Wildlife Surveys and wildlife conservation in Nuristan, Afghanistan

Including Scat and Small Rodent Collection from Other Sites

Wildlife Conservation Society / United States Agency for International Development,

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Photo 1 (previous page): Nuristan.
The country is characterized by inaccessible and rugged terrain.

Executive Summery

Nuristan province, situated in the northeast of Afghanistan, still holds an extensive portion of the country's remaining forests, which play an important role for the country's biodiversity and its overall economy. However, extensive deforestation and hunting pose serious threats to the future existence of these forests, the survival of the wildlife they harbor, including four globally threatened large mammal species: snow leopard *Uncia uncia,* markhor *Capra falconeri*, urial *Ovis orientalis*, and Asiatic black bear *Ursus thibetanus* (IUCN 2007), and are menacing the source of livelihood of rural residents. This study, whose preliminary results are presented here, aims at updating 30 year old information about wildlife species occurrence in Nuristan as a means of providing base line data for the development of environmental conservation strategies for the province' forest region, which are part of a Gobal 200 Ecoregion (Olson & Dinerstein 2002). The study was conducted in the framework of a greater initiative of the Wildlife Conservation Society (WCS), Afghanistan Biodiversity Conservation Program, in Afghanistan's eastern forests, which is funded by the United States Agency for International Development.

Surveys were conducted in the project's study site, located in south central Nuristan on the border to Kunar province, and included camera trap surveys, large mammal surveys, scat collection for species identification via DNA analysis, small rodent collection, community interviews and community wildlife mapping. We found solid evidence of species presence (photographs from camera traps, scat DNA analysis, and unambiguous direct sightings) for leopard cat *Prionailurus bengalensis,* grey wolf *Canis lupus*, golden jackal *Canis aureus*, red fox *Vulpes vulpes*, Asiatic black bear *Ursus thibetanus*, markhor *Capra falconeri*, rhesus macaque *Macaca mulatta*, crested porcupine *Hystrix indica*, a civet species, suggested to be the common palm civet *Paradoxurus hermaphroditus*, and yellow-throated marten *Martes flavigula*. In addition, camera trap photographs confirmed the presence of four bird species, the chukar patridge *Alectoris chukar*, common woodpigeon *Columba palumbus*, large-billed crow *Corvus macrorhynchos japonensis*, and scaly-bellied woodpecker *Picus squamatus*.

Although we lack proven evidence, interviews with residents suggest that common leopard *Panthera pardus*, snow leopard *Uncia uncia*, lynx *Lynx lynx*, brown bear *Ursus arctos*, and musk deer *Moschus cupreus* still occur in the study site. No reliable information was obtained about the occurrence of Pallas' cat *Otocolobus manul*, jungle cat *Felis chaus*, wild cat *Felis silvestris*, ibex *Capra siberica*, and urial *Ovis orientalis*. Our study does not provide evidence-based information about species abundance and only limited information about species distribution. The existence of species found during this study confirms previous findings of wildlife surveys in the area. For one species, the common palm civet, the first live record according to the literature could be provided for Afghanistan.

Beyond a first assessment of current wildlife composition in south central Nuristan, a need for extended wildlife surveys and environmental education persists in combination with a detailed impact assessment of factors that are detrimental to species survival. There is an urgent need to determine current hunting pressure, especially of the endangered markhor, the extent of logging and its economic role, grazing competition, disease transfer, rangeland condition and the economic impact of livestock losses due to predation.

Partly due to Nuristan's history and partly due to its inaccessible terrain, residents of Nuristan have resisted instances of external interference and have preserved a renowned independent mind. A traditional knowledge of sustainable management of natural resources in combination with a strong community governance and jurisdiction system may provide good preconditions for community based environment conservation. However, besides the current security situation, which does not allow for safe travel of international consultants to the area, major challenges for a successful implementation of conservation measures in Nuristan include a lack of education of local residents, lack of central governance and political stability. Options for minimizing and recovering opportunity costs of conservation may include measures to alleviate livestock predation in order to prevent retribution killings of carnivores and diversification of income sources, aiming at reducing dependence on livestock for subsistence.

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Introduction

Nuristan province, situated in the northeast of Afghanistan, still holds an extensive portion of the country's remaining forests, which play an important role for the country's biodiversity and its overall economy. However, extensive deforestation and hunting pose serious threats to the future existence of these forests, the survival of wildlife they harbor, and are menacing the source of livelihood of rural residents. With the exception of a forest cover change assessment of the United Nations Environment Programme (UNEP) in the year 2003, the latest studies of Nuristan's forests and its wildlife date back to work done three decades ago (Petocz 1977, Petocz and Larsson 1977). The study presented here is a first attempt to update the knowledge of wildlife occurrence in south central Nuristan. They are part of a greater initiative of the Wildlife Conservation Society (WCS), Afghanistan Biodiversity Conservation Program, which aims at developing mechanisms that help preserve Afghanistan's eastern forests and their wildlife by engaging local communities in environment conservation measures. The program is funded by the United States Agency for International Development.

Nuristan's climate is characterized by a transition of Mediterranean and tropical influences (Hayon et al. 1970) and its forests, together with forest sources in the provinces of Kunar, Laghman, Nangarhar, Paktya, Khost and Paktika, form the western most extension of the monsoon dependent forest belt accompanying the south front of the Greater Himalayan mountain chain. This habitat type is one of the most biologically distinct ecoregions[1] of the world and has been classified by the World Wildlife Fund as a Global 200 Ecoregion[2] (Western Himalayan Temperate Forest, Olson & Dinerstein 2002).

The small part of the eastern forest region of Afghanistan stands in sharp contrast to what Afghanistan is typically known for: a dry and barren land, dominated by continental, arid Central Asian climate. Yet, Afghanistan's east is reached by monsoon rains originating from the Indian subcontinent, which break the summer drought that limits plant life throughout most of the country. The rains allow for growths of dense forest stands dominated by oak *Quercus* spp., pine *Pinus* spp., cedar *Cedrus deodara*, spruce *Picea* spp., and fir *Abies* spp (Kullmann 1970, Petpcz & Larsson 1977). Representing a crossroads of the Palearctic and oriental region (Povolny 1966), these forests harbor a rich wildlife community, including four globally threatened large mammal species: snow leopard *Uncia uncia,* markhor *Capra falconeri*, urial *Ovis orientalis*, and Asiatic black bear *Ursus thibetanus* (IUCN 2007). At least six mammal species find their western-most distribution here, including the Asiatic black bear, musk deer *Moschus cupreus*, two species of flying squirrels *Petaurista petaurista* and *Hylopetes fimbriatus*, rhesus macaque *Macaca mulatta*, and yellow-throated marten *Martes flavigula* (Hasslinger 1973, Sayer & van der Zon 1981).

Little is currently known about wild animal distribution and abundance in Nuristan and Afghanistan in general and no formal assessment for species at risk has been made on a national level. In the 70's a series of studies were conducted in Nuristan (formerly divided between Laghman and Kunar province) on behalf of the Food and Agriculture Organization and the Afghan Tourism Organization to assess the potential of establishing sustainable trophy hunting programs in the area, targeting primarily markhor and ibex (Petocz 1972). These studies described a low degradation of pastures and still abundant wildlife. Petocz and Larsson (1977, p. 47) found that: "[the] pressure on natural rangeland is kept at a relatively low level." However, there is a reasonable likelihood that the situation has changed during almost 30 years of conflict because of large-scale deforestation, increased hunting pressure facilitated by an influx of modern weapons and increased and expanding human population depending mainly on livestock for subsistence (Katz 2007, Saba 2001). Particularly, large mammals face the risk of extinction (Shank 2006).

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[1] An ecoregion is defined by WWF as "a large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions." (WWF 2006).

[2] A Global 200 Ecoregion is an ecoregion that harbors exceptional biodiversity and is representative of its ecosystems. Olson and Dinerstein (2002) suggested a set of 238 ecoregions - the Global 200 - whose biodiversity features are distinct and irreplaceable, including species richness, endemic species, unusual higher taxa, unusual ecological or evolutionary phenomena, and the global rarity of habitats.

Over the last decades, Afghanistan has experienced large-scale deforestation, which resulted in a decrease of an already scarce natural resource. It is estimated that Afghanistan is currently left with roughly 5% of its pristine forests representing about 0.25% of the country's entire area (Shank 2006). Comparisons of Landsat satellite images from 1977 and 2002 (UNEP 2003) have suggested a forest cover decrease of 53% in Nuristan[3] (for comparison: Nangarhar province: 71%, Kunar: 29%). Commercial harvest has been intensified greatly since the 1960s (Petocz & Larsson 1977) and sustained yield and reforestation programs had been suggested already in the 70's. However, these programs ran with only limited success and faced opposition from local inhabitants, who feared conflicts with their own commercial interests (Sayer & van der Zon 1981). The deterioration of the political stability after the Soviet invasion has aggravated timber extraction by mostly externally driven enterprises, while providing only little economic return to local communities (Formoli 1995, UNEP 2003). Deforested areas face serious problems resulting from topsoil erosion, mudflows and aridification, causing floods and avalanches (Formoli 1995, Saba 2001). In most places livestock grazing and high soil temperature prevent natural regeneration of forests and even make reforestation programs a difficult and expensive endeavor.

However, deforestation is only one threat to the integrity of the ecosystems of eastern Afghanistan. Hunting for trophies, meat and trade in fur has a long history in Nuristan and Afghanistan in general (UNEP 2003). Rodenburg (1977) reported a notable growth of Afghanistan's fur trade in the 1960s, with increased exports to markets in Western Europe and the United States, and an increasing local market resulting from a rapidly expanding tourism industry. The latter being replaced nowadays by a solvent expatriate community (UNEP 2003). However, foreigners have not only contributed indirectly to the profitability of the fur trade business in Afghanistan, they also engaged actively in private hunting ventures, thereby reducing the range of certain species significantly, such as the wild boar *Sus scrofa*, eased through a lack of hunting regulations (Naumann & Nogge 1973). The influx of modern weaponry during the times of conflict (Naumann & Nogge 1973, Nauroz & Naumann 1975, Formoli 1995) in combination with the nearby basically uncontrolled border to Pakistan, which allowed for an unregulated cross border trade of wildlife products, resulted in an additional increase in hunting pressure.

Afghanistan currently lacks forest and hunting laws. Two Presidential Decrees on banning logging (No. 405) and hunting wildlife (No. 53) were issued in 2002 and 2004, however, both have had limited impact as governmental presence and enforcement have been largely absent. Recently a forest law was drafted by the government with the assistance of UNEP in order to create a framework for community management of Afghanistan's forest areas. Its adoption is still pending. A hunting regulation, which will regulate wildlife harvest and trade, is still in process.

Large-scale deforestation and uncontrolled hunting not only pose a severe threat to forests and wildlife but also to local communities, whose source of livelihood crucially depends on a healthy environment. There is an urgent need to support communities in their attempt to preserve their natural heritage by developing sound conservation measures, based on scientific assessments that enable them to regulate resource use in a sustainable manner.

Nuristan - Historical Background and Political Setting

Nuristan differs from other Afghan provinces not only because of its climate and extensive forest resources but also by an outstanding history, whose understanding is crucial for developing successful community based conservation concepts. Geographically, Nuristan province is divided into five major valleys, which are separated by high mountain chains - foothills of the Hindukush mountain ridge to the north. Fiercely independent for centuries, it's inaccessibility and remoteness have contributed to isolate local societies from external influences and preserved a pre-Islamic animistic and polytheistic religion until 1895/96, when the armies of King Amir Abdur Rahman violently forced them to convert to Islam. To commemorate their acceptance of the light of Islam, the

[3] An attempt to update GIS based information about forest cover change has been made by WCS' GIS program, however, it has so far failed to retrieve raw data from the UNEP 2003 study and is unable to confirm this result (Delattre 2008, pers. comm.).

name of their country 'Kafiristan', meaning 'land of heathens', was changed to 'Nuristan', 'land of Enlightenment' (Strand 1984a, Klimburg 2004). The original culture of a small population of Kalasha Kafirs survived in southern Chitral, Pakistan, bordering Nuristan to the east, until today. The Kalasha Kafirs are thought to be culturally related to former Kafirs in Afghanistan but mainly featuring characteristics on their own (Klimburg 2007).

Besides their history, Nuristanis differ from other Afghan tribes also because of their highly diverse ethnic-cultural and socio-political features (Klimburg 2004, Klimburg 2001, Photo 2). Dupree wrote (1978, p. 292): "Linguistically, physically, and culturally, they [Nuristanis] are remarkably unlike the rest of the Afghans. Further they do not form a cultural or linguistic unit. They speak many mutually unintelligible dialects of Nuristani [...] Recessive blondism occurs with a relatively high frequency, in combination with blue or mixed eye color." The geographic separation of Nuristan into several valleys, which complicate access and communication, has acted as a natural barrier and has supported division of different clans and languages. However, Dupree wrote (1974, p. ix): "[...] more appears to be involved than simple linguistic fragmentation. In-group identity and pride are the keys." With the exception of localized peaceful clans inhabiting the area around the province center of Parun (Klimburg 2007), Nuristani people are renowned for their history in warfare (Robertson 1896). Raids and bellicose contests with neighboring clans were an integral part of much of the Kafir society (Robertson 1896, Dupree 1974) and suspiciousness towards outsiders has prevailed until today.

The province' high level of independence and decision-making authority is reflected by another feature: its history in insurgency and strategic role during the anti-Soviet movement. Only shortly after the Soviet invasion in Afghanistan in 1979, political leaders from throughout Nuristan responded with the first sustained resistance against the communist regime, which sparked the nationwide uprising (Strand 1984a, Klimburg 2001). Nuristan feared to lose privileges to the communists, granted by the former government in exchange for their autonomy, plus a forcible replacement of Islam with communist doctrine. Eastern Nuristan became strategically important for the *mujaheddin*, who relied on an armament supply from Pakistan for areas of insurgency throughout Afghanistan. Arms and ammunition were transported to Laghman and Panshir province in exchange of lapis lazuli stones mined in Badakhshan, which left the country to Pakistan (Klimburg 2001). Ever since, the province has remained under an evolving system of well-armed local control (Strand 1984b).

Representing a relatively young Islamic culture, local communities show a strong belief (Petocz & Larsson 1977) - 'the fanaticism of the new convert' (Dupree 1974, p. xvii). During the *jihad* against the Soviet occupation much of north-eastern Nuristan experienced a re-Islamization in the Wahhabite sense (Klimburg 2007). Maulawi Mohammad Afzal, a mullah and former Islamic guerrilla, managed to temporarily transform part of eastern Nuristan in a semi-autonomous region in 1982. The Islamic Revolutionary State of Afghanistan was referred to as Daulat (Klimburg 2001, van der Schriek 2005) and had its own ministries, tax system and identification papers. In the late 1980s, it was recognized by Saudi Arabia, which helped to establish independent consulates in their own country and Pakistan. However, the Daulat soon fell victim to power struggles and in 1993 the province borders of nowadays Nuristan were set. During the civil war after the Soviet withdrawal, Nuristan stayed mainly neutral, affected by internal strife due to clashes erupting over conflicting land and water use, road and power station construction, lack of proper medical care, scarcity of education opportunities and employments (Klimburg 2001).

The current political situation in Nuristan is dominated by fights between coalition forces and insurgents along the border region with Pakistan's North-West Frontier Province. Nuristan and Kunar have seen more casualties than other places in Afghanistan over the last couple of years (Katz 2007). Only recently, in 2006, the International Security Assistance Force established a Provincial Reconstruction Team (PRT) and several Forward Operating Bases in Nuristan, mainly focusing on adopting counterinsurgency strategies, particularly on the province' border with Pakistan. The political importance of Nuristan has remained until today, as a key region in a strategic and ethnographic context (Katz 2007).

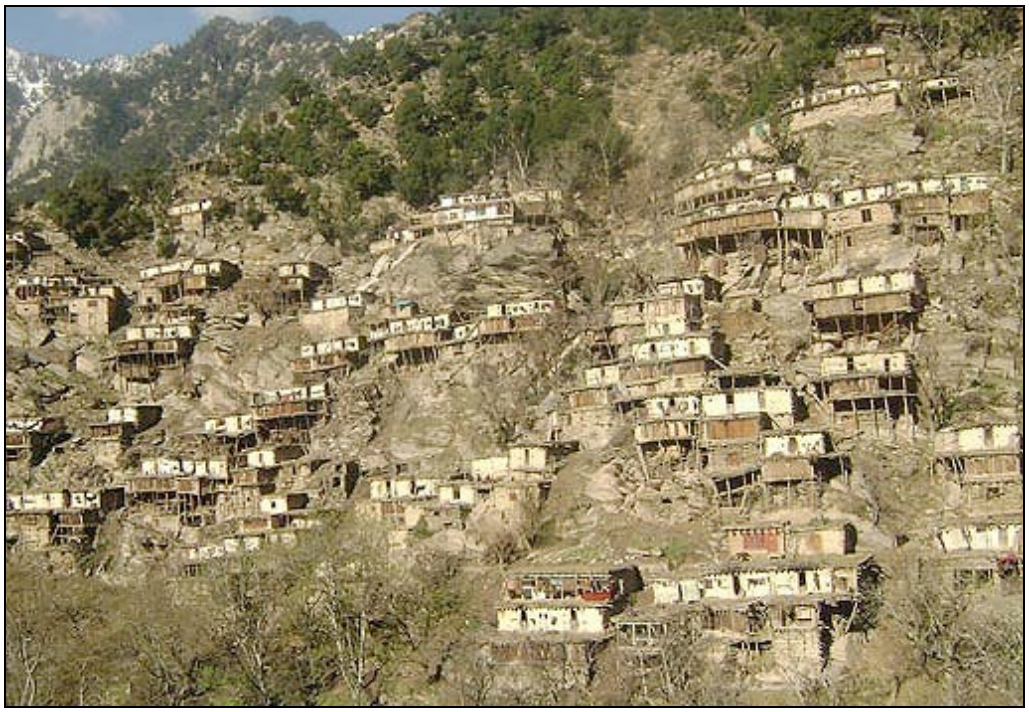


Photo 2: Nuristani stilt houses.
In order to save valuable land for agriculture, houses are traditionally built on steep slopes.

Objectives and Methods

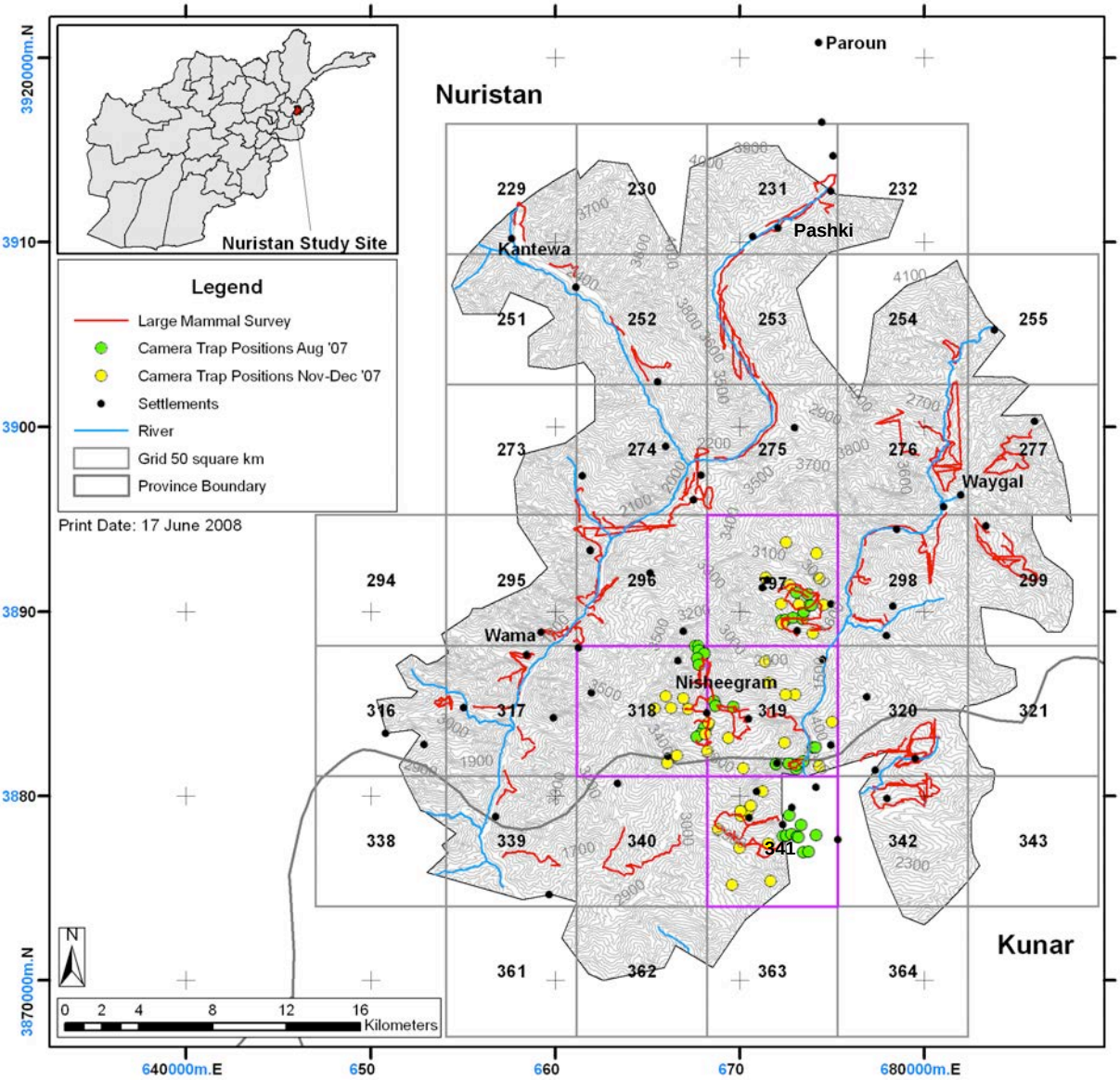
This study aims at updating 30 year old information about wildlife species presence in Nuristan as a means of providing base line data for the development of environment conservation strategies for the province' forest region. WCS teams have conducted 6 thematic distinct surveys in the project's study site, located in south central Nuristan on the border to Kunar province, whose preliminary results are presented here: camera trap surveys, large mammal surveys, scat collection for species identification via DNA analysis, small rodent collection, community interviews and community wildlife mapping. In addition, fecal samples were collected in Kunduz and Takhar and small rodents were collected in Bamyan, Kabul and Badakhshan province.

Study Site Description

The Nuristan study site is located in south central Nuristan straddling the border to Kunar province (centered UTM coordinates: zone 42 N, 670741 E, 3893561 N, Map 1) spanning about 1,050 km^3 and covering an approximate elevation range between 1,070 m asl. in the south and 4,500 m asl. in the north (+/- 90 m SRTM Digital Elevation Model, Global Landcover Facility, University of Maryland, US). The site encompasses Waygal valley in the east and Wama valley (Pesh/Pech valley) in the west, which splits into Kantewa valley and Parun valley in the north, including the villages of Kantewa and Pashki. Criteria for choosing the site included 1. good remaining forest cover according to the UNEP (2003) assessment on forest cover change, 2. the ability to compare site specific findings with previous surveys of Petocz and Larsson (1977), 3. a security situation that allows for local people to travel safely to and throughout the site according to information provided by the Afghanistan NGO Security Office.

Both, plant communities and wildlife occurrence, especially of markhor *Capra falconeri*, were surveyed and documented by Petocz and Larsson in the year 1977 in the framework of a feasibility assessment for setting up hunting tourism programs in the area. Sayer and van der Zon (1981) proposed a Nuristan National Park, whose borders encompassed part of the study site chosen by WCS because of its least disturbed forests compared to other sites in eastern Afghanistan, its species-rich ecosystems

and the traditional culture of local residents. Recent Landsat satellite images let us assume a still intact forest cover of the region (UNEP 2003), which suggests viable populations of wildlife species.



Map 1: Nuristan study site.

Selected for conducting a wildlife occurrence assessment by WCS in 2006 (polygon with apparent elevation contour lines).

The study site is characterized by rugged terrain, with scattered settlements along the river valleys. Terraced fields cut into the walnut forests at lower elevations and elaborate irrigation channels provide a sufficient water supply throughout the growing season. The economy of Nuristan is predominantly subsistence-oriented, including agriculture, arboriculture and pastoralism (Strand 1984a, Photo 3). Cows, goats and sheep are herded in familial herds on traditional village pastures while the fields are cultivated with crops of corn, millet, sorghum, wheat, barley, beans, peas, squash, and other staple crops (Petocz & Larsson 1977). Tree crops include walnuts, mulberries, grapes, apricots, pomegranates, jujubes, figs, pears, persimmons, and peaches and dairy products include butter, *ghee* (butter fat), buttermilk, buttermilk solids, and a variety of cheeses (Strand 1984a). The north of the study site is less densely populated than the south and relies more on cattle pastoralism as the high altitudes in the north impede two annual harvests (Klimburg 2007). Many families are capable of producing a substantial surplus to mere subsistence and in general Nuristanis are regarded

as achieving fairly good income from animal husbandry and additional sale of timber and precious stones, mainly emeralds, which are mined in many places (Klimburg 2001, 2004).

Petocz and Larsson (1977) described extended oak *Qercus* spp. forests in elevations of up to 2,500 m asl. where they were displaced by coniferous forests, composed by juniper *Juniperus* spp., pine *Pinus* spp. and deodar cedar *Cedrus deodara*. The tree line was found at around 3,300 m asl. with only single stands of juniper and pine species growing up to 3,600 m asl. and leading over to alpine shrublands, heaths and meadows. The latter was used extensively as grazing ground for livestock during the summer months. In early spring and late autumn shepherds used the lush grass meadows in lower valley bottoms, where stands of willow *Salix* spp., birch *Betula* spp. and poplar species *Populus* spp. grew along well watered river sides and main watercourses.

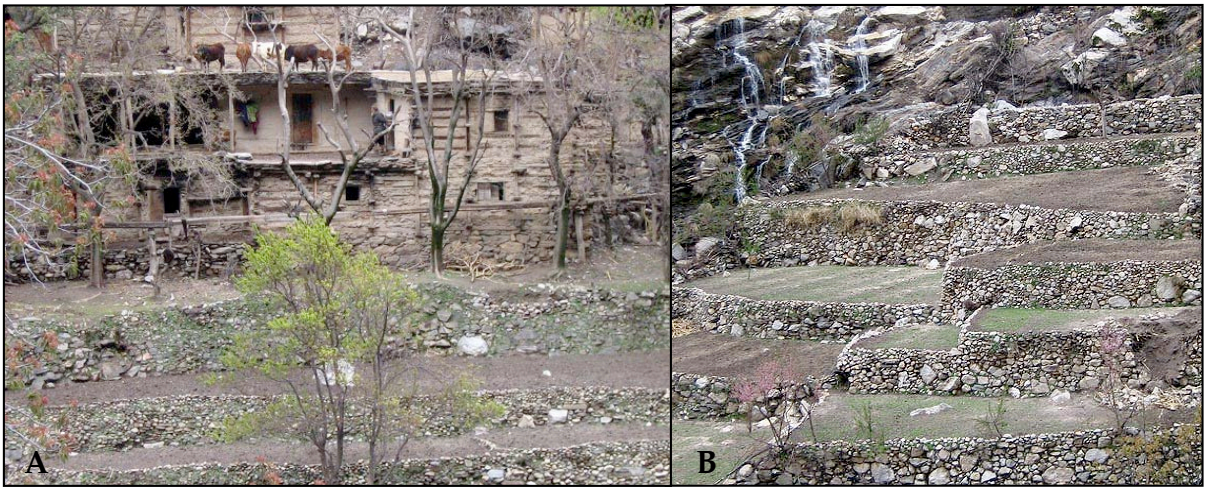


Photo 3: The economy is predominantly subsistence-oriented in Nuristan.
A) Agriculture, arboriculture and pastoralism are the prime sources of livelihood for Nuristani people; B) Terraced fields in Nuristan.

