

TIGER CONSERVATION IN SOUTH ASIA: LESSONS FROM TEARI ARC LANDSCAPES, NEPAL

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ABSTRACT

The Tiger (*Panthera tigris tigris*) is an iconic, charismatic and umbrella species of certain terrestrial ecosystems. Globally the species faces very serious threats through habitat loss, and human-tiger conflicts like poaching and illegal trade of its body parts. There is clear need for policy-makers and conservationists to give greater attention to conservation strategy, if the species is to be saved in the wild. The iconic status of the tiger in terrestrial ecosystems, means success in its conservation has wide implications for the survival of other species. This study aimed to assess and review the efforts made by the Government of Nepal and its achievements in terms of conserving the tiger population and its prey-base. We assess the status of the species with reference to the Global Tiger Recovery program (GTRP) and the progress made by the Government of Nepal. The study was carried out in the lowlands of Nepal, the Terai Arc Landscape (TAL), an important tiger landscape comprising six protected area of Nepal and nine protected areas in India. However, this paper covers only the Nepal part. The TAL (Nepal part) extends from Bagmati River in the east to Mahakali River in the west. There are six tiger bearing protected areas in the TAL, and Chitwan National Park supports the largest tiger population, one of the very few protected areas with more than 100 tigers. This study was largely based on review of literature, as well as informal interviews of the field staff involved in tiger conservation activities, protected area managers, and policy makers. Information was collected during the nation-wide tiger survey conducted from January to June 2013.

Results showed that the tiger population increased by 63% in four years from 2009 (from 121 in 2009 to 198 in 2013). The increase in tiger population in that area of Nepal is an indication of positive progress in terms of the GTRP objectives while some challenges associated to human-tiger conflicts remains. Results suggest that despite the significant gain in tiger populations, policy-makers need to pay even greater attention to safeguarding tiger habitat, addressing human-tiger conflict and combating poaching and illegal trade of tiger body parts on a perpetual basis. The study further suggested that engagement of local communities in tiger conservation is an essential requirement in reducing human-tiger conflicts, strengthening trust in wildlife conservation and ensuring that conservation benefits accrue to the communities and tigers. Effective law enforcement is equally imperative in ensuring long-term survival of the species.

Keywords: ecosystem conservation, Nepal, Terai Arc Landscape, tiger

INTRODUCTION

Tiger (*Panthera tigris tigris*) is an iconic and umbrella species to tropical ecosystems. The world species population is estimated to be around 3,000 in the wild, and South Asia has the largest population (GTI, 2010). Five sub-species of tiger survive today in the wild, while four species have disappeared. Among the surviving species, the Royal Bengal Tiger has the largest population and is restricted to South Asia, namely Bangladesh, Bhutan, India and Nepal. It is widely believed that 13 countries, namely Bangladesh, Bhutan, Cambodia, China, Indonesia, India, Malaysia, Myanmar, Nepal, Russia, Thailand and Vietnam provide habitat for tigers in the wild. North Korea was considered a tiger range country in the past, but there is no sign of tiger now. Kazakhstan is planning to introduce tigers in the wild, based on assessed ecological suitability. As the species is critically threatened by habitat loss, low prey-base, poaching and illegal trade of its body parts, and human-tiger conflicts, there is clear need for policy-makers and conservationists to give greater attention to conservation strategy, if the species is to be saved in the wild. As the tiger is an apex and iconic species in terrestrial ecosystems, its conservation has wide implications also in the survival of other species.

The tiger population is declining worldwide (Table 1). Sufficient habitat and adequate prey-base are two main prerequisites to conserving the tiger. Quality habitat management is always crucial to secure the better prey-base. Tiger habitat comprises two components, i.e. wetlands and grasslands. Healthy wetlands provide water while grassland supports nutrients and other dietary items from various species of herbivores, which are the main prey of tigers. Human-tiger conflicts and tiger poaching and illegal trade of tiger body parts are other threats to tiger conservation worldwide. Tiger range countries have committed to double the tiger population by 2022, under the objectives of the Global Tiger Recovery Program (GTRP) and Saint Petersburg declaration (GTI, 2010) – through a combination of ecological and social considerations.

