Exploration and Diet Analysis of Red Panda (Ailurus fulgens) for its Conservation in Rara National Park, Nepal

A report to

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Introduction

The *Ailurus fulgens fulgens* (Cuvier 1825) is a threatened (IUCN 2012) and endangered carnivore mammal species and occurs in the Himalayan mountain range (Roberts & Gittlemans 1984). Red pandas are currently distributed in Nepal, Bhutan, India, Myanmar and China, but were once widely distributed across Eurasia (Roberts & Gittlemans 1984). The ecology of red panda is poorly known due to low population size and restricted distribution in remote areas. The red panda receives much interest in the scientific field due to its specialized niche and feeding biology (Glatston 1994 ; Wei *et al.* 2000). Red pandas occur in coniferous, deciduous, and mixed coniferous and deciduous, forests with dense understory (Choudhury 2001 ; Pradhan *et al.* 2001; Roberts & Gittlemans 1984 ; Wei *et al* 1999; Yonzon *et al.* 1991). Red pandas prefer *Abis-Thamnocalamus* (fir-jhapra) forests from 2800 to 3900 m (Yonzon 1989). Within these forests red pandas have several microhabitat requirements including a dense understory with fallen logs, bamboo or fruiting vegetation, and close proximity to water (Pradhan *et al.* 2001; Wei *et al.* 1999).

Red pandas eat Bamboo leaves throughout the year and bamboo shoots in the spring (Wei *et al.* 1999) which together can constitute more than 95% of their annual diet (Wei *et al. 2000*). Other dietary components include berries, fruits, mushrooms, roots, acorns and lichen (Wei, Fgeng & Hu ; Yonzon). However, few studies on distribution (Pradhan *et al.* 2001; Sharma & Belant 2009; Roberts & Gittlemans 1984 ; Wei *et al* 1999; Yonzon *et al.* 1991), ecology and conservation status (Reid *et al.* 1991; Sharma & Belant 2010; Wei et al 2000) or feeding biology (Wei et al. 1990 & Yonzon 1989) have been carried out and more needs to be known about the habitat selection, population, and conservation status of this species. In this connection, this study will help to add more information on the distribution and conservation status of red panda.
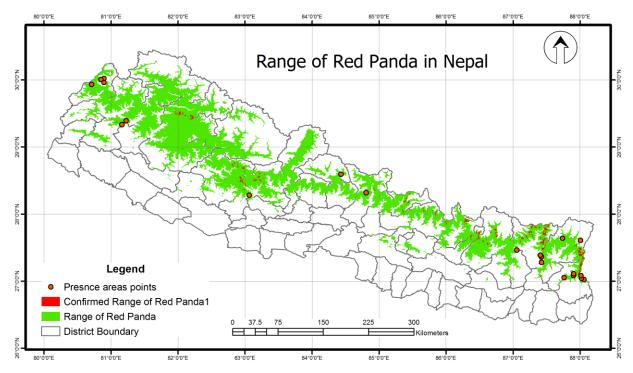
Objectives

The main objective of this study was to collect the basic ecological information of Red panda in the Rara National park. The specific objectives were;

> 1 to find out the distribution of red panda in the RNP,
> 2 to identify the diet composition of red panda, and
> 3 to conduct the Outreach and conservation education programs for the school children.

Study area

Rara National Park comprises 106 km^2 in mid-western Nepal (81° 59'54" to 82° 08'27" E, 29° 26' 28" to 29° 33'11" N) with elevations ranging from 2754 to 4097 m. It was established and gazetted in 1976 to conserve its biodiversity and the natural beauty of Rara Lake (10.8 km^2), also known as Mahendra Tal. The park contains mainly coniferous forest and the area around the lake is dominated by *Pinus wallachiana* (blue pine) up to 3200 m. Other tree species include rhododendron (*Rhododendron arboretum*), black juniper (*Juniperus indica*), west Himalayan spruce (*Picea smithina*), oak (*Quercus semecarpefolia*) and Himalayan cypress (*Cupressus torulosa*). From 3200 to 3550 m occurs a mixed-coniferous forest of pine, spruce and fir. At

about 3350 m the mixed-coniferous forest transition to fir, oak and birch forests. Other deciduous tree species in the park are Indian horse-chestnut (*Aesculus indica*), walnut (*Junglans regia*) and Himalayan poplar (*Populus ciliata*). Fauna in the park include Himalayan black bear (*Ursus thibetanus*), leopard (*Panthera pardus*), musk deer (*Moschus moschiferous*), goral (*Nemorhaedus goral*), jackal (*Canis aureus*), Himalayan tahr (*Hemitragus jemlahicus*), yellow-throated marten (*Martes flavigula*), and wild dog (*Cuon alpinus*), The park is surrounded by nine Village Development Committees within Jumla and Mugu districts, which have been declared as a Buffer Zone and comprise 198 km^2