Habitat Types

The flora of Nuristan is highly diverse and characterized by representative elements of the Himalayan, Mediterreanean, Iranotouranian and Paleotropical realms (Hayon et al. 1970). Four distinct habitat types associated with different elevation, moisture, exposure and soil configuration were described by Petocz and Larsson (1977) and the same categories have been used in our study:

1) Deciduous forests and grass meadows in valley bottoms: walnut forests *Juglans* spp. between 1,300 and 3,000 m. asl., birch *Betula kunarensis* and *B. jacquemontii* forests and thickets above 3,000 m asl., and valley meadows between 2,600 and 3,200 m asl. Owing to their proximity to human settlements or activity, wild ungulates were almost entirely absent from this habitat.

2) Evergreen oak forests: dominated by oak species in an elevation from 1,300 to 2,500/2,900 m asl. depending on moisture and exposure. *Qercus baloot* on lower elevations and drier soil, *Q. dilatata* in areas with more precipitation and *Q. semecarpifolia* in upper zones, extending into the coniferous belt. Oak forests are a probably valuable winter habitat for markhor (Schaller & Mirza 1971), branches were cut for animal fodder.

3) Coniferous forests: between 2,500 to 3,300 m asl. Cedar was found mostly between 2,500-2,800 m asl., from 2,800-3,300 m asl. forests were dominated by a combination of spruce *Picus smithiana* and fir *Abies webbiana*, intermixed with single pines *Pinus gerardiana* and *P. wallichiana* and deodar cedars. Highest stands were remnants of largely decimated juniper forests *Juniperus communis* var. *nana*, *J. squamata*, *J. semiglobosa, J. seravschanica.* Cliffs and steep mountain slopes were utilized by markhor in summer.

4) Alpine areas: above the tree line from around 3,300 m asl., alpine shrub land, alpine and sedge meadows, alpine heaths and steppes. Latter were found in elevations between 2,700-3,700 m asl. These

high elevation areas were utilized by domestic animals during summer and supported markhor populations, when free of humans and livestock. Similar to alpine meadows, alpine steppes were heavily used by both domestic stock and wildlife, but in contrast to the former many areas were seriously overgrazed already in 1977.

Data Collection

Because of security concerns no international staff has been able to visit the site during the present study and all data were collected by an Afghan team, composed by academics from Nangarhar University, provincial staff of the Ministry of Agriculture, Irrigation and Livestock, and local community members from the study site. Training in conducting community interviews and wildlife surveys, identifying species from scats and sings, such as tracks and/or scrapes, etc., setting up camera traps, using GPS, maps and other field equipment was provided to all project personnel as part of WCS' capacity building and training program (for more details see Vaidyanathan & Jathanna 2007). However, as none of the team members had previous experience in collecting wildlife data, setting up camera traps and/or conducting community interviews, in some cases collected data is inaccurate and/or information is missing and special care needs to be taken in interpreting data[4].

Camera Trap Surveys

Two camera trap surveys were conducted in the study site in August and November/December '07 (Table 1) to obtain information on the presence of wildlife species in Nuristan's forests. Camera traps cause minimal disturbance to the environment and thus have the advantage of detecting shy and/or nocturnal animals, which are rarely encountered by humans. The camera trap system is equipped with an infrared heat and motion sensitive sensor that triggers the camera when animal movements are detected.

For better orientation the study site was overlaid with a grid system, with one grid cell having the size of 50 km^3 (7.07 km x 7.07 km). The two consecutive camera trap surveys were conducted in the same four grid cells, which according to local residents showed good forest cover and wildlife species abundance (centered UTM coordinates of grid cell 297: zone 42 N, 671756 E, 3891732 N; grid cell 318: zone 42 N, 664671 E, 3884614 N; grid cell 319: zone 42 N, 671752 E, 3884578 N, grid cell 341: zone 42 N, 671733 E, 3877543 N; Map 1). Because no particular protocol about spacing camera traps was provided during the first survey, field teams tended to aggregate camera traps unevenly. During the second survey the teams were directed to distribute the traps as evenly as possible over the surveyed grid cells. During each survey, camera traps were positioned in 9-10 different sites per grid cell, totaling 78 different sites for both surveys combined, between 1,150 and 3,010 m asl. (mean= 2,160 m asl.).

Camera traps were set up preferably along pathways (Deer Cam DC 300, 35 mm, Non Typical Inc.., Park Falls, Wisconsin, US, and Wildlife Pro Camera System with Canon Sure Shot 115u II Date, 35 mm, Forestry Suppliers Inc.., Jackson, Mississippi, US), which showed signs of wildlife, such as tracks, scats, scrapes, etc. Fifty-nine sites were located in evergreen oak forest, 6 in coniferous forest, 7 in mixed oak and coniferous forest, and for five sites (grid cell 297, Aug '07 survey) information on the habitat type is missing. Of all sites, for which the habitat type was recorded, no sites were chosen in deciduous forest or alpine areas.

[4] Unless otherwise stated, caution must be exercised in the use of elevation figures as measurements were taken with GPS units, which did not get calibrated to the barometric pressure on a daily basis.

Table 1: Habitat type and elevation of camera trap sites, Nuristan, August and November/December 2007.

Date of Survey	No. Sites per Grid Cell	Elevation of Camera Traps in m asl.			No. Camera Trap Sites per Habitat Type*					
4th - 26th Aug '07		Min.	Max.	Average	OAK	CON	DFR	OAK/CON	OAK/DFR	ALP
Grid Cell 297**	9	1,914	2,749	2,337	1			3		
Grid Cell 318	9	2,199	2,535	2,396	7	1			1	
Grid Cell 319	10	1,204	1,858	1,532	10					
Grid Cell 341	10	1,152	1,872	1,537	10					
1st Nov - 15th Dec '07										
Grid Cell 297	10	1,841	2,940	2,475	6			4		
Grid Cell 318	10	2,080	3,010	2,549	5	5				
Grid Cell 319	10	1,762	3,008	2,256	10					
Grid Cell 341	10	1,762	2,427	2,115	10					
Total	78	1,152	3,010	2,159	59	6	-	7	1	-

* Habitat types: DFR: Deciduous forest; OAK: Evergreen Oak forest; CON: Coniferous forest; ALP: Alpine areas.
**Information about habitat type missing.

At each site two opponent camera traps were set at approximately at 40-50 cm above ground and GPS locations were taken centered between the two camera traps (Garmin GPSMAP 60CSx and eTrex Vista Cx, Garmin International Inc.., Olathe, Kansas, US). Cameras were checked every three days and films were changed if necessary. The number of camera trap nights per site varied between three and 14 (mean= 9.4 nights, Table 3), totaling 730 nights for both surveys.

Table 3: Number of camera trap nights per site, grid cell and survey period, Nuristan, August and November/December 2007.

	No. Camera Trap Nights in Aug '07				No. Camera Trap Nights in Nov/Dec '07			
Site No.	Grid Cell 297	Grid Cell 318	Grid Cell 319	Grid Cell 341	Grid Cell 297	Grid Cell 318	Grid Cell 319	Grid Cell 341
1	11	14	8	5	10	9	9	9
2	11	14	8	5	10	9	9	9
3	11	14	8	10	10	9	9	9
4	11	14	8	10	10	9	9	9
5	11	14	8	10	10	9	9	9
6	7	3	6	13	11	10	10	10
7	7	3	6	13	11	10	10	10
8	7	3	6	13	11	10	10	10
9	7	3	6	13	11	10	10	10
10	-	-	6	13	11	10	10	10
Subtotal	**83**	**82**	**70**	**105**	**105**	**95**	**95**	**95**
Total								**730**

Large Mammal Surveys

Large mammal surveys were conducted in four major surveys between December '06 and May '07 (Table 4, Photo 4) following an occupancy survey design developed by Vaidyanathan and Jathanna (2007). The surveys aimed at obtaining detection probabilities for large mammal species. However, reliable information on species abundance is extremely difficult to obtain if not impossible due to the rugged and inaccessible terrain and in particular when working with inexperienced field staff. Hence, we limited our efforts to obtaining presence/absence information.

Three teams consisting of three people each walked a total of 115 transects and spent a cumulative 350 h in the field, collecting species evidence of occurrence such as direct sightings, signs, tracks, scats, and carcasses. The type of evidence, time of record, GPS position, elevation and habitat type were recorded. Transects did not follow fixed directions because of terrain conditions.

Table 4: Location, date and number of teams conducting large mammal surveys, Nuristan, December 2006 - May 2007.

Location	Date	No. Teams	Total No. Surveys
Nuristan study site	19th - 28th Dec '06	3	20
Nuristan study site	8th - 20th Jan '07	2	7
Nuristan study site	17th - 26th Feb '07	3	32
Nuristan study site	10th - 19th Apr '07	3	23
Nuristan study site	10th - 30th May '07	3	33
Total			**115**

Concerning general information on survey transects, between December 2006 and January 2007 the teams recorded GPS location and elevation of start and end positions, respectively (Garmin GPSMAP 60CSx and eTrex Vista Cx, Garmin International Inc.., Olathe, Kansas, US), whereas between February 2007 and May 2007, the surveyors recorded GPS location, elevation and habitat type every 200 meters walked on the transect. The 200 m distance was determined with a measuring tape.

The total distance walked from February to May '07 was approximately 370 km (Annex 1, p. 43), varying from 0.8 - 7 km per transect (average distance per transect: 4.2 km). The wildlife surveys were not distributed evenly over the study site: the south and central parts were surveyed more intensively than the north, which is less accessible because of higher altitudes and associated snow cover. On average, four transects and 16.7 km per grid cell were surveyed in the south and central study site (grid cell 273-342, Annex 1, p. 43) compared to an average of only two transects and 8.7 km surveyed per grid cell in the north of the study site (grid cell 229-254).

For December '06 and January '07 the surveyed elevation range was between 1,200 and 2,850 m asl. (mean= 2,100 m asl.). From February '07 onwards the surveyed elevation ranged from 1,200 - 3,300 m asl. (mean= 2,200 m asl.). Most of the area surveyed was classified as evergreen oak forest (41%, Table 5), followed by coniferous forest (36%), mixed oak and coniferous forest (11%), mixed oak and deciduous forest (8%), deciduous forest (3%), mixed coniferous and deciduous forest (1%) and mixed oak, coniferous and deciduous forest (1%). These recordings suggest that no alpine areas were surveyed. However, results of direct sightings later showed (see below) that alpine habitat was covered to at least some extent through distant observations.

Photo 4: Data collection during the large mammals surveys.

Table 5: Habitat types surveyed during large mammal surveys, Nuristan, February - May 2007.

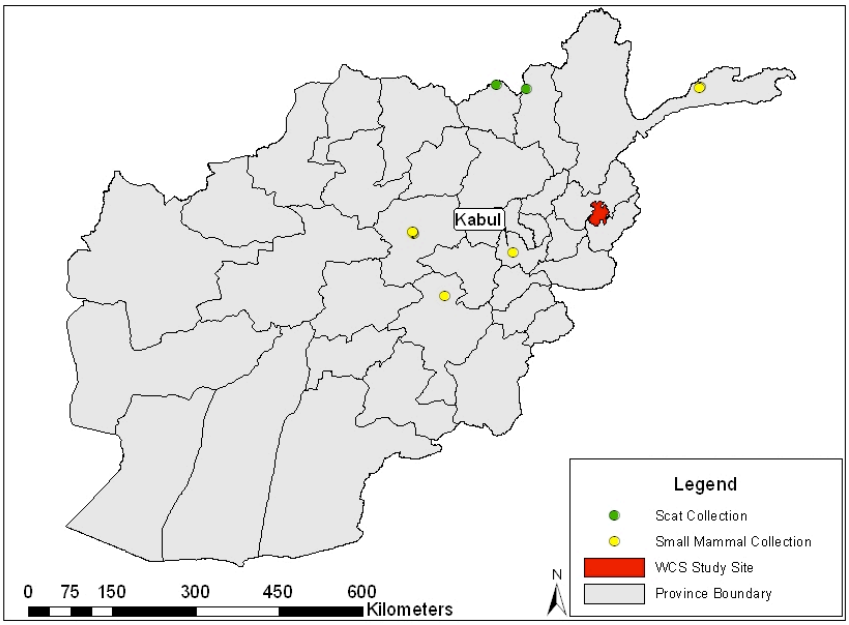
Habitat Type*	No. Reading Point**	% Reading Point**
OAK	788	41%
CON	674	36%
DFR	58	3%
ALP	0	0%
OAK/CON	206	11%
OAK/DFR	158	8%
CON/DFR	18	1%
OAK/CON/DFR	18	1%
Total	**1,920**	**100%**

*Habitat types: DFR: Deciduous forest; OAK: Evergreen Oak forest; CON: Coniferous forest; ALP: Alpine areas.
**Habitat types were recorded every 200 m distance walked.

Scat Collection

A total of 208 different scats of wildlife species were collected for later DNA analysis in the study site in Nuristan, in Kunduz and Takhar province starting in December '06 and throughout the year '07. Fecal samples contain sloughed intestinal epithelial cells from which the DNA can be retrieved and analyzed for species identification (Foran at al. 1997).

In the Nuristan study site fecal samples were collected during the large mammal surveys between December '06 and May '07 and the camera trap surveys from August '07 and November/December '07 (Annex 2, p. 43, Photo 5). For survey elevations and habitat types please see related sections. In addition to Nuristan, scats were collected in two riverine lowland areas along the Amu Darya river on the border to Tajikistan: Imam Sahib (UTM coordinates: zone 42 N, 485190 E, 4122619 N, elevation: 335 m asl., Map 2), located north of the city Kunduz, Kunduz province, and Aye Khanum (UTM coordinates: zone 42 N, 539943 E, 4115268 N, elevation: 410 m asl.), located at the confluence of the Amu Darya and the Kokcha rivers, Takhar province, during a two-weeks wildlife and hunting activities survey of WCS' Ecosystem Health Project Team (Ostrowski et al. 2008a).



Map 2: Scat and small rodent collection sites in Afghanistan, December 2006 - December 2007.

After collection, scat samples were air-dried away from direct sunlight and stored in labeled plastic bags at ambient temperatures. Probes of all 208 fecal samples were sent to the National Museum of Natural History, Washington DC, US, which is collaborating with WCS' Great Cats Program, for species DNA analysis between April '07 and June '08 (Annex 2, p. 43).

Total DNA was extracted using the QIAamp DNA stool mini kit (QIAGEN) with minor modifications (available upon request). In order to identify the species 422bp of the mtDNA 16S gene were amplified using universal primers (Hoelzel & Green 1998). PCR amplification was conducted in an Eppendorf Gradient Mastercycler in a 25μl reaction volume using Illustra PuReTaq Ready-To-Go™ PCR Beads (GE Healthcare), 0.3 μM primer concentration, and 1-2μl of DNA extract. An initial denaturation of 2 min at 94C was followed by forty cycles (denaturing at 94C for 15 sec, annealing at 51.5C for 15 sec, and extension at 72C for 45 sec) and a final extension at 72C for 10 min. PCR products were cycle-sequenced (both forward and reverse) with dye-labeled terminators using conditions recommended by the manufacturers and sequence reactions were analyzed using an ABI 3730 Genetic Analyzer (Applied Biosystems). Sequences editing and matching to GeneBank reference sequences was performed in Sequencher v. 4.6 (Gene Codes Corp. Ann Arbor, MI).

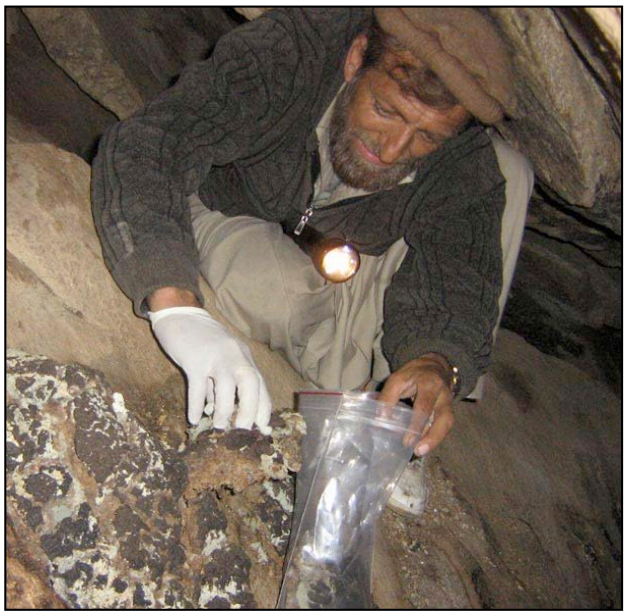


Photo 5: Scat collection during the large mammal surveys.

Small Rodent Collection

In order to assess and update species occurrence of small rodents in Afghanistan, 140 small rodents were collected in the Nuristan study site (Aug '07 and Nov/Dec '07), Dasht-e Nawar wetland and surrounding, Ghazni province (Jul/Aug '07, UTM coordinates: zone 42 N, 392017 E, 3744252 N, Ostrowski et al. 2008b, Map 2), Kabul city (Aug '07, UTM coordinates: zone 42 N, 514683 E, 3821379 N), at two sites in the Wakhan, Badakhshan province, (Aug '07, UTM coordinates: zone 43 N, 318658 E, 4113465 N and 318120 E, 4113254 N), and at four sites at Band-i Amir, Bamyan province (Sep '07, UTM coordinates: zone 42 N, 336272 E, 3855930 N; 334870 E, 3856787 N; 335844 E, 3860098 N; 335150 E, 3859667 N; Annex 3, p. 44).

In Ghazni, Kabul, the Wahkan and the Nuristan survey from August '07, Sherman and snap traps were laid out opportunistically. In Bamyan and in the Nuristan survey from November/December '07 traps were placed along transects with an average length of 440 m (min: 360 m, max: 560 m). Sherman and snap traps alternated every 20 m, whereas Sherman traps were roughly used twice as much as snap traps. Peanut butter, seeds, cheese, and butter were used as bait.

Caught animals were euthanized with chloroform via inhalation, their sex was determined, they were weighed (Pesola Precision Scale Micro-line 20030 (30g), 20100 (100g), Medio-line 41000 (1000g), Pesola AG, Baar, Switzerland) and measurements of body length, ear length, tail length, and hind foot length were taken using dial calipers. Animals were subsequently kept in 95% ethanol with 1 ml of ethanol injected directly into their abdomen. The ethanol was renewed once after the field teams came back to the WCS office in Kabul and so far 85 of the all 140 samples were sent to the Smithsonian Institution, American Museum of Natural History, Washington DC, US, for species identification in fall '07. The remaining 45 small rodent samples are still in the process of getting shipped to the US at this writing. We have no results yet about collected small rodent species.

Community Interviews

In order to cross-check wildlife species occurrence of previously described surveys (camera trapping, transect surveys, and scat collection), to evaluate the possible occurrence of otherwise undetected species, and to assess livestock predation and hunting activities in the study site, 138 interviews using standardized questionnaires were conducted in 49 villages/locations throughout the site during the

large mammal surveys between December '06 and May '07 (Annex 4, p. 45). All interviewees were male and their age ranged from 24 to 82 (mean= 44 years).

Part of the interview consisted of testing the reliability of the villagers' knowledge about wildlife species identification. For this purpose pictures of wild animals were shown to interviewees, who were subsequently asked to identify the depicted animals and give information about their occurrence in the study site (Photo 6). Pictures of animals native to the area were mixed with pictures of non-native animals, such as polar bear, sloth bear, cheetah, and jaguar. Other interview questions concerned occurrence of key wildlife species, observed population trends, incidences of man mauling by wild carnivores, livestock predation, and hunting activities in the study site.

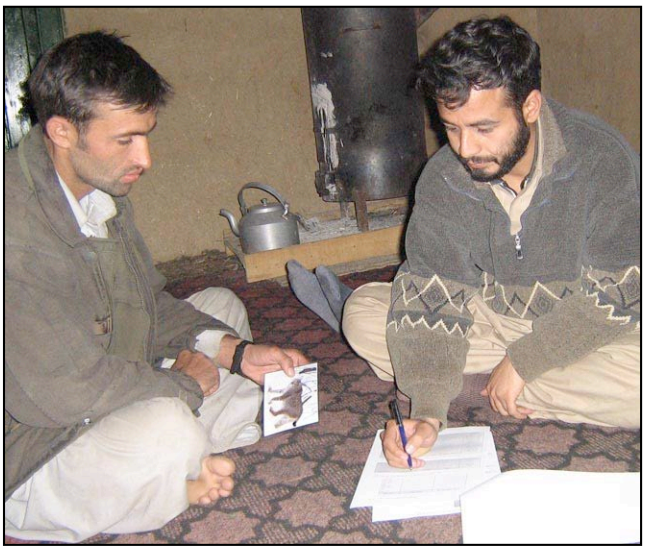


Photo 6: Community interviews in Nuristan.
Local residents were asked to name species shown to them on photographs in order to assess their reliability of species identification.

Since the interviews were concomitant to large mammal survey, the south and central parts of the study site were more intensely interviewed than the north. On average 5.9 interviews per grid cell were conducted in the south/central study site (grid cell 273-342) in contrast to only 3.2 interviews per grid cell in the north of the study site (grid cell 229-254).

Community Wildlife Mapping

In addition to the large mammal surveys and the community interviews, a wildlife mapping exercise based on interviews was carried out in April/May '08 (Table 6). Local residents of 26 villages were asked to pinpoint areas on a provided map where selected key wildlife species, including markhor, snow leopard, leopard cat, musk deer, and urial occur at present and where they occurred five years ago. In case villagers did not know how to read maps, our field teams translated mentioned sites and regions to the respective areas on the map. Though the reliability of the given information is vague, we hoped it would help to identify areas for future 'target-species' surveys. About 10 people per village were interviewed resulting in 250 interviews in total. In addition to the mapping interviews, the 26 villages were asked if and how wildlife could be efficiently protected in the study site. All interviewees were adult males between an age of 18 to 73 years (mean= 42.6 years).

Similarly to the large mammal surveys and the community interviews, the community wildlife mapping was conducted more intensely in the south and central parts of the study site than in the north. While 24 interviews were conducted in the south/central part (grid cell 273-342), only two interviews were conducted in the north (grid cell 229-254).

Table 6: General information on wildlife mapping based on community interviews, Nuristan, April - May 2008.

Date	No. Villages	No. Interviews	No. Interviews per Village
14th Apr - 23rd May '08	13	120	9.2
11th Apr - 21st May '08	13	130	10
Total	**26**	**250**	

Results

Camera Trap Surveys

During two camera trap surveys in August and November/December '07, 8 large mammal species and four bird species were photographed in a total of 229 pictures (Aug '07: 87 pictures; Nov/Dec '07: 142 pictures, excluding small rodents, Photo 7, Table 7). For both surveys combined, most pictures were taken from crested porcupines *Hystrix indica* (83 or 36% of all pictures taken), followed by Asiatic black bear *Ursus thibetanus* (44 or 19%), red fox *Vulpes vulpes* (42 or 18%), golden jackal *Canis aureus* (33 or 14%), common palm civet *Paradoxurus hermaphroditus* (9 or 4%), chukar partridge *Alectoris chukar* (7 or 3%), common woodpigeon *Columba palumbus* (3 or 1%), wild or domestic cat *Felis silvestris* or *F. catus* (2 or 1%), yellow-throated marten *Martes flavigula* (2 or 1%), large-billed crow *Corvus macrorhynchos japonensis* (2 or 1%), leopard cat *Prionailurus bengalensis* (1 or <1%), and scaly-bellied woodpecker *Picus squamatus* (1 or <1%). Obviously, the amount of pictures taken does not reflect species abundance, as individual animals could not be identified. Surprisingly, no wolves were photographed during both surveys.

For identifying the photographed civet species a Viverridae specialist, Dr. Geraldine Veron 2008, National Natural History Museum, Paris, France, was consulted since the specimen did neither resemble the mask palm civet (*Paguma larvata*) nor the small Indian civet (*Viverricula indica*), the only two civet species listed for Afghanistan by the IUCN Mustelid Specialist Group (1996a and b). The almost lack of a facial mask, its plump appearance, a long bushy tail without rings, dark longitudinal stripes on the back and dots on the flanks on the otherwise grey-brownish fur suggested that the species is a common palm civet *Paradoxurus hermaphroditus* (Dr. Veron 2008, pers. comm.), a species, of which previously no live records were documented in Afghanistan (Photo 7).

Two specimens of small cats, which fairly resembled each other in appearance, were photographed in two different grid cells, one in each survey, also pose identification problems. Back and legs are colored sandy brown with grayish/black dots that do not form bands, except for the tail and to a lesser extent the legs, and a white muzzle (Photo 7). The cats' appearance is not fully consistent with descriptions for wild cats *Felis silvestris,* which mention a well-defined pattern of black stripes (IUCN/SSC 1996) and thus they might as well be feral domestic cats *Felis catus*.

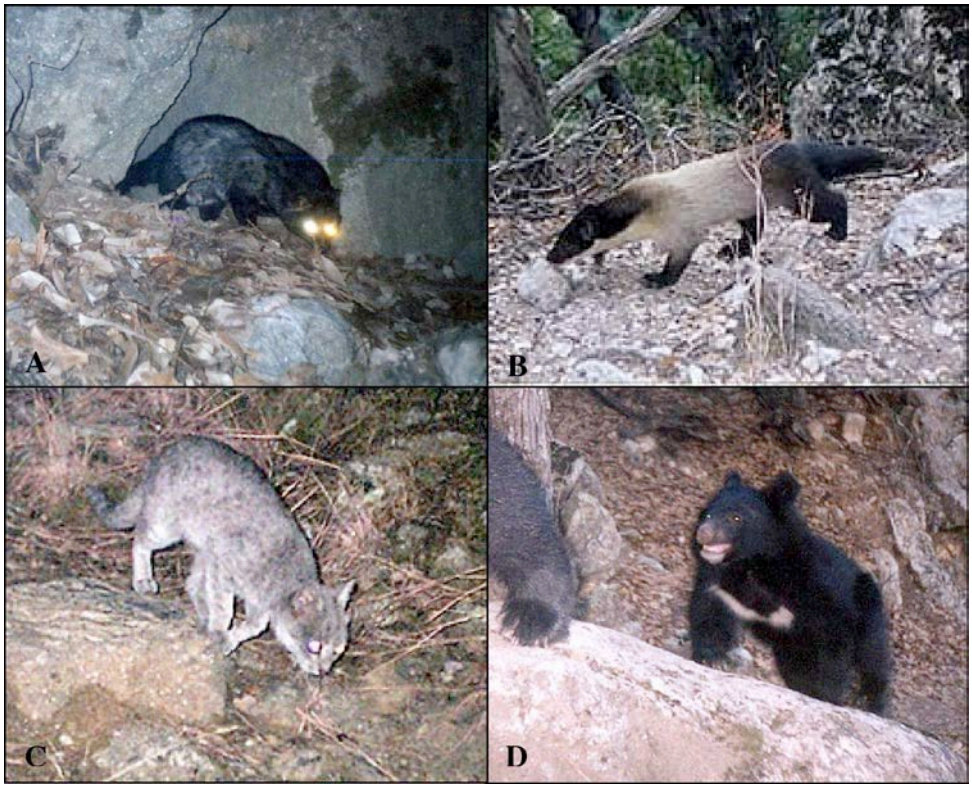


Photo 7: Camera trap photographs from the Nuristan study site, Aug and Nov/Dec '07. A) Common palm civet *Paradoxurus hermaphroditus*; B) Yellow-throated marten *Martes flavigula*; C) Wild or feral domestic cat *Felis silvestris* or *F. catus*; D) Asiatic black bear *Ursus thibetanus*.