Table 1: World-wide Tiger population

Country	Baseline tiger estimate in 2010	Target in 2022	Mid-term increase	Trend
Bangladesh	440	550	106	-Ve
Bhutan	75 (67-81)	90	103	+Ve
Cambodia	10-30	50	-	
China	45 (40-50)	90	-	
India	1,411(1,165-1,657)	2,100	2,246	+Ve
Indonesia	325 (250-400)	650		
Lao PDR	17 (9-23)	35	-	
Malaysia	500	1,000	-	
Myanmar	85	120	-	
Nepal	155 (124-229)	250+	198	+Ve trend
Russia	360 (330-390)	500	-	
Thailand	200	300	-	
Vietnam	Less than 10	50	-	

Source: Adapted from GTI, 2010

Protected area management in general and tiger conservation in particular involve a number of activities, and linear progress towards implementation of programs and achievement of targets cannot be expected. Integration of activities is always required, as are collective efforts from both state and non-state partners (Eric et al, 2010). Bhutan, India and Nepal have been conserving the tiger and its habitat collectively with local population increment. Despite the various conservation efforts made by tiger range countries, the tiger conservation task is facing various serious challenges at both national and transnational levels. The major challenges are habitat shrinkage and degradation due to invasive species and unplanned development works; loss of prey-base due to degradation in wetland and grassland condition; poaching and illegal trade of tiger parts and derivatives, and other human-tiger conflicts. Trans-boundary cooperation, on the other hand, is a positive emerging effort to share the best practices and enhance the capacity of frontline staff. Such collaborative efforts are equally important in combating wildlife crime and ensuring effective law enforcement. Capacity building activities carried out by the Global Tiger Forum (GTF) and Global Tiger Initiative (GTI) are also instrumental in bridging the gaps between two or more countries where tigers share habitat.

Tiger is an apex species to tropical and sub-tropical ecosystems and is endangered because of its limited global population. Therefore special attention is vital to its conservation and habitat management is a growing concern among protected area managers and policy-makers. The GTRP has identified seven major areas of intervention to conserve the tiger and manage its habitat. As Nepal is one of the ‘tiger countries’, it is highly crucial to assess the efforts, identify the gaps and suggest ways to policy-makers that Nepal can achieve the target of doubling the tiger number by 2022,

as stipulated in the GTRP. This study aimed to assess the efforts made by the Government of Nepal, and its achievement in terms of increasing tiger population and its prey-base. We assessed the status of the tiger with reference to the Global Tiger Recovery program (GTRP) and the achievements made by the Government of Nepal.

MATERIALS AND METHODS

Study Area

The study was carried out in the lowlands of Nepal, the Terai Arc Landscape (TAL), an important tiger landscape comprising six protected areas of Nepal and nine protected areas in India. However, this paper covers only the Nepal part. The TAL (Nepal part only) extends from Bagmati River in the east and Mahakali River in the west (Figure 1). There are six tiger bearing protected areas in the TAL while Chitwan National Park supports the largest tiger population, one of the very limited protected areas with more than 100 tigers within the ecosystem.