Map Red panda habitat in Nepal (Source: Red panda Workshop)

Methods

After confirmation of Red Panda presence in Jumla and Mugu district of Rara National Park nearest the Khaptad National Park, line transects were established to estimate distribution of fecal pellet groups at elevations ranging from approximately 2995 to 3,600 m. Twelve 500- m transects (horizontal distance) were delineated in north facing slope. All transects were not in similar slope. Sampling plots (10 X 10) m^2 for tree sampling were defined at the interval of 100 m of elevation. The number, elevation and location of pellet groups within the plots and 10 m to both sides of each transect were counted and recorded. Natural demarcations including springs, ridges and valleys were used as reference in orienting along transect lines. At each pellet group or red panda observation, information including altitude, latitude, longitude, aspect and slope were recorded. Woody plant species including stumps, dead standing trees and fallen logs were identified using Polunin & Stainton (1986).

Diet

Fecal pellet groups were collected along and also 10 m apart from transect line. Fecal pellet groups were also collected within 10 m of water sources along transects. The number of fecal pellet groups were counted on branches of trees, on logs and ground present on the transect. The fecal pellet groups were mixed and 25% of each pellet group was placed in individual plastic bags then dried. In cases of defecation over old pellets, both old and fresh pellets were collected separately.

Overall, 150 fecal pellet samples were collected. Samples were analysed using micro-histological techniques, based on identification of indigestible plant fragments, mainly epidermal features that serve as distinguishing characters of different plant species, at the Central Department of Zoology, Tribhuvan University. Reference plants slides were prepared with diagnostic key, and fecal samples prepared following established methods (Anthony & Smith 1997). Distinguishable histological features, such as cell wall structure, shape and size of cells, hairs and trichomes, shape and size of stomata for each species will be drawn as key features to match with fecal plant fragments. A compound microscope at 200 x magnification with an ocular measuring scale will be used to identify plant remains from fecal pellets.

Result and Discussion

Red panda distribution

Indirect observation of red panda was based on the presence of pellets and habitat utilization. A total of 222 GPS locations were fixed in 12 transects. Red Panda pellet groups were observed from 3117 to 3591 m of elevation. Frequency of pellet groups increased markedly from 3200 to 3350 m and became constant up to 3400 m declined sharply at higher elevations (Fig.1). No pellet groups were found at elevation greater
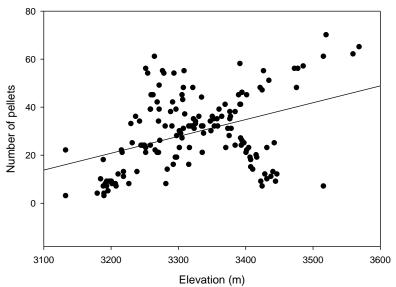

Fig.1 Distribution of fecal pellets of red panda in Rara National park.

then 3591 m and lower than 3100 m. The elevational distribution of red panda in Rara National Park was narrow due to its vegetation structure. The area just above the lake is dominated by blue pine up to 3200 m and pellets distribution is not common. Similarly, in other areas it distributed in the range of 3000 m to 3600 m elevation in Dhorpatan Hunting Reserve (Sharma & Belant 2009), from 2,800 – 3,600 m elevation in Singhalila National Park (Pradhan *et al* 2001) and in the Himalaya within an altitudinal range of 3,000 - 4,000 m (Yonzon & Hunter 1991). Red pandas defecate immediately after feeding due to short alimentary canal (Wei *et al.* 1999). They also feed large amount of food due to presence of less calorie found in the leaves of bamboo and they repeatedly used the certain spots or latrines for defecation (Johnson *et al.* 1988).

During March–May 2011, two Red Pandas were sighted on a northeast facing slope. The Pandas were resting on the branch of Abis tree. Similarly, four pandas were observed on March 2012 in Bhulbhule of Jumla District. One among four pandas was rescued by local people. After our conservation awareness programme held in 2011, local people become aware for the conservation of red pandas. It was kept in a house for 12 hrs in warm environment and after then it became active. Next day it was released in the jungle in presence of Park staff.

