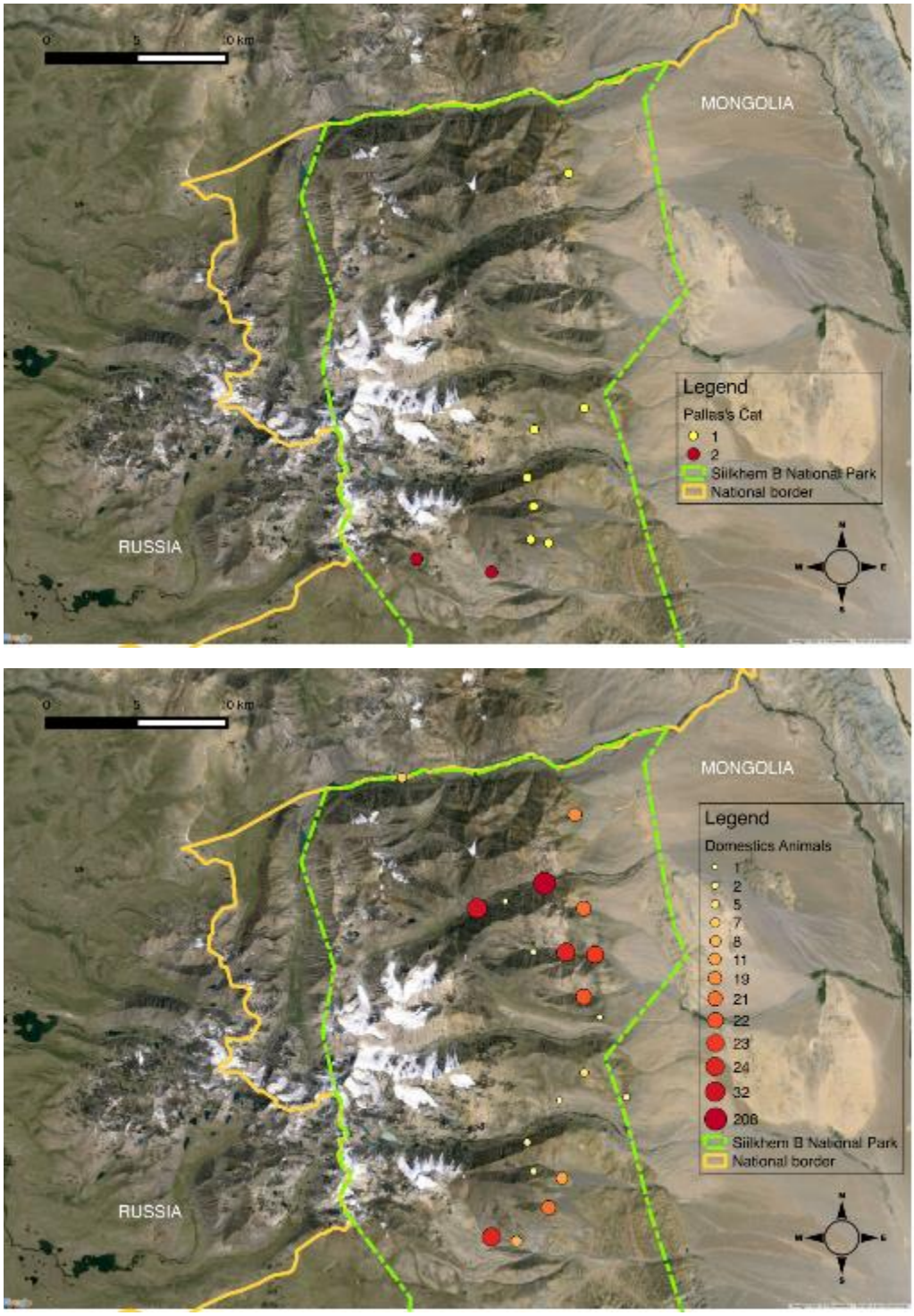
E
S



Maps of detection of selected species and domestic animals (see legend)

Conclusions and recommendations

This is a report aimed at providing the qualitative results from our study, while detailed data analysis is on-going for publication/s in scientific journals. Results show the presence in the study area of a diverse community of medium-to-large mammals with several species of conservation relevance, besides the snow leopard. Despite deploying a very robust and systematic sampling effort covering a relatively large chunk of the National Park (and likely

the most suitable habitat for the snow leopard), and having found tracks and sign of snow leopard at a number of sites, the very small number of individual leopards detected raises some concern that the species may be present in critically low numbers in the area. A crude calculation that assumes that between 5 and 10 individuals are found in the area would result in densities that may be well below 1 individual per 100 km^2, although this figure is NOT to not be considered of any accuracy.

Perhaps more importantly, our study indicates that despite almost saturating the study area, the density of snow leopard may be too low to be estimated with any accuracy within the area we studied, and only a larger sampling area - that would necessarily need to be extended into Russia to the N and W of the current study area - could yield the minimum number of individuals and recaptures needed to properly analyse data in Capture-Recapture framework. However, given the potential complexity of embarking in a trans-boundary study, a more feasible objective is to collect data from other 3-4 populations within the same region in Mongolia as this would allow to treat all data together and obtain an average snow leopard density estimate.

For the current data set, we will enroll into the analysis of the distribution and co-occurrence of snow leopard with preys and potential competitors using an occupancy analytical framework; whilst this will not allow to estimate density, it may reveal important ecological and conservation-relevant aspects of the snow leopard and its delicate co-existence with large amounts of livestock and what appears a low and localized abundance of ibex.

As for the conservation status of the area, the single, most evident issue is represented by the alarmingly high occurrence of livestock almost throughout the focal area (with peak of presence of herds in the central part). This likely impacts the occurrence and abundance of the ibexes as it creates competition for foraging grounds. How does livestock impacts the presence of the snow leopard remain to be determined, however, competition with livestock, habitat degradation (as a consequence of overgrazing by livestock) and declines of prey represent the first threat to the snow leopard across its range as indicated by the most recent Snow Leopard Survival Strategy (2014) of the Snow Leopard Network (www.snowleopardnetwork.org). It is therefore likely that the presence of large amounts of livestock and the consequent overgrazing in our study area represents a critical threat to the snow leopard, potentially restricting the distribution range of the species, reducing the population of its natural prey/s (mainly the ibex), and causing potential conflicts with shepherds (that could in turn lead to retaliatory killings of snow leopards). Traditional livestock keeping is allowed in the limited use zones of National Parks (article 17 of the Mongolian law on special protected area; 1994). However, in the last two decades the number of livestock - mainly represented by goats due to the increased global demand of cashmere - has increased steadily. Hence, the current protection regime may not be suitable for 'Siilkhemin B' National Park, where strict protection is advocated or, alternatively, livestock numbers allowed in the park should be reduced.

In conclusion, we have conducted the first systematic camera trapping study in the Mongolian portion of the Altai Mountains and provided novel information on the snow leopards and other mammals. We revealed a context whereby the long-term viability of the snow leopard population needs careful and timely attention. We recommend future efforts consider sampling additional populations in the same region to achieve a more robust data set for snow leopard density estimation.

Part of the field team, local collaborators and hosting family during the first expedition in March 2015