

Designation of Ranipur Wildlife Sanctuary as Tiger Reserve: steps towards landscape level biodiversity conservation

It is now widely acknowledged that landscape-level conservation is an important paradigm that addresses scaling up our conservation initiatives and actions, especially when the entire world, including wild species, faces the consequences of climate change, pollution and expanding linear infrastructure. Current conservation instruments, including the protected areas on which the species rely, are insufficient to halt biodiversity loss. Thus, conservation initiatives in the wider landscape surrounding protected areas are needed to achieve the impact required for reversing negative biodiversity trends¹. Landscape conservation facilitates bringing all the sectors and stakeholders in a single platform to collaborate their ideas on managing important biodiversity areas for long-term sustainability. As several ecological and evolutionary processes are associated with the management of an area, systematic conservation planning is needed to ensure sustainable developments of the area, including economic, cultural, social and economic developments. Over the last decade, Governments have been making efforts to consider the biodiversity-rich areas and management and conservation of species across the larger landscapes, not confining the conservation approaches to the protected habitats.

Located in the foothills of the Vindhyan-chal mountain range in Uttar Pradesh (in Chitrakoot district), Ranipur Wildlife Sanctuary (RWS; 24°53'–25°02'N and 80°48'–81°14'E) has recently been notified as Ranipur Tiger Reserve (RTR). This protected area is now the 53rd Tiger Reserve in the country and the fourth in Uttar Pradesh. Spread over an area of 230.31 sq. km, RWS was established in 1977, considering its ecological significance and conservation of biodiversity. Declaring RWS as the Tiger Reserve is noteworthy because it has great ecological and conservation values and sustains a wide range of threatened species in Deccan Peninsula (Central Highlands) biogeographic zone, including tiger (*Panthera tigris*), leopard (*Panthera pardus*), striped hyaena (*Hyaena hyaena*), sloth bear (*Melursus ursinus*), wolf (*Canis lupus*), wild dog (*Cuon alpinus*), Indian fox (*Vulpes bengalensis*), Indian porcupine (*Hystrix indica*) and chinkara (*Gazella gazelle*). It will serve in the long-term man-

agement and conservation of a viable population of tigers across a large landscape. The forest of the sanctuary mostly falls under the dense deciduous forest type, dominated by sal (*Shorea robusta*); however, quite a few ranges, namely Chauri, Lakhanpur and Rujhawa, also have diverse grasslands².

A total of 299.05 sq. km area has been added to the sanctuary making it 529.36 sq. km. The forests of Manikpur, Markundi, Karvi, Raipura and Bargarh have been merged for its expansion as a Tiger Reserve. Now, the area which was earlier notified as the Wildlife Sanctuary (c. 230.31 sq. km) will serve as the core or Critical Tiger Habitat, and the area which has been included newly (c. 299.05 sq. km) will serve as a buffer zone of the RTR. As the eastern, southern and western boundaries of the Tiger Reserve are adjacent to the border of Madhya Pradesh, there would be huge scope to implement an integrated approach for developing a long-term management action plan for tiger conservation and interstate cooperation.

Considering the development of the Ken–Betwa River Interlinking Project, it is assumed that the tiger movement may increase in RWS from the Panna Tiger Reserve (PTR) in the following years, which would mainly happen because of the waterlogging in PTR. The project is expected to serve the drought-prone areas in the Bundelkhand region in Uttar Pradesh. It is expected that a significant part of PTR will face geographical changes due to the consequences of waterlogging and submergence. A recent study revealed that 58.03 sq. km of the Critical Tiger Habitat in PTR will be sacrificed due to the Ken–Betwa River Interlinking Project, owing to submergence, and an indirect loss of 105.23 sq. km of Critical Tiger Habitat will be inevitable due to fragmentation and loss of connectivity³. Tigers from PTR usually disperse up to RWS in Uttar Pradesh; however, their population is fleeing in nature. The tiger population in this block is estimated to be 33 (27–39), and notably, one of the camera trap studies conducted by the Forest Department captured 12 images, which estimated three individuals of tigers in the sanctuary (one male and two females)².

Tigers are known to occupy large home ranges and travel long distances across dif-

ferent landscapes, and in fact, such exhibition of the interstate movements by the tigers exposes the species to threats, including poaching and illegal trade; therefore, landscape-level conservation planning would be one of the important aspects. Providing natural connectivity for the frequent movement of tigers is one of the major challenges which has to be addressed on a priority basis.

In the year 2019, one tiger of unknown sex was captured in a camera trap in the Madhmaheswar area of Ukhimath forest of the Kedarnath Wildlife Sanctuary at an elevation of 3,431 m, which was the highest elevation record of tiger's presence in the state, as well as in India⁴. Prior to this observation, in 2016, a female tiger was recorded at an elevation of 3,274 m from the Askot landscape in the state⁵.