The Asiatic black bear, common palm civet, yellow-throated marten and all of the four bird species were only photographed during the second survey in November/December '07. In contrast, more pictures of porcupines were taken during the first survey in August '07 (Table 7). These differences in the number of photographs per species during the two surveys might be due to different camera trap locations (different habitat, distance to human settlements, etc.) and different seasons.

Unfortunately, information about the exact locations of photographs taken during the second camera trap survey got lost because of inaccurate labeling of film rolls. All we know are the different grid cells, in which the photographs were taken. See Annex 5, p. 46, for locations of species detection in the Nuristan study site.

Table 7: List of species photographed with camera traps, Nuristan, August and November/December 2007.

No.	Latin Name	English Name	IUCN Red List Category (Year Assessed)	Elevation in m asl.	Habitat Type*	No. Photographs**	Photographs per 100 Trap Nights
1	*Prionailurus bengalensis*	Leopard cat	LC (2002)	2,511	OAK	1/0	0.1
2	*Felis catus/silvestris*	Domestic/wild cat	LC (2002)	1,204	OAK	1/1	0.3
3	*Canis aureus*	Golden jackal	LC (2004)	1,204 - 2,749	OAK, OAK/DFR	12/21	4.5
4	*Vulpes vulpes*	Red fox	LC (2004)	1,780 - 2,462	OAK, OAK/CON	23/19	5.8
5	*Ursus thibetanus*	Asiatic black bear	VU A1cd (1996)	-	-	0/44	6.0
6	*Hystrix indica*	Crested porcupine	LR/lc (1996)	1,157 - 2,535	OAK, OAK/DFR	50/33	11.4
7	*Paradoxurus hermaphroditus*	Common palm civet	LR/lc (1996)	-	-	0/9	1.2
8	*Martes flavigula*	Yellow-throated marten	LR/lc (1996)	-	-	0/2	0.3
9	*Alectoris chukar*	Chukar partridge	LC (2004)	-	-	0/7	1.0
10	*Columba palumbus*	Common woodpigeon	LC (2004)	-	-	0/3	0.4
11	*Corvus macrorhynchos japonensis*	Large-billed crow	LC (2004)	-	-	0/2	0.3
12	*Picus squamatus*	Scaly-bellied woodpecker	LC (2004)	-	-	0/1	0.1
	Total					**87/142**	**31.4**

* Habitat types: DFR: Deciduous forest; OAK: Evergreen Oak forest; CON: Coniferous forest.

** Aug '07 survey / Nov/Dec'07 survey.

Large Mammal Surveys

Results on species occurrence given here are limited to direct sightings and fecal samples, for which species DNA could be successfully identified by the American Museum of Natural History. As the reliability of species evidence drawn from data, which could not be proven otherwise, such as tracks/ pug marks or scrapes, is questionable they are not mentioned here.

Direct Sightings

During the large mammal surveys, carried out between December '06 and May '07, field teams made direct sightings of 8 different mammal species (Table 8), which included in order of their decreasing frequency: red fox (seen 57 times or 29% of all sightings, average no. of individuals per sighting: 2), golden jackal (33, 17%, 1.7), crested porcupine (29, 14%, 1.5), rhesus macaque *Macaca mulatta* (28, 14%, 4.7), grey wolf *Canis lupus* (27, 14%, 2.5), Asiatic black bear (19, 10%, 2.6), markhor *Capra falconeri* (3, 2%, 1.5), and common leopard (2, 1%, 2). However, due to probable inconsistencies in translation, as pointed out later (p. 27), it is questionable if the leopard seen was a common leopard or a snow leopard. Thus, direct sightings add three new mammals to the list of wildlife species that could be detected with reasonable reliability: wolf, rhesus macaque, and markhor.

Similarly to the camera trap surveys, figures given here do not contain information about species abundance since surveys were carried out over a period of several months and individual animals were not identified. For locations of direct sightings in the study site see Annex 5, p. 46.

Table 8: Direct sightings during large mammal surveys, Nuristan, December 2006 - May 2007.

No.	Latin Name	English Name	IUCN Red List Category (Year Assessed)	Elevation in m asl.	Habitat Type*	No. Direct Sightings	% Direct Sightings
1	*Panthera pardus*	Common leopard	LC (2002)	-	CON	2	1%
2	*Canis lupus*	Grey wolf	LC (2004)	1,990 -2,997	OAK, CON, OAK/CON	27	14%
3	*Canis aureus*	Golden jackal	LC (2004)	1,460 - 3,051	OAK, CON, OAK/CON	33	17%
4	*Vulpes vulpes*	Red fox	LC (2004)	1,289 - 2,597	OAK, CON, DFR, OAK/CON	57	29%
5	*Ursus thibetanus*	Asiatic black bear	VU A1cd (1996)	1,723 - 2,575	OAK, CON, DFR	19	10%
6	*Capra falconeri*	Markhor	EN A2cde (1996)	1,750 - 2,047	OAK, ALP	3	2%
7	*Hystrix indica*	Crested porcupine	LR/lc (1996)	1,552 - 2,732	OAK, CON, DFR, OAK/DFR	29	15%
8	*Macaca mulatta*	Rhesus macaque	LR/nt (2000)	1,900 - 2,971	OAK, CON, ALP	28	14%
	Total					**198**	**100%**

*Habitat types: DFR: Deciduous forest; OAK: Evergreen Oak forest; CON: Coniferous forest; ALP: Alpine areas.

Scat Collection

Twenty-five scats, collected during the large mammal surveys in December '06 and January '07, were analyzed by the American Museum of Natural History at the time of writing this report. A total of 12 scats could be identified to the species level, three were identified to the order *Rodentia*, and 10 identifications failed (Table 9). The identified species included golden jackal, grey wolf, leopard cat, red fox, and Asiatic black bear. DNA analysis confirmed findings made with camera trap photographs and direct sightings but did not allow identification of yet undetected species. For detailed information about respective locations of species evidence derived from fecal sample DNA in the study site see Annex 5, p. 46.

Table 9: Details of DNA species identification made by the American Museum of Natural History of the December 2006/ January 2007 survey, Nuristan.

No.	Latin Name	English Name	IUCN Red List Category (Year Assessed)	Elevation in m asl.*	Habitat Type*	No. of Scats Identified
1	*Prionailurus bengalensis*	Leopard cat	LC (2002)	2,060 - 2,650	OAK	2
2	*Canis lupus*	Grey wolf	LC (2004)	-	-	2
3	*Canis aureus*	Golden jackal	LC (2004)	2,640 - 2,740	OAK	6
4	*Vulpes vulpes*	Red fox	LC (2004)	1,794	OAK	1
5	*Ursus thibetanus*	Asiatic black bear	VU A1cd (1996)	-	-	1
6	*Rodentia*	Rodent	-	2,840**	OAK**	3

* OAK: Evergreen Oak forest.
**Information only given for one sample.

Community Interviews

A total of 138 community interviews were conducted in 49 villages/locations throughout the study site from December '06 to May '07, however, the number of given answers varied between single questions. Given percentage figures in the following always relate to the respective total number of responses per question.

Reliability of Species Identification and Occurrence

Interviewees had some difficulties with naming species correctly shown to them on photographs, especially if these did not occur in Nuristan. Concerning the latter, they also had problems giving correct answers about their occurrence in the province. However, for species that are native to Nuristan, it can be concluded in general that the more common these animals are, the less problems people had with naming them correctly and presumably the more reliable was information about their occurrence.

Although reliability of both species identification and species occurrence varied extensively among interviewees, less correct answers were given in average concerning species identification (Figure 1). In average, 43% of all 136 answers given regarding species identification were correct. The percentage of correct responses ranged from 10-100% when considering interviewees, whereas considering correct answers per wildlife species figures ranged from 8-92%. As mentioned above, respondents had the greatest problems with recognizing species absent from Nuristan. The polar bear received the least amount of correct answers (8% correct answers), followed by the sloth bear (16%), the cheetah (19%), and the jaguar (20%). Concerning species presumably present in Nuristan, the snow leopard was identified correctly only in 20% of all interviews, followed by the brown bear (35% of correct answers), the Asiatic black bear (42%), the red fox (86%), the grey wolf (90%), and the common leopard (92%)[5].

In general, answers given regarding the occurrence of depicted species in Nuristan were more reliable compared to species identification (mean= 67% compared to 43% correct responses regarding species identification). Except for two interviewees who did not give one correct answer, the lowest percentage of correct responses was 30% and the highest 100%. Considering asked species instead of interviewees, the lowest percentage of correct answers was 21% and the highest 98%. Similar to species identification, species non-native to the area received the lowest percentage of correct answers: cheetah (21% correct answers), sloth bear (37%), jaguar (43%), and polar bear (43%). For species occurring in the area, reliability of responses were in an acceptable range: brown bear *Ursus arctos* (77%), common leopard *Panthera pardus* (78%), snow leopard *Uncia uncia* (85%), grey wolf (95%), Asiatic black bear (97%), and red fox (98%).

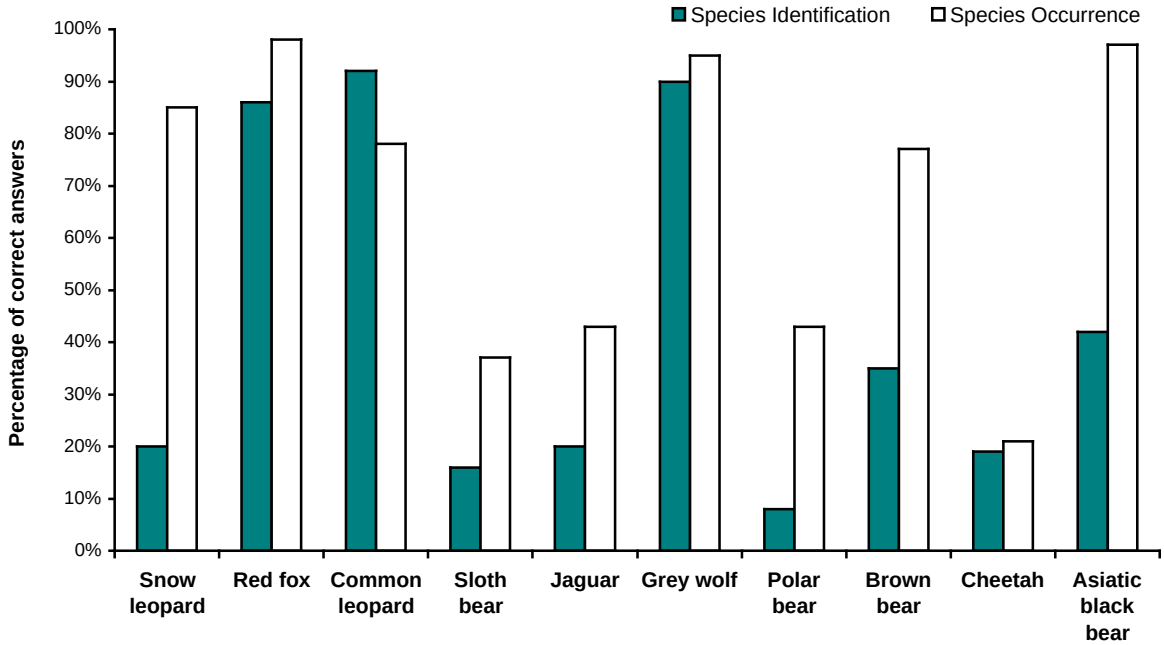


Figure 1: Correct answers given in regard to species identification and occurrence, Nuristan, December 2006 - May 2007.

Man Mauling and Livestock Predation

Incidences of man mauling by wild carnivores during the last year relating to December '06 - May '07 were reported by 22% of all interviewees (136 responses, multiple answers were permitted). Carnivore species involved in attacks of humans were in order of the reported frequency: common leopard (43%), grey wolf (37%), and Asiatic black bear (40%). No attacks of snow leopards or brown bears

[5] As discussed later, it can be assumed that failures in correct translations led to probable skewed results for common and snow leopards. Hence, care needs to be taken in interpreting information presented here referring to one or the other species - not only for the reliability questions but for all questions covered by the community interviews.

were recorded[6]. As reported, many incidents of man mauling occurred while local people tried to kill the animal in retaliation for or prevention of livestock predation, hence carnivores mentioned here are similar to carnivore species responsible for livestock predation (see below). No information was recorded on the frequency of involved carnivore species in man mauling or the number of injured men and women.

Livestock predation during past one year was reported by 98% of all interviews (136 responses), whereas the greatest loss incurred to goats and sheep (79% of all interviews), followed by cows (50%), poultry (11%), and dogs (7%). Anecdotal information suggests that predation happens during winter, when carnivores come close to human settlements in search for food, however no information about livestock numbers being killed or season/causes of predation was recorded.

Carnivore species, which reportedly predated on livestock in the last year, included in order of the frequency they were mentioned: grey wolf (68% of 133 responses, multiple answers were permitted, Figure 2), common leopard (52%), Asiatic black bear (38%), snow leopard[6] (4%), feral dog (3%), and brown bear (1%). No livestock loss caused by lynx was reported and no jackals and foxes were mentioned. When asked how carnivore species were identified, interviewees most often referred to killing marks (63% of 131 responses, multiple answers were permitted), followed by tracks (63%), direct sightings (41%), and scats (31%).

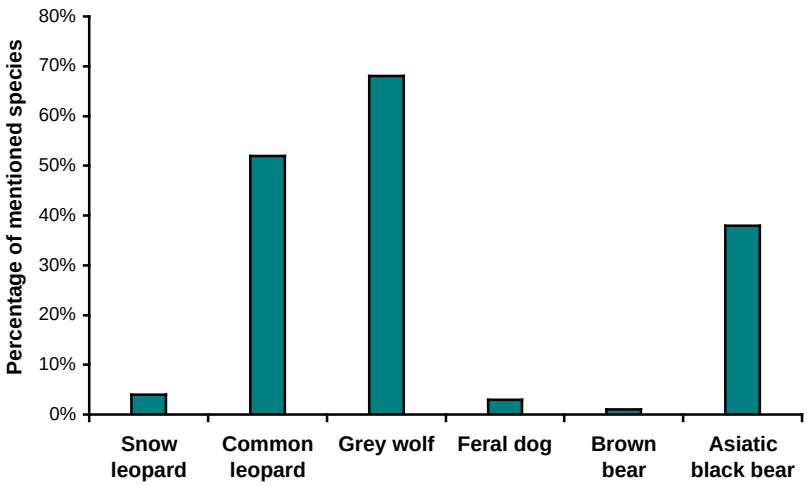


Figure 2: Predation on livestock in Nuristan during past one year relating to December 2006 - May 2007. Multiple answers were permitted.

Species Occurrence

The following species were mentioned to occur in the study site during past one year relating to December '06 - May '07, given in order of frequency of respective positive replies: grey wolf (99% of 136 responses), Asiatic black bear (98%, 136), markhor (94%, 131), common leopard (91%, 135), snow leopard (87%, 134), brown bear (84%, 136), leopard cat (47%, 133), wild cat (44%, 131), Pallas' cat *Otocolobus manul* (35%, 131), Himalayan lynx *Lynx lynx* (28%, 134), jungle cat *Felis chaus* (26%, 133), Siberian ibex *Capra siberica* (18%, 134) and urial *Ovis orientalis* (13%, 134) were said to occur in the surveyed area. These results resemble in part what was already found during the reliability question and mirror to a large extent what we found during the camera trap and large mammal surveys except for the large number of positive replies regarding the brown bear. Even if the leopard cat was mentioned to occur in the study site only in less then half of the interviews, it received the most positive replies of all four small cat species.

When asked how information about species occurrence was obtained, interviewees reported direct sightings in most of the cases (mean= 59%, all species combined, Table 10), followed by knowing about the species' occurrence through a secondary source (mean= 33%), and signs, such as tracks/pug

[6] For discussions on common and snow leopard see below.

marks, scratches, feces, etc (8%). However, the most reported evidence type for species occurrence varied among species. Species, for which direct sightings were recorded most, included wolf (direct sighting: 86%, tracks: 13%), jungle cat (direct sightings: 74%, secondary source: 26%)[7], common leopard (direct sighting: 73%, tracks: 20%), markhor (direct sighting: 72%, secondary source: 18%), black bear (direct sighting: 71%, tracks: 20%), snow leopard (direct sighting: 68%, secondary source: 21%), brown bear (63%, 23%), Pallas' cat (57%, 41%), wild cat (56%, 39%), and lynx (56%, 44%). In other species, evidence provided through a secondary source outweighed direct sightings, such as urial (secondary source: 72%, direct sighting: 22%), ibex (71%, 25%), and leopard cat (52%, 47%).

Table 10: Evidence types for species occurrence in Nuristan during past one year relating to December 2006 - May 2007.

	Evidence Type					
	Direct sighting		Sign		Secondary Source	
Species	No. Cited during Interviews	% Cited per Species	No. Cited during Interviews	% Cited per Species	No. Cited during Interviews	% Cited per Species
Snow leopard	79	68%	14	12%	24	21%
Common leopard	90	73%	24	20%	9	7%
Himalayan lynx	20	56%	0	0%	16	44%
Wild cat	32	56%	3	5%	22	39%
Leopard cat	29	47%	1	2%	32	52%
Jungle cat	26	74%	0	0%	9	26%
Pallas' cat	26	57%	1	2%	19	41%
Grey wolf	116	86%	18	13%	1	1%
Brown bear	70	63%	16	14%	26	23%
Asiatic black bear	95	71%	26	20%	12	9%
Markhor	92	72%	13	10%	23	18%
Siberian ibex	6	25%	1	4%	17	71%
Urial	4	22%	1	6%	13	72%
Average		**59%**		**8%**		**33%**

Carnivore Population Trends

In an average of 35% interviewees believed that carnivore populations were declining during the past 10 years relating to December '06 - May '07 (mostly due to common leopard and snow leopard), in 27% population trends were reportedly increasing (mostly due to the wolf), in 22% populations were regarded to be stable (mostly due to the black bear) and in 16% information about population trends was lacking (mostly due to the brown bear).

As mentioned above the most often reported decrease in population was that of the common leopard (decrease: 62%, stable: 21%, no information: 10%, increase: 7%, 136 responses, Table 12), which was shortly followed by the snow leopard (decrease: 55%, no information: 22%, stable: 15%, increase: 8%, 134). Although most interviewees had no information about the brown bear, 33% reported that its populations are declining as well (no information: 34%, decrease: 33%, stable: 22%, increase: 11%, 130). Populations of the Asiatic black bear were said to be stable in most cases and given information about decrease and increase were almost the same (stable: 40%, increase: 25%, decline: 24%, no information: 12%, 136). The only species, whose population apparently was clearly increasing, was the grey wolf (increase: 85%, stable: 12%, decrease: 3%, no information: 1%, 136).

[7] The large number of mentioned direct sightings for the jungle cat is surprising as the specie's occurrence in Nuristan has not been described in the literature before (Habibi 2003).

Table 12: Population trend of carnivore species in Nuristan during past 10 years relating to December 2006 - May 2007.

	Stable		Declining		Increasing		No Information	
Species	**No. Cited**	**% Cited**	**No. Cited**	**% Cited**	**No. Cited**	**% Cited**	**No. Cited**	**% Cited**
Snow leopard	20	15%	74	55%	10	8%	30	22%
Common leopard	29	21%	84	62%	9	7%	14	10%
Grey wolf	16	12%	4	3%	115	85%	1	1%
Brown bear	29	22%	43	33%	14	11%	44	34%
Asiatic black bear	54	40%	32	24%	34	25%	16	12%

Hunting

Incidental hunting, meaning hunting when a favorable opportunity arises, was reportedly the most common hunting type in the study site during the past three years relating to December '06 - May '07 (positive answer: 75%, negative answer: 14%, no information: 11%, 133 responses). People, mainly shepherds reportedly take guns with them while herding and hunt opportunistically when encountering wildlife by chance. In contrast, only 10% of the respondents said organized poaching for trade is occurring (negative answer: 82%, no information: 8%, 131). Trophy hunting by foreigners was the least often mentioned hunting form (positive answers: 3%, negative answers: 87%, no information: 10%, 134). All interviewees said shotguns were the only weapons used, no use of traps was supposedly made (100%, 98 responses).

As reason for hunting, personal consumption was mentioned in 100% of all responses (98) in contrast to hunting for trade, which was mentioned to take place in only 7% of all responses. Forty-two percent of people interviewed responded that they were hunters (128 responses), 34% said they have never been hunting and another 24% stated that they stopped hunting in the past, mainly in the year 2005 (50%, 14 responses). Reasons for stopping hunting were not recorded.

More than half of the respondents who stated they have been hunting or hunted in the past referred to the markhor as target species (55%, 97 responses, multiple answers were permitted). The second most frequently mentioned mammal species was the Asiatic black bear (26%), followed by common leopard (20%)[8], wolf (11%), musk deer *Moschus cupreus* (7%), fox (6%), and jackal (1%). Hunting of birds was practiced by 16% of all interviews, however, no information about hunted species was given. No hunting of snow leopards[8], lynx, ibex, urial, and brown bear was mentioned. Our teams found furs of four leopard cats, which apparently were shot opportunistically when preying on villager's poultry (Photo 8).

The musk deer was hunted because of trade in its abdominal glands, for which traders apparently pay prices between US $200-250 per gland. According to local people, this trade was brought to the region about 30 years ago (see also below). The meat of the musk deer represents a local delicacy, however, personal consumption might be only a secondary reason for hunting these profitable animals. During summer the species stays in higher mountain regions and is supposedly only opportunistically hunted by shepherds who occasionally encounter it when herding their livestock. Most animals are hunted in winter when musk deer distribution and ranging patterns are most predictable. Apparently, the deer not only faces hunting pressure from local Nuristanis but also from people coming from Kunar province searching for the species.

When comparing target species of hunters that are still hunting (54 responses) with those that claimed they stopped hunting in the past (31 responses) the frequency of mentioned target species changed. Whereas the latter more often stated they hunted common leopards (42% versus 8%, Figure 3), black bears (29% versus 18%) and foxes (10% versus 4%), respondents who are still hunting more frequently mentioned to hunt markhor (55% versus 45%) and birds (22% versus 0%). However, caution must be taken when interpreting this result, as the interview question asked was not exactly tailored to answer

[8] For discussions on common and snow leopard see below.

a possible shift in hunting preferences. While interviewees that claimed they stopped hunting - as a matter of fact - only referred to past preferences, responses of interviewees that are still hunting probably but not necessarily referred to recent hunting preferences.

Not mentioned in the interviews but reported otherwise was the hunting of yellow-throated martens for the fur trade and of leopard cats apparently in retaliation of predating on poultry. Four leopard cat pelts were seen near Nisheegram village (Photo 8). However, our data does not allow for assumptions on whether retribution or trade in fur is the prime reason for hunting carnivores in the study site.

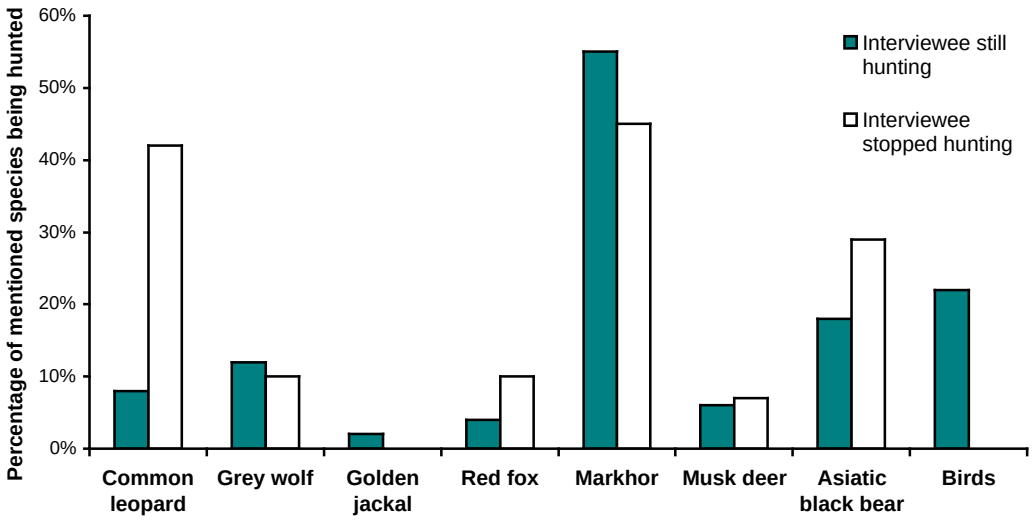


Figure 3: Species hunted by interviewees, who are still hunting, versus species hunted by interviewees, who stopped hunting in the past, Nuristan, December 2006 - May 2007.
Multiple answers were permitted.

Hunting in the study site occurred mainly in winter (72% of 99 responses, multiple answers were permitted), followed by summer (45%), spring (43%), and autumn (29%). Surprisingly, autumn was the least frequently mentioned season. However, the winter usually comes with a thick layer of snow and wildlife is forced to move to lower elevations in search for food. The winter '07/'08 was reportedly extremely cold all over Afghanistan and local residents told us that markhor were descending to village levels, where people were able to catch the exhausted animals with bare hands. For details on species-specific hunting grounds see Annex 6, p. 57.

Community Wildlife Mapping

Community interviews regarding the mapping of key wildlife species in the study site, conducted in April-May '08, resulted in 250 responses from 26 villages. The presence of markhor in the study site was affirmed in 82% of all responses (Figure 4), followed in order of the frequency of positive replies by the leopard cat (72%), the snow leopard (58%), the musk deer (14%), and the urial (12%). Except for the leopard cat, these results confirm findings of previous community interviews. The leopard cat's occurrence was reported far more often during the wildlife mapping exercise than during the standardized interviews presented above.

