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COMMUNICATION

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RECORDS OF THE INDIAN PANGOLIN (MAMMALIA: PHOLIDOTA: MANIDAE: *MANIS CRASSICAUDATA*) FROM MANSEHRA DISTRICT, PAKISTAN

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Abstract: This study investigated records of distribution and population density of the Indian Pangolin *Manis crassicaudata* in Mansehra District, Pakistan. Field surveys were conducted from September 2015 to August 2016 to record direct and indirect signs of the species, including burrows and faecal matter. Information was also collected from local people through unstructured interviews. Our results show that the Indian Pangolin occurred at two sampling sites only (Lassan Nawab and Paras) in the study area. We recorded low numbers of burrows (feeding and permanent burrows) at these two sites. One direct field sighting of one individual was made at Paras. A low mean population density of 0.28 ± 0.45 per km² was estimated at seven different selected sites, but for the district as a whole, the population density was as low as 0.00044 individuals per km². This study recommends initiating conservation efforts in the study area to further understand and conserve the remaining population of Indian Pangolin in Mansehra District.

Keywords: Abundance, distribution, *Manis*, Pakistan, Pangolin, Pholidota.

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Author Details: TARIQ MAHMOOD is serving as Assistant Professor of Wildlife management at PMAS-AAU. He is conducting and supervising research on ecology of mammals, especially carnivores. He has also completed a three years research project on Ecology of Indian Pangolin in Potohar Plateau funded by HEC Islamabad. Ms. Konish Kanwal did her M.Phil. thesis research work on Indian Pangolin inhabiting Mansehra District, KPK. She is now enrolled in PhD degree program in the Department of Wildlife Management, PMAS-AAUR. MR. IFTIKHAR-UZ-ZAMAN is currently serving as Divisional Forest Officer Wildlife in the Galliat Forest Division Abbottabad, Khyber Pakhtunkhwa, Pakistan.

Author Contribution: TM and KK designed the study, analyzed the data and wrote the manuscript; IUZ helped and facilitated in field data collection and also provided logistic support for the research work.

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INTRODUCTION

The Indian Pangolin *Manis crassicaudata* is listed as 'Endangered' on the IUCN Red List of Threatened Species because of increasing levels of illegal hunting principally for its meat and scales, both for local use and for illicit international trade in scales, which has occurred historically (Baillie et al. 2014). The trade in its scales is typically destined for East Asia where they are used in traditional medicines (Baillie et al. 2014). This species is distributed in South Asia, from eastern Pakistan and parts of northern Pakistan through much of India south of the Himalaya, southern Nepal, Bangladesh and Sri Lanka (Schlitter 2005; Srinivasulu & Srinivasulu 2012).

In Pakistan, the Indian Pangolin occurs in all four provinces of the country, although it is locally distributed. In Punjab province it is reported from Kasur, Lahore, Sialkot, Gujrat, Jhelum Chakwal, Rawalpindi and Attock districts, and also in the districts of Bhakar and Jhang (southern Punjab). The species range extends northwards towards Nowshera, Swabi, Mardan and Peshawar districts in Khyber Pakhtunkhwa (KP) province (Roberts 1977; CITES 2000). In Sind Province, it is reported from Dadu, Larkana, Hyderabad and Tharparkar districts, extending eastwards to Kutch (Roberts 1977; CITES 2000). In Baluchistan, its localized populations occur in Las Bela and Mekran districts.

The species has been hunted historically as a local source of protein and for medicinal purposes. The scales of the species are used as a whole, or in powdered form in the preparation of traditional medicines and as curios (Misra & Hanfee 2000). The scales of this species have been used by Hakims in Pakistan historically and this still occurs in many remote areas in the country. Its skin has also been used to manufacture leather goods such as boots and shoes internationally, however, this species constitutes lower volumes in the trade compared to other Asian pangolins (mainly the Sunda Pangolin and Chinese Pangolin). There has been an established international trade in Chinese Pangolin *Manis pentadactyla* derivatives, principally scales, from northeastern India to Myanmar and possibly China (Misra & Hanfee 2000) and such trade has come to include *Manis crassicaudata* scales in recent years (Mahmood et al. 2012; Challender et al. 2015; Mohapatra et al. 2015).

