

Technical Report (PR-150)

# Population Status of Rhesus Macaque (*Macaca mullata*) in Himachal Pradesh, India

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**Himachal Pradesh Forest Department, Wildlife Wing**



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**Singh, Kumara and Velankar**

## 1.1 Study Area and Species

Among 22 species of primates in India, many are highly confined to the forest habitat. However, few species have adapted to live in human dominated landscapes and these include bonnet macaque, rhesus macaque, long-tailed macaque and Hanuman langur. They are also known as 'commensal' primates in India (Southwick and Siddiqi 1994, Bishop et al. 1981), which have adapted to live with humans either by directly occupying the same habitat or marginal habitat in contact with humans. Among them, rhesus macaque is known to range from north of rivers 'Tapti' and 'Godavari', to the entire northern India. Rhesus macaques are found throughout continental Asia; from Afghanistan to India and Thailand to southern China (Smith and McDonough 2005). Two subspecies of rhesus macaque *viz.*, *M. m. villosa* and *M. m. mulatta* are found in Indian subcontinent and South-East Asia. The *M. m. villosa* is found in the Kashmir and Punjab regions of India (the northern part of the country), Pakistan and Afghanistan, where *M. m. mulatta* is found in India, Bhutan, Burma, Nepal, Bangladesh, Thailand, Laos, and Vietnam (Groves 2001; Smith and McDonough 2005). Thus, the rhesus macaque is the primate with broadest geographical distribution (Southwick et al. 1996). Rhesus macaques are known to occur from dry scrub forests of lower altitude to as high as 3000 m asl in Himachal Pradesh, and in all possible forest types and human dominated landscapes including urban and rural areas, agriculture fields, temples and tourists sites.

Rhesus macaques are a multi male-multi female society, and they live in groups with the mean group size of 35, though the group size could be up to 250 animals in some of the temples and tourists sites. The average age-sex ratio is about 2 adult females to one male, 1.7 immature per one adult female, 0.6 infants per one adult female or 1 immature per one adult. However, these ratios vary according to variation in the ecological conditions and interference in their social system. This will also have impact on reproductive behavior and survival rate of an individual. Females attain puberty at the age of 3, and start reproducing at the age of 3.8, where males attain puberty at the age of 4 but attain full adulthood at the age of 8 years. Majority of mating occur between October and December, and births coincides with the end of

rainy season (Lindburg 1971). Gestation lasts for 164 days, and the inter birth interval vary between 12 and 24 months.

Rhesus macaque is omnivore and feeds on a wide variety of plant and animal (invertebrate) origin foods (reference). Home range sizes vary a lot depending on the occupied habitat and the resource availability i.e. 0.1 to 15 km<sup>2</sup>, however, the average home range size is about 5 km<sup>2</sup> reference.

## **1.2 Human-Rhesus Macaque Conflict**

Due to commensal nature of rhesus macaques, crop raiding in the agriculture fields, food snatching in the temples, tourist sites, railway stations and urban areas persists from ages in its entire range of distribution. This has led to high degree of human-rhesus macaque conflict that has drawn the attention of wildlife managers and policy makers. Due to the large number of complaints on regular basis, monkeys have been often translocated to different places. Such translocations have not resolved the conflict rate in the country; conversely such translocations shifted the problem to new areas instead of resolving the issue, however, translocation of monkeys is often practiced in its entire distribution range.

Human –Macaque conflict in Himachal Pradesh is known from the last hundred years (reference). One of the working plans – (1955 of Chamba) -has special section on macaque management that includes allocation of budget for translocation of macaque. Although the high density of rhesus macaque was known from Himachal Pradesh, the first estimate of their numbers came in 1977-83 (Table 1). Zoological Survey of India reported 19,500 rhesus macaques in Himachal Pradesh (as reported in Southwick and Lindburg 1986). This low density may be due to high export of macaques between 1950 and 1960, which had drastically reduced the population size in the state. Dolhinow and Lindburg (1980) reported the forest rhesus macaque population to be between 60,000 and 70,000 for entire Himachal Pradesh using vehicle survey. After ten years, Pirta et al. (1997) conducted a survey between 1988-90 using existing trails, and reported 1, 55,080 macaques in forest and 67,934 macaques in non-forest areas of Himachal Pradesh which amounted to a total of 2,05,274 rhesus macaques for the entire state.

Table 1 indicates that the rhesus macaque population bounced back from once sharp declination due to high exploitation of macaques due to export, which was banned by Government of India in 1978. Similar trend of decline in the population was reported from Uttar Pradesh following ban on monkey export and later the population bounced back (Southwick and Siddiqui 1994). Gradually human-monkey conflict also increased with increase in the population of monkeys. In Himachal Pradesh, conflict between humans and macaques is more than conflict with any other species. Further, local people have lost their tolerance towards monkeys due to loss of crop and property (Pirta et al. 1997). Local people are of the opinion that they should be compensated for the loss incurred due to monkeys, and also monkeys should be relocated somewhere else. These factors took socio-political turn, and pressure was mounted on Forest Department to take action on the issue to reduce the rate of conflict. Knowing the population size in the state became a prerequisite to initiate any steps to mitigate the conflict. Thus department initiated the head count of rhesus macaque in the state in 2003, which reported 3,19,168 macaques for the state. Although, there were few attempts to reassess the population in 2010 and 2012, assessment could not be carried out in the entire state. The entire state was reassessed with the same protocol in 2013 that reported 2,26,086 macaques in the state. To understand the current status of them, the monkeys were assessed in June-July 2015 with the improvised old protocol. The details of the method followed to assess the population and the population status of rhesus macaque is presented in this report.

**Table 1. Population of rhesus macaques over the period in Himachal Pradesh**

<b>Year</b>	<b>Estimated population</b>	<b>Reference and Remarks</b>
1977	19500	Report by Zoological Survey of India, methodology in not clear
1980	70000	Dolhinow and Lindburg (1980), conducted vehicular survey and documented direct sightings and preferred habitat.
1990	205274	Pirta et al (1997), walked existing trails and paths spread over entire state. Extrapolated encounter rate to estimate population
2004	319168	Forest department conducted head count of macaques. Counts were taken in selected trails and paths of every beat.
2013	224613	Head count, same as above.



### 2.1 Survey Methods

Since the entire terrain of Himachal Pradesh comprises highly undulating mountain ranges of Himalayas, straight transect lines could not be established. Thus in each forest administrative beats, two to three existing trails or animal pathways (transect lines) were selected for sampling the primates. Each transect line was separately marked on 1:50000 toposheet, and three copies of the same were given to the respective team. Each team included trained department personnel and one local assistant. A total of 2631 transects were walked consecutively for three days between 06:00 hr and 11:30 hr. Out of these, 1617 transects which were not intersecting with beat boundaries and other transects were selected for analysis. The total kilometers walked amounted to 12782.85 km. During the walk each sighting of the primate species was recorded on map and in the data sheet. Sufficient time was spent with the group to record the group size and demography of the individuals in the group with the species identity. Differentiating sub-adults and juveniles was difficult, hence, only number of adult males, adult females, infants (I) and immatures were recorded. In addition to this, habitat type of the location of the sighted group was also recorded.

### 2.2 GIS and Statistical Analysis

All the sampling trails and detection of macaques were digitized based on the toposheets, with the help of digital toposheets obtained from Survey of India by Forest Department of Himachal Pradesh using ArcGIS 9.2 (ESRI co.). Trail length was calculated using field calculator in QGIS Pisa (v2.10).

**2.2.1 Estimation of Suitable habitat for rhesus macaque:** A total of 8500 non-overlapping occurrence records were obtained for rhesus macaques. These occurrence records were used to model the 'realized niche' (possible extent of the niche of species) using maximum entropy algorithm available in MaxEnt 3.3.3k (Phillips and Dudik 2008).