The distribution of species, based on results of the community wildlife mapping, in general reflected figures for species occurrence given above. The more often the species' occurrence was affirmed, the wider it seemed to be distributed throughout the study site[9]. Results showed a wide distribution for markhor and leopard cat in the study site and apparently only little decrease in their ranges have

[9] However, for interpreting results presented here, it needs to be considered that the south and central parts of the study site were more intensely surveyed than the north. As a result, information about wildlife distribution is underrepresented for the north, which is of particular significance as the north is less densely populated with humans than the south and central parts and thus is likely to support higher numbers of wildlife.

taken place over the last five years. Similarly, the snow leopard seems to be fairly evenly distributed throughout the site, except for the upper part of Waygal valley, including Waygal village. Information given about its former range assumes that it was still present in this region only five years ago.

Distribution of the musk deer was reportedly limited to the mountain chain between Nisheegram and Wama village in the center of the study site, to surroundings of Kantewa and Pashki village in the north of the site and to Kond Kaly in the south east on both sides of the border to Kunar. Its range from five years ago showed a more widely spread distribution in the south of the study site.

Mapping results indicated that the urial was still fairly evenly distributed over the entire study area five years ago. However, its recent distribution was limited to the south western part of the study site, to mountainous areas around Archano and Pounce village. For more details on the results of the community wildlife mapping see Annex 7, p. 58.

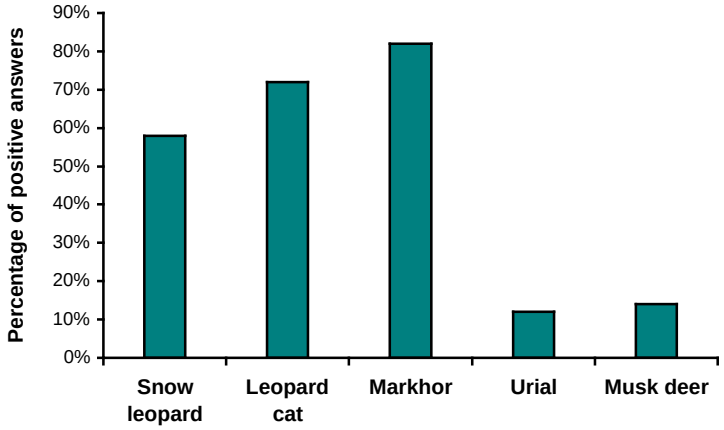


Figure 4: Species occurrence according to the community wildlife mapping, Nuristan, April - May 2008.

When asked how sustained wildlife protection can be achieved in the study site, 62% of all respondents (26 villages, multiple answers permitted, Table 13) replied that a paid ranger patrol is necessary for protecting forests and wildlife, whereas 35% suggested that ranger payments should derive from governmental institutions, 12% proposed payments through non-governmental organization and 15% responded either government or non-governmental organizations should be responsible for salary payments of rangers. Twenty-seven percent mentioned reimbursement of livestock loss due to predation as being crucial for preventing retaliatory killing of carnivores and another 19% suggested the assignment of protected areas. 19% believed that protection of wildlife in the study site is impossible.

Table 13: Community answers given to the question: if and how wildlife can be protected, Nuristan, April - May 2008.

Reasons given for successful protection of wildlife	No. Cited	% Cited*
Paid ranger patrol paid by the government	16	62%
Reimbursement of killed livestock	7	27%
Protected Area	5	19%
Protection impossible	5	19%

*Multiple answers were permitted.

Conclusion of Species Presence/Absence

During our wildlife studies in south central Nuristan we found evidence (photographs from camera traps, scat DNA identification, and unambiguous direct sightings) of the presence of leopard cat *Prionailurus bengalensis,* grey wolf *Canis lupus*, golden jackal *Canis aureus*, red fox *Vulpes vulpes*, Asiatic black bear *Ursus thibetanus*, markhor *Capra falconeri*, rhesus macaque *Macaca mulatta*, crested porcupine *Hystrix indica*, a civet species, which is suggested to be the common palm civet *Paradoxurus*

hermaphroditus, and yellow-throated marten *Martes flavigula*. In addition, camera trap photographs confirmed the presence of four bird species, the chukar patridge *Alectoris chukar*, common woodpigeon *Columba palumbus*, large-billed crow *Corvus macrorhynchos japonensis*, and scaly-bellied woodpecker *Picus squamatus*.

Evidence is lacking of the presence of common leopard *Panthera pardus*, snow leopard *Uncia uncia*, Himalayan lynx *Lynx lynx*, Pallas' cat *Otocolobus manul*, jungle cat *Felis chaus*, wild cat *Felis silvestris*, brown bear *Ursus arctos*, Siberian ibex *Capra siberica*, urial *Ovis orientalis*, and musk deer *Moschus cupreus*. However, interviews with residents suggest that the following species still occur, albeit in probably small numbers, common leopard, snow leopard, lynx, brown bear, and musk deer. No reliable information was obtained on the occurrence of Pallas' cat, wild cat, ibex, and urial[10].

Discussion

Mammal Species Of Evident Occurrence

The existence of species found in south central Nuristan confirms previous findings of wildlife surveys in the area. For one species, the common palm civet, the first live record according to the literature could be provided for Afghanistan (Kullmann 1970, Petocz 1972, Hassinger 1973, Petocz et al 1977, Petocz & Larsson 1977, Rodenburg 1977, Habibi 2003). We have good evidence that the following species are present in the surveyed area: leopard cat, grey wolf, golden jackal, red fox, Asiatic black bear, markhor, rhesus macaque, crested porcupine, yellow-throated marten, and common palm civet.

Photo 8: Leopard cat furs from Nuristan, Apr/May '07.

Leopard cat *Prionailurus bengalensis*

The leopard cat was photographed by camera traps and identified by scat DNA analysis. The community wildlife mapping showed a wide distribution of the cat throughout the study site and four cat pelts were seen near Nisheegram village (Photo 8). We found evidence of the species in elevations between 2,100 and 2,700 m asl., which is in accordance with the literature (1,000-3,000 m asl., Habibi 2003). The species was reportedly hunted in retribution of killing poultry and it's fur is the second most abundant on Kabul's markets of all CITES listed cat species of Afghanistan (CITES listed cats on Kabul's fur markets in order of frequency: 1. lynx, 2. leopard cat, 3. wild cat, 4. common leopard, 5. snow leopard; Clay Miller, per. comm. 2008). However, little is known about the furs' origin in Afghanistan and we lack data about actual population density and hunting pressure in Nuristan. No evaluation of the species' status in Afghanistan was made by Habibi (2003) because of insufficient information.

[10] Our study does not provide proven information about species abundance and only limited information about species distribution.

Grey wolf *Canis lupus*, **golden jackal** *Canis aureus*, **and red fox** *Vulpes vulpes*

Although local residents referred to the wolf as being widespread and its population was reported to be increasing, our camera traps failed to detect its existence. Proven information about the wolf is thus derived from direct sightings and scat samples. The wolf seems to be present in most of the study area, however, its population size is uncertain. Golden jackal and red fox seem to be still common in the study site. They were photographed by camera traps, seen directly in several occasions and could be identified by scat DNA analysis. While Habibi (2003) classified the jackal as being rare in Afghanistan, his assessment of the red fox is consistent with our findings.

Recorded elevation ranges for wolf, jackal and fox were in line with information given in the literature (wolf: 2,000-3,000 m asl. compared to 1,000-4,600 m asl. according to Habibi 2003; jackal: 1,200-3,100 m asl./300-3,500 m asl.; fox: 1,300-2,600 m asl./300-4,500 m asl.). All three species were reported to predate on livestock, whereas the wolf is causing the highest economic loss for local communities among wild canids. They all face retaliatory hunting and Kabul's markets see large numbers of their furs (Rodenburg 1977). However, it is uncertain whether retaliatory killing or fur trade is the prime reason for hunting these animals in Nuristan.

Asiatic black bear *Ursus thibetanus*

The Asiatic black bear was photographed in all four surveyed grid cells, was seen throughout most of the eastern part of the study site and got identified by scat DNA analysis (exact location missing). Evidence of the bear was found between 1,700-2,600 m asl., which is in line with descriptions from the literature (1,500-3,000, Habibi 2003). It appears to be still widespread, however, similar to other species, we lack figures about species abundance. The black bear faces retribution killings for predation on livestock and raiding crops (Petocz & Larsson 1977). The fat of the bear is reportedly given to goats in late autumn as it is believed the fat strengthens the animals for the upcoming winter months. No furs of black bears were found on Kabul markets (Rodenburg 1977, Povolny 1966) and no trade of the species' gall bladders for traditional Chinese medicine was reported from the study site, as described throughout most of its range in Southeast Asia. However, cubs are occasionally captured and kept as pets or sold to Pakistan, usually by killing the mother bear (Naumann & Nogge 1973, Habibi 2003, Photo 9). Being a typical representative of the oriental realm, the Asiatic black bear finds its westernmost distribution in Nuristan (Povolny 1966). Habibi (2003) classified the Asiatic black bear as threatened for Afghanistan; word wide it is listed as vulnerable (VU A1cd, year assessed: 1996, IUCN 2007).

Photo 9: Two orphaned bear cups found in Nuristan.
The fate of the mother bear is unknown.

Markhor *Capra falconeri*

Most of the information obtained about the markhor came from community interviews. No photographs of markhor were taken by camera traps and only three animals were seen in two locations in the east of the study site during the large mammal surveys. The two sightings were at elevations of 1,600 and 2,000 m asl., which is within the range given by Habibi (1,000-4,000 m asl., 2003). The community wildlife mapping showed a wide distribution of the species throughout the study area, which is in line with Petocz and Larsson's findings from 1977. People referred to the species as being the most hunted of all wildlife.

Reasons for not photographing the animal during the first camera trap survey in August might include the low elevations of the camera traps, which hardly reached 3,000 m asl. and mostly stayed

below 2,500 m asl. (mean= 2,160 m asl.) in addition to the primarily forested habitat, in which the cameras were located. Although markhor descend during winter months to more forested areas in elevations below 2,200 m asl. (Schaller 1975) in response to snow conditions and to avoid cold temperatures, they prefer grazing in rugged, alpine habitat in high elevations throughout the summer. Only single males were occasionally observed in forested areas during that time as a probable result of human activity above and below the forest belt (Petocz et al. 1977, Petocz & Larsson 1977). Other possible reasons for not photographing the animal include closeness to human settlements and human and/or livestock disturbance.

As mentioned earlier, our results showed that markhor is the most hunted species in the study site. Several authors (Roberts 1969, Naumann & Nogge 1973, Petocz & Larsson 1977) found hunting to be the major cause of mortality of the species, besides predation by wolf, common and snow leopard, and prime reason for the species' population decline. Hunting is deeply rooted in the Nuristan culture and tradition (Robertson 1896, Petocz et al. 1977). Markhor horns held important symbolism in the Kafir religion and were stylized in elaborated wood carvings (Photo 10, Photo 12), which were the basic design employed to signify wealth and prowess of hunters. After their forced conversion to the Islam these hunting traditions have persisted and through the influx of modern weapons during the time of conflict hunting pressure has increased (Roberts 1969, Naumann & Nogge 1973). Only recently the PRT based in Nuristan, as part of the International Security Assistance Force, has been engaged in collecting weapons from local inhabitants and hunting activities apparently have declined.

Grazing competition between markhor and domestic stock was reportedly not intensive in 1977 (Petocz & Larsson). Rangelands were in acceptable condition as were forests, and regarded capable of supporting a higher markhor population than observed (Petocz et al. 1977). Petocz and Larsson (1977) assumed that the number of domestic animals is restricted by the area's capacity to produce and store winter fodder, as heavy snowfall in winter prevents winter grazing (see below). Current numbers of livestock are unknown for Nuristan and we lack information about rangeland conditions. The same applies to disease transfer between livestock and wild ungulates.

Photo 10: Markhor hunting is deeply rooted in Nuristan's culture.
Markhor horns were stylized in wood carvings as seen in the right of the picture.

As no information about species abundance was obtained, no assessment of the species' status can be made based on our results. The historic range of the markhor in Afghanistan is uncertain, however, several authors have reported that the populations in Nuristan have undergone a significant reduction in numbers (Roberts 1969, Naumann & Nogge 1973, Petocz & Larsson 1977). Nothing is known about the species' occurrence in Nuristan outside the study site or other provinces, such as Kabul, Parwan, Laghman, Kunar, Paktya and Takhar, for which markhor populations were reported in the past (Petocz 1972, Petocz at al. 1977, Petocz & Larsson 1977). However, already in 1977, Petocz et al. believed that only the populations in Nuristan have occurred in any abundance. Habibi considered the markhor as being threatened in Afghanistan; worldwide it is listed as endangered (EN A2cde, year assessed: 1996, IUCN 2007).

Number and distinction of subspecies are a matter of discussion: Petocz et al. (1977, Petocz & Larsson 1977) listed four subspecies occurring in Afghanistan - *Capra falconeri cashmiriensis* in the north eastern

part of the Hindukush in the provinces of Nuristan, Kunar and Laghman, *C. f. megaceros* mainly in the Kohi Safi region in nowadays Parwan province, *C. f. heptneri* in the Darvaz region of Takhar province on the border to Tajikistan, and *C. f. jerdoni*, which was thought to be a remnant population occurring in the mountains of Paktya province. West of Barak in Badakhshan province an addition population was assumed by Nauroz & Naumann (1975), however, its occurrence has never been confirmed. IUCN (SSC Caprinae Specialist Group 1996) in contrast lists only three subspecies for the worldwide population: *Capra falconeri falconeri*, *C. f. heptneri* and *C. f. megaceros*, of which only the latter two are supposed to occur in Afghanistan. Habibi (2003) in turn, lists all of these three subspecies for Afghanistan, including *C.f. falconeri*.

Rhesus macaque *Macaca mulatta*

The rhesus macaque was seen in several occasions, mainly in the east and the center of the study site. The elevation range of our records was between 1,900 and 3,000 m asl., which matches information given by Habibi (1,000-3,000 m asl., 2003). The average group size of five animals per group was low compared to findings by Petocz and Larsson (1977), who stated that local inhabitants reported group sizes of up to 30 animals. From east Nuristan, Puget (1971) reported groups composed by up to 180 animals near Kamdesh and Naumann and Nogge (1973) once counted 250 animals in one group during the winter in the Linday-Sin valley. The observed small group size could indicate a drastic population decline. Formerly widely distributed throughout Nuristan, Kunar and Paktya (Hassinger 1973, Habibi 2003) their habitat shrunk considerably due to deforestation and habitat destruction is probably the greatest threat they face. No hunting of macaques was reported during our survey. The species is reportedly barely hunted as both killing and consumption of its meat is forbidden in Islam culture and its fur is of low quality (Kullmann 1970, Rodenburg 1977). Occasionally infants are captured and kept as pets. Habibi (2003) assessed the macaques' status as common in Afghanistan.

Crested porcupine *Hystrix indica*

Porcupines were detected throughout the study site. Various photographs and direct sightings proved their existence. We found porcupines in elevations of 1,200-2,700 m asl., which differs slightly with what is recorded by Habibi (2003), who mentioned an elevation range of only up to 2,600 m asl. (Min.: 500 m asl.). Porcupines are of no commercial value (Habibi 2003) and we were told that in some places they were considered as pests because of their tree barking (Photo 11), which not seldom causes the trees' death. Some authors reported that the animals were shot or trapped because they are depredating on crops (Hutton 1846, Kullmann 1970), however, no hunting of porcupines was mentioned to us. Habibi (2003) classified the porcupine as being common in Afghanistan.

Photo 11: Porcupines feed on the bark of trees.

Common palm civet *Paradoxurus hermaphroditus*

One civet species was photographed by camera traps in the center of the study site. Unfortunately, information about the exact position of the site got lost, however we can reconstruct an elevation range of 2,100-2,700 m asl. As mentioned earlier, the civet gave some reason for discussion. Habibi (2003) did not list civets for Afghanistan at all and the IUCN Mustelid Specialist Group (1996a and b) lists the mask palm civet (*Paguma larvata*) and the small Indian civet (*Viverricula indica*) for Afghanistan. However, the almost lacking mask and the plump appearance of the photographed civet, a long bushy tail without rings, dark longitudinal stripes on the back and dots on the flanks on the otherwise grey-brownish fur let assume that it is neither a mask civet nor a small Indian civet.

According to a civet specialist (Dr. Geraldine Veron 2008, National Natural History Museum, Paris, pers. comm.), who was consulted, the photographs depict a common palm civet.

There are no published live records of common palm civets in Afghanistan. Rodenburg (1977) found furs of two different civet species on the markets of Kabul. One species was identified as a small Indian civet, for the second species a common palm civet was suggested. Rodenburg stated the identification of the latter should be regarded with a certain amount of doubt, as they did not see any complete skins on the markets. However, his descriptions of the fur pattern are in accordance with the appearance of the civet photographed during our surveys. Whereas most of the shopkeepers referred to Pakistan as the origin of the civet furs found by Rodenburg, two shop owners stated that their pelts came from Nuristan province. All in all, Rodenburg concluded that it is rather doubtful whether the common palm civet occurs in Afghanistan. The literature describes the western most distribution of the species to be Kashmir, India (Prater 1971). Nothing can be said about the palm civet's status in Afghanistan, further investigations would certainly be of great interest.

Yellow-throated marten *Martes flavigula*

The yellow-throated marten was photographed in the center of the study site during the camera trap surveys. Unfortunately, as for the civet, the information about the exact location of the camera traps got lost and we only know that the photographs were taken somewhere between 1,800-2,900 m asl. In comparison, Habibi (2003) gave an elevation range for the yellow-throated marten of 500-2,500 m asl. The marten is reportedly hunted for its fur (Petocz & Larsson 1977) and Rodenburg (1977) mentioned Nuristan to be the main purchasing center for this species. He assessed its status to be severely threatened and recommended a complete ban on the sale of its fur already in 1977. Habibi (2003) listed the marten as threatened for Afghanistan.

Reports from western Pakistan stated that the marten was found killing domestic chickens and occasionally feeding on cultivated fruit trees (Roberts 1970). However, we have no information if the species causes noteworthy economic losses in Nuristan resulting in retribution killings.

Mammal Species Of Unconfirmed Occurrence

Solid evidence of occurrence is lacking, such as photographs from camera traps, scat DNA analysis or unambiguous direct sightings for common leopard, snow leopard, lynx, Pallas' cat, jungle cat, wild cat, brown bear, ibex, urial, and musk deer. However, responses from community interviews suggest that the following species are still present in south central Nuristan even if in probably only low numbers: common leopard, snow leopard, lynx, brown bear and musk deer. We have no reliable information about the presence of Pallas' cat, jungle cat, wildcat, ibex, and urial. However, the existence of jungle cat has not been reported for Nuristan (Habibi 2003) and it is questionable if ibex reaches the particular area surveyed in south central Nuristan (Petocz & Larsson 1977).

Common leopard *Panthera pardus* **and snow leopard** *Uncia uncia*

Our results from the community interviews for the common and the snow leopard are not consistent with the literature and with information we obtained during discussions with local residents beyond the standardized interviews. According to these interviews the common leopard is more common in the study site, is responsible for most of the man mauling (whereas no incidences were reported involving snow leopards), is predating far more often on livestock than the snow leopard, and is apparently the only cat of the two which is being hunted. However, when asking local residents directly, which of the two cats is more common in the area, the uniform answer was the 'snow leopard'. Petocz and Larsson, studying central Nuristan in 1977, came to the same conclusion that "snow leopards (*Uncia uncia*) are evidently more common than leopards (*Panthera pardus*) [...]" (p. 36), which is in accordance with findings of Naumann and Nogge (1973).

A possible explanation for these inconsistencies is found in mistranslations. In the Nuristani language the term *zhunt* is used as a general expression for leopard and it seems likely that the same word was used for both cats, without specifying, which leopard actually was meant (snow leopard - *shetra zhunt*). The Nuristani term for leopard subsequently got translated by our teams into 'common leopard', thus probably resulting in an under representation of positive responses for the snow

leopard. This assumption is confirmed by our results obtained from the reliability questionnaire. The snow leopard was named correctly least frequently of all species native to Nuristan (see above). A remarkable difference between the percentages of correct answers regarding its identification versus its occurrence becomes obvious. Apparently only few people named the species correctly, however most of them knew very well about its existence. Considering the same results for the common leopard the opposite result was achieved. More correct answers regarding the common leopard's identification than regarding its occurrence were given.

Although our teams recorded one direct sighting of two common leopards in the study site's east, due to the probable inconsistencies in differentiating between common and snow leopard it remains uncertain which of the two species was actually seen. The elevation from the sighting was not recorded, which could have given an additional hint to the species, as common leopards are described to inhabit lower elevations (1,500-4,000 m asl.) than snow leopards (3,000-5,000 m asl., Habibi 2003).

The community wildlife mapping showed a still wide distribution of the snow leopard in the study site. Recent collaring of a snow leopard female in the Chitral Gol National Park (Snow Leopard Trust 2007, Chadwick 2008) in neighboring Pakistan revealed that the snow leopard crossed the border to Afghanistan, as signals of the satellite collars were found in Nuristan in summer 2007. Although the collared female did not reach our study site in south central Nuristan, it seems likely that snow leopards still occur in the area.

Reasons for not photographing the snow leopard despite its occurrence probably include elevation of camera traps, habitat and proximity to human settlements. It can be assumed that the snow leopard's major natural prey in the study area is the markhor, whose seasonal movements in elevation the cat follows (Prater 1971), thus in terms of choosing appropriate elevations for setting up camera traps the same applies for the snow leopard as for the markhor (see above). In addition, snow leopards prefer rugged and steep alpine terrain (Hussain 2003, Habibi 2003), in which no camera traps were placed during our surveys. Camera trap surveys tailored to photograph markhor and/or snow leopard certainly would need to follow another design as applied by us. They require an intense study of the specific habitat use of snow leopards and their prey in the area prior to setting up camera traps. Surveys focused on signs, such as tracks/pug marks, bedding areas (markhor), scrapes/scent sprays (snow leopard), feces, etc. are needed for choosing promising camera trap sites.

Most interviewees replied that populations of both leopard species have declined in the past. Both cats are hunted in retribution of killing livestock and for trade in the animal's fur. A widespread availability of modern weapons during the period of conflict has facilitated hunting activities. Rodenburg (1977) stated that both species were present on Kabul's fur markets and recommended a complete ban on the sale of their furs already in 1977. However, the cats can still be seen (Clay Miller, per. comm. 2008) despite a Presidential Decree on banning hunting since 2004. Buyers of leopard furs are almost exclusively solvent westerners then, as now (Kullmann 1970). A population decrease of important prey species, such as markhor and musk deer, due to hunting and habitat destruction, has posed an additional threat to the cat's survival in the region and aggravated conflicts with local residents resulting from incidences of livestock predation. Both cats are classified as threatened for Afghanistan (Habibi 2003) and both, the subspecies *Panthera pardus saxicolor* and the snow leopard, are listed as endangered worldwide (*P. p. saxicolor*: EN C2a, year assessed: 1996; snow leopard: EN C2a(i), year assessed: 2002, IUCN 2007).

Himalayan lynx *Lynx lynx*

The lynx' presence in the study site is questionable. All information about its occurrence was obtained from community interviews and the number of positive replies was low. No livestock predation was caused by lynx and no hunting of the animal was reported. Habibi (2003) described records of the lynx's occurrence in upper forested regions in Nuristan and it might well be that the cat, which inhabits the Hindukush mountain ranges in Badakhshan only rarely descends as far south as the study site is located. Despite a current Presidential Decree on banning hunting of all wildlife, issued in the year 2004, the cat represents the most common species of all CITES listed cats on Kabul's fur markets (CITES listed cats on Kabul's fur markets in order of frequency: 1. lynx, 2. leopard cat, 3. wild

cat, 4. common leopard, 5. snow leopard; Clay Miller, per. comm. 2008). Rodenburg (1977) considered the lynx as rare in Afghanistan and its populations as certainly declining. He recommended a complete ban on the sale of its fur in the year 1977. Habibi (2003) assessed the cat's status for the country as threatened. Globally, the lynx is listed as near threatened (NT, year assessed: 2002, IUCN 2007).

Jungle cat *Felis chaus*

Positive replies from community interviews referring to the jungle cat's occurrence in the study site were low in numbers and the fewest among all cats. Petocz and Larsson did not mention the species in their report about the Nuristan survey in 1977 and even if the cat was the second most abundant species on Kabul's fur markets in 1977 (Rodenburg), Nuristan was not listed among the purchasing centers. Although probably more widespread in western Afghanistan, for the country's east the literature described its occurrence only for Nangarhar province (Niethammer 1966). Habibi (2003) gave an elevation range of the cat of 400-1,000 m asl., which does not overlap with the study site's elevation (1,100- 4,500 m asl.) and a habitat description of semi-deserts, open plains, watercourses, and reed beds, which can be little found in our study site and are not typical for Nuristan in general. Thus it is uncertain whether the cat ever inhabited the study site. Habibi (2003) referred to its status in Afghanistan as being threatened due to intense hunting pressure for fur trade.

Pallas' cat *Otocolobus manul*

Slightly more positive replies than the jungle cat were received regarding the occurrence in the study site of the Pallas' cat or manul. However, positive answers were low in numbers and community interviews represented the only source of information we have about the species' presence. No records of the species' occurrence in Nuristan are mentioned in the literature. However, the cat is described as inhabiting alpine and subalpine valleys of mountainous regions in elevations of 1,500-3,500 m asl. (Naumann & Nogge 1973, Habibi 2003). Among others it was found in Panshir and Badaskshan province, thus it seems reasonable to assume its occurrence in Nuristan. Even if present in the study site our survey design was not likely to detect the cat as our teams hardly surveyed alpine and subalpine habitat. The cat is hunted for fur, although the pelts were considered to be not very attractive (Rodenburg 1977). Habibi (2003) listed the cat as threatened for Afghanistan because of hunting and trapping practice; IUCN (2007) assessed its worldwide population status to be near threatened (NT, year assessed: 2002).

Wild cat *Felis silvestris*

Two photographs of small cats were taken, which could not be identified reliably. Either the pictures depict a wild cat *Felis silvestris* or a feral domestic cat *Felis catus*. Photographs were taken in two different grid cells in the center of the study site. The recorded elevation ranges are in line with Habibi's (2003) descriptions for wild cats (500-2,000 m asl.): one photograph was taken in 1,200 m asl. and the other between 1,800 and 1,900 m asl. (information about the exact elevation of the second picture was lost). Naumann and Nogge (1973) mentioned a wild cat that was brought to the Kabul zoo apparently from Waygal valley. Recent investigations of Kabul's markets show a good supply of wild cat fur (CITES listed cats on Kabul's fur markets in order of frequency: 1. lynx, 2. leopard cat, 3. wild cat, 4. common leopard, 5. snow leopard; Clay Miller, per. comm. 2008) and Rodenburg found it was the second most abundant cat species on the markets in 1977. However, Rodenburg did not mention Nuristan as one of the main purchasing centers and nothing is known about the hunting pressure the cat is facing in the study site. Habibi (2003) listed the wild cat as threatened in Afghanistan as indiscriminate hunting is likely to decrease numbers.