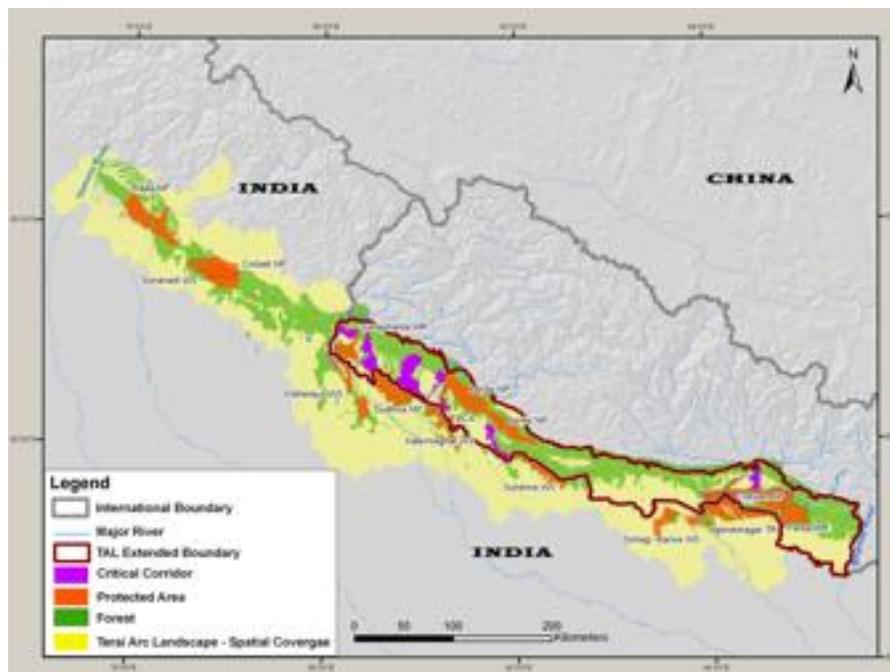


Figure 1. Terai Arc Landscape and tiger bearing protected area

Method

This study was largely based on review of reports and other literature and on informal interviews of the field staff involved in tiger conservation activities, protected area managers, and policy makers. Information was collected during the national wide

tiger survey that was carried out from January to June 2013. The national tiger survey involved camera trapping to estimate tiger population, and transect surveys to estimate the tiger prey base. The camera trapping results, tiger numbers and their prey-base were compared with previous reports from 2008 and 2009. In 2013 camera trapping work was carried out using the same method across the country, while the previous camera trapping was mainly based on the results of sampling of selected areas.

The Government of Nepal, together with conservation partners, has carried out various tiger conservation activities based on the GTRP recommendation. Therefore, it is important to assess the tiger conservation achievements to date against the GTRP targets after five years of GTRP implementation. The interventions by the Government of Nepal together with conservation partners and local communities were analyzed, and gaps were identified. Involvement of local communities in conservation, daily patrolling by the Nepal Army and tactful intelligence from the Nepal Police were assessed in order to understand whether the Government has produced measurable achievements in reducing poaching, bringing wildlife crime culprits to law and eventually increasing the tiger population.

RESULTS AND DISCUSSION

Tiger Population in Nepal

In South Asia, Bangladesh, Bhutan, India and Nepal are the main tiger range countries. India has the largest wild tiger population (2,246 wild tigers in 2015) while the latest estimates show that Bangladesh has 106 wild tigers (as of 2015), Bhutan has 103 tigers (as of 2015) and Nepal had 198 in 2013 (Figure 2). The Nepalese tiger population increased by 63% between 2009 and 2013 (Dhakal *et al.*, 2013). The increase in tiger population indicates that the conservation strategy adopted by the Government of Nepal has been effective. Nepal and India are the only two countries that carried out a nationwide census using the same methods and hence able to publish a joint tiger report in 2014 (Chanchani *et al.*, 2014). Bangladesh and Bhutan applied the same method developed by Nepal and India and this showed that the tiger population had declined drastically in Bangladesh, while the number increased in Bhutan. The fluctuation in tiger population suggests to tiger range countries that the species is primarily threatened by anthropogenic pressures and the conservation of tiger should continue till the species are secure in the wild. Maintaining healthy ecosystem in one side and control of anthropogenic activities on the other were observed crucial for long-term existence of tiger in the wild.

Tiger-bearing protected areas are expected to conserve tigers as a meta-population with transboundary ecological linkages and doubling the tiger number by 2022 at large. The Chitwan National Park is a unique protected area, with the highest tiger population worldwide, and having more than 100 tigers within the same tiger habitat. Because of rich ecological and cultural resources, this was listed as a UNESCO World Natural Heritage Site in 1984. The Bishazaari Lake of the park is included in the Ramsar Site in 2003 and was the first tiger bearing protected area under Conservation Assured/Tiger Standard (CA/Ts) in 2014. The limited tiger habitat may lead to doubt over the possibility to achieve the objective of doubling the tiger number by 2022.