**Environmental Coverage Variables:** To model the suitable habitat, 22 environmental variables were used of which 18 were bioclimatic and 3 were altitude, slope and ruggedness index (Table 2). Bioclimatic and Altitude layers were obtained from global climate data repository ([www.worldclim.org](http://www.worldclim.org)). Slope and Ruggedness Index layers were generated from altitude layer by using digital terrain modeling module in QGIS Pisa (v2.10). All layers were of 1 km spatial resolution and details are given in table below.

Maximum entropy algorithm available in MaxEnt (Phillips and Dudik 2008) was used to model the probability distribution of rhesus macaques across the environmental layers. Model was set with random test percentage of 25 % and output of 5 models run separately was averaged to obtain final model.

**2.2.2 Population estimation:** The mean number of groups sighted was calculated for each transects. We considered 5 sq. km. as average home range of rhesus macaques in India. Keeping this as reference point, we created a 1.261 radial distance from transect, and thus the strip width calculated was 2.522 km, which we multiplied with length of transect to arrive the area that was sampled for each transect. We calculated the numbers of groups in an area (group density= groups/ sq. km.) by using mean number of groups in that transect and the area estimated. Further, we calculated the mean group size using the numbers of individuals recoded for the detection of groups on that transect, which was multiplied with the density of macaque group to arrive number of macaque/sq km. Estimation of density for division and circles: The density of macaque from all the transects of the interest areas were pooled and we computed the mean density of macaques. The realized niche model by MaxEnt provided the suitable area for entire state, from which the area of interest (circle or division) was clipped, that provided the suitable habitat available in each circle or division. The total population size for each unit area was arrived at by multiplying the mean density of macaques with the total suitable habitat available.

**Table 2.** Details of environmental layers used to build the models using MaxEnt.

Layer	Description
BIO1	Annual Mean Temperature
BIO2	Mean Diurnal Range (Mean of monthly (max temp - min temp))
BIO3	Isothermality (BIO2/BIO7) (* 100)
BIO4	Temperature Seasonality (standard deviation *100)
BIO5	Max Temperature of Warmest Month
BIO6	Min Temperature of Coldest Month
BIO7	Temperature Annual Range (BIO5-BIO6)
BIO8	Mean Temperature of Wettest Quarter
BIO9	Mean Temperature of Driest Quarter
BIO10	Mean Temperature of Warmest Quarter
BIO11	Mean Temperature of Coldest Quarter
BIO12	Annual Precipitation
BIO13	Precipitation of Wettest Month
BIO14	Precipitation of Driest Month
BIO15	Precipitation Seasonality (Coefficient of Variation)
BIO16	Precipitation of Wettest Quarter
BIO17	Precipitation of Driest Quarter
BIO18	Precipitation of Warmest Quarter
BIO19	Precipitation of Coldest Quarter
ALT	Altitude
SLP	Slope
RI	Ruggedness Index

High-density hotspots: Average density for each beat was calculated. Centroids of beat polygons were appended with the respective density of the beat. Inverse Distance Weighing (IDW) was used as method to interpolate the density for the entire state. Raster image of interpolation was clipped to state boundary (Sarmiento et al. 2009).

Variation in estimation: Most of the geographical data was collected by manually tracing trails and group locations on 1: 15000, 1: 25000 and 1 : 50,000 scale toposheets. This data was later digitized using ArcGIS 9.3 as line and point features. Maximum error in digitizing was for 1 : 50,000 scale toposheet since it spatially covers larger area and small deviations in mapping contributes to larger deviations from actual situation. Digitizers took precaution of working at higher zoom levels to accurately digitized depicted information. Mapping error of 1 cm on 1 : 50000 scale equals to deviation of 500 m from actual situation. Home range of rhesus

macaques being 5 km<sup>2</sup>, group locations marked within 1.26 km i.e. ~2.5 cm on toposheets would not contribute to error in estimation.

Further, Bioclimatic layers used to model the suitable area were of 1 km<sup>2</sup> spatial resolution. Due to use of low resolution imagery, group locations marked with up to 2.5 cm error could be used for habitat suitability prediction using MaxEnt.

Hence, error in estimation was calculated based on standard deviation of the density estimate for each circle (Table no. 4).

### 3.1 Population Trend of Rhesus Macaque in Himachal Pradesh

Suitable habitat area for rhesus macaques was found to be 27276.83 km<sup>2</sup> (Fig 1). Northern parts of Himachal Pradesh comprising high altitude alpine habitats are not suitable for rhesus macaques, which was modeled correctly by MaxEnt algorithm. The MaxEnt prediction shows high suitability in the central, western and eastern regions of the state while the northern divisions of Pangti, Lahul and Spiti show low probability along with northern regions of GHNP, Kullu wildlife division and Kinnaur division. Based on the density, average group size and suitable area available in each division, total population of rhesus macaques was estimated to be 2,06,650 individuals in Himachal Pradesh. Division-wise breakup of the population is given in Table 3. In comparison to 2013 census estimates, it is evident that overall population of the rhesus macaques has decreased. Although overall trend is showing decline, some divisions viz. Rohru, Renukaji, Bilaspur, Palampur, Nurpur, Dharamshala, Pangti and Dalhousie show sharp increase in population. Similarly sharp decline can be seen in case of Hamirpur and Jogindar Nagar divisions. Population in Anni, Rajgarh, Suket, Chamba, Bharmaur and Nalagarh remained stable without sharp increase or decrease. Figure 2 shows the rate of change of macaque population in all the divisions.

**Table 3 . Division-wise breakup of population estimation and comparison with 2013 estimates.**

DIVISION	Density (strip area)	Number of groups	Average group size	Population estimation		
				2004	2013	2015
<b>Bilaspur circle</b>						
BILASPUR	0.33	322	33	12383	9151	13810
KUNIHAR	0.19	98	38	7569	5310	6035
NALAGARH	0.13	70	38	2021	2996	3114
<b>Chamba circle</b>						
BHARMAUR	0.06	32	35	1491	1916	1839
CHAMBA	0.14	150	38	6912	7648	7888
CHURAH	0.13	68	31	16370	4854	2756
DALHOUSIE	0.39	250	40	28077	8404	10869

PANGI	0.22	61	45	1409	973	2764
<b>Dharamshala circle</b>						
DHARAMSHALA	0.2	191	36	13787	6841	8884
NURPUR	0.37	448	30	18885	12548	14931
PALAMPUR	0.24	243	31	16319	6340	8676
<b>Dharamshala Wildlife North Circle</b>						
CHAMBA WL	0.06	9	32	182	1026	419
HAMIRPUR WL	0.11	39	4	1538	1989	154
<b>GHNP Circle</b>						
GHNP	0.25	52	14	1860	1684	1231
KULLU WL	0.1	62	26	3349	2000	1611
<b>Hamirpur Circle</b>						
DEHRA	0.11	100	35	0	8601	6246
HAMIRPUR	0.17	183	25	13487	11772	5541
UNA	0.34	499	31	11798	20454	18174
<b>Kullu Circle</b>						
KULLU	0.27	181	16	4075	3597	3052
PARVATI	0.07	40	10	5964	2949	424
SERAJ	0.24	80	22	2451	3868	2088
Lahul	0	0	0	0	0	0
<b>Mandi circle</b>						
JOGINDERNAGAR	0.16	99	38	10046	9430	4609
KARSOG	0.17	95	38	7055	5916	3611
MANDI	0.14	109	38	6808	5348	4128
NACHAN	0.15	90	34	6767	4422	3129
SUKET	0.17	147	42	7510	7904	7797
<b>Nahan Circle</b>						
NAHAN	0.22	103	39	13888	6981	5743
PAONTA SAHIB	0.11	49	35	9224	3108	2546
RAJGARH	0.26	186	38	12500	10041	9905
RENUKA JI	0.37	339	27	75	5902	12466
SOLAN	0.23	120	33	1833	7900	5319
<b>Rampur circle</b>						
ANNI	0.19	121	23	5411	2790	3015
KINNAUR	0.03	18	32	3832	2690	575
KOTGARH	0.13	33	16	2555	3567	730
RAMPUR	0.08	55	27	6473	4297	2465