Brown bear *Ursus arctos*

Although not photographed, the brown bear's occurrence was affirmed during community interviews, obtaining only slightly less positive responses than the snow leopard. However, only little livestock predation caused by brown bears was reported. Most villagers had no information about the species' population trend, however almost the same amount of respondents replied the bear's population is declining. Petocz and Larsson stated in 1977 that the brown bear apparently does not descend to

forested areas, but can be seen in alpine habitat, which is in accordance with Habibi (2003), who gave an elevation range for the bear of 2,500-5,000 m asl. It was unlikely to photograph the bear during the camera trap surveys, as during the first survey in August the camera trap locations were placed not higher than 2,700 m asl. (mean= 2,000 m asl.) and during the second survey in November/December the bears most probably stayed underground, as they go into hibernation for a period of five months (Habibi 2003) starting in October. The brown bear seems to be not as common in the study site as the Asiatic black bear and most probably occurs more frequently in the north of Nuristan in higher elevations at the border to Badakhshan. Habibi (2003) assessed its status in Afghanistan as threatened; globally the brown bear is common and widely distributed.

Siberian Ibex *Capra siberica*

The Siberian ibex received only little positive replies regarding its occurrence in the study site and was not mentioned as a target species for hunting. Naumann and Nogge (1973) found evidence of its occurrence in east Nuristan around Barg-e Matal. Petocz and Larsson (1977) reported extensive seasonal movements from ibex to and from the neighboring Badakhshan province in the north and due to their findings it can be assumed that ibex inhabit the northern part of the study site only in late September until the end of May. Reportedly they spend the winter months on rangeland occupied by markhor during warmer seasons. Thus ibex were unlikely to be present in the locations of the camera trap sites. In addition, the northern part of the study site was less intensely surveyed during the large mammal surveys and the community interviews, resulting in a probable under representation of species that more frequently occur in the north. However, there are good chances the ibex still occurs in northern Nuristan, as the north is considered to be less populated (Petocz & Larsson 1977), thus leaving more undisturbed habitat for wildlife. Habibi assessed its population status in Afghanistan as rare; worldwide the Siberian ibex is still abundant.

Urial *Ovis orientalis*

The urial received the fewest positive replies regarding its occurrence in the surveyed area of all species asked during both, the community interviews and the community wildlife mapping. The latter showed a localized presence of the sheep in the study site's southeast. Respondents claimed that the species was distributed throughout wide areas of the study site only five years ago, which would be confirmed by a record of the species near Nisheegram village from the year 1977 (Petocz & Larsson). The animal was supposedly not hunted. No national assessment of the urial's population status was made by Habibi (2003) due to insufficient data. IUCN (2007) lists the sheep as vulnerable (VU A2cde, year assessed: 1996).

Musk deer *Moschus cupreus*

The community wildlife mapping suggested that small numbers of musk deer are still present in the study site. However, numbers are likely to be low and according to the interviews very localized. Besides hunting for meat, which is considered a local delicacy, the animal is hunted primarily because of its abdominal glands, for which traders reportedly pay prices up to $ 200-250 per gland. According to locals the trade in musk glands reached the area about 30 years ago and has led to a substantial increase in hunting since then. Although Petocz and Larsson had not seen the musk deer during their study in 1977, they were told that moschus glands were sold to Sikhs and Hindus in the Jalalabad valley at prices of 1,000 -1,500 Afs/$ 20-30. This would represent an approximate 10 fold increase in the value of musk glands over 30 years. The lack of detection of musk deer might be linked to its secretive behavior on one side but may as well indicate low population numbers, which would be backed by results we obtained from the community wildlife mapping. Habibi (2003) assessed its status in Afghanistan as being extremely rare.

As there are inconsistencies regarding the systemic classification of the musk deer, a global risk assessment becomes difficult. While Habibi (2003) referred to the Afghan musk deer species as *Moschus moschiferus*, IUCN (2007) and Shank (2006) listed the deer as *M. chrysogaster*. The nomenclature *M. cupreus* used here refers to Goves et al. (1995), who revised the taxonomy of the musk deer based on a craniometric mulitvariate analysis.

Conservation Implications

The source of livelihood of local communities in Nuristan is based on an intact forest ecosystem and residents are aware of threats linked to deforestation, such as loss of topsoil, water and non-timber forest products. In contrast to provinces such as Paktya, which lost great portions of their pristine forests already in the 70ies, Nuristan still holds comparably extensive forested areas. Strict regulations regarding pasture and forest management, which root in ancient Kafir traditions and have outlasted the conversion to Islam, have enabled Nuristan to preserve their resources to a large extent (Kullmann 1970). Kullmann (1970) reported that no livestock was allowed to graze inside forests and fines were imposed if regulations were violated. It was forbidden to cut deciduous trees, even the cutting of branches was prohibited. Felling of trees was restricted to certain species and age. Even if Kullmann (1970) found regulations already softened in lower elevations and Petocz and Larsson (1977) could observe both during their mission, grazing inside forests and cutting of branches for animal fodder, one can hope to build on the knowledge of traditional management systems when designing conservation measures.

In addition to pasture and forest management, Nuristan retained many elements of its pre-Muslim political structure (Dupree 1974). Internal affairs are arranged on the basis of local traditions and decision-making bodies (Petocz & Larsson 1977, Klimburg 2001). Referring to the residents of primarily Waygal valley, Katz (1984, p. 95) described: "Each *des* [community] is politically autonomous and exercises exclusive control over the resources in its territory [...] No corporate organization, economic or political, exists at levels more inclusive than the individual *des*." Non-governmental mediation practices have been used for centuries to resolve interpersonal conflicts arising within and between communities. Annually chosen village policemen were responsible to control and enforce community regulations, such as irrigation, harvesting and transhumant schedules and were empowered to fine transgressors according to traditional rates. Comparable to models of community conservation funds, these fines usually have been split between the policeman and a village fund. The latter has been maintained to support expenses associated with external political affairs (Strand 1984a, 1984b). A traditional knowledge of sustainable management of natural resources in combination with a strong community governance and jurisdiction system may provide good preconditions for community based environment conservation.

However, threats to the environment are manifold and opportunities for implementing active conservation measures are limited primarily by the current security situation, which does not allow for safe travel of international consultants to the area. The following sections deal with threats and challenges to environment conservation in Nuristan and discuss recommended actions. General issues, such as lack of capacity of governmental structures, in particular of the Ministry of Agriculture, Irrigation and Livestock and the National Environmental Protection Agency, lack of policy and legislation, as well as lack of financial means certainly play a major role in a comprehensive threat assessment. However, as these are already discussed in detail elsewhere (UNEP 2003), analysis is limited to threats which are directly linked to Nuristan.

Threats and challenges

Insufficient data

The lack of sufficient data about forest and wildlife status in Nuristan is one of the foremost challenges the implementation of conservation measures is currently facing. Valid data are crucial and indispensable for developing sound conservation strategies. The presented wildlife surveys certainly give a first impression of large mammal occurrence and status in Nuristan. Evidence of presence was obtained for a number of large mammals and a population decline was suggested for most of the species according to community responses. However, information is still lacking about species abundance, which is crucial for assessing the species' potential to survive in the area. In addition, a range of factors that exert a detrimental influence on wildlife populations are known, such as habitat loss/deforestation, hunting, and grazing competition. However, there is no detailed information about the dimensions of impact of single factors on wildlife abundance. A sound knowledge about causes that drive population decrease is essential to address threats appropriately. There is an urgent

need to determine current hunting and logging pressure and its economic role, grazing competition, disease transfer, rangeland condition and the economic impact of livestock losses due to predation.

Hunting

The increased availability of modern weapons over the last few decades and the political instability in the area have probably resulted in an increase in hunting over the last decades. Hunting has a long-standing history in Nuristan, which dates back to the pre-Islamic culture of the Kafirs (Robertson 1896, Petocz & Larsson 1977). Afghanistan has no hunting law and the current Presidential Decree on banning hunting of all wildlife, has had little impact in Nuristan, as there is virtually no enforcement of the decree. Only recently, the PRT were reported to collect weapons from local people, which supposedly has reduced overall hunting activities. However, as mentioned above, detailed information about species-specific hunting pressure and trade values and volumes is lacking, which is important to understand the extent and economic role of hunting in Nuristan.

Markhor were the most commonly hunted species in Nuristan according to community interviews and in turn, hunting by man is reportedly the principal factor in limiting markhor numbers not only in Nuristan (Roberts 1969, Petocz & Larsson 1977). Hunting in general and markhor in particular, has been closely linked to social prestige and status enhancement in Nuristan. Various authors (Robertson 1896, Petocz & Larsson 1977) reported the important symbolism of markhor horns, which are found stylized in elaborate wood carvings and indicate wealth and prowess.

Community interviews suggest that local people in general hunt opportunistically in the study site and personal consumption was reported to be the prime reason for hunting wildlife, meaning that wildlife, in particular ungulates, provide an additional meat source for local people. However, meat might not always be the prime reason to hunt wildlife. Hunting, especially of markhor is deeply rooted in the culture and tradition of Nuristani people and even if the meat is consumed after a successful hunt, the foremost reason might be rather status related. Our data does not allow for distinctions between hunting for meat, which represents an essential part of the people's diet, versus hunting as a means of adding to one's prestige, in which case consumption of meat can be regarded as a secondary reason. However, trade might be in part again be only a secondary reason. Similarly, trade in carnivore fur of especially wolves, bears and leopards, might be motivated by retaliating or preventing livestock predation. Once hunted, the furs are sold to traders, which compensates for livestock loss. However, these differentiations in reasons for hunting are important when targeting conservation measures.

Hunting for trade is responsible only for a small portion of hunted wildlife according to community interviews. This result might be different for certain species, such as the musk deer, which most likely is primarily hunted because of its valuable glands and only secondary for its meat, and the yellow-throated marten, which reportedly is hunted for its fur (Rodenburg 1977, Petocz & Larsson 1977). Trade in fur is likely to occur for other species as well in the study site. However, similar to hunting for personal consumption, it is unclear whether fur trade or retaliation of livestock loss is the prime reason for killing carnivores, such as snow and common leopard, wolf, jackal, fox, and black bear. The black bear was also hunted for its fat, which supposedly was given to livestock prior to the winter months to fatten it. However, no trade in the bear's gall bladders was reported. Other reasons for hunting included selling infant bears and monkeys as pets to traders. The basically uncontrolled border to Pakistan probably has added to the amount of wildlife being hunted for trade.

Habitat loss

Many species occurring in Nuristan owe their existence to the dense forest stands. Forest dwelling species such as the Asiatic black bear, musk deer, rhesus macaque, flying squirrels, and the yellow-throated marten depend on an intact forest ecosystem. Same as the wildlife, local people crucially depend on products provided by the forests. Wood is used for construction and fuel and a series of non-timber forest products are utilized, such as herbs, nuts, fruits, mushrooms and leaves for animal fodder. An inherent part of the former Kafir culture, the artistry in wood carving is well known outside the province borders and even outside Afghanistan. Dupree wrote (1974, p. xiv): "Probably the most significant difference in Nuristani material culture when compared to the rest of Afghanistan is

the dominant role wood plays in the lives of the people [...] With only the adze and the knife, the *bari* (former slaves of the Kafirs [...]) craftsmen dress the logs and often carve elaborate designs into the wood, particular doors, lintels, and the four pillars centered inside the house around a fireplace."

Nuristan as any other of the eastern forest provinces has experienced large-scale deforestation over the last decades even though the exact extent to date in unknown. Commercial harvest started before the Soviet occupation (Petocz & Larsson 1977). Sayer and van der Zon (1981) reported an overexploitation of forests in Kunar province in 1973 and Kullmann expressed his concerns about a worrisome and uncontrolled timber harvest in Paktya already in 1970. First attempts to halt the forest loss were made in late 1970, including programs focusing on sustained yields and reforestation (Sayer & van der Zon 1981). However, these programs met little success due to opposition from local inhabitants, who feared conflicts of interests with their own commercial forestry activities.

Lawlessness and an uncontrolled border to Pakistan fueled illegal timber trade and export to Pakistan, where the wood has been sold for higher prices compared to national markets (Saba 2001, UNEP 2003). Especially deodar cedar *Cedrus deodara*, the most valuable species within the eastern conifer forests, was cut in great quantities for export to Pakistan and Arab countries (Klimburg 2001). Clashes over Nuristan's forests were rising, as revenues generated by timber trade represented an important extra income for economic rehabilitation of losses experienced during the war for local people, many of whom were returning from refuge in Pakistan (Klimburg 2001, Katz 2007). An analysis of Landsat satellite images from 1977 and 2002 represents the latest study of forest cover change of the area (UNEP 2003). WCS has been working to update this assessment based on ground-truthed satellite images, however results are still pending.

With the assistance of UNEP a forest law was drafted "to create a framework for community management of Afghanistan's forest areas in order to provide for their conservation and sustainable use and management" (Article 1, Forest Law of the Islamic Republic of Afghanistan, Draft 4.1, May 2007), which currently is being reviewed by the Ministry of Justice (Belinda Bowling 2008, pers. comm.). Similar to a decree of the Afghan Transitional Authority, which was the governance unit prior to the elected Afghan Government, President Karzai issued a Presidential Decree on banning logging (No.405) in the year 2002. However, both decrees have stayed without relevant impact in the eastern forest provinces due to lack of enforcement, disputes over resource ownership and commander influence (UNEP 2003). Of prime importance are a better understanding of trade chains and improved transboundary cooperation with Pakistan about cross border trade in timber. Recommendations towards a sustainable, community based forest management are manifold (UNEP 2003), however, successful implementation has proved difficult in the present fragile political environment.

Grazing competition and pressure, and disease transfer

Nuristan ranges receive abundant water supply over the year and compared to rangelands in central Afghanistan, its carrying capacity exceeds the average by a factor of several times. In the year 1977, Petocz and Larsson found little signs of localized overgrazing or over-utilization of forests, which they assumed has apparently resulted from a long-term adaptation of local inhabitants to their environment. Overgrazing occurred primarily on alpine steppes and in the vicinity of dense human populations in the south of our study area. However, competition for rangeland of wildlife with domestic stock was regarded as being not intense (Petocz et al. 1977). Alpine meadows were in good condition and considered to sustain combined utilization of both markhor and domestic animals, provided domestic stock numbers were not increased.

Petocz and Larsson (1977) assumed that the total number of domestic animals was limited by the region's capacity to produce sufficient winter forage. As heavy snowfall prevents winter grazing, forage production and storage becomes necessary. However, the rugged terrain poses restrictions to land use and agricultural practice, which in turn limits livestock numbers that can be fed during the winter months.

No information about current rangeland and forest conditions and/or livestock numbers is available. However, assessments are important to determine carrying capacity of both, pastures and forests, and

to estimate the impact of livestock grazing on wild ungulate populations and forest regeneration. Some information about livestock numbers might be obtained from WCS' household surveys, which were conducted in the region during the year 2007. Results are still pending.

In particular for small isolated wildlife populations disease transfer from domestic stock can become a reason for local extinction. The risk of disease transfer is probably highest in summer months, when the domestic stock is driven to the mountain crests. In the year 1966 an epidemic - presumably Rinderpest - occurred in Chitral, Pakistan, which caused deaths among markhor and ibex, and from the same region, the transfer of the Bot Fly larvae (*Hypoderma* sp.) from domestic sheep to markhor was reported (Roberts 1969). Same as for grazing pressure and competition in Nuristan, nothing is known about disease transfer between livestock and wildlife species for this area.

Lack of education

Implementation of community based conservation measures are hampered by a lack of well-educated people available in Nuristan. Nuristan's history and its cultural background have resulted in a noticeable distrust of foreigners, whereas 'foreigners' here not only refers to other nationalities but to all people, whose origin lies outside of Nuristan. Therefore, the success of community based conservation actions is most promising if implemented and spread by local Nuristanis, who have the ability to take over leadership and responsibility of coordinating conservation work on site. In addition, the current security situation does not allow international experts to visit the site personally, thus working in the region through local residents is the only option available at present and probably for the near future.

However, qualified people with appropriate English language skills, which are necessary for receiving a proper training in environmental conservation, a basic level of computer skills and/or a background in science are rare in Nuristan. Due to the province's geographical and cultural isolation, the people's chances for higher education have been scarce throughout most of their history. Petocz and Larsson wrote in 1977 (p. 44): "...aside from two schools, one in Waygal and the other a newly built primitive structure erected in Nisheigram, there is no other education except some Koranic instruction taught to the youth by village mullahs, who are ill-equipped to deal with subjects outside religion." In addition to the limited range of subjects taught by these village mullahs, they often barely can read and write (Katz 2007). During Maulvi Afzal's dominance in Nuristan (see above), the traditional Nuristani leadership was killed or exiled, resulting in the least educated province in Afghanistan nowadays (van der Schriek 2005). Many local residents expressed limited access to education with concern on several occasions and prompted WCS to grant a request from communities to extend learning opportunities by offering English classes.

With little other prospects in Afghanistan, Pakistan has played a major role in educating the youth. During the Taliban regime many Nuristani boys were sent each year to attend one of the thousands of Islam schools in Pakistan, which provided them for years with free education, board and lodging until graduating as mullahs (Klimburg 2001). More recently trained scholars often show good levels of education and English language skills. However, in terms of performing management tasks related to conservation work, most of these returnees lack sufficient experience of life for mobilizing and engaging communities in a highly hierarchical culture.

Lack of central governance, security and political stability

After the forced conversion to Islam, the sovereignty of the central government was soon acknowledged in exchange of a privileged position among the minorities of Afghanistan. Katz (1984, p. 100) wrote: "Nuristanis exemplified the ideals of bravery, love of freedom, simplicity, and the ability to survive in a harsh and hostile environment. The physical features of many Nuristanis, which are more typical of northern European [...] also endeared them to the elite [...]". Privileges included grants for education in Kabul, especially the military. With their reputation as skilled mountain warriors, the integration of Nuristanis into the Afghan military was a major means for tying these isolated peoples into the national society. Many Nuristanis have subsequently risen to the highest military ranks. In addition, shortly after Kafiristan's conquest, Nuristani women were taken as hostage to Kabul, where they went to the Amir’s harem or members of his court as wives or consorts. Their

descendents, together with Nuristani military officers and direct links to the royal family or head of state provided effective access to highest governmental levels through mainly informal contacts (Katz 1984, Strand 1984b). Katz (1984) described the relationship of inhabitants primarily of the Waygal valley with the central government as characterized by loyalty, respect and mutual benefit.

However, before and after the Soviet occupation, Nuristan was mainly left to its own devices as long as it created no disturbance in terms of threatening regional security and did not openly challenge the government (Katz 1984). Local political organization and leadership were kept largely intact and traditions and customs have formed the law of each village. In 1977, Petocz and Larsson still referred to the province as being not fully integrated into the Afghan national society and Klimburg described the political situation in the year 2001 (before the US invasion) to be reminiscent to pre-Islam times, when the communities where entirely autonomous. The presence of governmental administrators in Nuristan was seen as nuisance, but for the most part Nuristan has been free to run its own internal affairs (Strand 1984b).

The institutional void caused by a lacking central government presence has been filled with a nexus between warlords, criminals and insurgents (Strand 2007). Together with tribal conflicts over land rights and access to natural resources, they are responsible for the poor security situation in the province (Klimburg 2001, van der Schriek 2005). Timber smuggling and illegal mining of Nuristan's mineral resources of untapped precious stones, tide up to a network of Pakistani traders, has become a lucrative business (Katz 2007). Additional risk for international development aid workers emanates from resentments of less privileged Pashtun tribes inhabiting the crowded, relatively resource-poor lowlands of Wama valley (Pesh/Pech valley) situated mainly outside Nuristan in Kunar province (Klimburg 2001).

In terms of environment conservation the current security situation limits possibilities for obtaining crucial data and implementing, monitoring and evaluating conservation measures. Even local people, who have been brought in in association with international organizations, the Afghan government or coalition forces, have been targeted by insurgents (Katz 2007). Last but not least, a lack of government presence prevents monitoring and enforcement of existing laws and decrees as is the case for the current ban on logging and hunting.

Recommendations

Recommendations for a sustained conservation of Nuristan's forest ecosystem include intensified surveys of wildlife, particularly in high elevations, which would increase chances to detect snow leopard and/or markhor presence - two species of global importance. Beyond information about species presence, it is highly desirable to answer questions about abundance of key wildlife species. However, the rugged and inaccessible terrain poses a challenge to this task, which will be difficult to meet if it is possible at all. In addition, there is a need to better understand the impact and economic role of hunting, logging and livestock loss due to predation in the region, in line with the extent of grazing pressure, livestock competition and disease transfer between domestic stock and wild ungulate species. Besides gathering baseline information about the status of wildlife and forest cover, extended environmental education is needed for building up awareness of ecosystem function among local people and for educating qualified local key personnel in order to enable them to take over management roles on site.

When communities were asked how to protect forests and wildlife efficiently, answers included in order of their frequency: the establishment of a paid ranger patrol, compensation of livestock loss due to wild carnivore predation and assignment of protected areas. The establishment of a protected area in Nuristan was already proposed by Sayer and van der Zon in the year 1981 and the province's species rich ecosystem certainly qualifies the area for being listed among potential protected area sites of Afghanistan. However, recent experiences of WCS in setting up protected areas in combination with paid ranger patrols around the Band-i Amir Lakes, Bamyan province, shows that lack of governmental authority and control in the region in combination with lack of financial means to maintain a protected area administration would impede efforts to establish a protected area in Nuristan - not to mention the unstable security situation in the province.

However, the concept of assigning no-use or limited-user areas, which ban logging, hunting, and grazing activities could still be developed on a community level even in the absence of direct government involvement, but opportunity costs of conservation - costs associated with hiring community ranger patrols and compensating restricted natural resource use – would still need to be covered.

In addition, grazing restrictions would have not only implications for the economy of local people. Livestock plays an important role in Nuristan, which goes beyond a mere livelihood source. Petocz and Larsson stated (1977, p. 49): "Any system of imposing temporary restrictions on rangeland utilization would in most cases involve a coordinated reduction in domestic stock numbers. It is assumed that such action would be viewed with contempt by local residents and could not be enforced. [...] Wealth is shown outwardly by the number of domestic animals a man owns and even the dowry payment for a wife is carried out by an exchange of domestic animals. Every effort is made to increase stock numbers." Enabling a change in economy and attitude is thus necessary for allowing local communities to reduce their livestock numbers.

It is noted that the current political situation in Afghanistan and in particular Nuristan has significant negative impacts on strategic action planning because of its instability and unpredictability. The feasibility of implementing conservation measures crucially depends on the future development of the security situation in the province and the whole country. Status assessments, monitoring and evaluation of conservation measures are hampered if experienced project staff cannot visit the site personally.

Alleviation of livestock predation

Livestock predation is reportedly one of the prime reasons for killing of wild carnivores in the study site. Communities claimed losses of sheep, goats, cows and to a lesser extent poultry due to attacks of wolves, snow and common leopards, black and brown bears, jackals, foxes and leopard cats. Further investigations of the economic impact of these losses and a root cause analysis of livestock predation are needed to tailor effective alleviation measures. Studies in other areas of the snow leopards range in Pakistan have shown that lax day time guarding of domestic stock and poorly constructed pens to house livestock during the night in combination with the fact that domestic livestock outnumbers wild ungulate prey species are among the main reasons for livestock predation (Jackson & Wangchuck 2004). Strategies used elsewhere aiming at reducing predation of livestock and hence preventing retribution killings of wild carnivores include preventive and remedial measures.

Preventive measures such as predator-proofing of night corrals have been successfully applied in villages of the Hemis National Park of the Trans-Himalaya Range in Ladakh, State of Jammu and Kashmir (Jackson & Wangchuk 2004). Jackson and Wangchuck (2004) found that predator-proofing of corrals was given the highest priority by herders for preventing livestock predation (followed by protection of natural prey and education for improving day time guarding of livestock). Besides anecdotal evidence from the Nuristan study site about leopards and bears entering pens to predate on livestock, detailed information about the frequency of livestock attacks inside corrals and their portion of overall livestock predation is lacking. In addition, there is only limited information about current pen construction and resulting options for possible improvement.

Other preventive measures as mentioned above include improvements of day-time guarding of domestic stock and the efficiency of livestock guarding dogs (Rigg 2001, Treves & Karanth 2003). Kaczensky (1996 in Rigg 2001) found that differences in guarding techniques appeared to have the greatest effect on predation levels in Europe, including the use of livestock guarding dogs. Dogs reportedly play a certain role in protecting domestic sheep and goats against carnivores in Nuristan but detailed information about the extent and efficiency of their use is missing.

Increased natural prey populations may result in increased snow leopard populations and hence increased livestock predation (Shackleton 2001, Hussain 2003). Thus, wild ungulate conservation measures aiming at raising population numbers need to be combined with improved livestock protection measures.

Remedial measures include simple livestock loss compensation and more complicated livestock insurance schemes, which apparently have been successfully implemented elsewhere (Hussain 2000, Mishra et al. 2003, Millar 2008). Only recently the World Wildlife Fund initiated a livestock insurance scheme for part of the Kalasha Kafir community in southern Chitral, Pakistan, on the very border to Nuristan province (Aziz Ali 2008, pers. comm.). Often compensation funds are closely linked to revenues generated by ecotourism business, which is based on a healthy environment and thus provides additional incentives for resident people to protect wildlife. As the establishment of any kind of tourism most probably won't be feasibly in Nuristan in the near future because of the current security situation (see below), functional livestock insurance schemes need to be adapted appropriately and linked to other incentives. The often-claimed role of tourism in terms of securing compensation funds and providing incentives to protect wildlife could be substituted for support and investments from the international donor community and non-governmental organizations.

In addition, compensation schemes can become part of conservation agreements (see below) between communities and funding agencies, in which each party commits to specific actions - e.g. compensating livestock loss versus a complete ban on hunting of snow leopards and their prey. In any attempt, an intense study of livestock loss numbers plus a long-term involvement and commitment of experienced personnel are mandatory for developing successful livestock insurance schemes.

In general, a greater financial security of village people arising out of alternative income sources can contribute to mediating people's attitude towards wild carnivores (Bagchi & Mishra 2006). Options focusing on enhancing the villager's capacity for income generation as one means of offsetting unavoidable predation and associated economic losses are discussed in the following section.

Diversification of income sources

For successfully engaging resident people in community-based conservation, appropriate economic incentives need to be provided (Ferraro 2001, Hussain 2003, Mishra et al. 2003, Bagchi & Mishra 2006). An understanding of the socioeconomic context of conservation measures is crucial if the use of livelihood sources is affected by those measures. Monetary returns gained through incentive programs may safeguard subsistence without involving overuse of limited natural resources (Mishra et al. 2003). Thus, the assignment of a no-use or restricted-use area in Nuristan requires calculations of economic losses incurred through grazing restrictions and hunting and logging prohibitions plus the development of an appropriate compensation scheme. Costs arising from restricted natural resource use may be covered either by providing alternative income sources linked to development interventions, by direct payments or a combination of both (Ferraro 2001, Mishra et al. 2003).

It goes without saying that implementing any form of tourism in Nuristan will depend on political stability and security in the region. However, the natural beauty of the area in combination with possible good populations of markhor has led to discussions about implementing trophy hunting and/or cultural tourism since the early 1970s (Petocz 1972, Petocz et al. 1977, Petocz & Larsson 1977). Hunting activities in Nuristan by non-Nuristanis go back more than four decades and included members of Afghanistan's former royalty. As the king's interest declined, the Afghan Tourist Organization was permitted to organize markhor hunts for foreigners in the area starting in the mid 1960s (Ahlemann 1970, Nauroz & Naumann 1975, Petocz & Larsson 1977), similarly to hunting tourism conducted between the years 1968-79 in the Big Pamir Wildlife Reserve targeting Marco Polo sheep (Petocz 1978).