Source: Adapted from Dhakal *et al.*, 2013

Figure 2. Tiger population trend in Nepal 1995 to 2013

Habitat Conservation and Management

TAL is one of the priority tiger landscapes spanning both Nepal and India transborder areas. As stated earlier, six areas in Nepal are declared for conservation of tigers and their habitat, namely: Parsa and Shuklaphant Wildlife Reserves, Krishnasar Conservation Area and Chitwan, Banke and Bardia National Parks. The Government of Nepal has applied two approaches to tiger habitat management in (TAL). First, tiger habitat has been expanded through declaration of Banke National Park, an extension of Parsa Wildlife Reserve, and the declaration of Protection Forest. These are the best examples of habitat expansion in Nepal during past five years. By 2015 the Government of Nepal has expanded the core protection area of 1,375 km² by 50% and the buffer zone of 343 km² by 19% in 2015 (Table 2). The Government declared Brahandabhar, Khata, Basanta, and Laljhandi as protection forests and these areas were managed as critical tiger corridors to improve habitat connectivity, following the TAL strategy 2004 and Action Plan 2004 (MFSC 2004). It is generally believed that these corridors could provide the lifelines to allow tiger genetics to mix from one habitat to another (Dhakal *et al.*, 2013 and Dhakal *et al.*, 2014). The second approach is to improve the quality of the existing habitat through grassland and wetland management efforts. Our study observed that tiger, as an umbrella species, depends on prey base largely herbivores species. The nutrients and food diets come from the grassland and wetlands.

The Government also has implemented various conservation efforts together with conservation partners, in terms of financial and technical inputs to grassland and wetland management. However this assistance has been very limited. It is clear that both the Government and conservation partners need to revise their planning and to focus on wetlands and grasslands and hence to enlarge the prey-base and tiger population, if they want to double the tiger number by 2022 as stipulated in GTRP. Over-grazing, encroachment, deforestation and forest degradation, uncontrolled forest fire, expansion of invasive species like *Mikania micrantha*, are others threats to successful tiger habitat management. Other major threats to keeping tiger habitat intact in Nepal are the re the construction of development infrastructure without Environment Impact

Assessment (EIA) and Initial Environment Examination (IEE) and fragmentation of tiger habitat. Examples are the Hulaki Road and proposed Railway construction in the lowland particularly Chitwan National Park and other tiger bearing protected areas.

Table 2: Tiger habitat expansion in 2010 and 2014 (Area in km²)

SN	Major tiger habitat area	Before 2010			After 2015		
		Core	Buffer Zone	Total	Core	Buffer Zone	Total
1	Chitwan National Park	932	750	1,682	932	750	1,682
2	Bardia National Park	968	507	1,475	968	507	1,475
3	Banke National Park	-	-	-	550	343	893
4	Shuklaphanta Wildlife Reserve	305	244	549			
5	Parsa Wildlife Reserve	499	298	797	637	298	285
6	Krishna Conservation Area	-	-	-	16	-	16
7	Brandabhar Protection Forest	-	-	-	104	-	104
8	Khata Protection Forest	-	-	-	50	-	50
9	Baanta Protection Forest	-	-	-	408	-	408
10	Laljhadi Protection Forest	-	-	-	247	-	247
Total		2,704	1,799	4,503	4,217	2,142	6,206

