Evaluation of Tiger Conservation in India: the use of comparative effectiveness research

By

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Abstract

Tigers, the largest of the felids, are now a globally threatened species with only approximately 3000 wild tigers surviving. India contains about 60% or 2000 of the animals, yet despite aggressive conservation efforts the number of tigers is declining. The causes of the decline are prey depletion, habitat destruction and poaching.

Over the past 30 years of tiger conservation efforts in the various protected areas within India, success has been incredibly variable, with few documented cases of parks were the numbers of tigers have risen, but many more cases of parks where tiger populations have plummeted. There are very few scientific papers that assess the effectiveness of conservation efforts and when it is considered, implementation rather than outcome is evaluated. Recent literature suggests that evaluating outcomes in more predictive of conservation success. This thesis attempts to use comparative research effectiveness techniques, a methodology used to evaluate medical therapy effectiveness, to evaluate tiger conservation in India.

Various tiger conservation experts were polled and a list of 7 successful protected areas—Kanha, Corbett, Pench, Kaziranga, Bhadra, Bandipur, and Nagarhole—and 5 failed protected areas—Palamau, Dampa, Panna, Sariska and Namdapha—were generated. A list of variables that could impact outcome at these protected areas was generated and included biologic (tiger density, prey density, area of the reserve, the presence/absence of a biological corridor), geographical (the Indian State the reserve is in eco-region of the reserve), economic (number of tourists, revenue from tourism, forestry, funding per sq km) and socio-political factors (human population data, presence/absence of a "conservation hero", Park Management Effectiveness Rating, poaching).

The factors that were positively correlated with success included tiger density and the presence of a biological corridor. Population density and level of funding did not correlate with success or failure. Many of the successful reserves were in areas of high human population density and many of the failures were in areas of low human population density. Although not statistically correlated, the presence of a "conservation hero" was seen in 5 of the 7 successes but in only 1 of the failures.

The lack of correlation between many of the independent variables evaluated and success or failure of the tiger reserves has revealed that tiger conservation can be successful despite factors such as high human population densities and only average funding to the reserve. Comparative effectiveness research techniques can be used to evaluate conservation outcomes.

Introduction:

Tigers, the largest of the felids, are top predators that are now a globally threatened species. There are only approximately 3000 wild tigers surviving in only 7% of their historical range, with about 60% or 2000 of these animals living in India. Tiger conservation has been a priority for the Indian government since Prime Minister Indira Gandhi implemented Project Tiger April 1, 1973. Despite this aggressive conservation effort, which at the time was the largest conservation effort aimed at a single species ever attempted, the number of tigers in India is declining. The cause of this decline is prey depletion, habitat destruction and poaching.

There are over 40 Tiger Reserves, National Parks or other protected areas scattered across India that harbor or can harbor tigers. Despite the wide variation in habitat within the Indian sub-continent the tiger is able to live in most of these areas. These protected areas were created to provide a sanctuary for the threatened wildlife of India, and in other areas of the world this idea has worked.

The need for endangered species conservation was raised in our awareness when Rachel Carson published her book Silent Spring. The possibility of man causing a species to go extinct was further thrust into the collective conscious of the world when the Americans watched as the passenger pigeon vanished. Since that time, our scientific knowledge about the number of species threatened or endangered has exploded. The IUCN (World Conservation Union) publishes a yearly book, The IUCN Red List of Threatened Species™, which even keeps count of the number of species that are threatened worldwide. Yet despite this increased knowledge, our ability to implement effective conservation efforts is sometimes dramatically impotent.

Over the past 30 years the “success” of tiger conservation efforts in the various protected areas within India has been incredibly variable. There are few documented cases of parks where the numbers of tigers have risen, but unfortunately more cases of parks where the tiger population has plummeted or been reduced to zero.

The number of hits in Google when endangered species conservation is put in the search field is over 5 million. Yet despite this massive amount of information, there are very few scientific papers that evaluate the effectiveness of conservation efforts. And when effectiveness is evaluated, the process and type of management structure is most often evaluated while the desired result of a biologically healthier (and safer) species population is not measured. Implementation, not outcomes, has been the standard measured. Recent literature suggests that evaluating outcomes is more predictive of conservation success than is evaluating implementation (Kapos et al. 2009).