In the Pamirs temporal grazing restrictions were compensated by economic advantages deriving from salaries for porters, guides and cooks, free medical facilities during hunting programs, and distribution of clothing and school materials. The acceptance of local residents was described as being good in general, however, Petocz (1978) stated that the program led to overgrazing in other parts of the region. When Petocz and Larsson (1977) assessed the potential of central Nuristan for conducting trophy hunting programs, locals were willing to support a tourism program as they understood it would involve jobs and hence an opportunity to better their livelihood. Currently, reliable information about markhor abundance in Nuristan is lacking and it is questionable whether the population can support additional hunting pressure from tourists.

In neighboring Pakistan various community-based trophy hunting programs have been established aiming at generating economic incentives for local people to protect markhor and other wild ungulates (Society for Torghar Environmental Protection, northwest Balochistan, since 1986; initiatives in the Northern Areas and Chitral led by WWF, since 1989, and IUCN, since 1995; Shackleton 2001). However, if only tailored to preserve single ungulate species, rather than entire ecosystems, incentives gained through trophy hunting programs bear the risk of worsening human-carnivore conflicts, as a recent case has shown from Baltistan, Pakistan. In addition to predating on domestic stock the snow leopard has been held responsible for predating on valuable trophy sized ungulates, a fact that has enhanced the resident's motivation to kill the cat (Hussain 2003). In an attempt to conserve wild ungulates, such as the endangered markhor, local people's engagement in community-based trophy hunting programs thus has resulted in possible negative impacts for snow leopards. IUCN therefore advises against hunting for purely economic reasons (SSC Caprinae Specialist Group 2000) and it is regarded crucial to link tourism programs to conservation actions and to educate local people about the ecological role and importance of large predators.

Other possible ways than tourism for generating alternative income sources include intensifying production of agricultural land as a means of direct improvements of household food security and livelihood. Options for applying agro ecological technologies and principles could be investigated, such as crop rotation, poly-culture, agro forestry systems, cover crops, and animal integration (Altieri & Nicholls 2000), which have proven successful in regions of Latin America and beyond (Altieri et al. 2000). In addition, Kullmann (1970) reported that beekeeping (*Apis cerana*) has a long history in Nuristan, however, honey production was limited by an antiquated technology. Since Beekeeping can be practiced in a home compound it was regarded by the Taliban as an acceptable activity as well for women and the Food and Agriculture Organization had started apiculture projects already during the Taliban regime (Bradbear 2003). By training of advanced technologies, gains can be enhanced and in addition to harvesting honey, production of secondary products, such as skin ointments, can be promoted.

Providing access to markets and opening up trade chains can contribute to the profitability of handicraft production. Nuristan's ancient and unique tradition in woodcarving has the potential of producing high quality goods sought after not only on national markets. At present, there is only little left of the Kafir material culture, as a massive sale and disposal of objects has taken place as a means of emptying houses of Kafir relics (Klimburg 2004). Wood carving skills and the knowledge about the meaning of used symbols are becoming increasingly rare among Nuristanis. Possible reluctance of local residents in getting involved in ancient Kafir-related woodcarving might hamper attempts to revive this particular handicraft. However, many *bari* craftsmen, the former Nuristan caste responsible for wood carving work, currently face high rates of unemployment due to competition from outsiders (Klimburg 2004) and they might well welcome alternative income opportunities. The Turquoise Mountain Foundation, a non-profit, non-governmental organization, fosters and promotes successful education in traditional arts and architecture, including the traditional technique of shallow relief carving, for which Nuristan is renowned (Babs Alink 2008, pers. comm.). Value added wood processing is of particular importance to Nuristan as it reduces indirect economic losses resulting from selling timber in raw form.

The use of renewable energy sources as well as introducing fuel-efficient stoves may reduce the pressure on forest resources (Ebrahimian 2003), as currently primarily firewood is used for heating and cooking (UNEP 2003). Without any help from outside local people in central Nuristan have already constructed small hydroelectric power stations, which provide electricity for lighting houses and for operating community-owned threshers (Klimburg 2007, Katz 2007). These initiatives should be supported and options to spread them across the region should be explored.

Besides engaging local people in development interventions for generating alternative income sources and hence reduce dependence on limited natural resources, direct payments in exchange for effective conservation measures provide immediate and direct benefits to communities (Ferraro 2001). Stepping into a sort of conservation agreements with households or villages, followed by possible 'sales' of these agreements to potential funders (Anonymous 2007) allows for quick and probably effective conservation actions. A combination of both, direct payments and development interventions, may reduce dependence on conservation funds, as once development measures have proven successful they can replace direct payments.

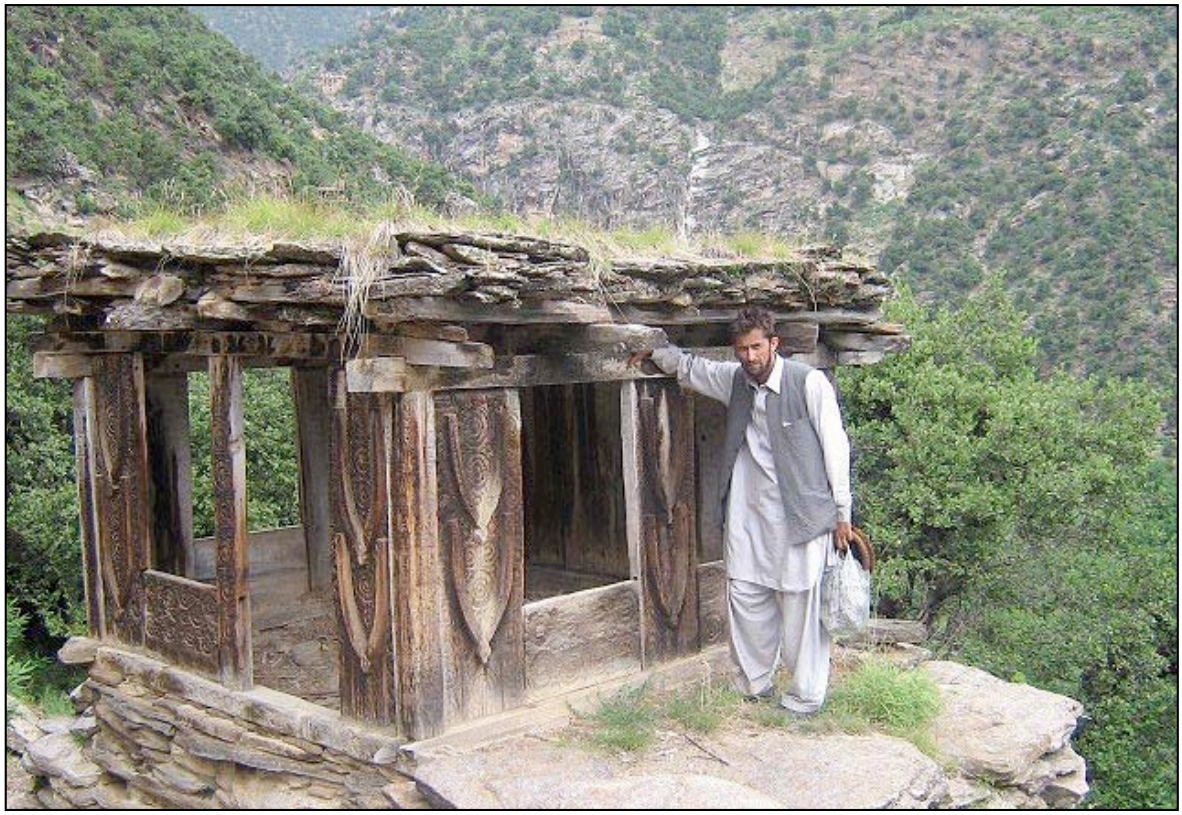


Photo 12: Wood carvings have an old tradition in Nuristan.
Stylized markhor horns were a basic design employed to signify wealth and prowess of hunters.

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Annex 1: Grid cells coverage during large mammal surveys, Nuristan, February - May 2007.

No.	Grid Cell No.	No. Surveys per Grid Cell	Total km Surveyed	% km Surveyed
1	229	1	4	1.1%
2	231	3	13	3.5%
3	251	1	4	1.2%
4	252	3	9	2.4%
5	253	3	15	4.0%
6	254	1	7	1.9%
7	273	1	4	1.1%
8	274	5	18	4.9%
9	275	3	11.8	3.2%
10	276	5	20.4	5.5%
11	277	3	12.8	3.5%
12	295	5	18.4	5.0%
13	296	5	25.2	6.8%
14	297	5	21	5.7%
15	298	6	19.8	53%
16	299	4	15.8	4.3%
17	316	2	8.2	2.2%
18	317	6	22.2	6.0%
19	318	5	19.2	5.2%
20	319	4	20.2	5.5%
21	320	5	21.8	5.9%
22	339	2	10.6	2.9%
23	340	2	11.2	3.0%
24	341	4	18.4	5.0%
25	342	4	19	5.1%
	Total	**88**	**370.4**	**100%**

Annex 2: Overview of scat collection in Nuristan, Imam Sahib, Kunduz province and Aye Khanum, Takhar province, December 2006 - December 2007.

Location	Date	No. Teams	No. Samples Processed	Sent to AMNH	Status
Nuristan study site	19th - 28th Dec '06	3	11	Apr '07	5 successful identifications
Nuristan study site	8th - 20th Jan '07	3	1	Apr '07	0 successful identifications
Nuristan study site	*Information missing*	-	13	Apr '07	7 successful identifications
Nuristan study site	17th - 26th Feb '07	3	26	Sep '07	Still in process
Nuristan study site	10th - 19th Apr '07	3	24	Sep '07	Still in process
Nuristan study site	10th - 30th May '07	3	7	Sep '07	Still in process
Nuristan study site	*Information missing*	-	4	Sep '07	Still in process
Nuristan study site	4th - 25th Aug '07	1	19	26th Dec '07	Still in process
Nuristan study site	4th - 26th Aug '07	1	34	26th Dec '07	Still in process
Nuristan study site	1st Nov - 12th Dec '07	1	22	Jun '08	Still in process
Nuristan study site	1st Nov - 15th Dec '07	1	40	Jun '08	Still in process
Imam Sahib	5th Dec '07	1	6	Jun '08	Still in process
Aye Khanum	8th Dec '07	1	1	Jun '08	Still in process
Total			**208**		

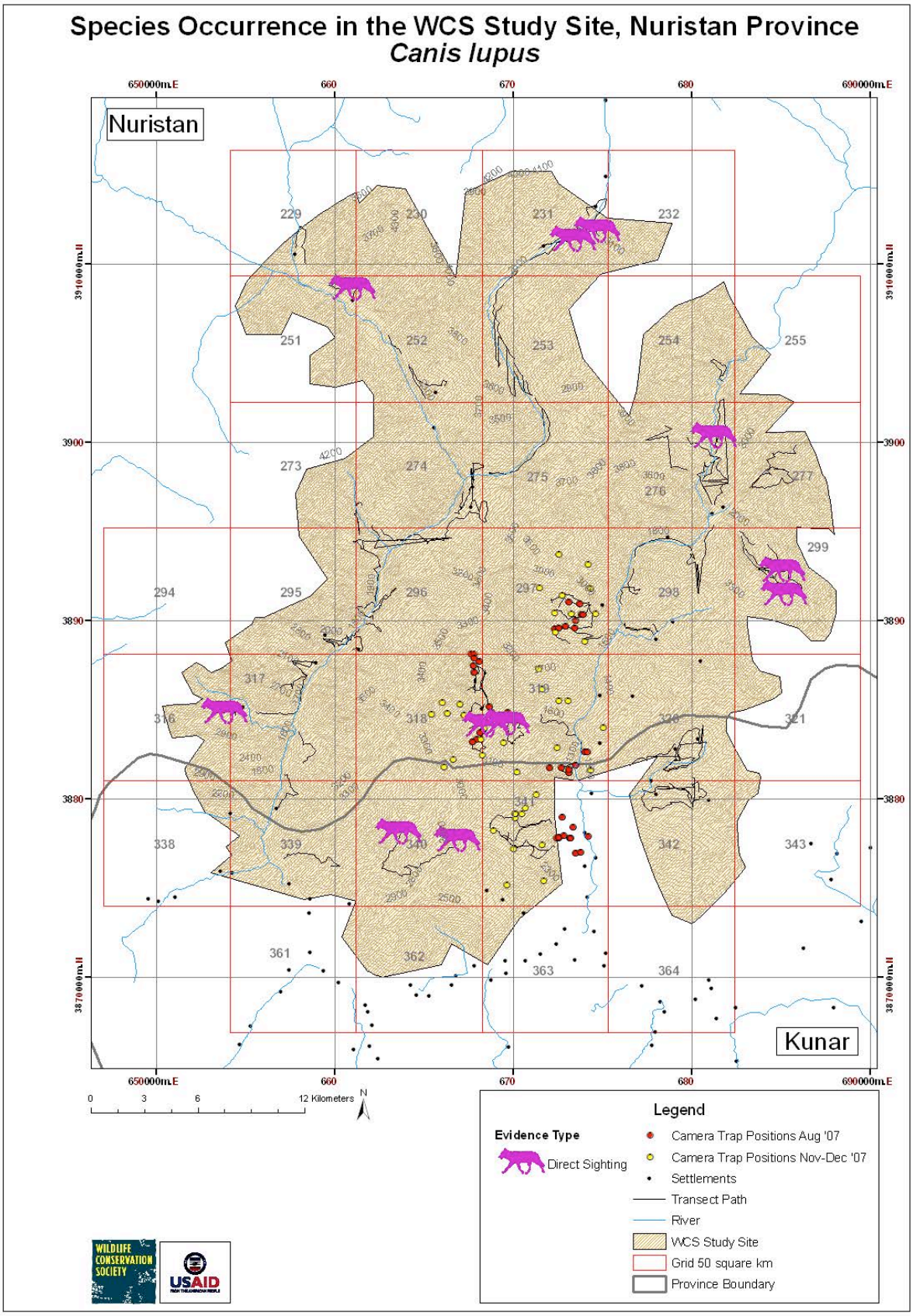
Annex 3: Overview of small rodent collection in Nuristan and other provinces of Afghanistan, July - December 2007.

Location	Date	Average Elevation in m asl.	Habitat	Transect Length in m	No. Samples Collected	Sent to Smithsonian Institution
Dasht-e Nawar	31st Jul - 10th Aug '07	3,141	Dasht-e-Nawar w etland	-	8	Fall 2007
Kabul	16th - 17th Aug '07	1,799	Kabul city, indoors	-	3	Fall 2007
Wakhan	10th - 23rd Aug '07	3,609	Grassland	-	2	Fall 2007
Nuristan study site	Aug '07	2,467	Oak and deciduous forest	-	13	Fall 2007
Nuristan study site	4th - 25th Aug '07	1,614	Oak forest	-	10	Fall 2007
Band-i Amir	11th - 17th Sep '07	2,991	Rocky hill side	540	25	Fall 2007
Band-i Amir	12th - 17 Sep '07	3,090	*Information missing*	560	0	Fall 2007
Band-i Amir	17th - 24 Sep '07	3,271	Rocky hill side	540	22	Fall 2007
Band-i Amir	18th - 24th Sep '07	3,532	Sandy top of mountain	560	2	Fall 2007
Nuristan study site	1st - 9th Nov '07	2,040	Oak forest	380	13	Still in Kabul
Nuristan study site	12th - 21st Nov '07	2,233	Oak forest	380	6	Still in Kabul
Nuristan study site	21st - 29th Nov '07	2,424	Oak and coniferous forest	380	5	Still in Kabul
Nuristan study site	3rd - 10th Dec '07	2,195	Oak forest	360	10	Still in Kabul
Nuristan study site	1st - 8th Nov '07	2,923	Mountain top, small plant communities	380	7	Still in Kabul
Nuristan study site	11th - 18th Nov '07	2,617	Rocky mountain top	380	2	Still in Kabul
Nuristan study site	24th Nov - 2nd Dec '07	2,544	Oak and coniferous forest	380	12	Still in Kabul
Total					**140**	

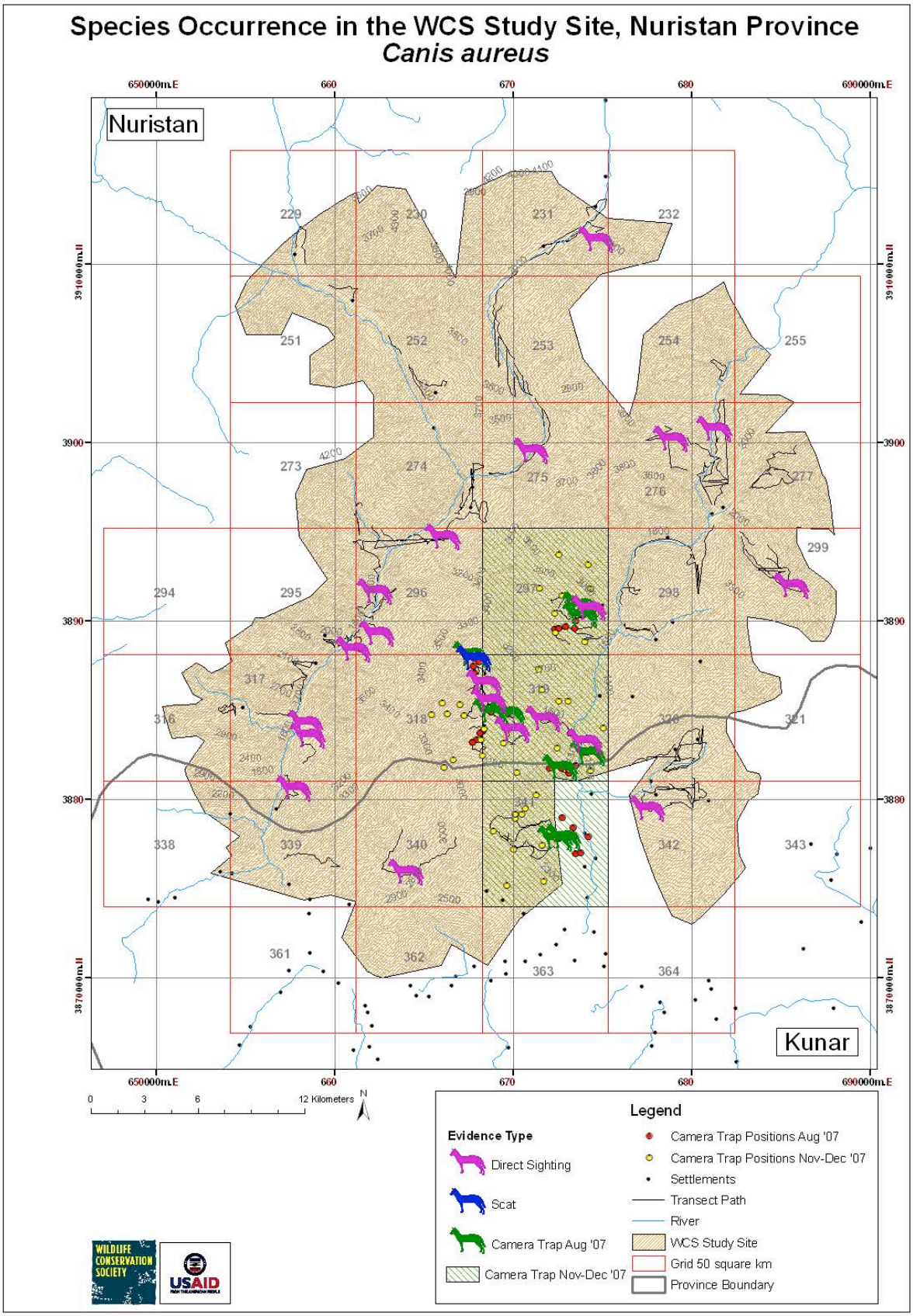
Annex 4: Grid cells coverage by communtiy interviews, Nuristan, December 2006 - May 2007.

No.	Grid Cell No.	No. Interviews per Grid Cell	Percentage
1	229	1	1%
2	231	5	4%
3	251	4	3%
4	252	4	3%
5	253	3	2%
6	254	2	1%
7	273	2	1%
8	274	5	4%
9	275	2	1%
10	276	16	12%
11	277	2	1%
12	295	4	3%
13	296	3	2%
14	297	6	4%
15	298	12	9%
16	299	3	2%
17	316	2	1%
18	317	21	15%
19	318	6	4%
20	319	4	3%
21	320	6	4%
22	339	5	4%
23	340	4	3%
24	341	4	3%
25	342	6	4%
	Information missing	6	3%
	Total	**138**	

Annex 5: Species occurrence, Nuristan, December 2006 - May 2007.

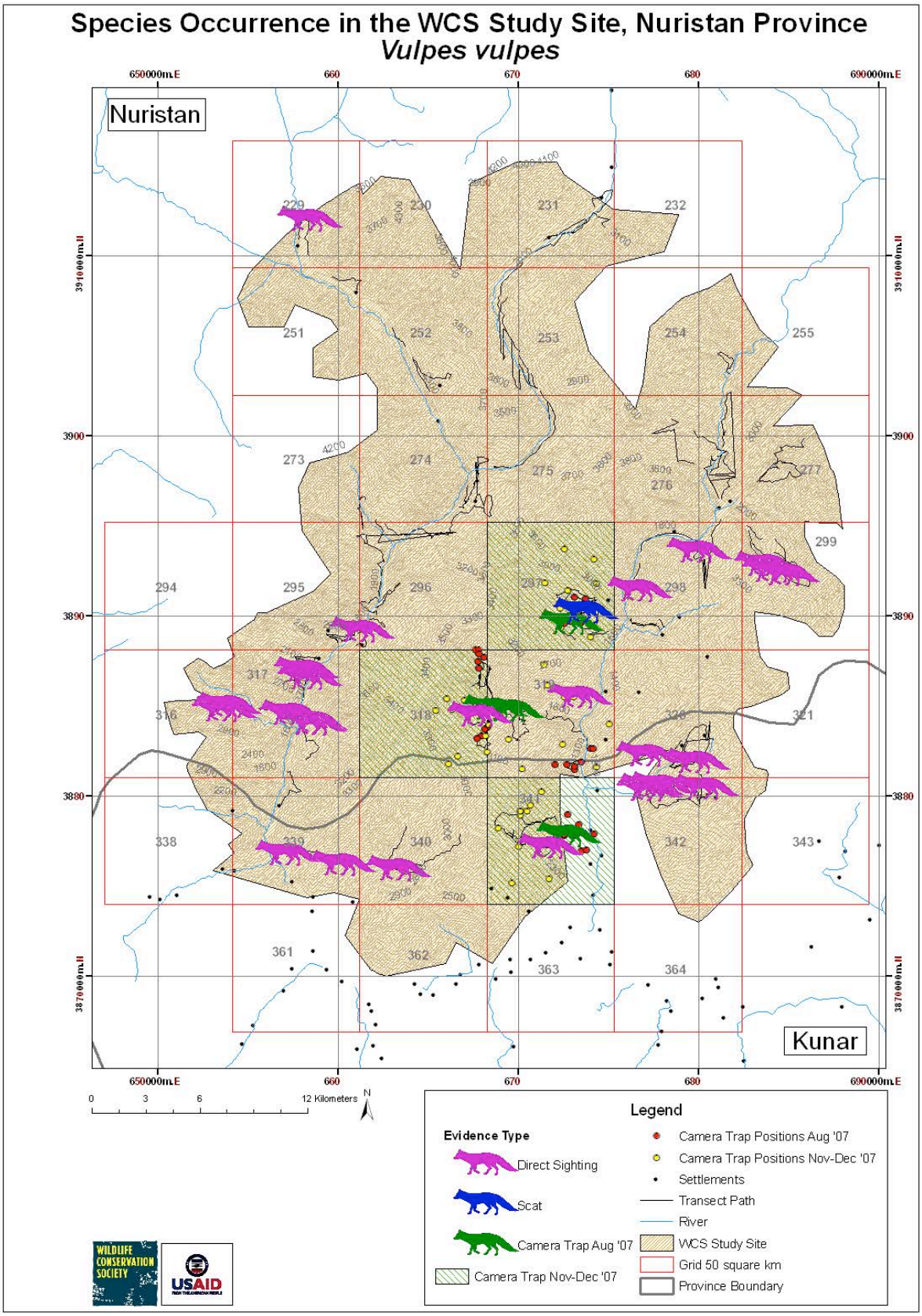


Map 3: Species occurrence of *Canis lupus*, Nuristan, December 2006 - May 2007.



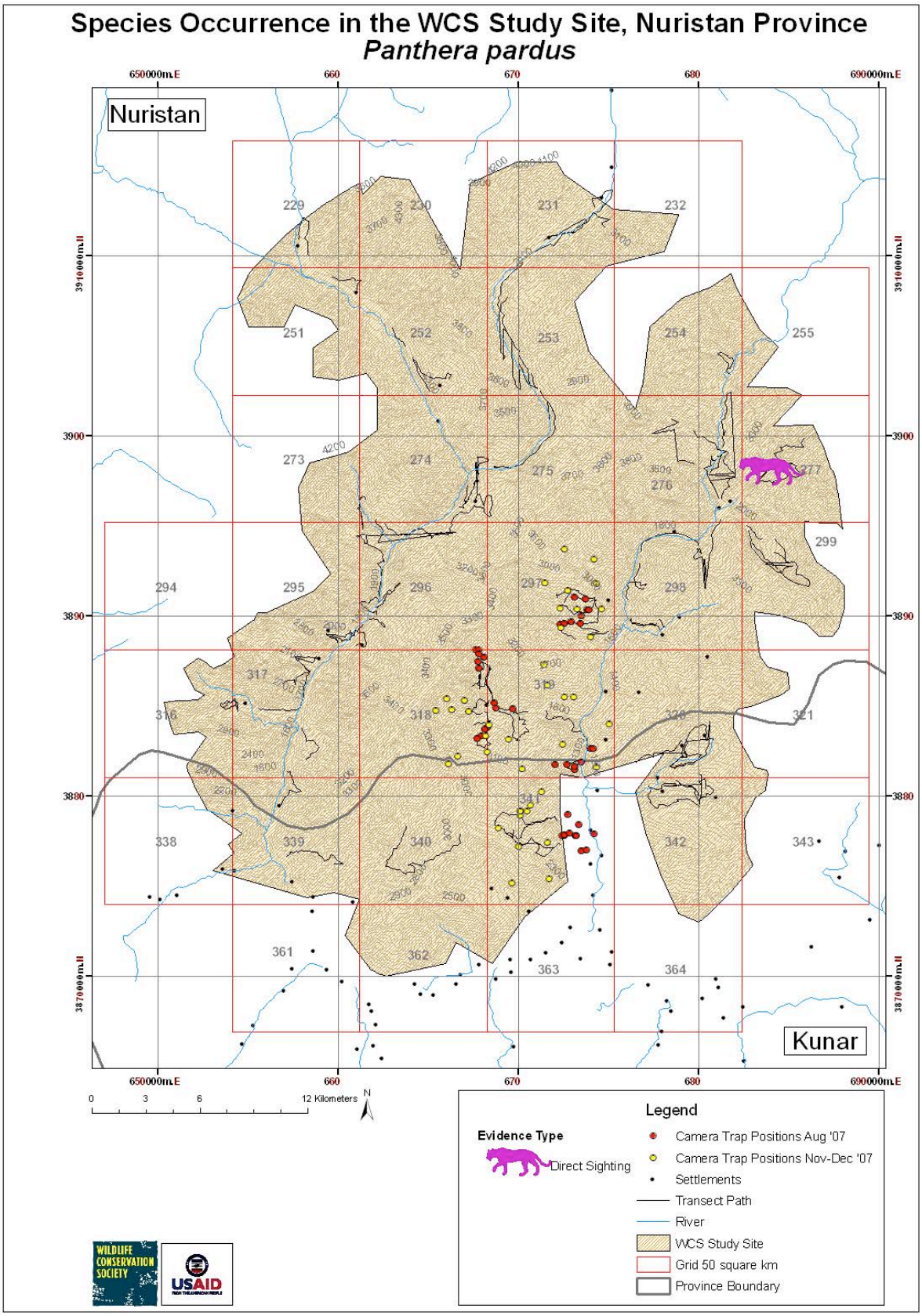
Map 4: Species occurrence of *Canis aureus*, Nuristan, December 2006 - May 2007.