The Indian Pangolin plays an important ecological role by consuming termites: a serious insect pest of agricultural crops and buildings, and ants (Roberts 1997). It is a toothless mammal, having overlapping horny scales, a protractible very long tongue and prehensile

tail, rolling up into a ball when it is threatened. It is myrmecophagous (Prater 2005), feeding on termites and ants. It has highly specialized feeding habits, consuming mainly eggs, adults of termites and ants, also their young ones by digging the nests of ants and termites (Pai 2008). Its specific diet is thought to limit the species' ability to survive in captivity (Yang et al. 2007; Pattnaik 2008), although a small number of this species do occur in captivity in India. It is estimated that one adult pangolin may consume approximately more than 70 million insects annually (d'Aulaire & d'Aulaire 1983).

The Indian Pangolin is included in 'Appendix-I' of CITES (<http://cites.org/eng/app/appendices.php>). In Pakistan, this species is protected under the Islamabad Wildlife Protection, Preservation, Conservation, and Management) Ordinance, 1979 (Schedule-III) and included in Schedule-I of the Wildlife Acts and Rules of Khyber Pakhtunkhwa.

In Pakistan, research into the ecology of this species in the Potohar Plateau region in the last few years has documented rapid population declines locally as a result of illegal killing to obtain scales for international trade (Irshad et al. 2015). All Asian Pangolin species, including the Chinese Pangolin, Sunda Pangolin (*M. javanica*), Indian Pangolin, and Philippine Pangolin (*M. culionensis*), are threatened by illegal hunting for international trade (Wu et al. 2004; Challender 2011) for their meat and their scales which are used in Traditional Chinese Medicines (Pantel & Chin 2009; Challender 2011). The Mansehra District of KP province in Pakistan, is not currently part of the species recognized range by IUCN. The current study, therefore, is aimed at investigating the distribution records of this species in Mansehra District, based on the hypothesis that the species does in fact occur there.

MATERIALS AND METHODS

The current study was conducted in Mansehra District, Khyber Pakhtunkhwa Province of Pakistan (Fig. 1). The district includes the Hazara division, and covers 4,579km², located at 34.233–35.183°N & 72.816–74.133°E. It lies at the eastern border of the Province, four hours away from Peshawar and three hours away from Islamabad by road. The climate is warm in summer but cold in winter; the average annual temperature being 18.5°C. The northern part, where there are high mountains, is cold in summer due to snow covering the mountains and it is very cold in winter. The winter

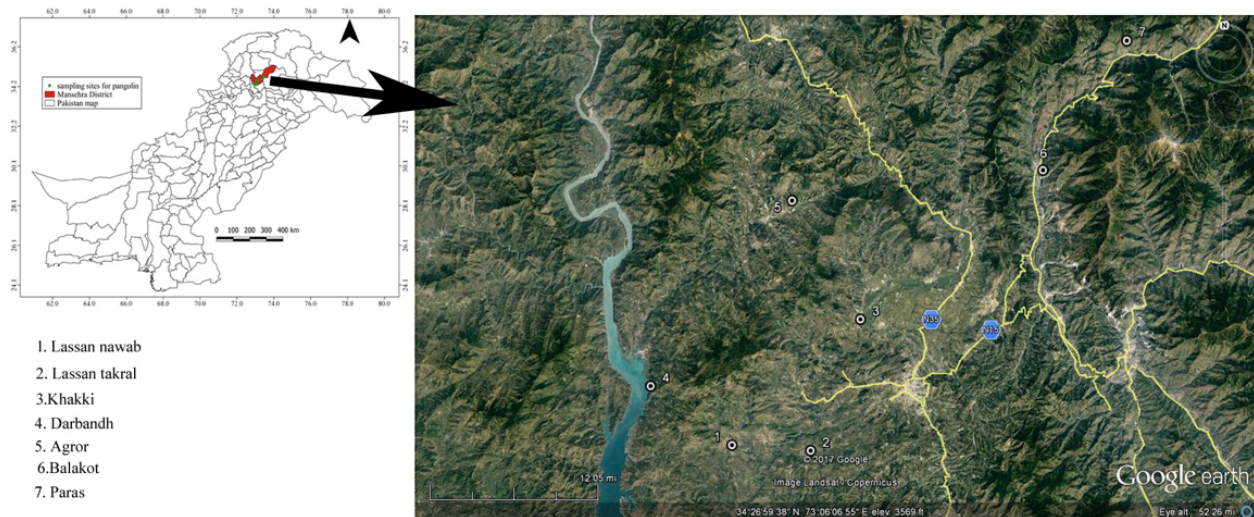


Figure 1. Map of Pakistan (inset) showing location of Mansehra District and seven selected sampling sites for Indian Pangolin *Manis crassicaudata* distribution.

season spans seven months and the summer period is shorter at only five months. Average annual rainfall is 209mm during summer (e.g., July), followed by 108mm during February. In the winter the temperature varies from -1 to 37 °C (Waheed et al. 2013).