Over thirty years ago, it was demonstrated in the medical field that many of the commonly used procedures and therapies were not always the most effective (Cochrane). There is a need for evidence-based conservation and the medical field can serve as an example of how to pursue this goal (Pullin & Knight 2001; Sutherland et al. 2004). Comparative Effectiveness Research is a type of investigation common in the medical field and is now being used to evaluate the various cancer therapies utilized in the United States (http://www.focr.org/download-repeort-improving-medical-decisions-through-comparative-effectiveness-research-cancer-as-a-case-study.html). In medical terminology: efficacy refers to how well an intervention works in a controlled setting; effectiveness refers to how well it works in real world situations, and efficiency relates to how well it works in relation to its cost. This format, of comparing various interventions over varied real-world scenarios lends itself well to conservation evaluations and could potentially demonstrate conservation strategies that are worth pursuing and those that are inadequate or context dependent.

Objective:

Tiger conservation has been extensively reviewed in the scientific literature but what strategies within a single geopolitical landscape that are effective has not been attempted. This master's project will use comparative effectiveness research techniques to evaluate a number of these strategies. The goals of this paper are:

1. To determine what tiger conservation strategies within India are associated with success

2. To determine what tiger conservation strategies within India are associated with failure

3. To potentially guide the Global Tiger Initiative of the World Bank as to how to most effectively fund tiger conservation efforts

Methods:

Various experts (Bivash Pandav, Ullas Karanth, and Eric Dinerstein) involved in tiger conservation within India were polled to determine the documented cases of "success" and "failure" of protected areas to protect tigers. Success was defined as the improvement in the tiger population and failure as the decline in the tiger population within the protected area over the years 1995-2005. A list of 7 successful tiger reserves (Kanha, Corbett, Pench, Kaziranga, Bhadra, Bandipur, and Nagarhole) and 5 failed tiger reserves (Palamau, Dampa, Panna, Sariska, and Namdapha) was generated. A list of variables that could impact outcome associated with each protected area was generated and included, biological, geographical, economic, and socio-political factors. These factors are: the number of tigers and their density, prey density, area of the reserve, the presence or absence of a biological corridor, the Indian State the tiger reserve is located in, the eco-region the reserve is in, land use (although due to insufficient information this factor was dropped from the evaluation and population data was used as a surrogate) the presence of a conservation hero at the tiger reserve, the number of tourists visiting the reserve and the tourism revenue generated per year, the revenue from Forestry in general (The Ministry of Forestry and Environment is responsible for tiger reserves) in the Indian State where the reserve is located, the Park Management's Effectiveness (as rated by the IUCN), amount of poaching, funding per sq km per year, and the size of the reserve. Many of these metrics are known to be important for long term tiger conservation (Sanderson et al. 2006).

Binomial logistic regression (Minitab 15) was used to compare the relationship between outcome (success and failure) and the variables discussed.

Tiger Number and Density:

The number of tigers at each reserve was retrieved from the most recent census data (Jhala et al. 2008). The number of tigers varied from a high of 164 tigers at Corbett reserve to a low of 0 at Sariska (see Figure 1). The area of each park was obtained from the official Project Tiger web site (http://projecttiger.nic.in/yearofcreation.htm). Tiger density at each reserve was calculated by dividing the total number of tigers by the area of the park and multiplying by 100 to give tiger density per 100 sq km. Tiger density varied from a low of 0 at Sariska, to a high of almost 15 tigers per 100 sq km at Nagarhole.

Prey Density:

Prey density information was also retrieved from the most recent census data published (Jhala et al. 2008). The prey species evaluated were chital, Sambar, Wild pig and Nilgai, the most common prey species of *Panthera tigris tigris* (Karanth & Nichols 1998). Density of the four main tiger prey species was available at the scale of region not at the finer scale of individual reserves, however, GIS data (Jhala et al. 2008) was used to refine the assessment.

Biological Corridors:

Biological corridors are known to be important for the movement of tigers from one area to another and for successful conservation efforts (Johnsingh & Negi 2003; Wikramanayake et al. 1998). Various surveys of tiger habitat, and GIS data were used to determine the presence or absence of a biological corridor (Dinerstein et al. 2007; Jhala et al. 2008; Wikramanayake et al. 1998). Their presence or absence was evaluated.

Geo-political Region:

Because many of the political decisions about the tiger reserves are made at the state level (Kothari et al. 1995) the Indian State where the tiger reserves are located was evaluated.