As we lost information about the exact position of photographs from the second camera trap survey (Nov/Dec '07) the only information we still have is the grid cell no. Grid cells, in which respective species were photographed during this survey, are shaded green.

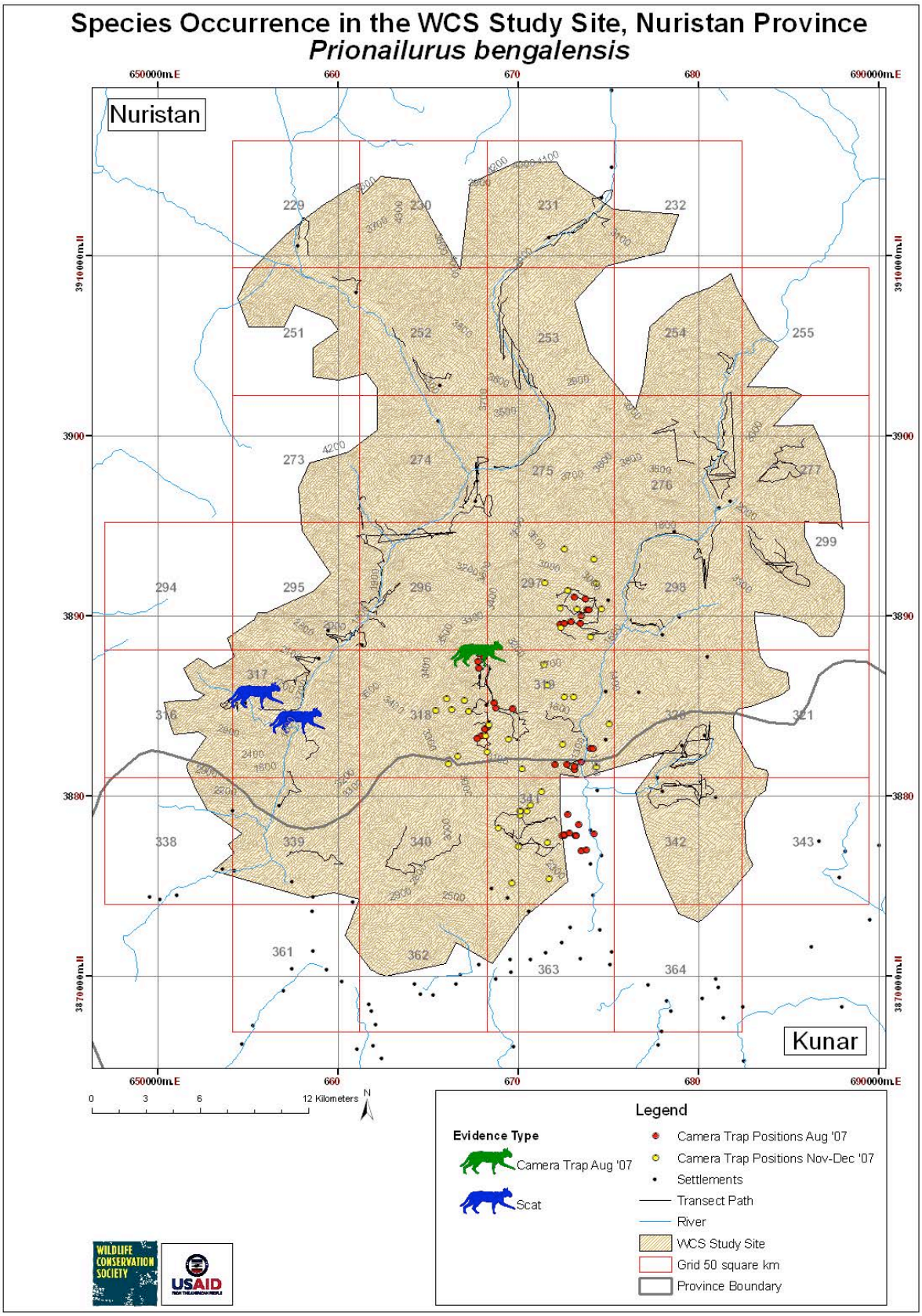


Map 5: Species occurrence of *Vulpes vulpes*, Nuristan, December 2006 - May 2007.

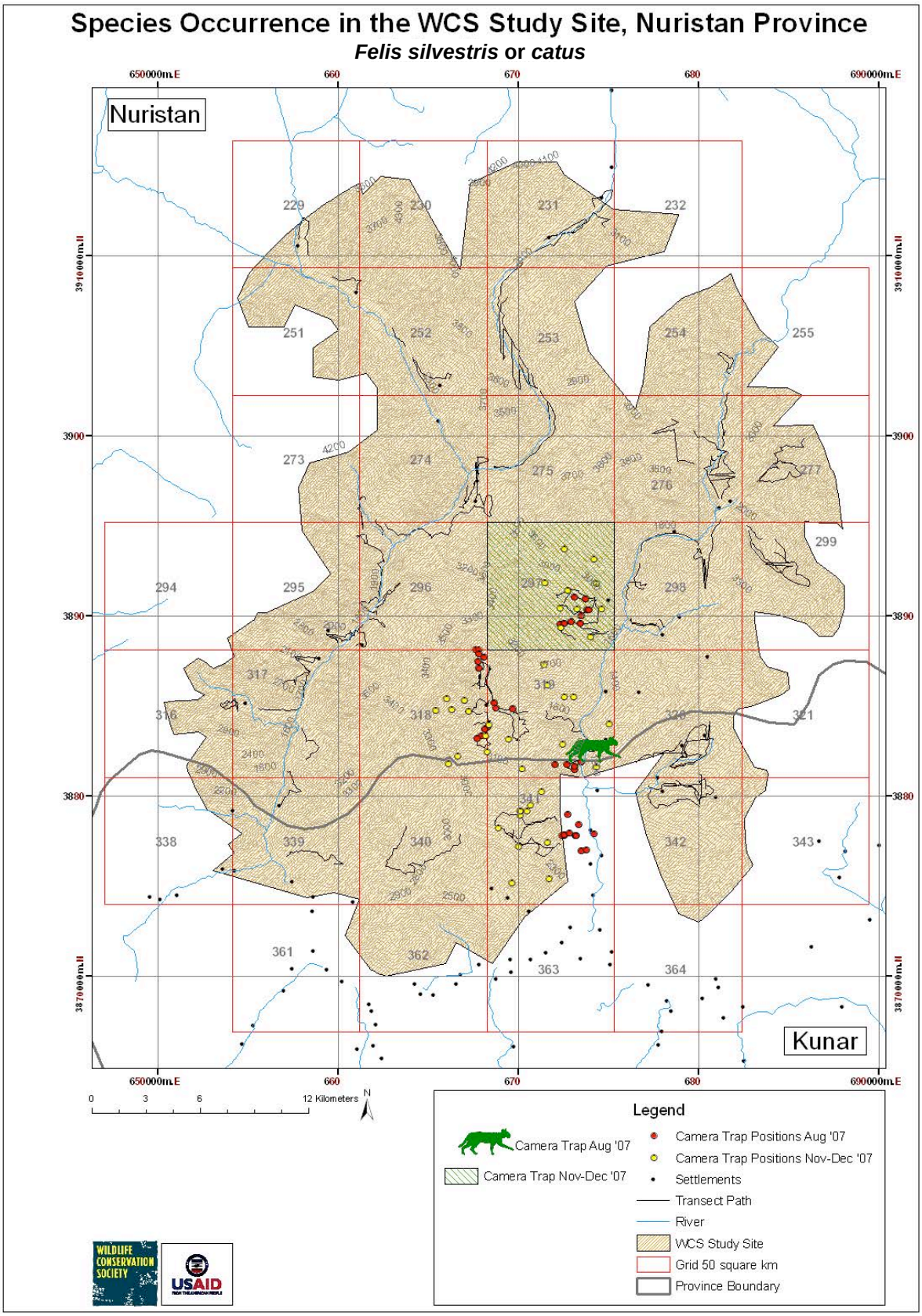
As we lost information about the exact position of photographs from the second camera trap survey (Nov/Dec '07) the only information we still have is the grid cell no. Grid cells, in which respective species were photographed during this survey, are shaded green.



Map 6: Species occurrence of *Panthera pardus*, Nuristan, December 2006 - May 2007.

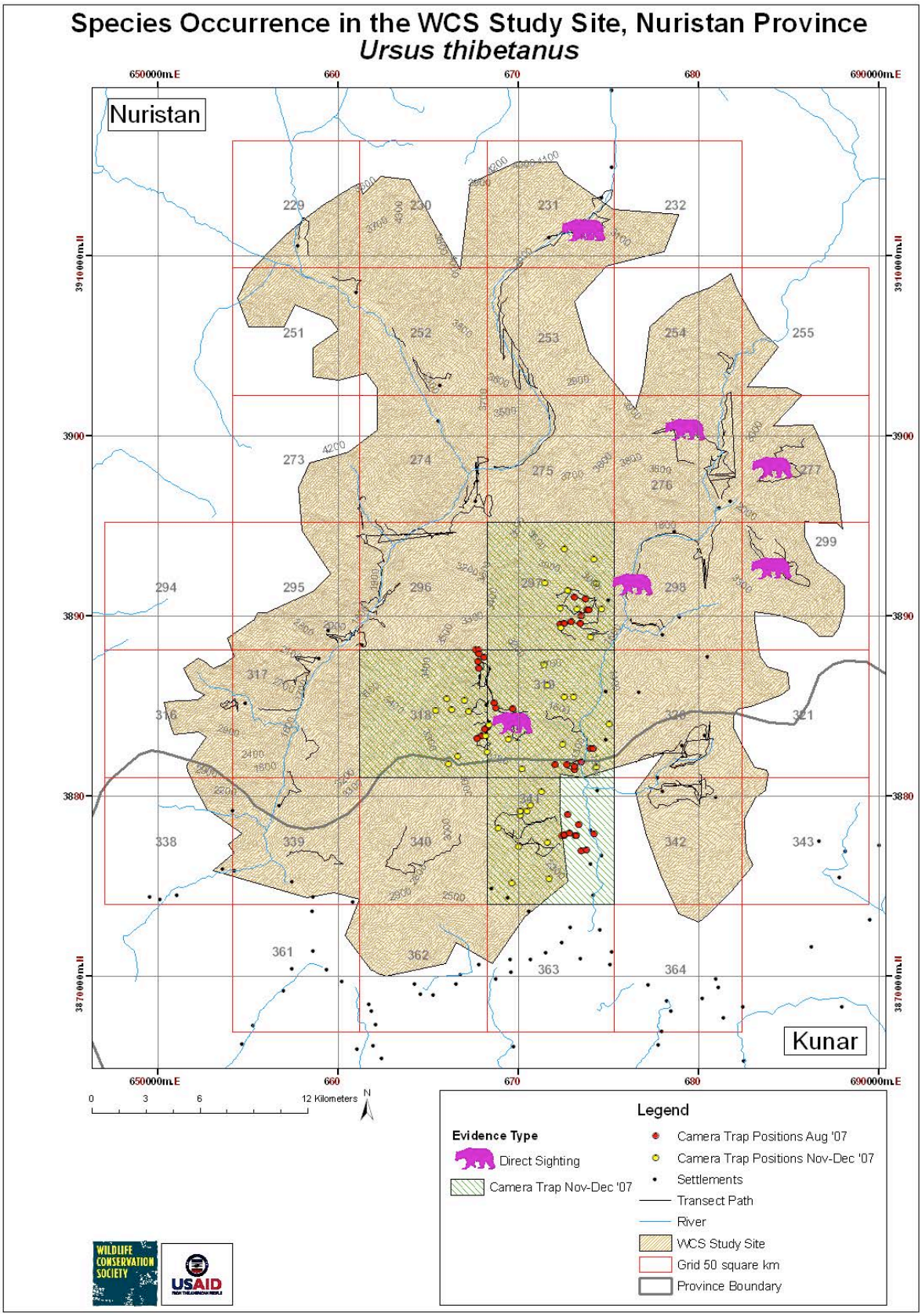


Map 7: Species occurrence of *Prionailurus bengalensis*, Nuristan, December 2006 - May 2007.



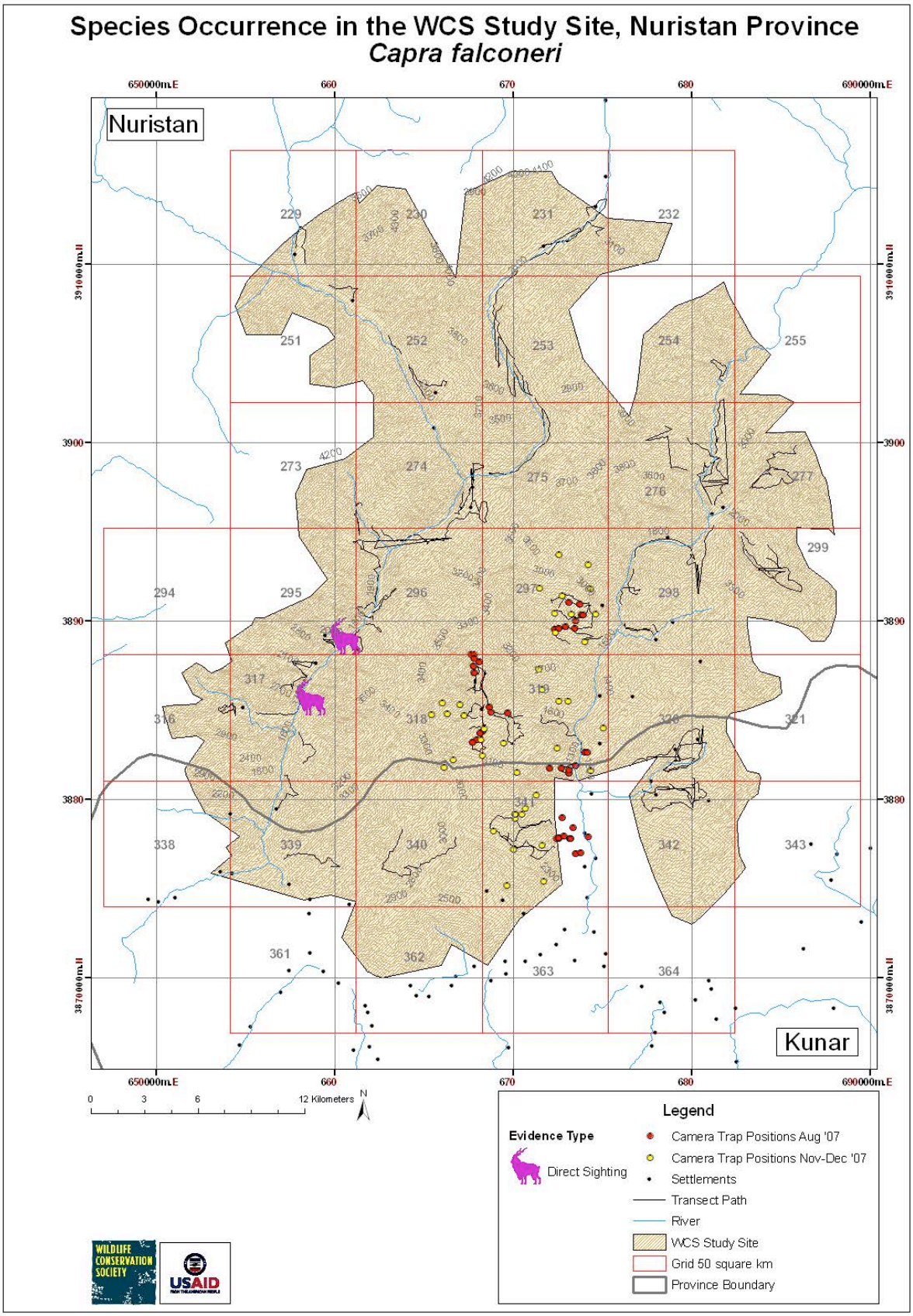
Map 8: Species occurrence of *Felis silvestris* or *F. catus*, Nuristan, December 2006 - May 2007.

As we lost information about the exact position of photographs from the second camera trap survey (Nov/Dec '07) the only information we still have is the grid cell no. Grid cells, in which respective species were photographed during this survey, are shaded green.

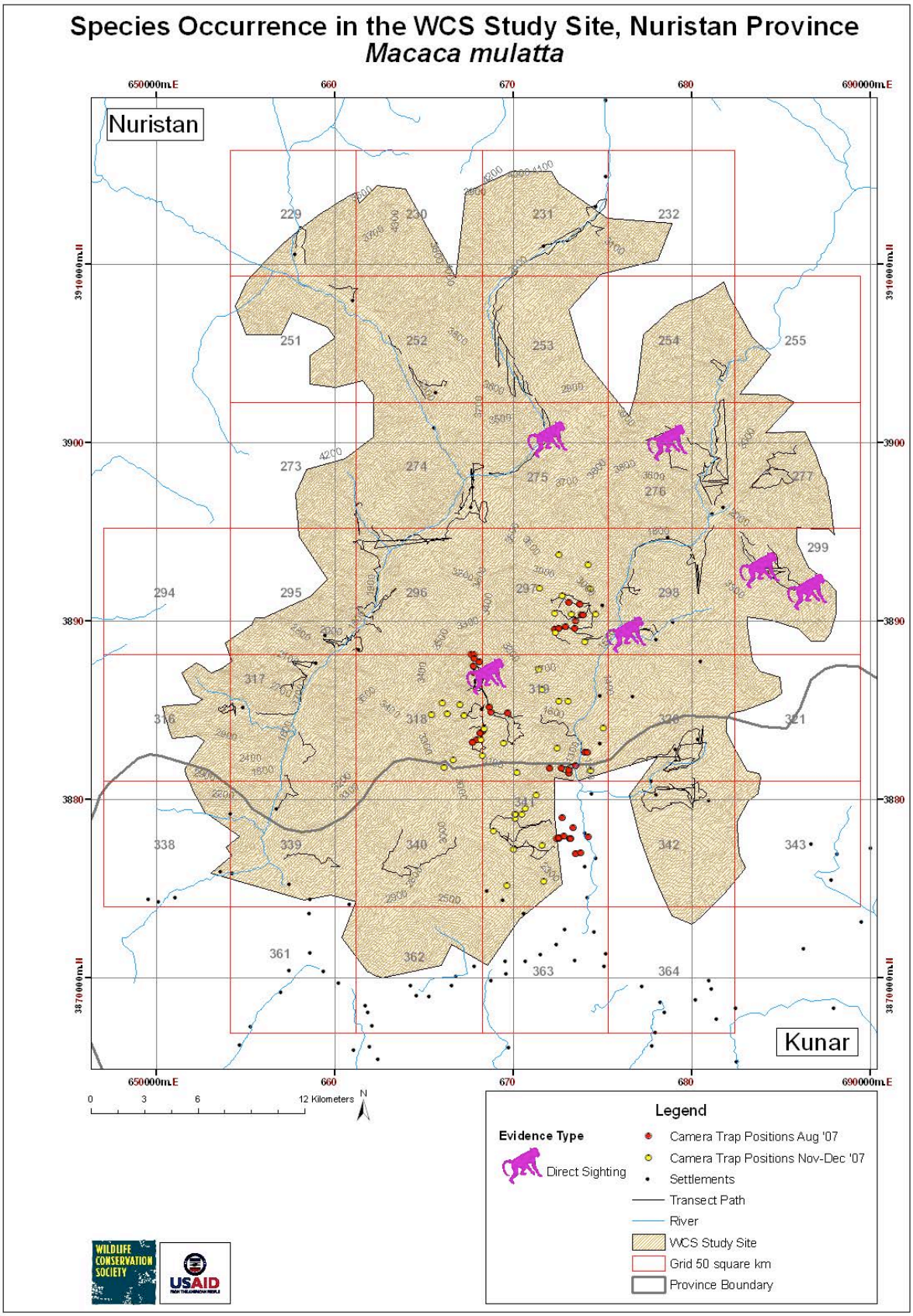


Map 9: Species occurrence of *Ursus thibetanus*, Nuristan, December 2006 - May 2007.

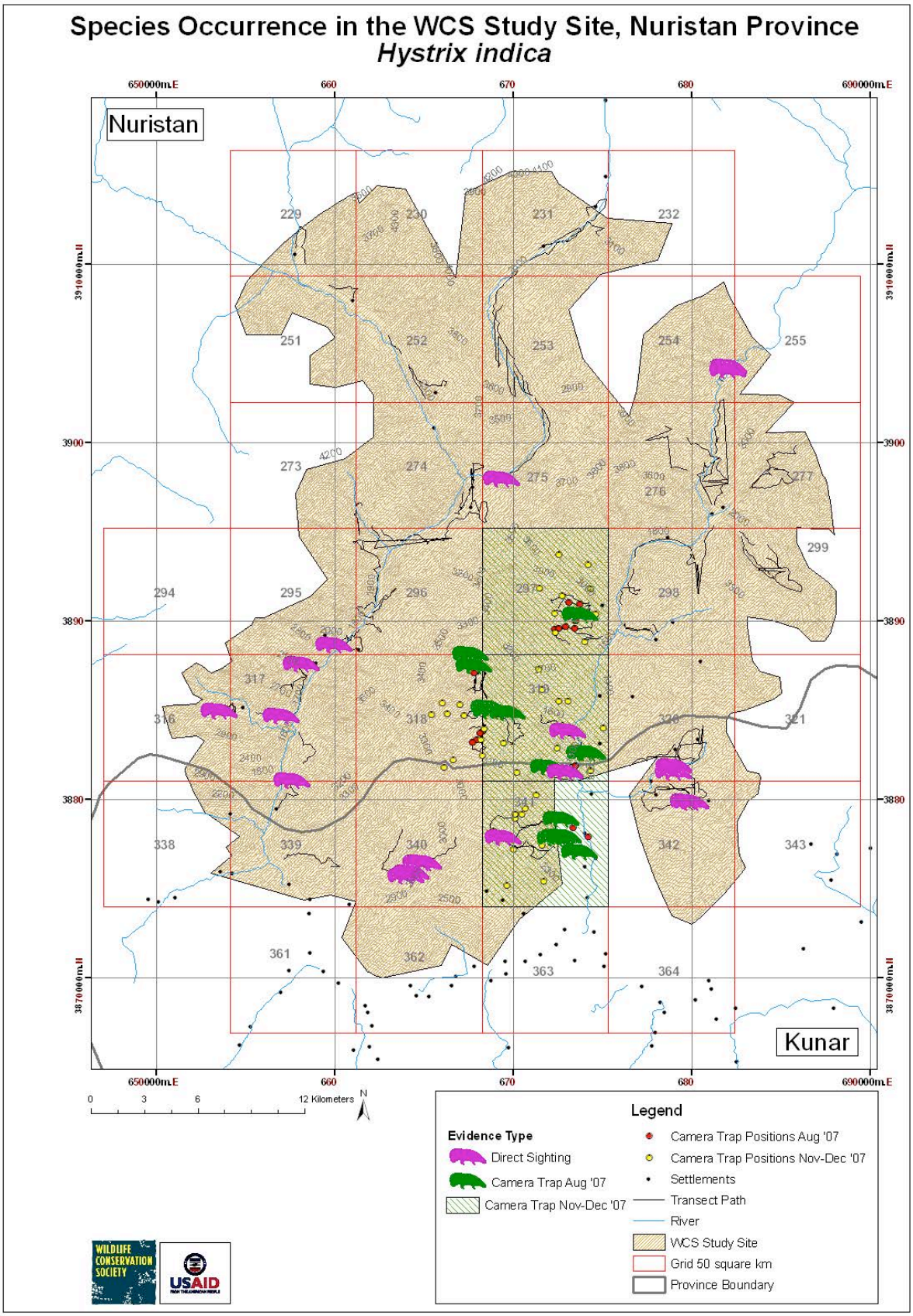
As we lost information about the exact position of photographs from the second camera trap survey (Nov/Dec '07) the only information we still have is the grid cell no. Grid cells, in which respective species were photographed during this survey, are shaded green.



Map 10: Species occurrence of *Capra falconeri*, Nuristan, December 2006 - May 2007.