Vegetation

A total of 15 species of trees were recorded in the sampling plots. *Abies spectabilis* was found higher Relative density of 40.19 which is followed by *Pinus wallichina Quercus semicarpefolia*, Betula *utilis, Juniperus indica,* and *Sorbus cuspidata* of 20.79207921, 8.052805281, 5.742574257 and 3.696369637 respectively. *Abies spectabilis*, Pinus *Betula utilis*, *Quercus* were over exploited for fodder and fuelwood purpose. Result showed that the area just above the lake is dominated by blue pine up 3200 m and from 3200 to 3550 m by a mixed-coniferous forest of pine, spruce and fir. At about 3350 m the mixed-coniferous forest transition to fir, oak and birch forests takes place. Red panda distribution in the Rara National park is determined by this vegetation structure. Nearly 85 % of fecal pellets were found in *Abies spectabilis* among tree species followed by *Betula utilis* and *Rhododendron*.

Diet composition in the fecal pellets

A total of 150 samples were analyzed for diet composition in the fecal pellets. It showed leaf, shoot, fruit and seed of ten different plant species. Fruits and seed components were found only in post monsoon period. The diet of red pandas consisted primarily of *Thanmocalmus* sp. as shown by a sample of 150 droppings inspected at pre and post monsoon season but this percentage comparatively low then the 99 % of *Sinarundinaria fangiana* (Johnson *et al*. 1988).
Fig. 2 showed that the leaf and shoot parts of *Thanmocalmus* sp was 95.2 % and leaf component of *Abies*, *Rhododendron*, *Quercus, Betula, Tsuga, Texus* and *Acer* was found 1.677 %, 0..988 %, 0.74 %, 0.53 %, 0.299 %, 0.299 % and 0.230 % respectively in the pre monsoon period. Similarly, fig. 3 of post monsoon period showed that the leaf and shoot parts of *Thanmocalmus* sp was found 76.7 % and leaf component of *Abies*, *Rhododendron, Quercus, Tsuga, Betula* and *Acer* was found 0.92%, 0.67 %, 0.58 %, 0.50 %, 0.48 % and 0.20 % respectively in post monsoon period. The seed components of Aconogonum, Juniperus, Sorbus represented 15 %, 2.73 % and 1.47 % respectively. Mushroom component represented only 0.66 % of total

components. The highest plant fragment 42.386 ± 1.141 and 42.859 ± 1.218 of *Thamnocalamus sp* was found highest in both pre monsoon and post monsoon period. No component of *Aconogonum sp, Sorbus cuspidate, and Juniperus indica* was found in the sample of pre-monsoon period while Texus wallichiana was also absent in the sample of post monsoon period. *Acer acuminatum 0.1139* ± 0.0476 was found lowest component fragment among the food in both seasons. In spite of *Thanmocalmus* sp. In the droppings throughout the year, berries of *Sorbus*, *Aconogonum* and *Juniperus* were found occasional feeding components but bamboo becomes to be their dietary staple (Roberts & Gittlemans 1984)
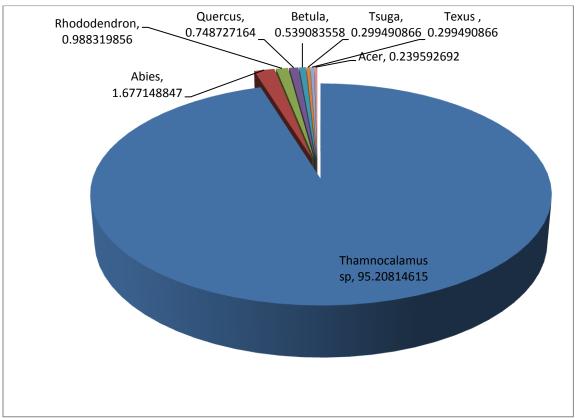

Fig 2. Percentage of diet components in the fecal pellets of Red panda in pre monsoon period.