<b>Shimla Circle</b>						
CHOPAL	0.16	122	27	4653	3937	3293
ROHRU	0.09	98	49	4582	2906	4855
SHIMLA	0.05	31	38	11165	5827	5580
SHIMLA URBAN	0.75	44	33	1786	1464	1166
THEOG	0.15	96	21	5602	3761	2092
<b>Shimla Wildlife South</b>						
SARHAN WL	0.11	23	29	1071	1006	673
SHIMLA WL	0.25	44	22	4405	1959	964
Spiti	0	0	0	0	0	0
<b>Total estimated population</b>				299787	224613	206650

**Table 4. Circle-wise error in estimated population.**

<b>Circles</b>	<b>Suitable area</b>	<b>Standard Deviation</b>	<b>Average of average group size</b>	<b>Estimation Variation</b>
Bilaspur	2196.7643	0.21	32.8	15345
Chamba	3099.0558	0.11	37.8	12464
Dharamshala	3205.3816	0.21	32.3	21523
Dharamshala Wildlife North	492.5974	0.09	18.0	789
GHNP	801.7796	0.13	20.0	2043
Hamirpur	3451.8896	0.16	30.3	16432
Kullu	1580.1627	0.16	16.0	4147
Mandi	3441.0164	0.13	38.0	16770
Nahan	3070.221	0.16	34.4	17075
Rampur	2073.2988	0.07	24.5	3717
Shimla	3119.0262	0.10	33.8	10817
Shimla Wildlife South	210.6673	0.27	25.5	1462
<b>Overall error in estimate</b>				<b>10215</b>

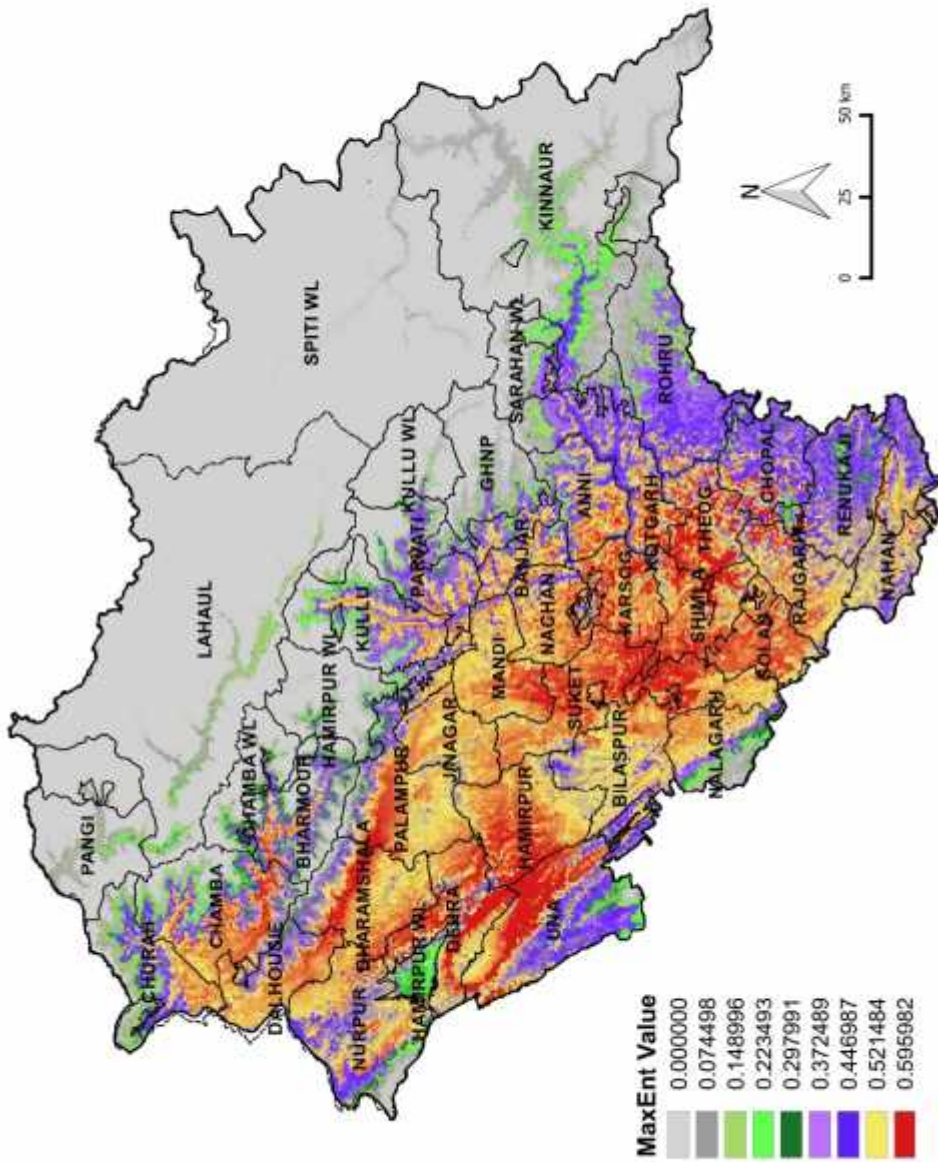
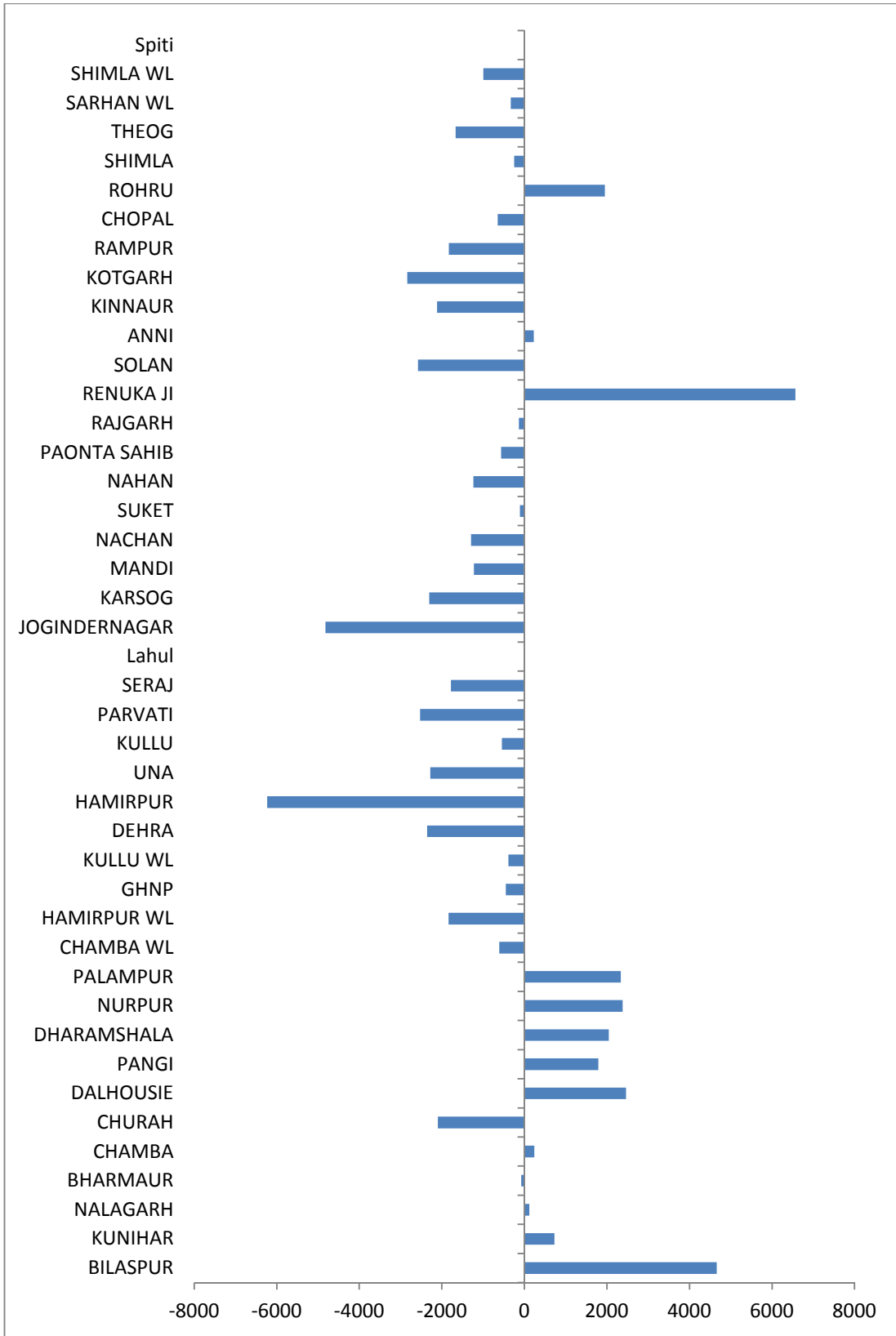