To record the distribution of Indian Pangolin in the study area, field surveys were conducted from September 2015 to August 2016, using a motor vehicle (average speed 20–30 km/hour) in three different kinds of habitats; natural, human occupied areas, and agricultural lands of the study district. Based on the surveys, seven different potential sampling sites were selected (Fig. 1; Table 1) to collect data on the Indian Pangolin. The sampling sites were selected on the basis of mentions about habitat of Indian Pangolin in the literature and also on the information collected from the native people. Each sampling site had variable size due to varied topography and mixed habitat type. The selected sampling sites were visited on a fortnightly basis for recording direct and indirect signs of Indian Pangolin including its burrows, scats, footprints, and body prints. A total of 20 field visits were made to the selected sampling sites.

Among selected sampling sites, both Lissan Nawab and Paras encompass mixed habitat types including mountains, wild or natural areas, agricultural land, and human occupied areas (Image 1 A&B). The natural area at Lissan Nawab possessed five tree, four shrub and five herb species. The tree species present at this site included Kikar *Acacia nilotica*, Chir Pine *Pinus roxburgii*, River Red-gum *Eucalyptus camaldulensis*, China Berry Tree *Melia azedarach*, and Himalayan Poplar *Populus*

ciliata. The four-shrub species occurring at this site included Rubber Brush *Calatropis procera*, Hop Brush *Dodonea viscosa*, Castor Bean Shrub *Ricinus communis*, and Winged Prickly Ash *Zanthoxylum armatus*. While the five-herb species occurring here included Hairy Fleabane *Conyza bonariensis*, Hemp *Cannabis sativa*, *Euphorbia indica*, Narrowleaf Indigo *Indigofera linifolia*, and Himalayan Indigo *Indigofera heterantha*. The crop and vegetable species being cultivated at the two positive sites in agricultural land included Wheat *Triticum sativum*, Maize *Zea mays*, Tobacco *Nicotina tabacum*, Peanut *Arachis hypogaea*, Potato *Solanum tuberosum*, Cabbage *Brassica oleracea* and Peas *Pisum sativum*.

At the second positive site (Paras) in the habitat of Indian Pangolin, four tree, four shrub and five herb species were recorded. The tree species occurring at this site were Chir Pine, Shisham *Dalbergia sissoo*, and Blue Pine *Pinus wallichiana*. The shrub species were hop brush, tick berry *Lantana camara*, winged prickly ash, and castor bean, while the five-herb species occurring at this site were hairy fleabane, *Euphorbia indica*, hemp, cat mint *Anisomella smalabarica* and *Cynoglotum lanceolatum*.

Information was also retrieved from local people through unstructured interviews about occurrence of the species to determine presence. The areas were marked positive where any signs of occurrence of Indian Pangolin were found while those areas, which did not have any direct signs were considered negative. The burrows of Indian Pangolin were searched for at the positive sites and their characteristics such as depth, length, width and diameter, were recorded. The burrows

Table 1. Details of seven selected sampling sites in Mansehra District for data collection about distribution, and abundance of Indian Pangolin.

Site No.	Sampling site	Tehsil	Latitude (N)	Longitude (E)	Elevation (m)	Major Habitat features
I	Lassan Nawab	Mansehra	34.27416667	72.97416667	966	Mountains, pastures, agricultural lands, wild and human occupied areas
II	Lassan Takral	Mansehra	34.24745556	73.07444444	1008	Mountains, pastures, agricultural lands, wild and human occupied areas
III	Khakki	Mansehra	34.40000000	73.13333333	940	Mountains, pastures, natural and human occupied areas, agricultural lands
IV	Darbandh	Ogi	34.32916667	72.85027778	1572	Pastures, human occupied areas mountains, wild areas, agricultural lands
V	Agror	Ogi	34.50138056	72.04805556	1306	Agricultural land, natural and human occupied areas, mountains
VI	Balakot	Balakot	34.22732500	73.36055556	2160	Mountains, natural and human occupied areas, agricultural lands
VII	Paras	Balakot	34.67399444	73.46138889	2246	Pastures, agricultural lands, mountains, human occupied areas