Even though the Rajaji National Park has been considered the northwestern limit of the geographical distribution range of the tiger in Uttarakhand (~1000 m)⁶, a recent study has identified the eastern and western Himalayan zones, spread across Bhutan, India and Nepal as a potential habitat for tigers⁷. There is also documented evidence confirming the presence of tiger tracks in the Himalayas at an altitude of 3,050 m (ref. 8). A study also indicated sporadic occurrence of tigers in Tehri forest up to 3000 m elevation⁹. Besides, reports of the presence of the tiger in the north-eastern Himalayas at an elevation of 3,630 and 3,571 m in the Mishmi Hills (Dibang Valley) in Arunachal Pradesh and east Sikkim (Kyongnosla Wildlife Sanctuary) respectively, were also received^{10,11}.

All these random observations indicate that the species can move across a wide array of habitats in case of adverse environmental conditions. Tiger is a territorial species that usually needs a home range of about 60–150 sq. km in the case of a male tiger and 20–60 sq. km in the case of a female tiger¹². Normally, they do not leave their territory unless necessary, which further depends on the environmental conditions. Given that the entire landscape of the RTR is endowed with a wide array of wild ungulates and other prey species, it can be assumed that the tigers may use the landscape of RTR for their movement. To manage a large landscape for tigers movement, the Government of Madhya Pradesh

has approved a proposal to establish a new tiger reserve named Durgavati Tiger Reserve. It has been proposed that a green corridor will be developed to link it with the PTR¹³. RWS and PTR are located at about 150 km along the border of the Uttar Pradesh and Madhya Pradesh. Notably, RWS does not have a resident population of tigers; however, the dispersal of tigers in the sanctuary from PTR has always been reported. The declaration of RTR would strengthen the landscape management approach, facilitate the population of tigers to move across a large landscape and establish their wider territories for gene flow.

About seven kilometres of the Allahabad–Manikpur–Mumbai railway route (Howrah–Mumbai railway track) passes through the RWS, which has the boundary of the sanctuary on one side and villages on the other. This railway line is a well-known bust track, and about 25–33 passenger trains run daily through the track. Notably, the track consists of sharp and blind turns and most trains run at high speed¹⁴. Mortality of several wild animals has been reported during train–animal collisions on the track. To mitigate the risk of train–wildlife collision, quite a few underpasses would be constructed. It is noteworthy to mention that to mitigate the train–wildlife collisions and wildlife mortalities, the Government of India is prioritizing permanent mitigation measures like the construction of underpasses and overpasses at railway lines passing across the sensitive wildlife habitats, particularly in tiger and elephant landscapes¹⁵.

One of the most challenging issues would be to relocate the villages, namely Ranipur, Giduraha, Matiah, Katra and Karauhan, which are located across the RWS, without disturbing the local rights of the forest-dwelling people. Besides, about 21 villages also exist within one kilometre beyond the buffer zone of the RWS, which need to be involved in every step of management planning for the newly established RTR. PTR is one of the most successful examples of tiger re-introduction. In the year 2009, the area had no tigers; however in 2019, the reserve was blessed with 54 tigers. Considering the breeding success rate among the tigers in PTR, a framework may be developed to integrate the Rani Durgawati, Nauradehi (both in Madhya Pradesh) and RWS (in Uttar Pradesh, already declared as Tiger Reserve) with PTR. However, as the buffer areas and corridors that link all three sanctuaries with PTR consist of densely populated areas and agricultural fields³, it would be challenging to restore

the corridors, which has to be addressed scientifically to ensure community participation.

On the one hand, the Wildlife (Protection) Act of 1972 empowers the State Government to relocate people from the Critical Tiger Habitats, whereas, on the other hand, the Forest Rights Act of 2006 mandates that the relocation of people from the Critical Wildlife Habitats should only be carried out after obtaining the consent from the village governing body, locally called as Gramsabha. To make an implementable comprehensive action plan, ensuring community participation at every level is important, which would also mitigate and address man–animal conflict in future.

The concept of ecotourism in protected areas and its implications for biodiversity conservation is globally significant. It is also widely acknowledged that ecotourism is an effective strategy and can act as a conservation tool to protect biodiversity through the participation of local communities, which ensures employment for local people, nature education, environmental awareness, development of skills and revenue generation. As the management and conservation of tigers is not an easy task, especially in populated areas, the ecotourism plan in RTR must be designed to create the right incentives to change people’s attitudes and adopt green social responsibilities. Besides, the ecotourism approach must also be ecologically sound, implementing a two-

way strategy linking tiger conservation and livelihood opportunities (Figure 1) to the local communities.

Although protected area networks play a crucial role in managing biodiversity in an ecosystem, the landscape surrounding the protected area has a vital role in the conservation of biodiversity within the protected area. To manage and protect the pristine biodiversity of the sanctuary, the Government of India has already notified an area to the extent of up to one kilometre around the boundary of the RWS as the Eco-Sensitive Zone in the year 2017. This 193.43 sq. km area has been protected beyond the boundary of the wildlife sanctuary, adhering to prohibited, regulated and promoted activities. PTR has already been included in the World Network of Biosphere Reserves by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2020. Therefore, considering the ecological integrity and significance, RTR may also be considered for designation as a Biosphere Reserve following the standard criteria of UNESCO in the near future for providing it with global recognition.