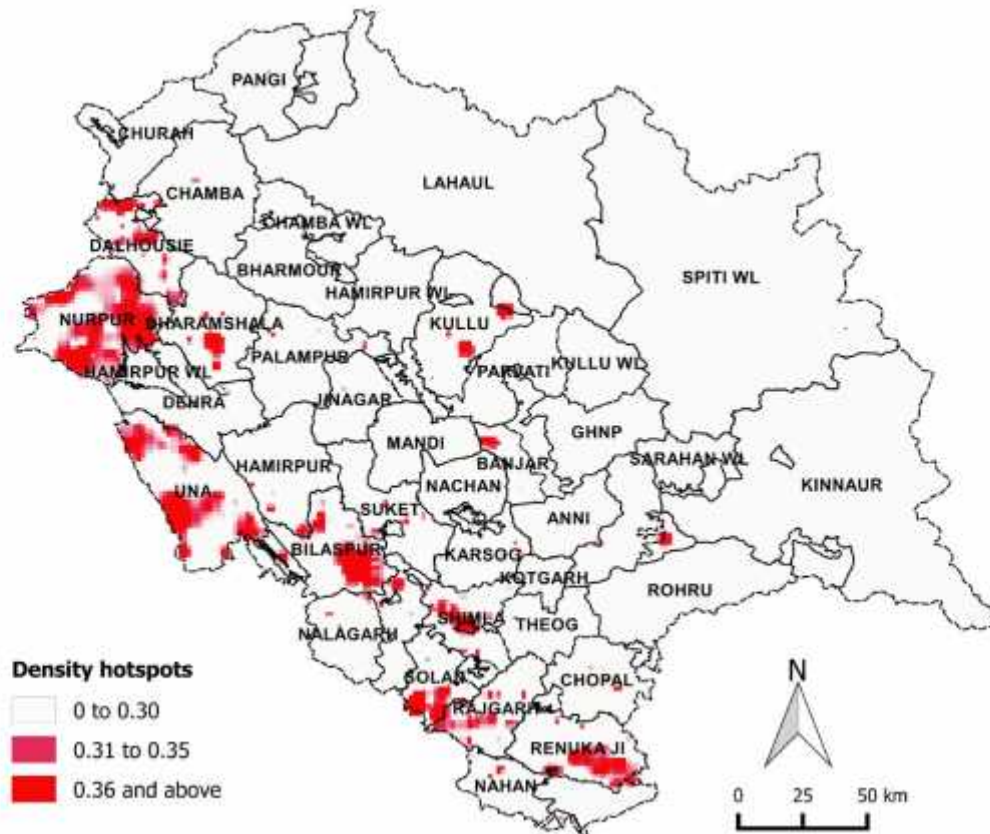
Fig 1. Himachal Pradesh with Forest Divisions showing the suitable habitat of Rhesus macaques modeled by MaxEnt.





**Fig 2. Change in the population size between 2013 and 2015 estimates in different forest divisions**

Inverse distance weighted interpolation of density shows distinct hotspots of density above 0.3 groups per km<sup>2</sup> (Fig 3). Total of 348 beats fall in these hotspot regions. The details of ranges falling under these hotspots are given in table 5.



**Fig 3. Inverse Distance Weighted Interpolation of density estimates of rhesus macaques in Himachal Pradesh. Hotspot areas of high density are depicted in dark colour.**

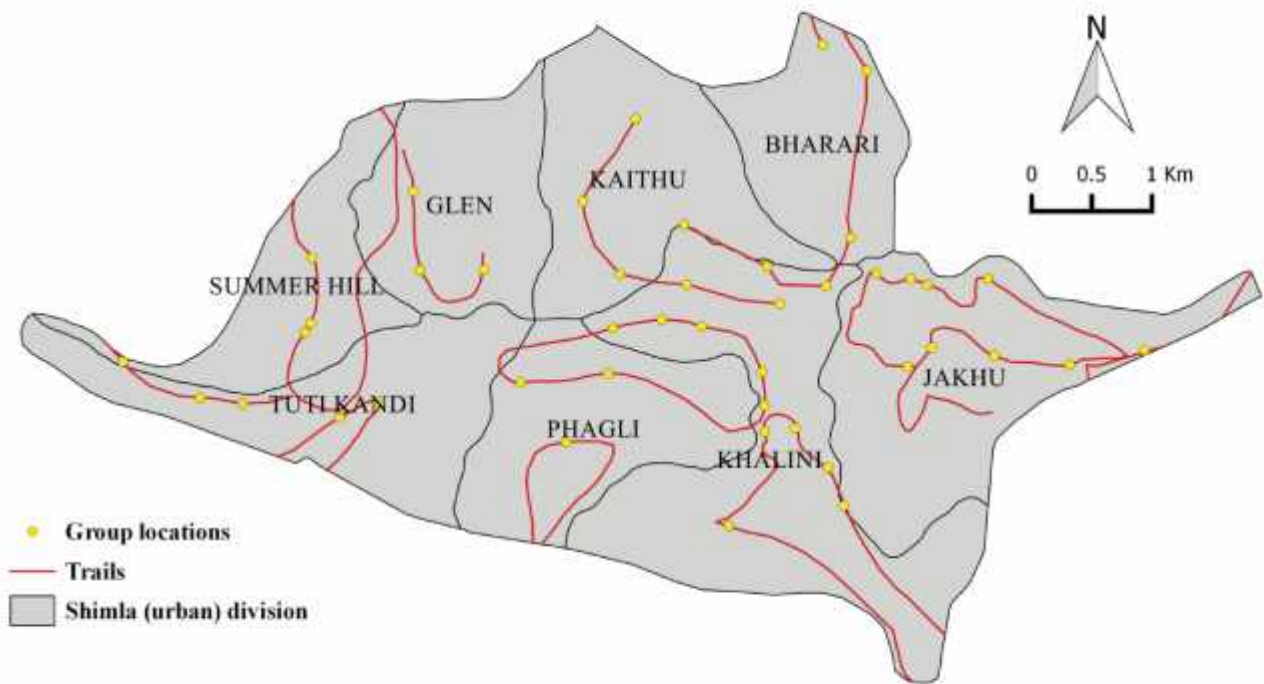
**Table 5. Circle wise names of ranges with number of beats falling under density hotspots**