were confirmed based on certain characteristics. First, they are round in shape. Second, they have got a specific burrow opening diameter of between 20 and 35 cm, and third they can be very deep (up to 9–10 m). In addition, signs of occurrence of the Indian Pangolin are also commonly found at the opening of the burrows of the species, for example, its footprints, body scale prints (Body scale prints means when Indian Pangolin rolls on soft soil near its burrows, prints of its body scales are left on the soil, which show its presence), and prey remains (chitinous body parts of ants left after feeding) at and around the burrow opening. These signs confirm that the burrow belongs to an Indian Pangolin. It is important to mention that some other burrowing rodents (Indian Crested Porcupine) and mammals (mongooses) are also found in the habitat of the Indian Pangolin, but their burrows are different. For example, the burrow opening of the Indian Crested Porcupine is very wide and not circular, while those of mongooses are much narrower in diameter. The burrow opening of the Indian Pangolin was measured in the field by using a measuring tape, while the depth of the burrow was measured by inserting a long, flexible stick deep into the burrow and then measuring it by using a measuring tape.

The population density of the Indian Pangolin was estimated at seven selected sampling sites, by counts of its active living/ permanent or resting burrows of the species following Southwood (1966) and Begon (1979), using the following formula:

$$D = N / A$$

where D= density of the species, N is the numbers of active living burrows, and A is the total area of the transect. The formula used here is based on the assumption that one living burrow was being used by one Indian Pangolin. This may be a limitation to this

study as it is known that other species of pangolin will use burrows used by absent con-specifics, and which may apply to this species, though more research is needed on this front.

The burrows of Indian Pangolin are of two types; one is known as a feeding burrow and the other one is resting or living burrows (Mahmood et al. 2015). The feeding burrows are less deep and excavated by the species while feeding on ant colonies and termite mounds. The Pangolin, having reached an occupied nest, feeds by rapidly extending its thin cylindrical, long sticky tongue into the galleries, and in this process a certain amount of earth is also swallowed (Roberts 1997). This process creates a shallow burrow in the soil, which is termed a feeding burrow. The second type of burrow is a permanent or resting burrow, which are used by Indian Pangolins for living or resting purposes during the daytime, coming out at evening and night to forage. Similarly, the permanent or resting burrows of the species can further be categorized either as active or inactive in the field, that is, if a burrow is being utilized by the Pangolin it is regarded 'active' but if abandoned then it is termed as 'inactive', i.e., the one which is not being used by the Pangolin at the moment is regarded as inactive.

RESULTS

Five out of the seven sampling sites were negative for the presence of Indian Pangolins while two sampling sites, 'Lassan Nawab' and 'Paras' were found to be positive. The two positive sites had an elevation range from 962–2,246 m (Table 2). Direct sighting of the Indian Pangolin was recorded at one site; 'Paras' (Image



Image 1. Photograph of the Indian Pangolin *Manis crassicaudata* field sighted at ‘Paras’ sampling site in Mansehra District. © Konish Kanwal

Table 2. Details of direct and indirect signs of the Indian Pangolin *Manis crassicaudata* recorded at selected sampling sites of Mansehra District.

Site name	Location	Burrows	Faecal samples	Direct sightings	Elevation range (m)	Results +/-
Lassan Nawab	Khalla Takha	yes	yes	No	825–966	+
Lassan Nawab	Batal Pine	-	-	-	966–987	–
LassanTakral	Gali Marjan	-	-	-	967–1002	–
LassanTakral	Nallah Nakkah	-	-	-	812–962	–
Khakki	Khawajgahn	-	-	-	940–976	–
Darbandh	Chakh Phansyal	-	-	-	1589–1642	–
Agror	Tarawayii	-	-	-	1306–1445	–
Balakot	Shahgaran	-	-	-	1681–1768	–
Paras	Bageer Guzara	Yes	No	Yes	2836–2918	+