Table 1 Fragment mean range of diet composition in the fecal pellets

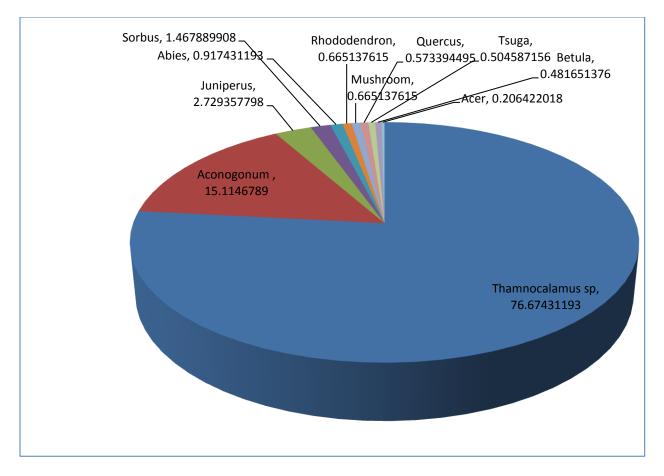| Fragment components in pre monsoon (mean ± SE)				Fragment Components in Post monsoon (mean ± SE)			
Thamnocalamus sp	42.3867	±	1.141	*Thamnocalamus sp*	42.859	±	1.2181
Abies spectabilis	0.7368	±	0.2632	*Aconogonum sp*	8.3418	±	1.0483
Rhododendron arboretum	0.4342	±	0.0865	*Sorbus cuspidate*	1.6203	±	0.8076
Quercus semicarpefolia	0.3289	±	0.0962	*Juniperus indica*	1.5063	±	0.2743
Betula ustilid	0.2368	±	0.0645	*Abies spectabilis*	0.5063	±	0.1109
Tsuga demosa	0.1316	±	0.0508	*Rhododendron arboretum*	0.3671	±	0.0848
Texus wallichiana	0.1316	±	0.0472	Mushroom	0.3671	±	0.1022
Acer acuminatum	0.1053	±	0.0516	*Quercus semicarpefolia*	0.3165	±	0.0755
				Tsuga demosa	0.2785	±	0.0719
				Betula utilis	0.2658	±	0.0758
				Acer acuminatum	0.1139	±	0.0476

Fig.3 Percentage of diet components in the fecal pellets of Red panda in post monsoon period.

Conservation of Red panda

Threats

There were 3124 households with total of 17139 people in the buffer zone of RNP. Village development committees of RNP are Rara, Shreenagar, Karkibada, Pina, Khamale, Seri, Bumramadichaur, Bota Malika, and Kanka Sundari and cover the area of 198 km². Almost all inhabitants live throughout the year in spite of extreme cold and snowfall in the winter season. They were directly involved in the red panda habitat for the collection of materials and grazing their livestock inside the Park illegally. Farmers used twigs of trees from the park for the formation of hedges (pylons) in their croplands and for daily uses. Due to inadequate production of timber, fuel-wood and lack of alternate energy resources in the buffer zone area, people collected fodder after taking the permission from Park authorities but the people were not skilled on the cutting and collection technique of the materials. The over exploitation was also for Diyalo (for lighting), stall feeding, forage, fodder and fuel-wood. These activities directly involved in the red panda habitat. Trees are important for the survival of red panda, especially for nesting, sleeping, and shelter and feeding. At the time of stall feeding and collecting forage, they mostly collected nigalo that is easy to cut and consumes less time to harvest. This species was also used for fencing in the cropland, for the formation of Basket, tube for Hukka etc.

More than 98 % households have at least one dog for security. The dogs are for security of livestock from leopard, Himalayan Black Bear etc. These dogs may pose threats to red panda by killing and chasing them away from the site. The incidences of killing red panda around villages and transition zones may be due to human interventions and their dogs. Two months ago the a dog carried for the protection of livestock in the forest tried to kill the red panda which is protected after threatening the dog (Lal Bahadur Rokaya per. comm. Nov.2011). Williams (2004) reported the killing of two red panda in Jamuna and Madhu village of eastern Nepal, which was an account of dog offence.

Conservation education

Because of the remoteness of Rara National Park from capital of the kingdom and lacking of transportation facilities, a few research works were carried out in this area. Management interventions were also inadequate because of its remoteness and wilderness. Local management system is inadequate and it often demands update and scientific management interferences. Species management strategies are most requisite for Park. Accounts of species conservation education programs were conducted in Park areas in this connection. Meetings, discussions and information sharing programs were launched with Park and Buffer Zone's authority level. The interactions were focused on sustainable resource use, species and habitat management and capacity buildings. The red panda conservation theme was in particular. One red panda eco-club was established, with the aim of conservation and conducting conservation awareness programme in the buffer zone areas through student. Small seed money was deposited for the club to run the programme and the programme will be in presence of park authorities. After ten months of our conservation awareness programme in Rara National Park, one red panda was rescued from Bhulbhule area of buffer zone.