Circle	Division	Range	Beats
Bilaspur	Bilaspur	Bharari	6
		Ghumarwin	5
		Jhandutta	5
		Sadar	13
		Swarghat	5
	Kunihar	Arki	2
		Darla	2
	Nalagarh	Kohu	2
		Nalagarh	1
Ramshehar		1	
Chamba	Chamba	L/Chamba	2
	Churah	Bhalei	1
	Dalhousie	Army Area	1
		Bakloh	7
		Bhattiyat	8
		Chowari	8
		Dalhausie	9
	Pangi	Killar	1
Dharamshala	Dharamshala	Dharamshala	2
		Kangra	9
		Lapiana	2
		Malan	1
	Nurpur	Indora	14
		Jawali	13
		Kotla	9
		Nurpur	15
		Rey	15
	Palampur	Palampur	2
HamirpurWI	Naina Devi	1	
	Pong Dam	1	
Ghnp	KulluWI	Inderkila National Park	1
		Karsog	1
Hamirpur	Dehra	Dehra	2
		NagrrotaSurian	1
	Hamirpur	Barsar	3
		Bijhari	3
	Una	Amb	9
		Bangana	1
		Bharwain	12
		Ramgarh	7
Una		13	

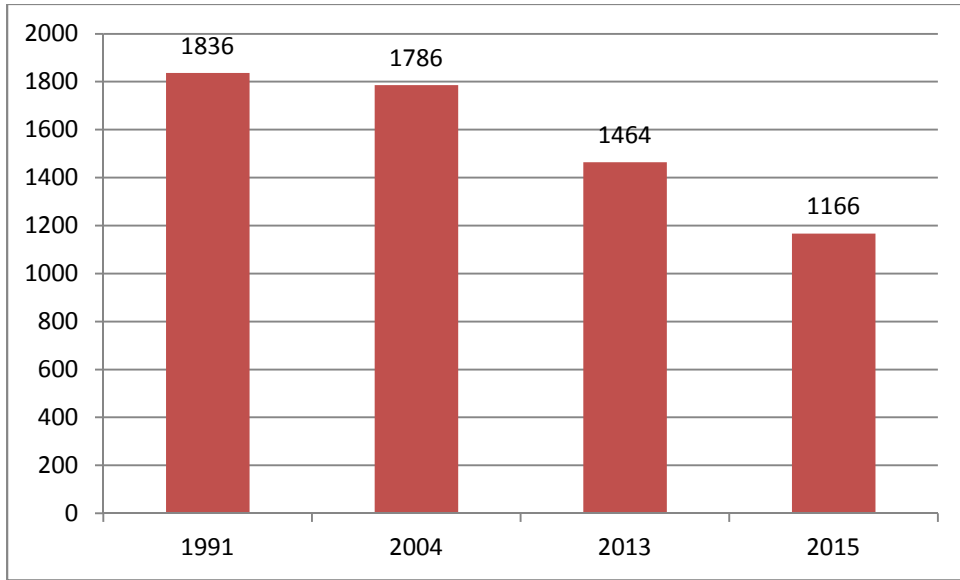
Kullu	Banjar	Sainj Range	3
	Kullu	Naggar	5
		Patalikuhhal	1
		Patlikuhhal	2
Mandi	Joginder Nagar	Ladbharol	1
	Karsog	Seri	3
	Suket	Jaidevi	3
		Kangoo	1
		Suket	1
Nahan	Nahan	Jamta	2
		Trilokpur	1
	Paonta Sahib	Bhagani	2
		Girinagar	1
		Majra	1
	Rajgarh	Narag	7
		Rajgarh	4
		Sarahan	5
	RenukaJi	Kafotta	8
		Nohra	1
		RenukaJi	6
		Sangrah	1
		Shillai	4
	Solan	Dharampur	8
		Kandaghat	1
		Parwanu	11
Solan		1	
Subathu		1	
Rampur	Anni	Arsoo	1
	Rampur	Rampur	1
Shimla	Chopal	Chopal	2
		Deya	1
		Nerwa	2
	Shimla	Bhajji	2
		Dhami	6
		Koti	2
		Mashobra	8
		Taradevi	6
	Shimla (Urban)	ChauraMaidan	8
Theog	Theog	1	
Shimla WI South	SarahanWI	Dharanghati	1
	Shimla WI	RenukaJi	2
		Simbalbara	2
<b>Total No Of Beats In Hotspot</b>			<b>348</b>

### 3.2 Population Trend of Rhesus Macaque in Shimla Urban Region

Due to high occurrence of macaques in urban landscape of Shimla, urban region and possibility of re-recording the same group being very high, total count method was employed. As per the total count method, there are 44 total groups in study region with 1166 individuals. Figure 4 shows the locations of trails and groups observed in Shimla urban division. Figure 5 shows population trend of macaques in Shimla urban region with population estimates from past surveys and historical records. Figure 5 shows the comparative estimates of rhesus macaque population in Shimla Urban region from 1991 to 2015 period.



**Fig 4. Trails and macaque groups observed in Shimla urban region during survey.**



**Fig 5. Population trend of rhesus macaque in Shimla urban region**

### 3. Conclusion

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Given that different methods were used at different periods of study to estimate the population size, the estimates are not comparable. However, earlier findings between 1977 and 1990 provide relative status of the population at that time (Table 5). Later the head count method provided the 'minimum population size' for the entire state. With the updated knowledge on the methodology, and improvement –availability of modeling or different algorithms, was used to provide the more reliable estimate. Population estimation by trail survey method extrapolates prediction to the non-sampled regions. Hence estimated population is always greater than that of 'minimum population size' derived by total count method.

Figure 2 shows drastic increase in macaque populations for divisions including **Nurpur, Renukaji, Bilaspur, Rohru, Dharamshala, Pangi and Dalhousie**. Most of these divisions lie on state boundary either on the North-Western or the South-Eastern side. Rest of the divisions showed declining trends from 2013 census. Although the decline is drastic in some of the divisions and also population has increased in some of the areas, the population estimates clearly indicate that the population is **gradually declining in the last one decade**.

The overall decline and change in the population size in some of the divisions can be attributed to random translocations of the animals over a period of ten years, gradual controlling of the population growth by sterilization programme and emigration of the individuals.

It is obvious that when the mass sterilization is done over a period of time, this will not bring down the population size immediately. However, this will have an impact on controlling the population turnover by arresting the reproductive rate and gradual death of old individuals.

In Indian scenario, we suggest continuation of systematic sterilization of adult individuals, by closely monitoring the impact on the overall population. We presume continued sterilization especially focused in hotspot areas will further help in managing the population.

Although the current study shows overall population reduced when compared to previous studies, more detailed comparisons cannot be made due to difference in scientific methodology used to estimate population. We recommend continuing with trail survey method used for this report to get better comparisons and discerning population trends in future. Thus it is suggested that one time population assessment per year in the month of June and July to understand the change in the population size is sufficient.

Quality of the data received was poor in terms of uniformity, tidiness and time. It was noted by the GIS team that there was a bias in reporting the geographical data. There were discrepancies in the beat boundaries among the field staff. Also due to lack of proper beat maps and toposheets, data was digitized using toposheets of different scales. This resulted in truncation of the problematic data to achieve reliable results. We suggest that the ground staff should be given more training for proper data collection, and proper beat maps should be provided before the next survey.

Further, there should be close monitoring of the demography of the selected sterilized populations to understand the reproductive behavior, social behavior and organization, and group dynamics.

We also suggest that the macaques captured for sterilization should be marked which can also be used as another population estimation techniques such as mark-recapture methods.