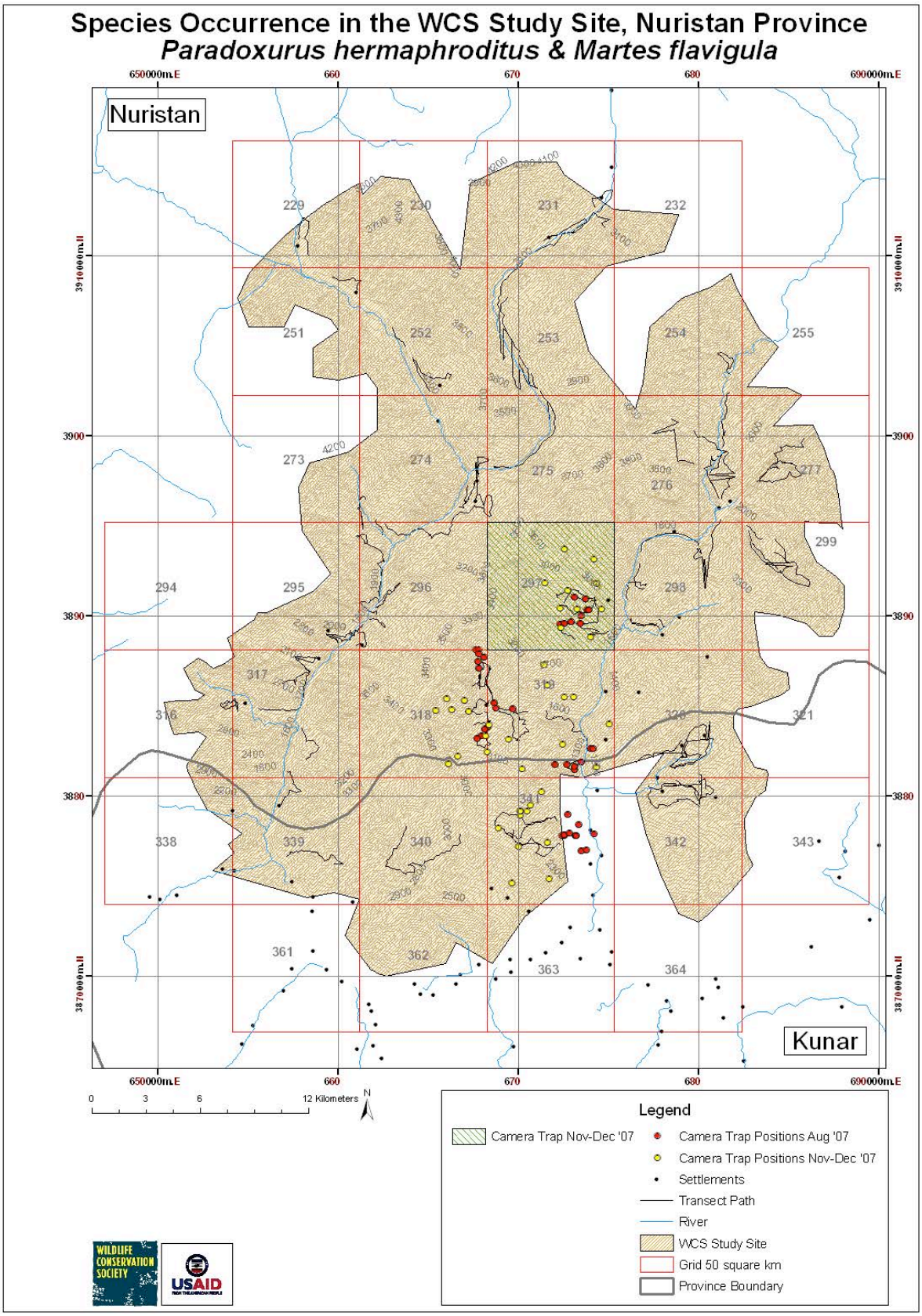


Map 11: Species occurrence of *Macaca mulatta*, Nuristan, December 2006 - May 2007.



Map 12: Species occurrence of *Hystrix indica*, Nuristan, December 2006 - May 2007.

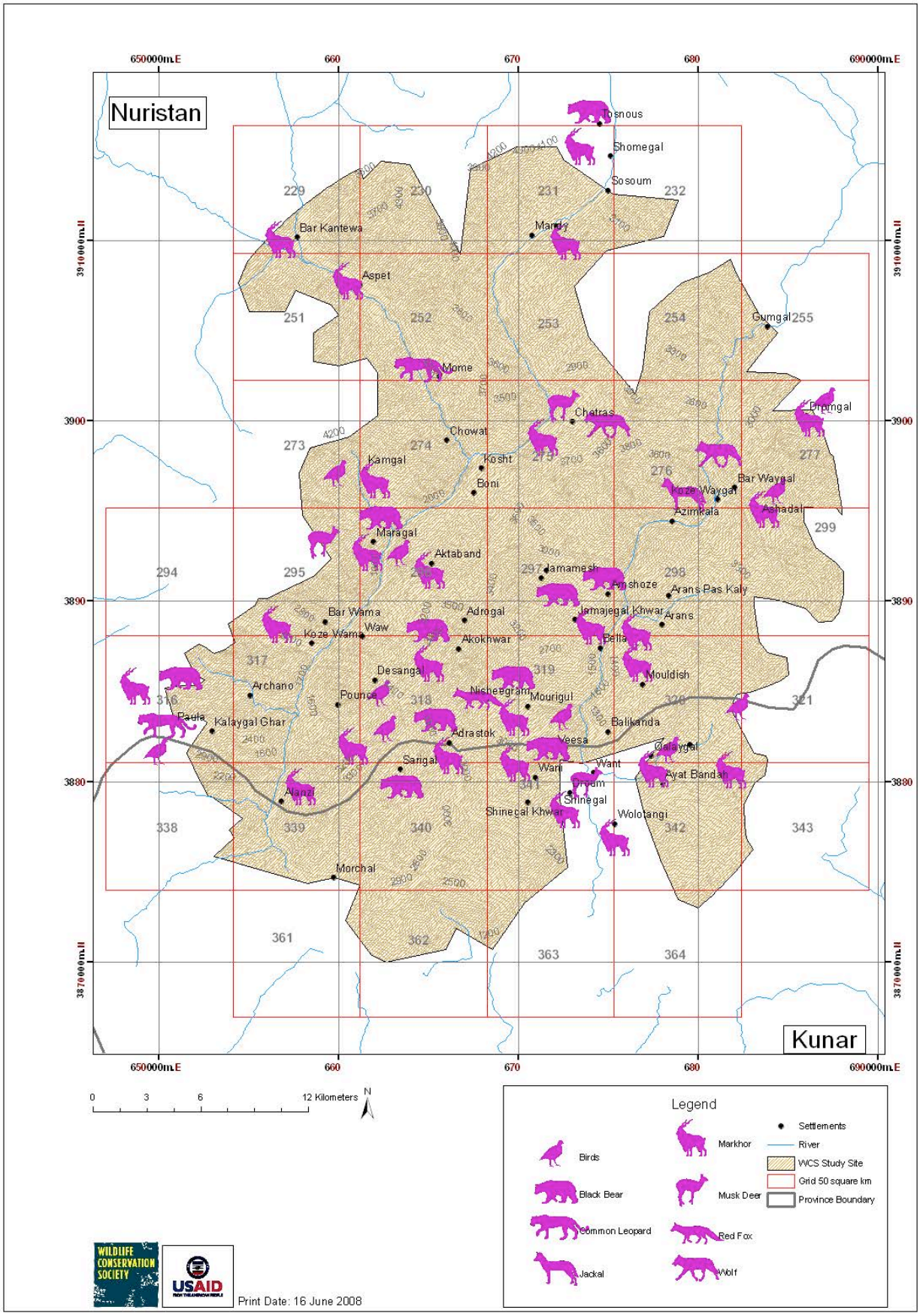
As we lost information about the exact position of photographs from the second camera trap survey (Nov/Dec '07) the only information we still have is the grid cell no. Grid cells, in which respective species were photographed during this survey, are shaded green.



Map 13: Species occurrence of *Paradoxurus hermaphroditus* and *Martes flavigula*, Nuristan, December 2006 - May 2007.

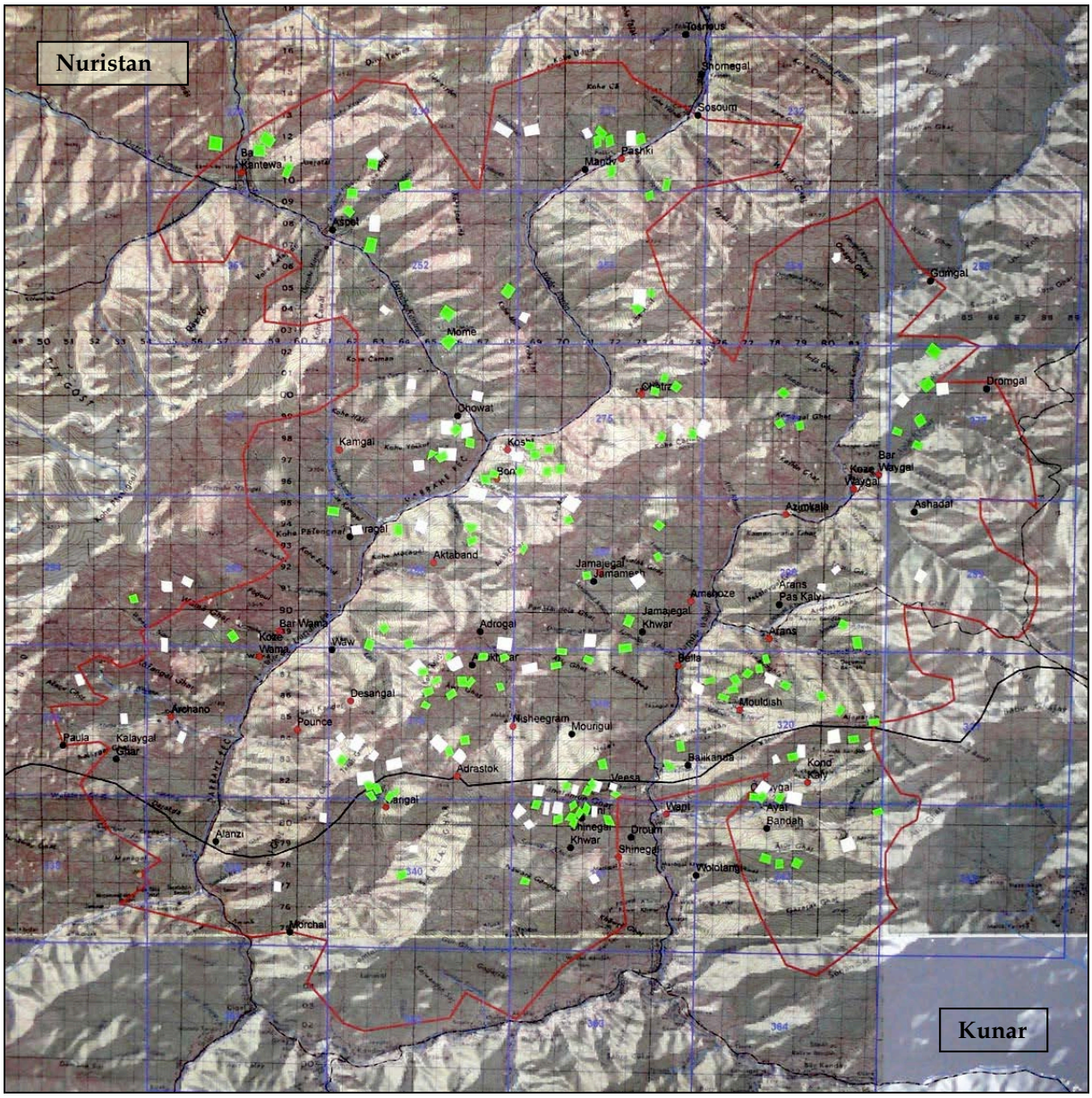
As we lost information about the exact position of photographs from the second camera trap survey (Nov/Dec '07) the only information we still have is the grid cell no. Grid cells, in which respective species were photographed during this survey, are shaded green.

Annex 6: Hunting grounds, Nuristan, December 2006 - May 2007.



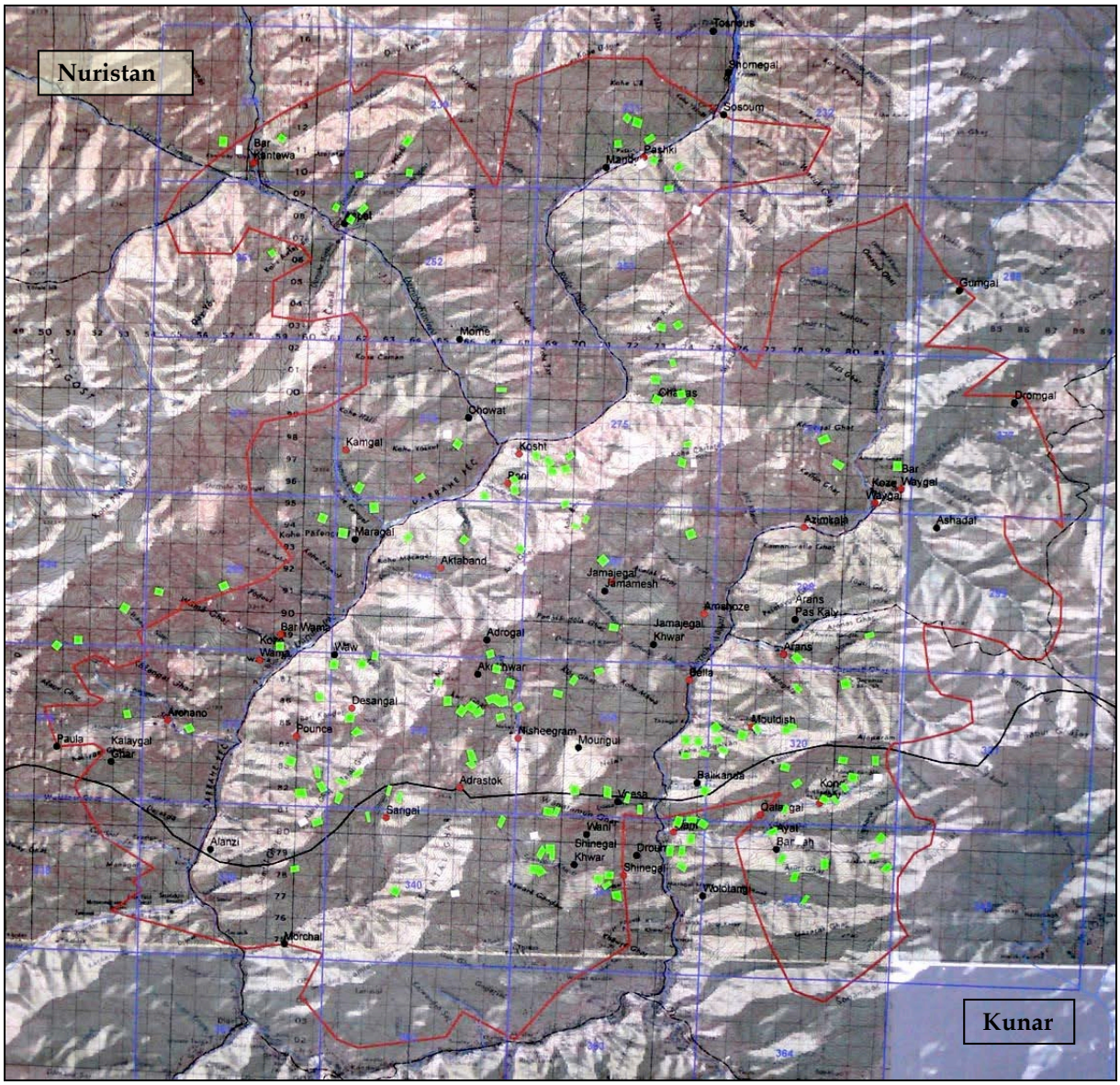
Map 14: Hunting grounds, Nuristan, December 2006 - May 2007.

Annex 7: Community wildlife mapping results, April/May 2008.



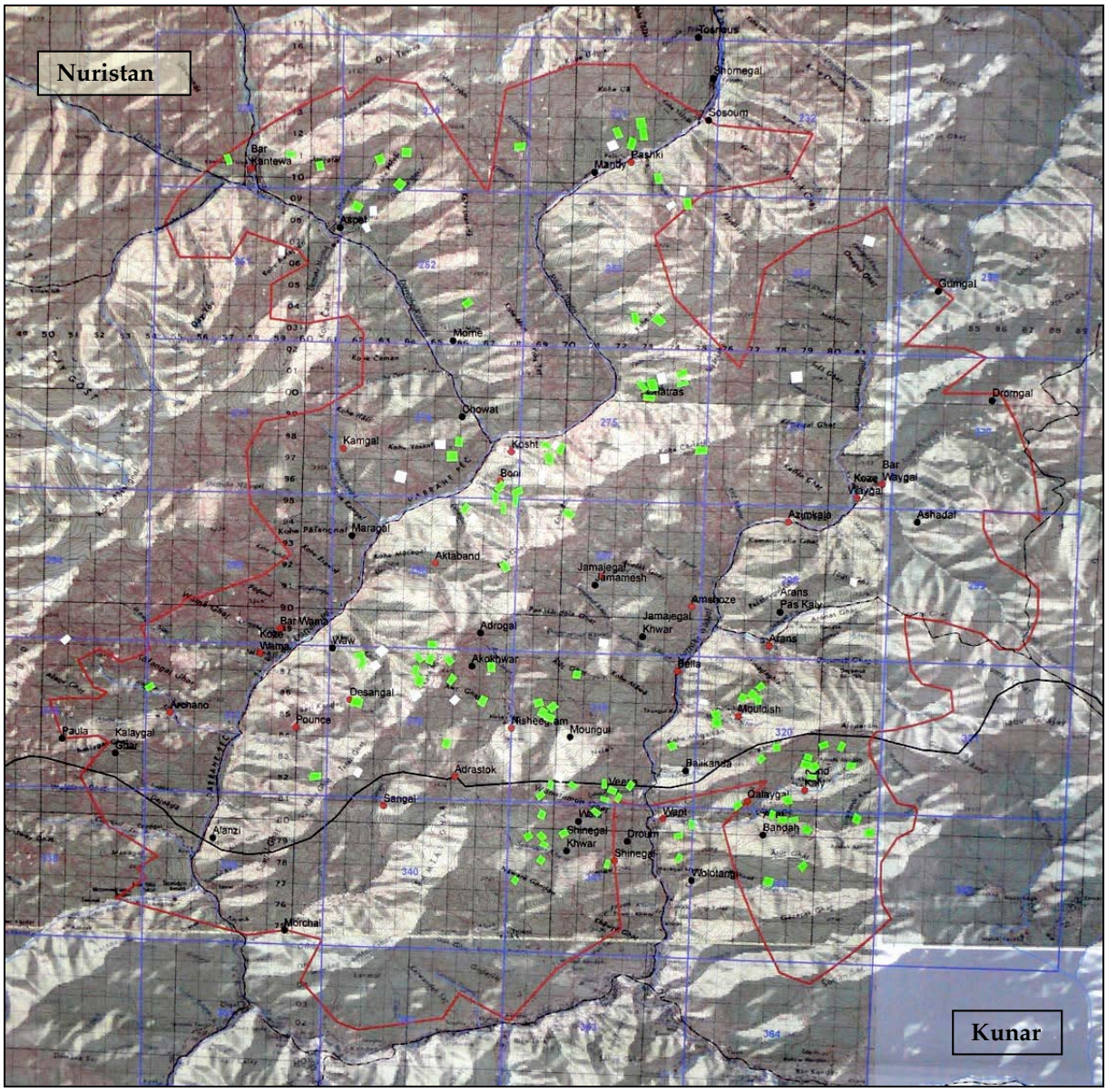
Map 15: Community wildlife mapping of *Capra falconeri*, Nuristan, April/May 2008.

Legend: Green squares: current species occurrence (2008); white squares: species occurrence of five years ago; red dots: interviewed villages; black dots: settlements in study site; red line: Nuristan study site; blue lines/numbers: survey grid system; thin black lines: roads; bold black line: province border.



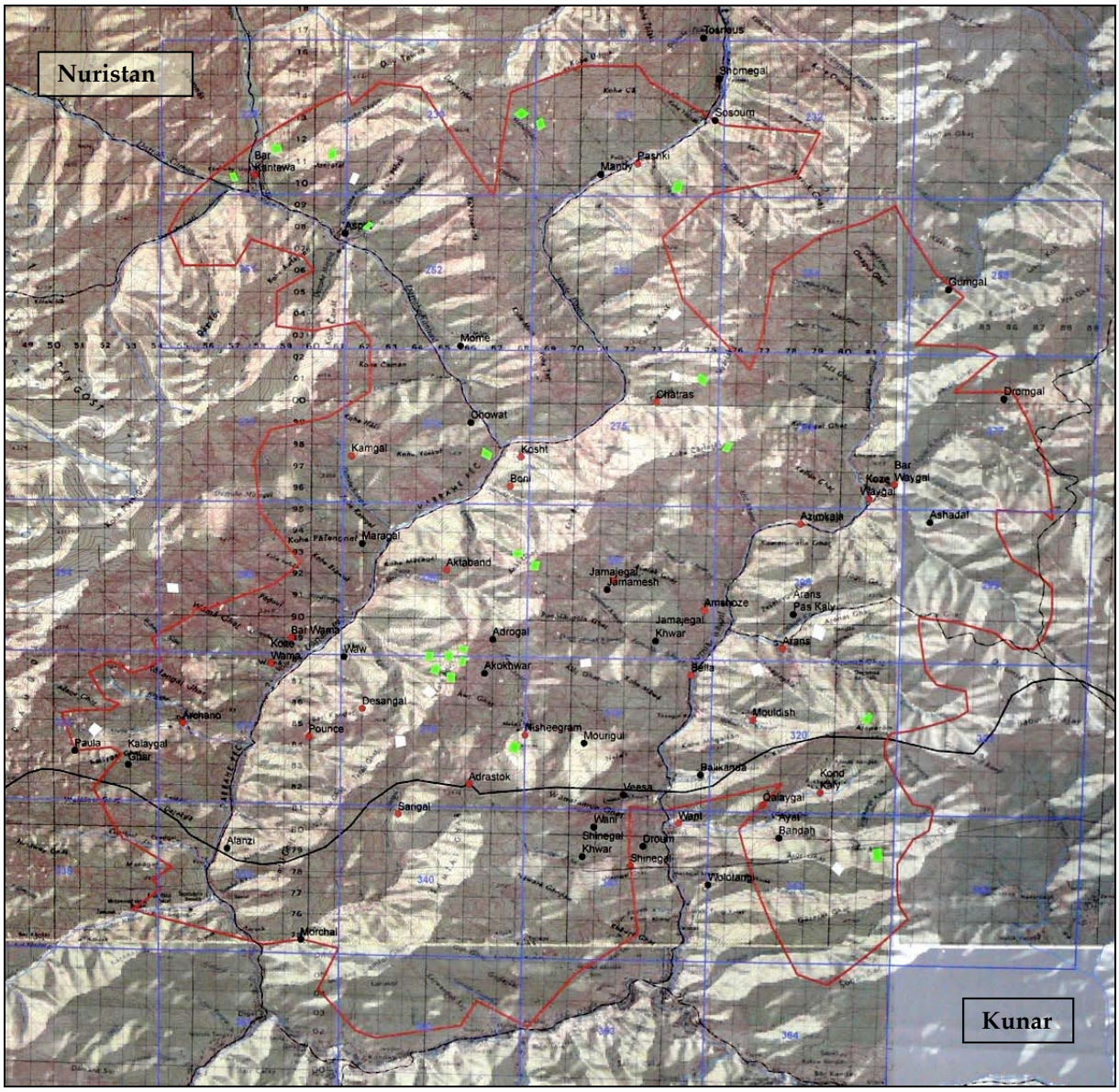
Map 16: Community wildlife mapping of *Prionailurus bengalensis,* Nuristan, April/May 2008.

Legend: Green squares: current species occurrence (2008); white squares: species occurrence of five years ago; red dots: interviewed villages; black dots: settlements in study site; red line: Nuristan study site; blue lines/numbers: survey grid system; thin black lines: roads; bold black line: province border.



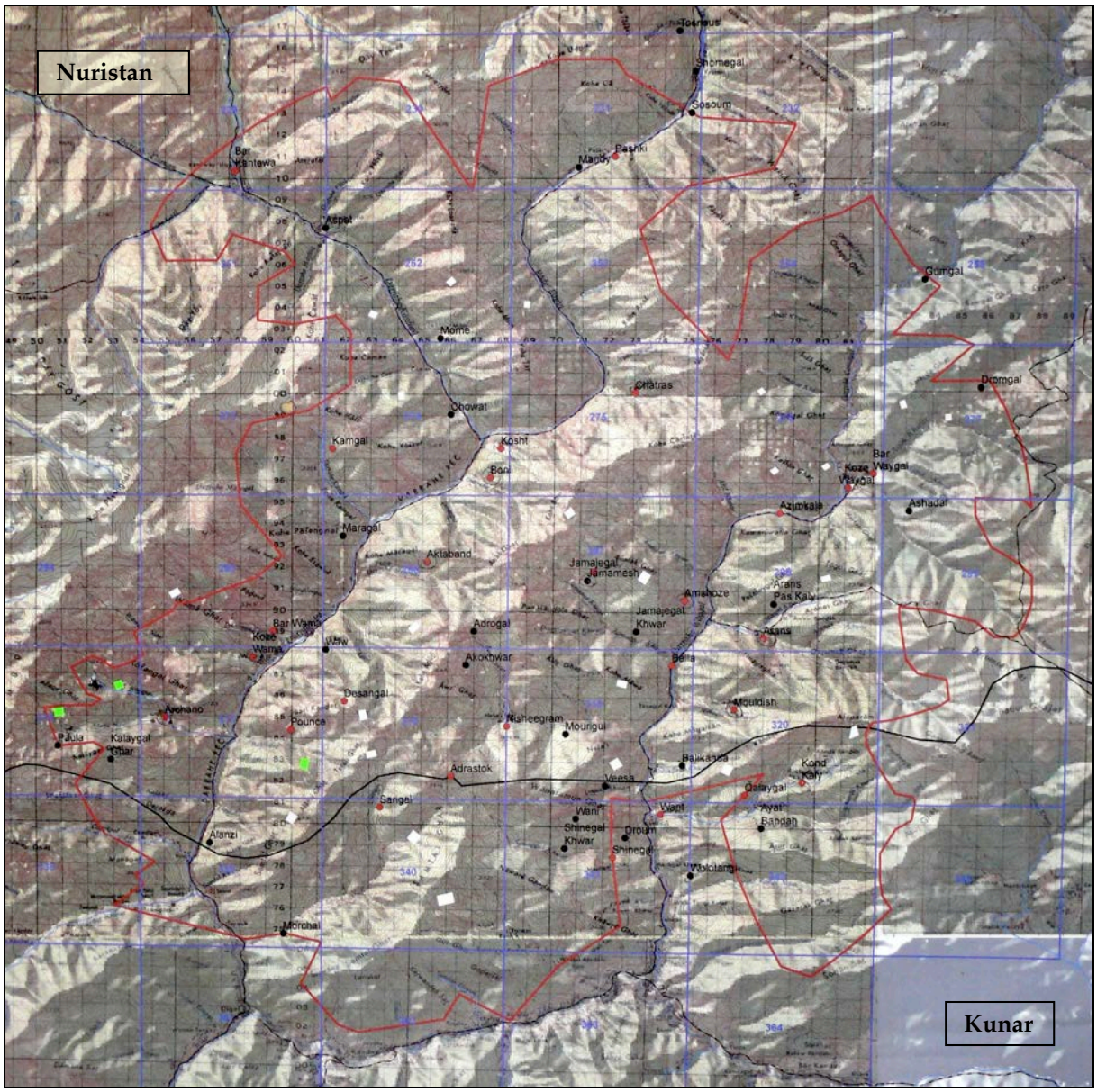
Map 17: Community wildlife mapping of *Uncia uncia,* Nuristan, April/May 2008.

Legend: Green squares: current species occurrence (2008); white squares: species occurrence of five years ago; red dots: interviewed villages; black dots: settlements in study site; red line: Nuristan study site; blue lines/numbers: survey grid system; thin black lines: roads; bold black line: province border.



Map 18: Community wildlife mapping of *Moschus cupreus*, Nuristan, April/May 2008.

Legend: Green squares: current species occurrence (2008); white squares: species occurrence of five years ago; red dots: interviewed villages; black dots: settlements in study site; red line: Nuristan study site; blue lines/numbers: survey grid system; thin black lines: roads; bold black line: province border.



Map 19: Community wildlife mapping of *Ovis orientalis*, Nuristan, April/May 2008.

Legend: Green squares: current species occurrence (2008); white squares: species occurrence of five years ago; red dots: interviewed villages; black dots: settlements in study site; red line: Nuristan study site; blue lines/numbers: survey grid system; thin black lines: roads; bold black line: province border.