The density of tigers in protected habitats is likely to be mediated primarily by the abundance of prey rather than interspecific social dominance and competitive exclusion¹⁶. Tigers are known to occur in a diverse range of habitats, including evergreen and deciduous forests, mangrove

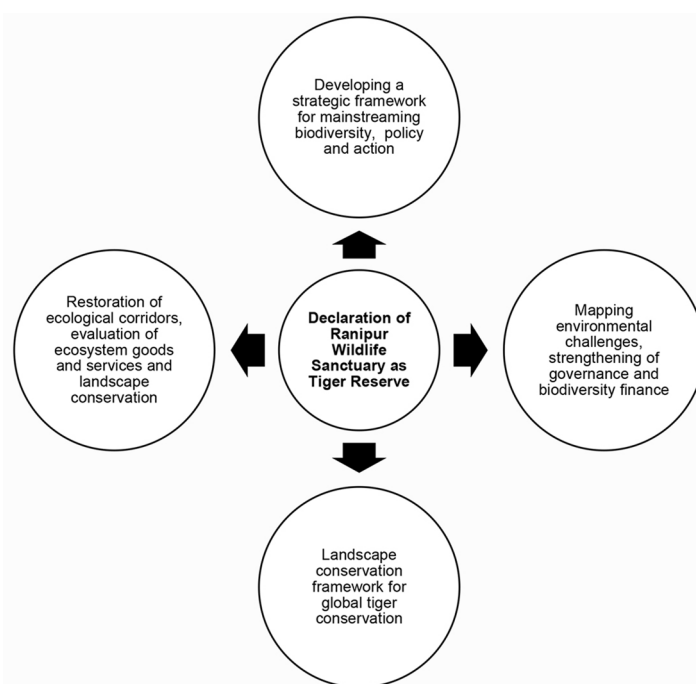


Figure 1. Opportunities from declaration of Ranipur Wildlife Sanctuary as Tiger Reserve.

swamps and hilly tracts of the Western Ghats and Himalayas; it can be assumed that tigers may acclimatize the local conditions and roam freely across the Panna and Ranipur landscape and tourists would be able to observe tiger's roar.

As it is expected that the tigers may seek refuge in parts of the RTR and other adjoining protected habitats, understanding the behaviour and ecology of tigers and their habitats across the Panna–Ranipur landscape, the availability of prey species and the evaluation of management and effectiveness of protected habitats are some of the important aspects to be considered for demonstrating a successful model of the relationship between people and wildlife. Further, mapping movement tracks and crucial corridors and identifying potential threats would strengthen our conservation actions.

Considering the rapid change in the climate and environmental conditions, it is important to prioritize the environmental and governance challenges. Besides, opportunities and challenges are also needed to be identified regarding large landscape management and conservation, which should foster a set of conservation initiatives and actions of research, policy, financing and actions. Moreover, a strategic framework needs to be developed covering various important aspects like water, biodiversity, climate, livelihood and economic and fiscal

profile, involving all stakeholders, especially local communities.

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Localized eradication of mango stone weevil *Sternochetus mangiferae* (Fabricius) (Coleoptera: Curculionidae) in India

The mango stone (nut) weevil (*Sternochetus mangiferae*) is a monophagous pest of mango, *Mangifera indica*. It is found in almost all the mango-growing areas of the world, except Egypt, Italy, Israel and the Canary Islands¹. In India, it is found mainly in the south². The adults lay eggs on immature fruits of 2–4 cm diameter. The grubs that hatch bore into the core of the fruit and eventually get enveloped by the seed coat. The grubs pass through five instars and pupate within the seed. The adults that emerge from the seed burrow through the pulp and emerge through a hole in the rind^{3,4}. During this process, they damage the pulp and contaminate it with their excreta, making it unfit for market, export and industry⁵. The overall loss varies from

5% to 80% (ref. 5). Early infestation can also lead to fruit drop^{6,7}. The weevil is of quarantine significance in fresh fruit export⁵.

The adults which emerge during fruiting (between June and August) were found to generally rest on the main tree trunk and the base of primary branches at their junction with the main trunk^{3,4}. These adults are in a state of rest/inactivity up to the following season when fruit formation takes place (by February/March of the following year). The adults at that stage stir out of their inactive phase, mate and oviposit on the immature fruits, and thus the life cycle repeats⁴. Once the grubs enter the seed core of the fruit, they are not susceptible to any insecticides⁸. Moreover, chemical sprays cannot be used at the immature fruit stage

of the tree, as the young fruits are used in pickles and chutneys in India. The present recommendation for the weevil is spraying decamethrin 0.0028% at the lime size of the fruit, coinciding with egg-laying. Even a safe insecticide like azadirachtin was found ineffective against the weevil⁸. In mango, prior to flowering, it is a common practice to spray imidacloprid 17.8% @ 0.4 ml/l to control mango hoppers (*Idioscopus* spp.)⁹. This insecticide is widely used by farmers to protect the inflorescence from hopper damage, which is crucial for good fruit set^{8,9}.

With the knowledge that adult weevils of *S. mangiferae* are found on the tree trunk^{3,4}, we tweaked the hopper spray schedule and applied it all over the trunk, branches and