## 4. References

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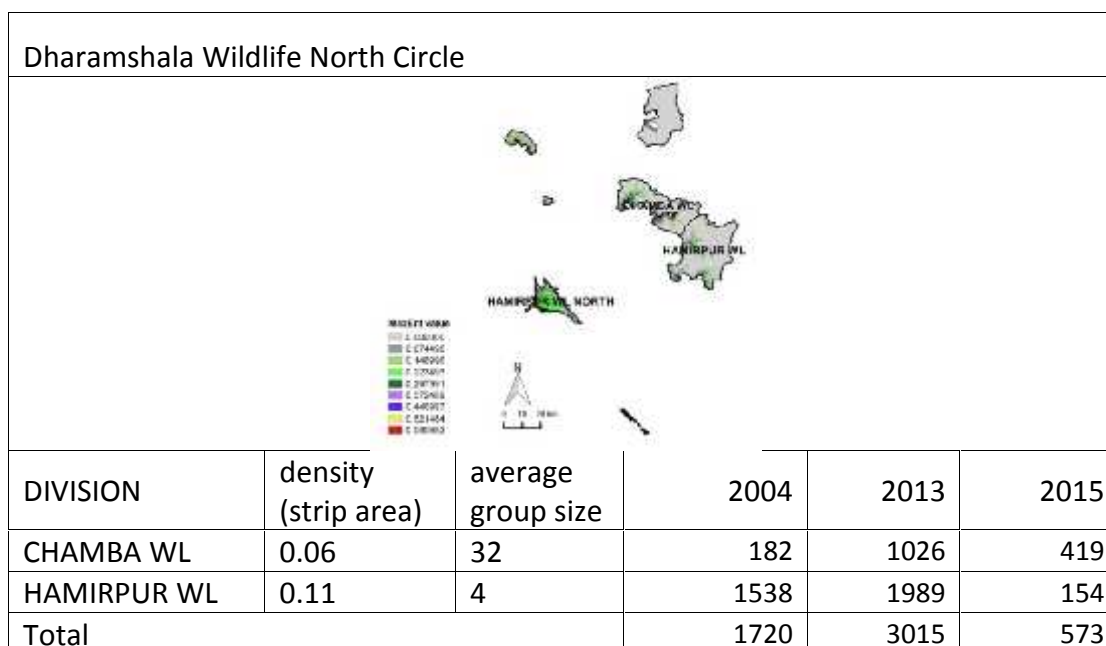
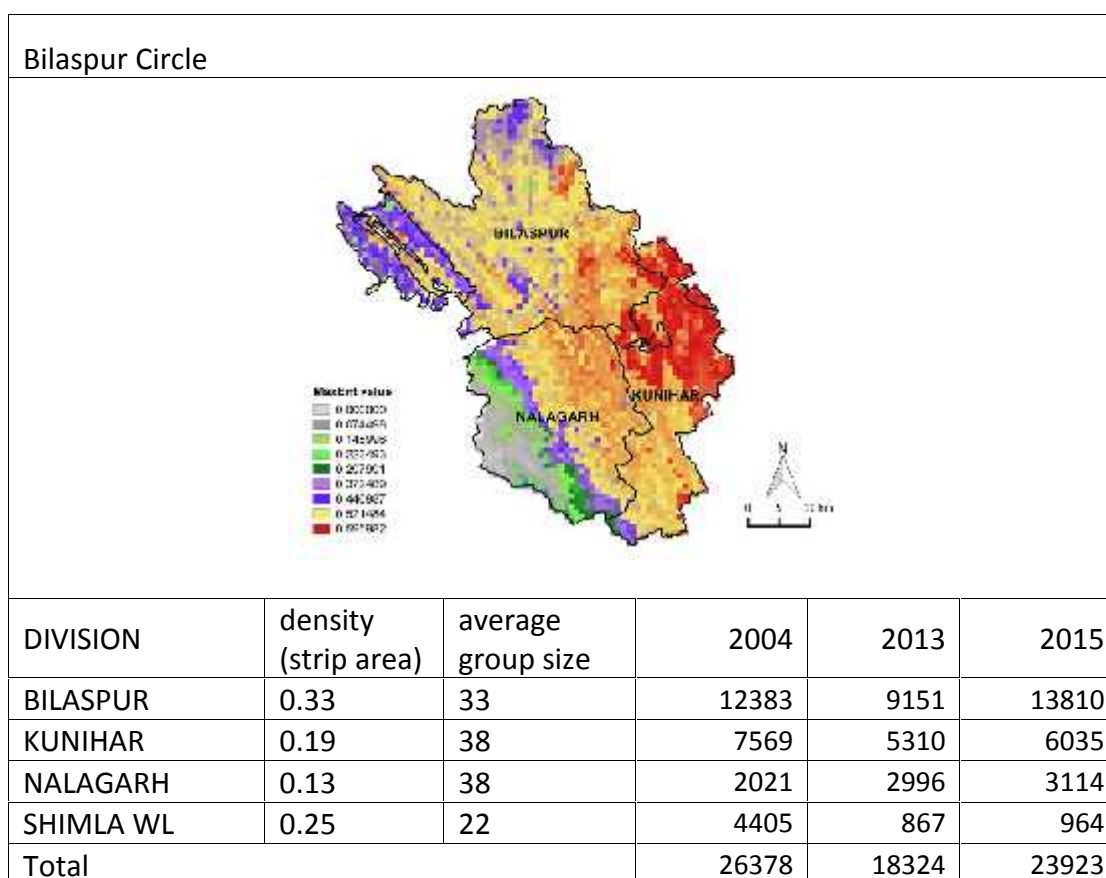
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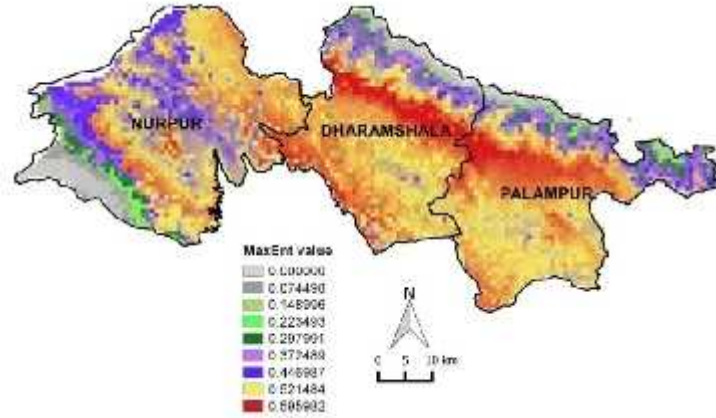
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## 5. Appendices

### I. Population status and extent of distribution in different wildlife circles

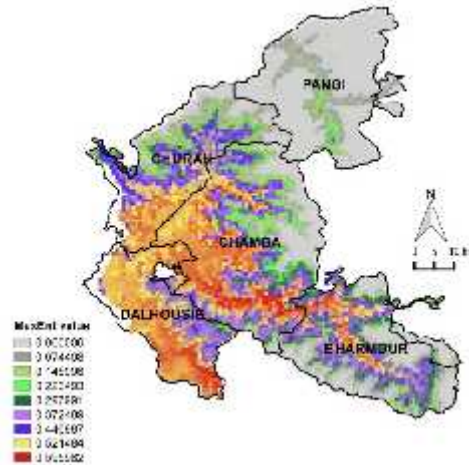


### Dharamshala Circle



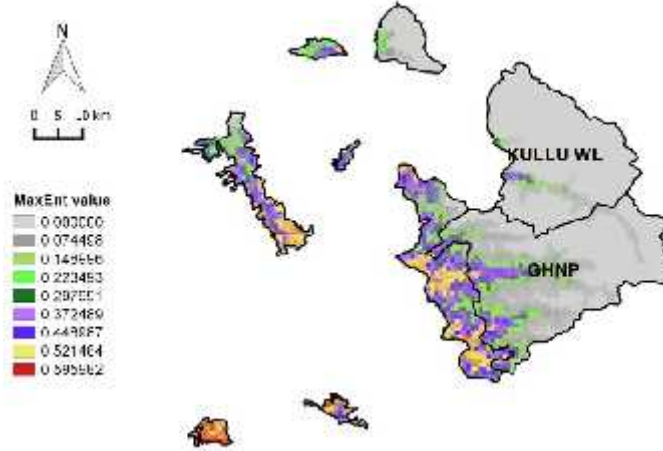
DIVISION	density (strip area)	average group size	2004	2013	2015
DHARAMSHALA	0.20	36	13787	6841	8884
NURPUR	0.37	30	18885	12548	14931
PALAMPUR	0.24	31	16319	6340	8676
Total			48991	25729	32491