Source: DNPWC, 2014

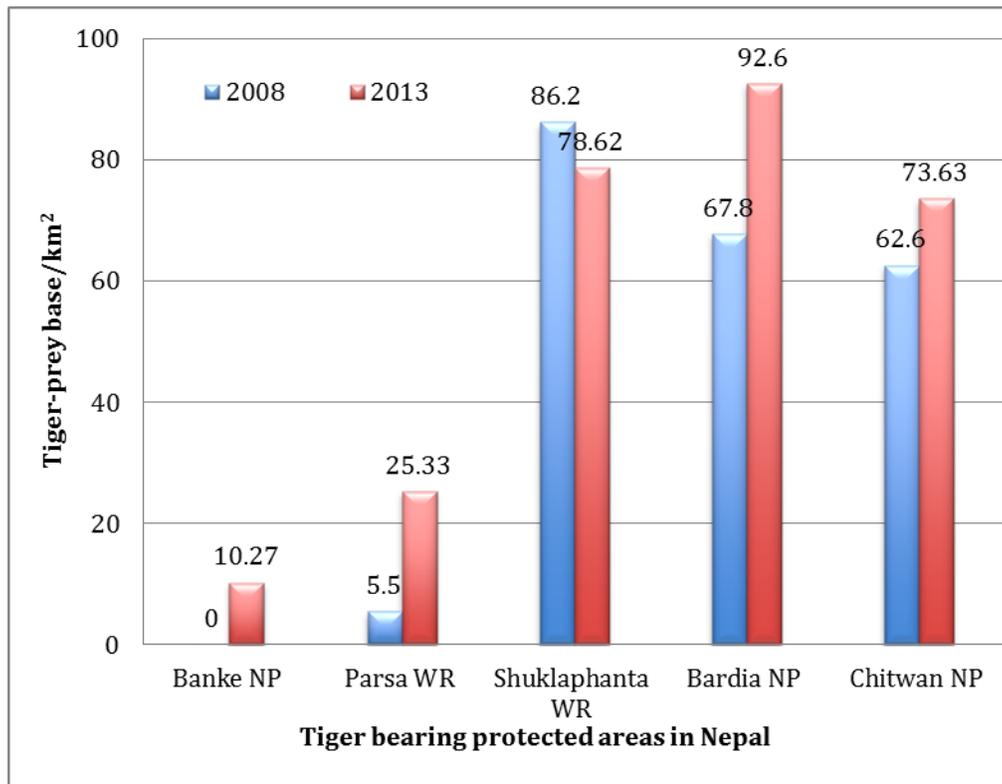
Expansion of protected area is one of the reasons behind the increase in tiger population in Nepal. The Banke National Park was just declared in 2010 where camera trapping in 2013 estimated four tigers (Figure 3).



Figure 3. Tiger capture in 2013 from camera records in Chitwan National Park

Tiger Prey-base

Sufficient prey-base is considered an essential ingredient for ecological integrity and hence tiger conservation. Tiger population depends on prey-base density, with higher density of prey base an indicator of healthy and hygienic ecosystem. Reducing poaching of the prey base is another need, in order to maintain healthy ecosystem and tiger population. Our study revealed that various species of deer, wild boar, bison, blue bull, and monkeys comprise the major prey base for the tiger. In order to collect prey-base information as a part of wildlife monitoring and surveillance, park officials in all tiger-bearing protected areas have implemented Management Information System Technology (MIST), with technical and financial assistance of WWF Nepal and National Trust for Nature Conservation (NTNC). Park personnel and Nepal Army staff patrol collected information on mainly species name, forest fires, grazing and illegal activities like poaching of animals. GPS was used to map the patrolling distance and species sighted. The report showed that Shuklaphanta, Chitwan and Bardia have a healthier prey-base, and that the prey-base needs to be improved in Parsa and Bank (Figure 4). This information is useful to law enforcement agencies, which decides daily with park managers on controlling poaching. Initially this system was piloted in Shuklaphanta Wildlife Reserve and was later replicated in other protected areas. MIST has proven to be very useful in mobilizing the frontline staff and developing a chain of command and performance-based patrolling. Following the experience of MIST, the government decided to advance the system through application of MIST and developing independent patrolling systems in Nepal based on real time information. The use of MIST is being piloted in Banke National Park, with plans to gradually extend it to other protected areas. The MIST system was also piloted during a Rhinoceros count in 2015, which led to suggestions for more training to make it more robust.