+ = present; - = absent

1). The burrows were recorded in both cultivated and wild habitats of the study area at the two positive sites (Image 2 C&D). The soil texture was sandy with some mixed clay and silt. Two types of burrows of the Indian Pangolin were found at the positive sampling sites; temporary or feeding burrows and the living or sleeping or permanent burrows. Feeding burrows were less deep and excavated by the species during foraging on ants and termites (evidence of foraging on ants), whereas the permanent living burrows were much deeper having round opening and used by the species for living (resting) purpose. At Lassan Nawab, a total of 11 feeding burrows were recorded whereas at Paras site, a total of 16 feeding burrows were recorded. The mean burrow height was 16.75cm, width 19.94cm, and depth 16.48cm (Table 3; Image 2; Fig. 2). The height of entrance of burrow was measured vertically at the burrow opening while width was measured horizontally. Far fewer permanent living burrows of the Indian Pangolin were found at the two positive sampling sites compared to feeding burrows. At Lassan Nawab only two living burrows of the species were

recorded, one found active while the second one was inactive. Similarly, at Paras a total of five living burrows were recorded but only one was active, the remaining four were found inactive. A living burrow of Indian Pangolin was considered ‘active’ when any of the direct or indirect signs of the species such as faecal dropping, body print, fresh soil digging, were recorded around the burrow opening, otherwise it was considered ‘inactive’. For inactive burrows, mean burrow height was 33.73cm, width 78.52cm and depth 8.68m while for active living burrows, mean burrow height being 51.80cm, width 35.04cm and depth 6.70m (Table 4; Image 2; Fig. 3).

The burrows were recorded at both the positive sites, faecal samples were recorded at ‘Lassan Nawab’ site while one direct field sighting of Pangolin was made at ‘Paras’ sampling site. A very low average population density of the Indian Pangolin (0.28 ± 0.45 per km²) was estimated in the study area, covering all seven selected sampling sites (Table 4). At the two positive sampling sites, the phyto-association of the Indian Pangolin was measured by quantifying its resting or living burrows