Conservation Hero:

A number of tiger conservation experts (Bivash Pandav-WWF, Luke Hunter-Panthera) from two of the major conservation Non-Governmental Organizations (NGOs) working in the area were polled and a systematic review was performed (Pullin & Knight 2001) regarding the presence or absence of a conservation hero at each reserve. Ullas Karanth and K.M. Chinappa were determined to be conservation heroes at Nagarhole, N.K. Vasu at Kaziranga, H.S. Negi at Kanha, and Dr. Raghu Chundawat at Panna. These conservation heroes served different functions at each of the reserves, some serving as directors others as research scientists associated with the reserve. In each case, the expert opinion was that these individuals were a major pro-conservation force at a specific tiger reserve for some time between 1995 and 2005.

Tourism:

Tourism numbers for 2004-2005 were gleaned from the Project Tiger Task Force report (Narayan et al. 2005). Despite multiple requests for tourism statistics from the Ministry of Forestry and Environment, tourist numbers and revenue were not available for a number of the reserves—Dampa, Namdapha, Pench and Nagarhole. For Panna, Corbett, and Bandipur, only tourist numbers were available. Based upon published data (Narayan et al. 2005) the average price of admission at a tiger reserve was calculated as 37.5 rupees per person. The revenue at these parks was calculated by multiplying the number of tourists by the average admission price. Due to the inability to obtain documented revenue at each of the parks, I analyzed a surrogate data set, the total revenue generated by the Forestry Department (which includes all revenue from tiger reserves) at the State level (Source: State Forest Departments, Forests & Wildlife Statistics, INDIA, 2004---http://ifs.nic.in/rt/misc/fwstats04/contents.htm).

Park Management Effectiveness Rating:

Park management effectiveness was rated by the IUCN/Project Tiger Directorate (***projecttiger****.nic.in/Report-1_****Review****ofTRAssessmentReport.pdf*). Every park except Nagarhole and Kaziranga were evaluated by this method. Management effectiveness was evaluated by a team of experts and each park was given a score, with scores above 135 denoting very good management, 108-134 meaning good management, scores between 72-107 denoting satisfactory management and scores below 71 meaning the management effectiveness was poor. The management of protected areas and the species within is a very important component of endangered species conservation (Bruner et al. 2001; Hockings 2003; Soulé et al. 2005).

Poaching:

Poaching is one the most important causes of tiger population declines in India (Damania et al. 2003; Kenney et al. 1995). The number of poaching cases in each Indian state from 1999-2002 was available from the Forests and Wildlife Statistics: India 2004 web site (http://ifs.nic.in/rt/misc/fwstats04/contents.htm).

Funding:

As funding is critical for the management of any nature reserve (James et al. 2001), I evaluated the amount of funding per year each of the tiger reserves received (again Kaziranga and Nagarhole data were not available)((Narayan et al. 2005).

Land Use and Human Influence:

Land use around the tiger reserves was going to be reviewed but after a systematic review ((Pullin & Knight 2001) (pers. comm. Krithi Karanth) there was insufficient information to be able to evaluate this factor. As a surrogate, I evaluated data involving the population surrounding the tiger reserves. Data from the 2001 Census of India was available at the level of the individual districts (http://www.censusindia.gov.in/maps/censusgis/Census_GIS/page/India_WhizMap/IndiaMap.htm) and those districts within which the reserves were located were analyzed. Since people and human activity have been shown to effect the conservation of large carnivores (Pimm et al. 1995; Purvis et al. 2000; Treves & Karanth 2003; Woodroffe 2000), total population, rural population, population density, percentage of total population involved in the agricultural sector and percentage of the rural population involved in the agricultural sector was gleaned from the online Indian census database.

Results:

Results of the biological, geographical, economic, and socio-political factors are displayed in Figures 1-4. The 12 tiger reserves analyzed resided in 4 regions of India: Western Ghats, Central, North Eastern and Himalayan. It is interesting to note that 3 of the seven successful reserves were located in the Western Ghats region while this region did not contain any failed reserves.

Tiger numbers ranged from a low of zero at Sariska to a high of 164 at Corbett and the area of the reserves ranged from 500 square kilometers to over 1900 square kilometers.

Tiger density was positively correlated with success (Pearson correlation = 0.809, P-Value = 0.008). When prey density was analyzed, however, there was no correlation with success or failure (see Figure 5).