Conclusion

The study indicated the presence of red panda in Rara National Park. The research showed that pandas are living in narrow elevational range due to vegetation structure and physiographic structure of the area. The fecal pellets were found only from 3,117 to 3,591 m of elevation. The fecal pellets density of red panda was higher in the areas, where *Abies*, *Rhododendron*, *Betula*, *Quercus* and bamboo were dominant. *Abies* was important for providing shelter, *Rhododendron* and *Betula* for movement, rest and bamboo as source of food. New area of red panda habitat in Jumla district at the Buffer zone of Rara National Park was identified during this period.
Strict rule and regulation abide the local people and it helps to control illegal hunting and poaching. Many trees were also looped and felled as a mean of timber and agriculture implements after taking the permission from park with minimal charge The over exploitation was also for Diyalo (for lighting), stall-feeding, forage, fodder and fuel-wood create problems to the species for surviving. In rural areas habitat degradation was mainly caused due to over exploitation of natural resources for daily uses. Most of the people of RNP were indigent and ignorant on the method of consumption of resources and they had also low-income sources. It ultimately creates conflict with Park. Adoption of alternative and renewal energy, enhancing eco-tourism, publicity of Rara Lake, retaining and effective Park management system, and capacity building programs were imperative after discussion for the conservation of red panda in Rara National Park.

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Annex 1. GPS location of red panda in Rara National park

Observed site	Latitude and longitude	Elevation	Remarks
T1p1	N-29° 31′ 34.20″ E-082° 03′ 57.26″	2985	
T1p2	N-29° 31′ 30.76″ E-082° 03′ 47.38″	3085	
T1p3	N-29° 30′ 26.32″ E-082° 03′ 36.24″	3185	T---Transect
T1p4	N-29° 31′ 22.16″ E-082° 03′ 29.15″	3232	p--Plot
T2p1	N-29° 31′ 17.09″ E-082° 04′ 02.88″	2994	
T2p2	N-29° 31′ 08.04″ E-082° 03′ 54.21″	3086	
T2p3	N-29° 31′ 1.17″ E-082° 03′ 46.76″	3190	
T2p4	N-29° 30′ 57.78″ E-082° 03′ 41.41″	3292	
T2p5	N-29° 30′ 51.36″ E-082° 03′ 35.47″	3392	
T3p1	N-29° 31′ 06.77″ E-082° 04′ 12.08″	3008	
T3p2	N-29° 30′ 56.32″ E-082° 03′ 58.25″	3108	
T3p3	N-29° 30′ 50.99″ E-082° 03′ 50.66″	3202	
T3p4	N-29° 30′ 46.26″ E-082° 03′ 44.20″	3306	
T3p5	N-29° 30′ 42.74″ E-082° 03′ 39.00″	3405	
T3p6	N-29° 30′ 40.40″ E-082° 03′ 35.87″	3447	
T4p1	N-29° 30′ 57.99″ E-082° 04′ 20.83″	2995	
T4p2	N-29° 30′ 53.54″ E-082° 04′ 13.75″	3072	
T4p3	N-29° 30′ 46.39″ E-082° 04′ 01.96″	3194	
T4p4	N-29° 30′ 41.08″ E-082° 03′ 53.46″	3294	
T4p5	N-29° 30′ 36.45″ E-082° 03′ 45.82″	3395	
T5p1	N-29° 30′ 53.95″ E-082° 04′ 32.57″	2992	
T5p2	N-29° 30′ 46.47″ E-082° 04′ 23.13″	3097	
T5p3	N-29° 30′ 38.66″ E-082° 04′ 12.47″	3196	
T5p4	N-29° 30′ 33.45″ E-082° 04′ 05.29″	3296	
T5p5	N-29° 30′ 30.44″ E-082° 04′ 01.08″	3336	
T6p1	N-29° 30′ 50.43″ E-082° 04′ 48.55″	3008	
T6p2	N-29° 30′ 36.84″ E-082° 04′ 35.30″	3107	
T6p3	N-29° 30′ 28.18″ E-082° 04′ 27.06″	3208	
T6p4	N-29° 30′ 20.99″ E-082° 04′ 20.93″	3306	
T6p5	N-29° 30′ 16.33″ E-082° 04′ 15.58″	3376	
T7p1	N-29° 30′ 44.74″ E-082° 05′ 05.86″	2998	
T7p2	N-29° 30′ 32.47″ E-082° 04′ 57.80″	3092	
T7p3	N-29° 30′ 21.54″ E-082° 04′ 50.12″	3192	
T7p4	N-29° 30′ 08.44″ E-082° 04′ 41.79″	3293	