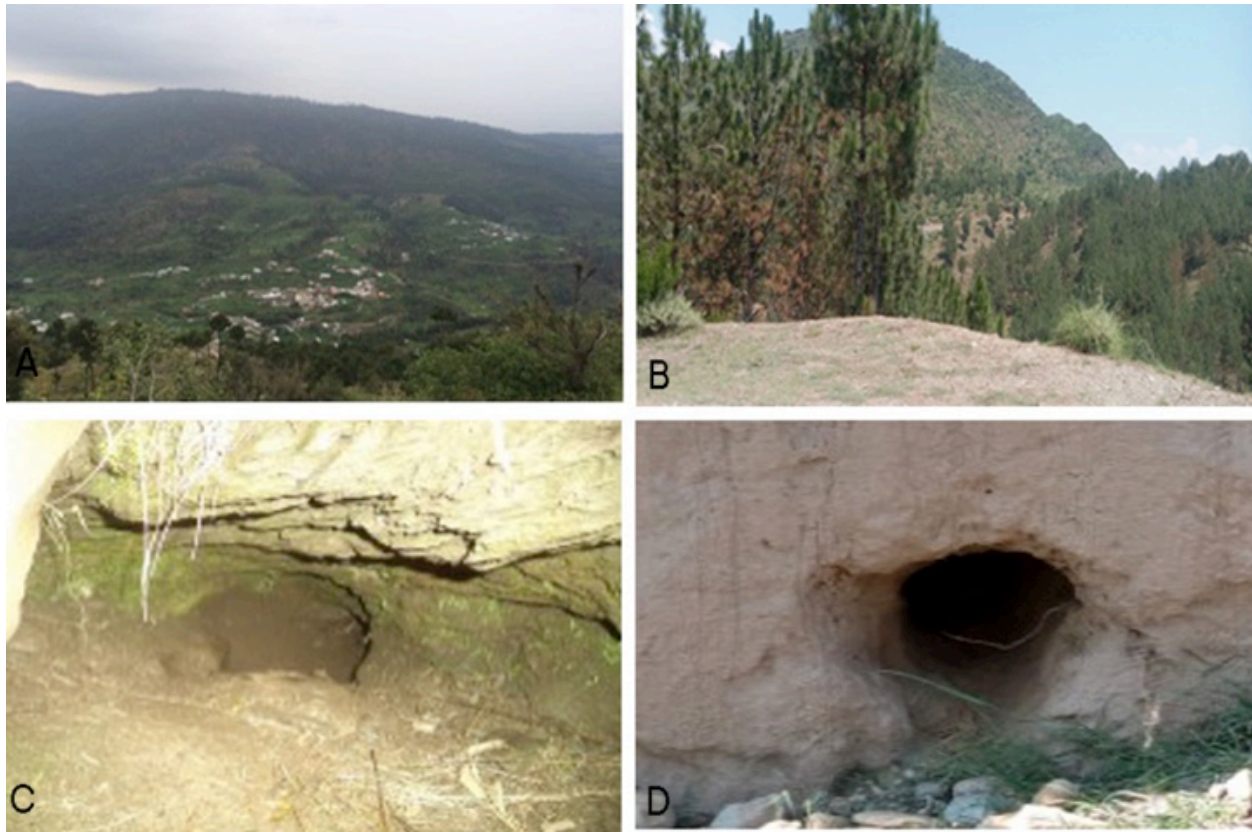


Image 2. Photographs of the habitat of Indian Pangolin *Manis crassicaudata* from Mansehra District, (A) habitat of Pangolin at Lissan Nawab site, (B) habitat at Paras site, (C & D) active living / resting burrows of Pangolin. © Konish Kanwal

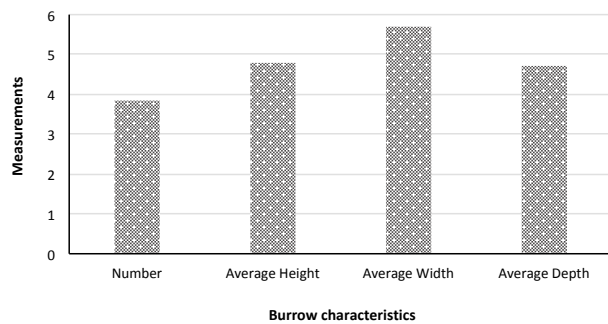


Figure 2. Average parameters of feeding burrows (cm) of the Indian Pangolin *Manis crassicaudata* recorded at two selected sampling sites of the Mansehra District.

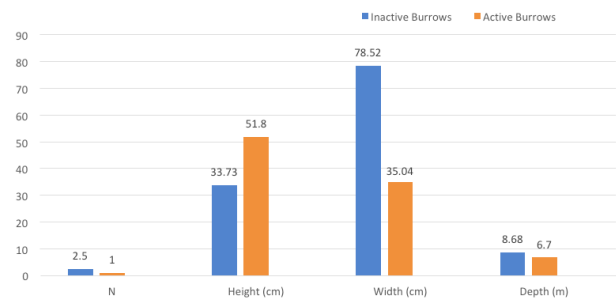


Figure 3. Average parameters of inactive and active living / permanent / resting burrows of the Indian Pangolin *Manis crassicaudata* recorded in Mansehra District.

found near or around the particular vegetation type. The Indian Pangolin was found more associated with the tree species *Eucalyptus camaldulensis* and *Pinus roxburgii* whereby its permanent living burrows were found around these tree species, although *Dodonaea viscosa* was the most abundant shrub species in the habitat.

DISCUSSION

The Indian Pangolin, is listed as ‘Endangered’ by IUCN because of hunting and increasing levels of poaching, principally for its meat and scales, both for local use and for illicit international trade in scales. There has also been an established international trade in *Manis pentadactyla* derivatives, principally scales, from northeastern India to Myanmar and

Table 3. Characteristics of feeding Burrows of Indian Pangolin *Manis crassicaudata* quantified at two positive sampling sites of Mansehra District during the study period.

Site no.	Sampling site	Numbers of feeding burrows (n=27)	Average parameters of feeding burrows		
			height (cm)	width (cm)	depth (cm)
I	Lassan Nawab	11	16.53	17.45	16.31
II	LassanTakral	-	-	-	-
III	Khakki	-	-	-	-
IV	Darbandh	-	-	-	-
V	Agror	-	-	-	-
VI	Balakot	-	-	-	-
VII	Paras	16	16.98	22.43	16.65
	Mean ± SE	13.5±5.75	16.75±11.62	19.94±18.37	16.48±11.40

Table 4. Details of living burrows and population density of Indian Pangolin *Manis crassicaudata* in Mansehra District of KP province during the current study period.