When the presence or absence of a biological corridor was evaluated, a positive correlation (Pearson correlation = 0.683, P-Value = 0.014) was found.

Nine Indian States were represented in the analysis. There are total of 28 States in India, with tiger reserves present in 17 of them.

Four of the seven tiger reserves rated as successful had conservation heroes associated with the reserve at some time period from 1995-2005, while only one of the reserves judged to be a failure had a conservation hero associated with it. It was interesting to note, that although this relationship was not statistically significant ($p=0.235$), the potential for one charismatic person to make a profound difference is evident.

Tourism numbers (for the period 2004-2005) were available for only six tiger reserves, 3 successes and 3 failures. Revenue from the Forestry sector (2001-2002) was available only at the scale of Indian State rather than at the district or reserve level and was found not to be statistically correlated with success or failure ($p=0.557$). Although there was no statistically significant relationship between tourism numbers or tourism related revenue and success, there was data deficiency for 6 of the reserves concerning tourism numbers and revenue.

Park Management Effectiveness rating varied widely with one reserve achieving a poor rating, two getting a satisfactory rating, two a good rating, and 5 getting the top rating of very good (Review of Tiger Reserve Assessment). The rating involved 45 categories (listed in Table #3). When analyzed, a Pearson correlation of 0.490 was found, but was not statistically significant $p=0.150$)

Poaching cases were gleaned from the Forest and Wildlife Statistics in India for 2004 and the numbers were at the scale of Indian State. These numbers likely under represent the true number of poaching incidents (http://www.wpsi-india.org/tiger/poaching_crisis.php).

Funding information was available for 10 of the 12 reserves analyzed, and varied from 42 Lakh (1 Lakh =100,000 Rupees) to 150 Lakh per reserve and from a little over 2000 Rupees per square kilometer to over 9700. There was no positive correlation between funding per unit area and the success of the reserve (Pearson correlation = -0.042, P-Value = 0.902).

The most current census data (2002) was gleaned from the official web site of the Indian government and the relevant information is displayed in Figure 6. This information was available at the scale of individual districts. When reserves were situated in two districts, both districts were used for analysis.

Discussion:

This evaluation was unique in several ways. This is the first evaluation of tiger reserves to specifically address success and failure in terms of the biologic endpoint of healthier populations of tigers. This was the first time in the author's knowledge that comparative effectiveness research was used to evaluate an endangered species conservation effort.

The lack of positive statistical significance between outcome (success or failure) and the multiple independent variables evaluated should not detract from the conclusions of this paper; indeed, negative findings often reveal useful scientific information (Editors (2009)).

The real value of tourism/eco-tourism to conservation is a current topic of much research (Adams & Infield 2003; Archabald & Naughton-Treves 2002; Blom 2000; Cleary 2006; Garnett et al. 2003; Lerner et al. 2007; Lindsey et al. 2007; Salzer & Salafsky 2006; Sandbrook 2008; Udaya Sekhar 2003). The value of this industry to conservation may depend upon how much revenue flows to the local people whose lives are most affected by conservation actions ((Archabald & Naughton-Treves 2002; Sandbrook 2008; Udaya Sekhar 2003). Tourism numbers were only available for a few of the reserves and the information about revenue may not reflect the benefit of the tourism to the local people. Future efforts should focus on how much economic benefit the local population receives from eco-tourism activities at tiger reserves and if there is any correlation with the level of benefit and the success of the reserve.

High population density has been shown to be correlated with high anthropogenic pressure on large mammals leading to their decline (Arjunan et al. 2006; Cardillo et al. 2005; Ceballos et al. 2005; Davidson et al. 2009; Johnson et al. 2006; McKinney et al. ; McKinney 2002; Nugraha & Sugardjito 2009; O'Brien et al. 2003; Woodroffe 2000). It was interesting to note that the human population density was very high in many of the successful tiger reserves and the human population density was low in many of the failed reserves. Future efforts could focus on delving into how the successful reserves with high human population density were managed or if there were any socio-economic factors that were different in those reserves as compared to reserves that failed or are failing due to high human population pressure.