### Chamba Circle



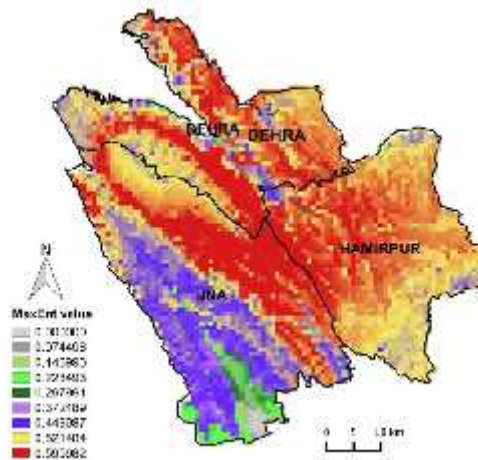
DIVISION	density (strip area)	average group size	2004	2013	2015
BHARMAUR	0.06	35	1491	1916	1839
CHAMBA	0.14	38	6912	7648	7888
CHURAH	0.13	31	16370	4854	2756
DALHOUSIE	0.39	40	28077	8404	10869
PANGI	0.22	45	1409	973	2764
Total			54259	23795	26116

### GHNP Circle



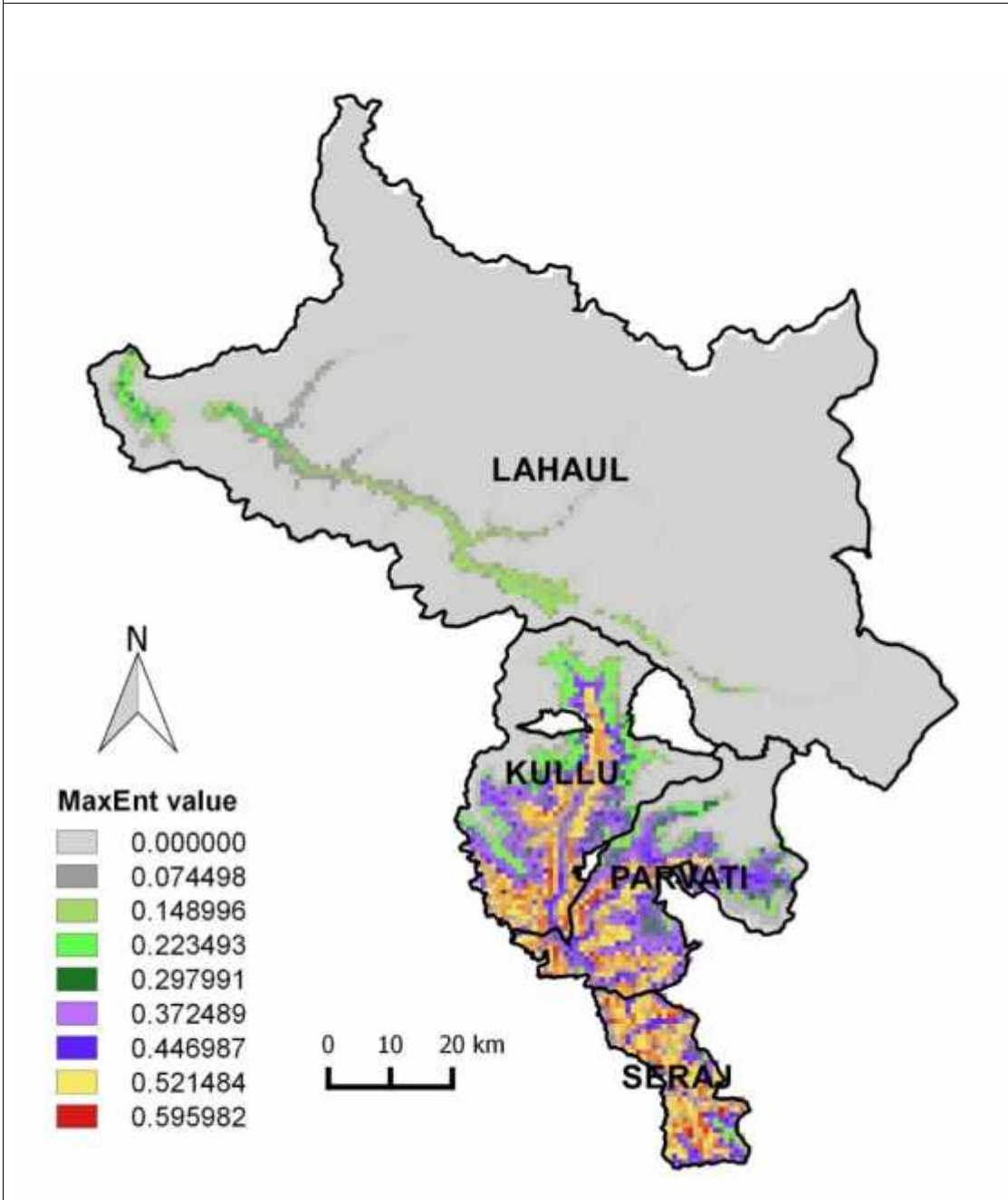
DIVISION	density (strip area)	average group size	2004	2013	2015
GHNP	0.25	14	1860	1684	1231
KULLU WL	0.10	26	3349	2000	1611
Total			5209	1684	2842

### Hamirpur Circle



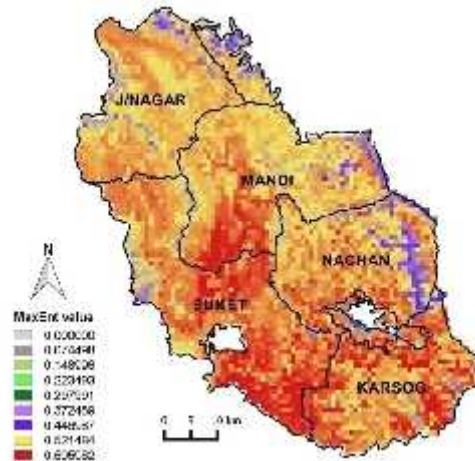
DIVISION	density (strip area)	average group size	2004	2013	2015
DEHRA	0.11	35	0	8601	6246
HAMIRPUR	0.17	25	13487	11772	5541
UNA	0.34	31	11798	20454	18174
Total			25285	40827	29961

Kullu Circle



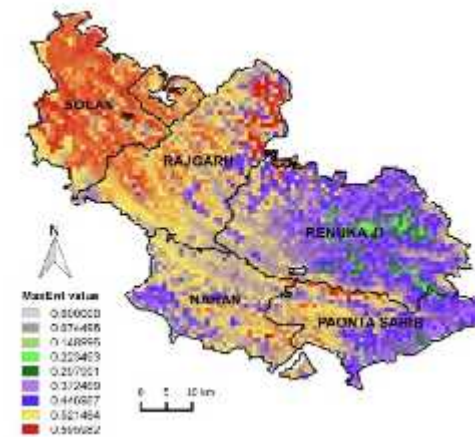
DIVISION	density (strip area)	average group size	2004	2013	2015
KULLU	0.27	16	0.27	16	4075
PARVATI	0.07	10	0.07	10	5964
SERAJ	0.24	22	0.24	22	2451
Lahul	0	0	0	0	0
Total			12490	10414	5564

### Mandi Circle



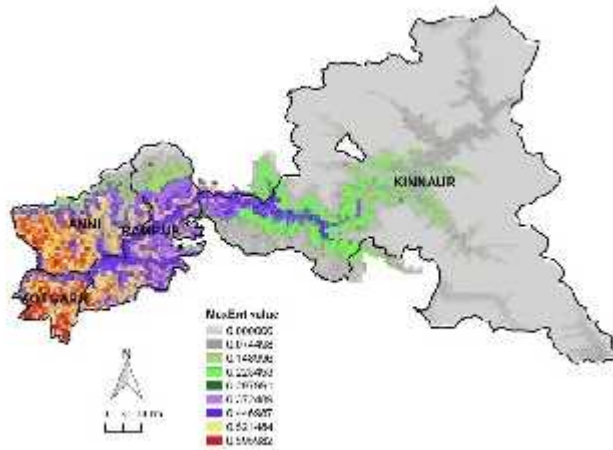
DIVISION	density (strip area)	average group size	2004	2013	2015
JOGINDERNAGAR	0.16	38	10046	9430	4609
KARSOG	0.17	38	7055	5916	3611
MANDI	0.14	38	6808	5348	4128
NACHAN	0.15	34	6767	4422	3129
SUKET	0.17	42	7510	7904	7797
Total			38186	33020	23274