Source: Dhakal *et al*, 2014

Figure 4. Tiger prey density in 2013 in different national parks and wildlife reserves in Nepal

Institutional Reform and Capacity Building

Tiger conservation polices institutional reform and capacity building of frontline staff. Strong law enforcement system in one of the major objectives of the National Tiger Recovery Program. In order to achieve these objectives, around US\$ 5.6 million is estimated to be required for first five years (2010-2015) for NTRP implementation. Many institutional reforms were made in 2010, from community to prime minister level. The creation of the National Tiger Conservation Committee (NTCC) and National Wildlife Crime Control Coordination Committee (NWCCCC) under the chairmanship of the Prime Minister, Wildlife Crime Control Bureau (WCCB) under the coordination of Director General of DNPWC, and establishment of 18 WCCB units that covered 20 districts (WCCB Kathmandu: DFO Kathmandu, DFO Lalitpur and DFO Bhaktapur) were major institutional reforms. Community-based Anti-Poaching Units (CBAPUs) at grass root level are found to be crucial in organizing local communities and involving them in anti-poaching activities (DNPWC, 2012).

Involvement of Local Communities

Nepal is a pioneer country in terms of involving local communities in forest resources and wildlife conservation, and introduced buffer zone policy in 1996 to enable work with local communities and wildlife. About 30 to 50 percent of total revenue collection from buffer zones go to local communities on an annual basis. Though the amount depends on the protected area, local communities can utilize the income to meet their needs, for community development and livelihood improvement activities that are supportive in safeguarding the biodiversity of protected areas. The involvement of local communities has been observed to have twin benefits. First, it has supported people’s participation in biodiversity conservation which ensures their feeling of ownership; and second it has a positive role in reducing human and wildlife conflicts. Nepal has also introduced a relief policy for wildlife victims and this has led to a positive response in increasing the community stewardship in conservation of wildlife including the tiger. This policy covers human casualties, injuries, crop depredation, damage to livestock, and property loss. As per the latest provision, people can receive NRs. 500,000 (equivalent to US\$5,000) if there is a human casualty during human-tiger conflict (MFSC, 2004; 2015).

The engagement of local communities in development activities, such as school and health programs, and public building has led to developing positive roles to create income and employment opportunities for poor and marginalized people who are dependent on the forests for their daily livelihoods. Similarly, provision of the relief policy to wildlife victims and quick response to human-wildlife conflict is appears to be assist in maintaining the co-existence between nature and humans.

Tiger Crime

Nepal has a strong penalty system in combating tiger crime, whether poaching or involving trade in tiger products. Though little is known about the extent and purpose of use of tiger skin and bones, many wildlife staff and agencies believe that tiger skin is used mainly for medicinal purposes and as an indulgent hobby for rich people in East and South-East Asian countries. In order to control poaching and illegal tiger trade, the Nepal National Parks and Wildlife Conservation Act 1973 envisaged penalties of NRs.50,000 to NRs.100,000 or 5 to 15 years jail or both for the culprits involved in tiger crime (DNPWC, 1973). As tiger crime is well organized and extends to the transnational level, control of poaching in source countries is not adequate, unless the demand country cooperates in wildlife law enforcement. As a result of collective efforts, Nepal was able to maintain zero poaching of Rhinoceros in 2011, 2013 and 2014, but tiger poaching remains rampant, as the species is more elusive in nature and for other reasons. Poachers used to take all tiger parts and were very difficult to apprehend on the spot. Field experience indicates that control of trade in tiger parts is crucial, as is harmonization of policy among the tiger range countries, because poaching is so well organized by international criminals at a transnational level.

Research and Monitoring

Nepal commenced research on tigers through a tiger ecology project in 1970s. However, the research on the tiger and its ecology is fragmented and lacks temporal and spatial analysis and hence has little institutional memory. We can read papers on tiger research from various perspectives, including tiger ecology and human-tiger conflicts and tiger crime, but there is lack of base line tiger information. A pugmark count is an old method of estimating tiger numbers, and was replaced by camera trapping for estimating the tiger and its prey populations.