Land use is also intimately tied to conservation issues (Damania et al. 2003; Madhusudan 2003; Rao et al. 2002; Sekhar 2002). The economic uses of land and its impact on tiger conservation have been evaluated (Damania et al. 2003). Certain agricultural uses have detrimental effects on conservation efforts through habitat destruction, the negative consequences of livestock predation by carnivores, or crop destruction(Madhusudan 2003; Sekhar 2002). In the tiger reserves evaluated, there seemed to be a trend toward (but not statistically significant) a negative correlation between the number and percentage of the human population around the reserve engaged in agricultural activities and success of the reserve.

The amount of funding is often correlated with protected areas and success (Carwardine et al. 2008; Damodaran 2009; Gratwicke et al. 2007; Gubbi et al. 2009; Linkie & Christie 2007). It was interesting to note that there was no correlation between funding and success or failure in the tiger reserves examined. This would indicate that neither failure nor success is dependent solely on funding. Future funders of tiger conservation efforts would be well served to examine this relationship; perhaps monies should be earmarked to specific projects that will likely have a positive impact.

The lack of correlation between outcome and funding or human population density are quite interesting. These facts indicate that increasing funding to failed or failing reserves alone will not alter the outcome. Additionally, successful reserves can be maintained in areas of very high human population density.

Based upon this research, evaluating other factors such as reserve guard training programs, the presence or absence of anti-poaching units and their effectiveness would be warranted. In addition, delving into the factors that allowed reserves in high density areas to be effective would be useful, given the growing human population and the increasing anthropogenic pressures most protected areas will be facing.

By evaluating more tiger reserves in this fashion, at a finer scale, it is hoped that independent and multivariate analysis will reveal factors (either alone or in combination) that are statistically correlated with outcome. Comparative Effectiveness Research techniques can also be used to determine which suite of options should be employed at specific tiger reserve locations in order to maximize chances of a successful outcome.

The lack of correlation between the independent variables evaluated and the success or failure of the tiger reserves is telling in its own right. This type of analysis allows conservationists to shed light on the fact that conservation efforts can be successful despite factors such as high population density or only average funding to a reserve. It is also hoped that with further comparative effectiveness research, we can identify what specific measures are necessary for success, whether it be a certain level of anti-poaching efforts, a certain amount of trained guards, or other factors. This analysis should not be viewed as an end product but more as the beginning of a new way to evaluate conservation efforts.

Faculty:

Dr. Stuart L. Pimm has graciously agreed to be the advisor to this Master's Project.

Outside of Duke University Dr. Eric Dinerstein, Chief Scientist of the World Wide Fund for Nature (WWF), and Dr. K. Ullas Karanth of the Wildlife Conservation Society in New York and the Centre for Wildlife Studies in Bangalore, India have agreed to offer guidance with this Master's Project.

Figure 1: Biological Data

Column1	Tiger Number	Area (sq km)	Tiger Density (per 100 sq km)	Prey Density	Prey Density2	Prey Density3	Prey Density4	Biological Corridor to another tiger reserve
				Chital /km2	Sambar/km2	Wild Pig/km2	Nilgai/km2	
Tiger Reserve								
Success								
Nagarhole	96	642	14.95327	42349	43412	21999		Yes
Bhadra	58	492	11.78862	42349	43412	21999		Yes
Bandipur	96	866	11.08545	42349	43412	21999		Yes
Khana	89	1945	4.575835	41509	33551	599033	41704	Yes
Kaziranga	35	626	5.591054		270	2047		Yes
Corbett	164	1316	12.46201	2161	2756	3214	422	Yes
Pench	52	758	6.860158	41509	33551	599033	41704	Yes
Failure								
Palamau	5	1026	0.487329	721	721	6226	1108	No
Namdapha	7	1985	0.352645		353	412		Yes
Sariska	0	866	0					No
Panna	24	542	4.428044	41509	33551	599033	41704	No
Dampa	6	500	1.2		1700	1489		Yes

Note: Red colored boxes =less complete data

Figure 2: Geographical Data

Column1	Region	Indian State
Tiger Reserve		
<u>Success</u>	_	
Nagarhole	Western Ghats	Karnataka
Bhadra	Western Ghats	Karnataka
Bandipur	Western Ghats	Karnataka
Khana	Central	Madhya Pradesh
Kaziranga	North Eastern	Assam
Corbett	Himalayan	Uttaranchal
Pench	Central	Madhya Pradesh
<u>Failure</u>	_	
Palamau	Central	Jharkhand
Namdapha	North Eastern	Arunachal Pradesh
Sariska	Central	Rajasthan
Panna	Central	Madhya Pradesh
Dampa	North Eastern	Mizoram