### Nahan Circle



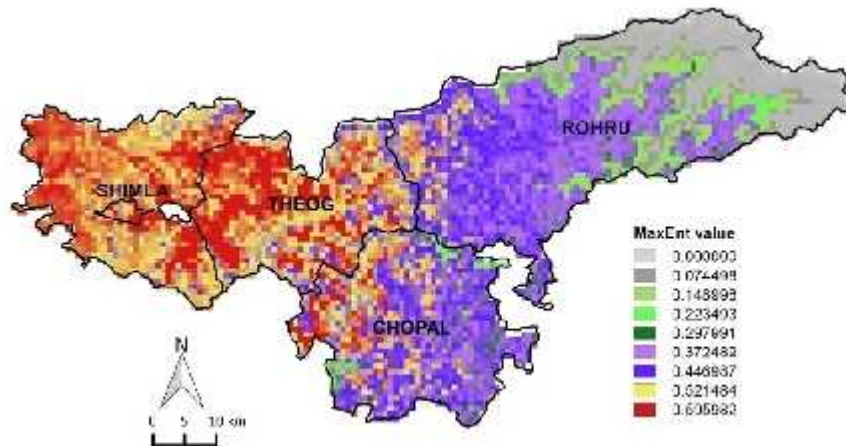
DIVISION	density (strip area)	average group size	2004	2013	2015
NAHAN	0.22	39	13888	6981	5743
PAONTA SAHIB	0.11	35	9224	3108	2546
RAJGARH	0.26	38	12500	10041	9905
RENUKA JI	0.37	27	75	5902	12466
SOLAN	0.23	33	1833	7900	5319
Total			37520	33932	35979

### Rampur Circle



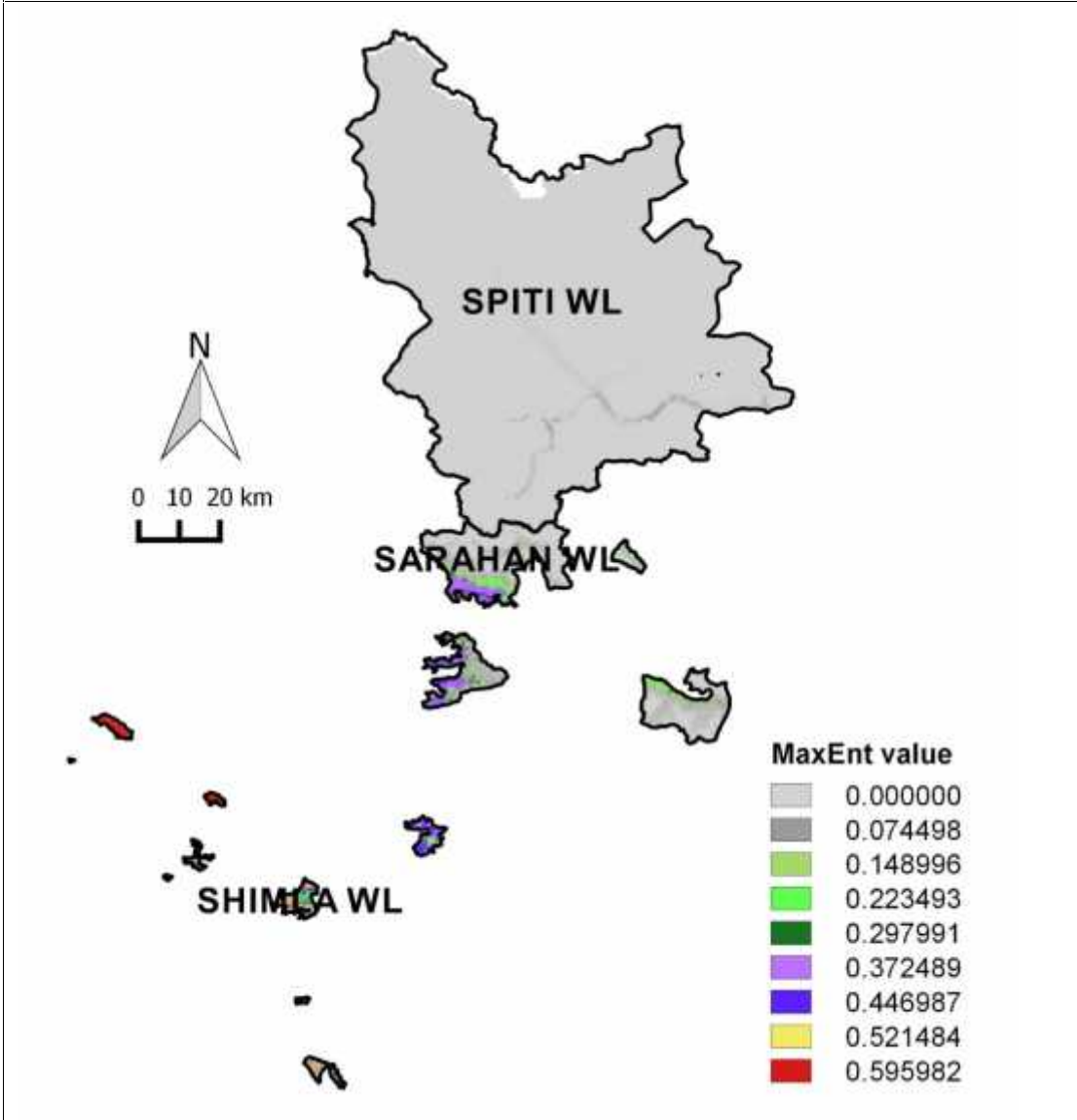
DIVISION	density (strip area)	average group size	2004	2013	2015
ANNI	0.19	23	5411	2790	3015
KINNAUR	0.03	32	3832	2690	575
KOTGARH	0.13	16	2555	3567	730
RAMPUR	0.08	27	6473	4297	2465
Total			18271	13344	6785

### Shimla Circle



DIVISION	density (strip area)	average group size	2004	2013	2015
CHOPAL	0.16	27	4653	3937	3293
ROHRU	0.09	49	4582	2906	4855
SHIMLA	0.05	38	11165	5827	5580
THEOG	0.15	21	5602	3761	2092
Total			26002	16431	15820

Shimla Wildlife South



DIVISION	density (strip area)	average group size	2004	2013	2015
SARHAN WL	0.11	29	1071	1006	673
SHIMLA WL	0.25	22	4405	1959	964
Spiti			0	0	0
Total			5476	2965	1637



Rhesus macaques (*Macaca mulatta*) in Himachal Pradesh have been known to cause heavy crop damage and other conflicts with humans. This has been a serious issue for the State. To address this issue, Forest Department has initiated various measures to control the population. Understanding of the population status is a key to understand the efficacy of the taken measures. Hence accurate estimation of population is pivotal to effective management of a species. Himachal Pradesh Forest Department, undertook a state-wide trail survey during June and July 2015 to estimate its population under the guidance of SACON. Current estimated population is 206650 individual macaques in 5153 groups distributed over 27276.83 km<sup>2</sup> in the entire state. The population of Rhesus macaques in Himachal Pradesh which was reduced to few thousands due to high export till 1970s, bounced back to more than 3 lacks by the year 2000 after ban on export. Mass sterilization and rapid translocation of macaques was carried out by Forest Department to control the increasing population of macaques in order to reduce the conflict. This has resulted in gradual decline in the population size to 206650 as estimated by current study.