Site no.	Site name	Inactive burrows				Active Burrows				Species density D = n/A
		N	Height (cm)	Width (cm)	Depth (m)	N	Height (cm)	Width (cm)	Depth (m)	
I	Lassan Nawab	1	36.57	30	1.828	1	33.52	36.57	3.962	1.0
II	LassanTakral	-	-	-	-	-	-	-	-	0
III	Khakki	-	-	-	-	-	-	-	-	0
IV	Darbandh	-	-	-	-	-	-	-	-	0
V	Agror	-	-	-	-	-	-	-	-	0
VI	Balakot	-	-	-	-	-	-	-	-	0
VII	Paras	4	30.89	127.05	15.54	1	70.09	33.52	9.448	1.0
	Mean ± SE	2.5±0.64	33.73±3.8	78.52±10.2	8.68±0.24	1.0±0.86	51.80±6.4	35.04±4.0	6.705±0.04	0.28±0.45

Total area of Mansehra District: 4,579km²

Average Population density of Indian Pangolin in the whole district: 0.00044 individuals per km².

possibly China (Misra & Hanfee 2000) and such trade has come to include *Manis crassicaudata* scales in recent years, including from Pakistan (Mahmood et al. 2012; Challender et al. 2015). There is evidence that the species is being severely impacted by hunting and poaching in India, which also occurs in Pakistan (Mahmood et al. 2012). However, there is little detailed information about its status range wide (CITES 2000; Baillie et al. 2014) but there is now greater evidence of its inclusion in illicit international trade, in particular its scales, from both India and Pakistan, with Myanmar and China comprising the most likely, final destinations (Zoological Society of India 2002; Challender et al. 2015).

Local populations of the Indian Pangolin occur in other provinces in Pakistan including Sind, Baluchistan and Khyber Pakhtunkhwa, but they have not been assessed in terms of population densities. The distribution range of the species in the province of KP in Pakistan,

its population status and the levels of threat it is facing require investigation which was the focus of this study. Our results have shown that the Indian Pangolin has got a very narrow range of occurrence in Mansehra District of KP province. Out of all areas surveyed for recording its distribution, and among seven different sampling sites, the species was recorded at only two sampling sites (Lassan Nawab and Paras). At Lassan Nawab, no direct sighting of the species was possible, and only its indirect signs of occurrence were found including burrows and faeces whereas at Paras site in addition to burrows and faeces, direct field observation of one individual of Indian Pangolin was recorded. Although the two types of burrows of the species were clearly distinguishable by their height, width and depth, the number of Pangolin burrows was very low, indicative of its very low density. A very low population density (0.28 ± 0.45 individuals per km²) for the Indian Pangolin

was estimated at the selected sites. Extrapolating this density to the whole district of Mansehra suggests the population density to be very low (0.00044 individuals per km²). There are a few density estimates available for Asian and African Pangolins including 0.0001/km² for the Indian Pangolin in Chakwal, Pakistan (Mahmood et al. 2014), 0.001 individuals per km² for the Chinese Pangolin in China (Wu et al. 2004) and 0.8 individuals per km² for the White-bellied Pangolin *Phataginus tricuspis* in Africa (Akpona et al. 2008) all of which suggest that these species occur at low densities. There is, however, little other published population data available for any other species of pangolins, not only from Pakistan, but also from the Asian region (Challender et al. 2014). One exception is in Taiwan (PR China) where higher densities (12 to 13 adult Pangolins per km²) have been found (IUCN/TRAFFIC 2016).

During the current study period, the two major threats being faced by the Indian Pangolin in its habitat include illegal killing of the species by local people and poaching. The native people kill Indian Pangolin in the study area because they have a “myth” that the Indian Pangolin digs graves and pulls out the buried dead bodies, and so locally it is referred to as “Ghorkush” (that is grave digger). Similarly, farmers of the study area also kill Indian Pangolins because they think that the animals damage their crops and agricultural lands by digging burrows, even though this could benefit their agricultural land by aerating the soil and add to its fertility. Finally, there are also reports about its illegal capture by poachers from the study area, but this needs further investigation. Nevertheless, the population estimates of the Indian Pangolin estimated in this study suggests that the species occurs at low densities in the Mansehra District and faces threats from persecution and likely, from poaching. Measures including the engagement of local communities and farmers in efforts to protect the Indian Pangolin, combined with effective law enforcement, are needed urgently in order to stand the best chance of conserving the Indian Pangolin in Mansehra District in KP, in Pakistan.

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