The results of tiger monitoring in 2013 by Department of National Parks and Wildlife Conservation showed that the tiger population in Nepal is now constantly increasing (Figure 2). However, verification of numbers is essential, by using various tiger survey methods, such as scat analysis and side-by-side genetic analysis as well as camera data - to ensure that the results accurate and robust.

Table 3: Tiger Population in Nepal

SN	Protected Area	Pre-base Density (km ²)	Estimated Tiger Population			Tiger Density (km ²)	
			Mean	SD	95% CI	Density	SD
1	Parsa WR	25.33	7	2.9	4 - 13	0.65	0.3
2	Chitwan NP	73.63	120	10.6	98 - 139	3.84	0.3
3	Banke NP	10.27	4	1.2	3 - 7	0.16	0.1
4	Bardia NP	92.60	50	2.85	45 - 55	3.38	0.2
5	Shuklaphanta WR	78.62	17	2.27	13 - 21	3.4	0.4
	Total		198		163 -235		

Source: Dhakal *et al.*, 2014

International Cooperation

The TAL area extends between Nepal and India. Here and in many other countries, the tiger shares the habitat of two countries. The Sundarban Forests between India and Bangladesh and TAL, which are between Nepal and India, is a good example. All tiger-bearing protected areas in TAL extend along the Indian border. In many instances, tiger share habitat across country borders. Nepal and India have established a legacy of transboundary cooperation through local to national level transboundary meetings annually since 1997. There is a system of annual transboundary meeting that approves resolutions and shares conservation efforts in both countries. In order to understand the best practices and lessons learned from the field, such meetings have tremendous value. Similarly, Nepal signed a Memorandum of Understanding (MoU) with

China in 2010 that covers a number of transboundary issues such as conservation, protection, and control of illegal wildlife crime. In addition, the secretariat of the South Asia Wildlife Enforcement Network (SAWEN) is established in Nepal and coordinates all eight countries of South Asia on tiger issues.

CONCLUSIONS

The tiger is an umbrella and iconic species to certain tropical and sub-tropical ecosystems, and conservation of tigers can help save many other species. Therefore, the situation demands intensive care of protected areas in a long-term and continuous process. It requires patient and dedication and collaboration among frontline staff, local communities, conservationists and policy-makers. Tiger conservation requires an ecosystem approach within the core areas and a multi-stakeholder approach in the buffer zone areas - if the tiger habitat, prey species and the population is to be restored. Tiger conservation efforts in isolation or government efforts alone have always been insufficient and ineffective. Local community participation in conservation activities provides multiple opportunities for improving livelihoods and promoting ecotourism. Assurance of conservation benefits to local communities through buffer zone activities have been observed to be crucial to reducing human-wildlife conflicts and reducing the animal poaching as well. Government efforts alone with limited resources have proved inadequate to save the tiger and other species in the past. However, promotion of integrated conservation and development together with local communities and conservation partners has produced positive results in terms of increasing tiger population and their prey base.

At the policy level, designing pragmatic policy and ensuring its implementation is crucial to increasing the tiger population and ensuring a healthy, adequate prey-base. Old conservation policies do not meet the demands and expectations of present communities. Allocation of adequate financial resources to reform and re-build protected area infrastructure (for example old guard posts and all-weather roads) and provision of well- equipped frontline staff with modern technique and technologies, are fundamental needs in sound protected area management and tiger conservation. Both preventive and curative measures need to be applied to reduce human conflicts. However, the increasing trends of increasing human-tiger conflict and unnecessary law enforcement over poor and marginalized people have sometimes created havoc and reduced the trust between local communities and park authorities. Lack of research and monitoring of the tiger and its habitat is also preventing the design of innovative policy and programs. Institutional reforms and effective law enforcement have been observed to have great potential to impact on wildlife crime.