Figure 3: Socio-political Data

Column1	Conservation Hero	Park Management Effectiveness	Tiger Poaching Cases 1999-2002)
Tiger Reserve			
Success			
Nagarhole	Ullas Karanth and K. M. Chinappa		1
Bhadra	Mr. Yatish and D.V. Girish	106	1
Bandipur		129	1
Khana	Mr. H.S. Negi	163	15
Kaziranga	Mr. N.K. Vasu		0
Corbett		152	0
Pench		144	15
Failure			
Palamau		141	3
Namdapha		95	0
Sariska		61	3
Panna	Dr. Raghu Chundawat	135	15
Dampa		121	0

Figure 4: Economic Data

Column1	Tourism Number	Local Benefit of Tourism	Revenue from Forestry by Indian State(2001-2002) in Lakh	Amount of funding (Lakh per year)	Funding per square km (Rupees/ year)
		(Tourism Revenue as proxy-- Rs Lakh/year)		1 Lakh = 100,000 Rupees	
Tiger Reserve					
Success					
Nagarhole			10046.94		
Bhadra			10046.94	150	30487.80
Bandipur	51,986	12.9965	10046.94	73	8429.56
Khana	70,464	52	30660	95	4884.32
Kaziranga			959.07		
Corbett	95,220	23.805	9150.41	82	6231.00
Pench			30660	74	9762.53
Failure					
Palamau	10,000	2.5	1491.57	55	5360.62
Namdapha			2524.29	42	2115.87
Sariska	49,451	28	4439.98	81	9353.35
Panna	36,404	9.101	30660	140	25830.26
Dampa				55	11000.00

Note: Red colored boxes =less complete data

Figure 5: Statistical Data

Results for: Minitab-Tiger Project.MTW

Correlations: Reserve Success and Tiger Density

Pearson correlation of Success and TigerDen = 0.809
P-Value = 0.008

Binary Logistic Regression: Reserve Success versus Prey Density

Link Function: Logit

Response Information

Variable	Value	Count	
Success	1	6	(Event)
	0	2	
	Total	8	

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	Upper
Constant	-28.7365	42075.7	-0.00	0.999			
Chital Den	-0.0849451	92.6343	-0.00	0.999	0.92	0.00	6.53145E+78
Sambar Dens	0.0833827	90.4448	0.00	0.999	1.09	0.00	1.05776E+77
Pig Dens	0.0012651	1.41151	0.00	0.999	1.00	0.06	15.92

Log-Likelihood = -1.910
Test that all slopes are zero: G = 5.178, DF = 3, **P-Value = 0.159**

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	10	83.3	Somers' D	0.83
Discordant	0	0.0	Goodman-Kruskal Gamma	1.00
Ties	2	16.7	Kendall's Tau-a	0.36
Total	12	100.0		

Figure 6: Human Population Data

Reserve	district	population density (per sq km)	population total	rural	% agricultural sector	% agricultural sector-rural
Nagarhole	Kodagu	133.8	548561	473179	12.2	13.5
	Mysore	385.4	2641027	1658899	58.4	81.1
Bandipur	Chamarajanagar	189.2	985462	817372	70.8	78.4
Bhadra	Chikmagalur	158.2	1140905	918181	49.7	56.7
	Shimoga	193.3	1642545	1071535	61.8	80.4
Kaziranga	Golaghat	270.1	946279	865141	55.6	59.5
	Nagaon	603.8	2314629	2036342	58.3	65.6
Pench	Seoni	133.1	1166608	1045921	83.1	88.1
	Chhindwara	156	1849283	1397080	74.3	86
Corbett	Nainital	198	762909	493859	50.6	68.5
Kanha	Mandla	154.1	894236	802322	85.3	90
	Balaghat	162.7	1497968	1303996	78.5	83.7
Palamau	Palamau	240.7	2098359	1973266	79.7	82.4
Namdapha	Changlang	27.1	125422	113034	75.1	80.8
Dampa	Kolasib	47.6	65960	29461	66.4	79.8
Panna	Chhatarpur	170	1474723	1150428	75.2	84.7
Sariska	Alwar	357.2	2992592	2557653	70.9	77.4

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