T8p1	N-29°30′47.96″ E-082°05′21.11″	3020
T8p2	N-29°30′27.77″ E-082°05′10.35″	3112
T8p3	N-29°30′14.74″ E-082°05′03.53″	3209
T8p4	N-29°30′04.23″ E-082°04′57.77″	3310
T8p5	N-29°29′56.97″ E-082°04′53.14″	3411
T8p6	N-29°29′49.66″ E-082°04′49.14″	3516
T9p1	N-29°30′59.40″ E-082°05′29.93″	3013
T11p1	N-29°31′15.08″ E-082°05′56.4″	3007
T11p2	N-29°31′04.71″ E-082°06′04.66″	3118
T12p1	N-29°31′20.76″ E-082°06′05.68″	3008
T12p2	N-29°31′59.40″ E-082°05′29.93″	3108

Annex 2. GPS for New red panda habitat in Bhulbhule of Jumla District (2012 May/ June)

Observed site	Latitude and longitude	Elevation
Bhulbhule	N-29°26′54.2″ E-082°07′44.5″	3441
	N-29°26′50.2″ E-082°07′45.8″	3542
	N-29°26′46.6″ E-082°07′46.7″	3579
	N-29°26′48.1″ E-082°07′43.1″	3455
	N-29°26′47.0″ E-082°07′38.8″	3357
	N-29°26′40.6″ E-082°07′36.4″	3362
	N-29°26′44.0″ E-082°07′28.3″	3257
	N-29°26′33.5″ E-082°07′21.3″	3317
	N-29°26′32.7″ E-082°07′16.2″	3556
	N-29°26′33.6″ E-082°07′14.6″	3591
	N-29°26′45.9″ E-082°07′18.7″	3372

Annex 3. Red panda location inside red panda habitat outside transect.

Observed site	Latitude and longitude	Elevation
Rigda	N-29° 30′ 22.4″ E-082° 04′ 84.9″	3227
Bagada Danda Lamo khutti ko Muhan	N-29° 31′ 21.3″ E-082° 03′ 55.8″	3298
	N-29° 30′ 83.7″ E-082° 03′ 67.8″	3427
	N-29° 29.7′ 68″ E-082° 05′ 008″	3569
	N-29° 29.3′ 08″ E-082° 05′ 16″	3560
	N-29° 29′ 7.7″ E-082° 04′ 66.2″	3416
	N-29° 29′ 83.2″ E-082° 04′ 62.5″	3323
	N-29° 30′ 29.9″ E-082° 04′ 80.1″	3298
	N-29° 29′ 94.5″ E-082° 04′ 94.2″	3393
Dara Khokhadi	N-29° 30′ 43″ E-082° 04′ 93.5″	3392
	N-29° 30′ 27″ E-082° 05′ 20″	3250
	N-29° 30′ 10.9″ E-082° 05′ 053″	3273
	N-29° 30′ 31.2″ E-082° 04′ 8.14″	3219
	N-29° 29′ 47.2″ E-082° 05′ 43.6″	3337
Bukiduska	N-29° 29′ 43″ E-082° 05′ 38.4″	3402
	N-29° 29.4′ 44″ E-082° 05′ 17.2″	3486
	N-29° 29.4′ 23″ E-082° 05.1′ 12″	3516
	N-29° 29.3′ 74″ E-082° 05′ 17.1″	3520
Dhanre kharka	N-29° 29.3′ 41″ E-082° 05′ 28.8″	3473
	N-29° 29′ 34.6″ E-082° 05′ 31.3″	3476
	N-29° 29.3′ 39″ E-082° 05′ 38.4″	3425
	N-29° 29.7′ 34″ E-082° 05.1′ 7.9″	3478
Mudani Sukadaha	N-29° 29.4′ 19″ E-082° 05′ 54.7″	3361
	N-29° 29′ 31.9″ E-082° 05′ 46.9″	3326
	N-29° 29′ 61.9″ E-082° 05′ 64″	3133
	N-29° 30′ 6.2″ E-082° 03′ 9.01″	3377
	N-29° 30′ 57.3″ E-082° 03′ 9.11″	3390
	N-29° 30′ 59.9″ E-082° 03′ 9.02″	3385
	N-29° 30.60′ 9.4″ E-082° 038′ 34″	3348
	N-29° 30.60′ 53″ E-082° 038′ 9.6″	3302
	N-29° 30.60′ 45″ E-082° 038′ 8.3″	3308
	N-29° 30.60′ 43″ E-082° 039′ 59″	3377
	N-29° 30.60′ 43″ E-082° 03′ 9.34″	3395