The Government of Nepal is committed to double the tiger number by 2022. Better management of wetlands and grasslands is paramount to supporting prey animals to ensure the survival of future tiger populations. Functionality of corridors and their connectivity are vitally important and the quality of habitat management directly determines the prey-base and predator relationships. Assessment of land cover use in the core areas may help to guide future budget and program planning and allow tiger conservation to move forward so as to achieve the target by 2022. Better poaching intelligence and investigation of wildlife crime, improved functionality of district level wildlife crime control bureau, and sounder record-keeping and reporting of wildlife crime are all crucial. Allocation of adequate budgets to preventive and curative measures may help reduce human-tiger conflicts. Quick response with relief packages is essential

during human-tiger conflicts, rather than provision of large relief packages in a slow process. Simplification of the process to release the funding support to ensure release of relief funds based on genuine evidence would be very beneficial. The need is clear for diligent research on tigers and their prey base on a periodic basis. Promotion of local community involvement in conservation with multiple perspectives and transboundary cooperation are also all essentials as tiger conservation is a human matter that goes beyond national boundaries.

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REFERENCES

- Chanchani, P., Lammichhane, B. R., Malla, S., Maurya, K., Bista, A., Warriar, R., Nair, S., Almedida, M., Ravi, R., Sharma, R., Dhakal, M., Yadav, S. P., Thapa, M., Janwali, S. R., Pradhan, N. M. B., Subedi, N., Thapa, G. J. V., Yadav, H., Jhala, Y. V., Wureshi, Q., Vattakaven, J, and Bohora, J., 2014. Tigers of the Trans-boundary Terai Arc Landscape: Status, Distribution and movement in the Terai of India and Nepal. National Tiger Conservation Authority, Government of India and Department of National Parks and Wildlife Conservation, Government of Nepal.
- Dhakal, M., Thapa, M. Lamichhane, B. R., Subedi, N. Thapa, G. J., Pokhrel, C. P. Yadav, H. K. Janawali, S. R., Pradhan, N. M. B., Bhatta, S. R. 2013. Status of tiger and prey-base population in Nepal, 2013. Government of Nepal, Department of National Parks and Wildlife Conservation, Nepal.
- Dhakal, M., Karki (Thapa), M., Jnawali, S. R., Subedi, N., Pradhan, N. M. B., Malla, S., Lamichhane, B. R., Pokhrel, C. P., Thapa, G. J., Oglethorpe, J., Subba, S. A., Bajracharya, P. R., Yadav, H., 2014. Status of Tigers and Prey in Nepal. Department of National Parks and Wildlife Conservation, Kathmandu.
- DNPWC, 2014. Protected Areas of Nepal. Booklet published by Department of National Parks and Wildlife Conservation, Kathmandu, Nepal.
- DNPWC, 2015. Annual Report of fiscal year 2014-15. Department of National Parks and wildlife Conservation, Nepal
- Eric, W., Manadhar, A., Bajimaya, S., Nepal, S., Thapa, G., Thapa, K. 2010. The Terai Arc Landscape: a tiger conservation success story in a human-dominated landscape, Edited by Tilson and Nyhus (2010), the tiger of the world, Academic Press is an imprint of Elsevier (2010), USA.

GTI, 2010. Global Tiger Recovery Program. The Global Tiger Initiative, World Bank, Washington DC.

Lamichhane, B. R., Dhakal, M., Malla, S., Subedi, N., Thapa, G. J., Pokhrel, C. P., 2014. How far we are to double tigers by 2022 in Nepal? Paper presented in World Park Congress Sydney 2014.

MFSC, 2004. Terai Arc Landscape Strategy and Action Plan. Ministry of Forests and Soil Conservation, Nepal.

MFSC, 2015. Relief policy guideline to wildlife victims. Ministry of Forests and Soil Conservation, Nepal.

DNPWC, 1973. National Parks and Wildlife Conservation Act. Department of National Parks and Wildlife Conservation, Nepal.

DNPWC, 2012. Annual Report of fiscal year 2069-70 BS. Department of National Parks and Wildlife Conservation, Nepal