



Community-led Turtle Conservation in the Rivers Ganga and Ramganga, Uttar Pradesh, India

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Abstract.—The Gangetic River System in Uttar Pradesh, India, supports 14 species of turtles. Excessive riverbed farming has encroached on turtle habitat used for nesting and basking. To conserve threatened turtles in the Upper Ganga, an in-situ turtle conservation program was initiated jointly by the Uttar Pradesh Forest Department and WWF-India in 2012 to engage the community in turtle conservation. The local riparian community was sensitized and mobilized to participate in conservation efforts. Turtles and the Ganga River have religious significance and are honored by the local riparian community, which encourages active participation in conservation efforts. During the study, 226 riparian community members have registered as Ganga Mitras (Friends of the River) and are involved in monitoring and other conservation efforts. A total of 828 turtle nests were rescued from riverbed agriculture with the help of 520 riverbed farmers in the Upper Ganga and Ramganga Rivers between 2012 and 2021. These nests contained 5,828 eggs, from which 4,529 turtles were hatched and survived (77.7% hatching success). These hatchlings were then reared in specially designed nursery ponds during the flood season and released into their respective rivers in winter. As poikilotherms, the food requirements of turtles are reduced during the winter season, making it easier for them to acclimatize to the new environment. Released turtle hatchlings were 1,945 Critically Endangered Three-striped Roofed Turtles (*Batagur dhongoka*), 1,292 Near-Threatened Brown Roofed Turtles (*Pangshura smithii*), and 1,480 Indian Tent Turtles (*Pangshura tentoria*), which are listed as being of Least Concern.

With 28 species of tortoises and freshwater turtles, India has one of the most diverse chelonian faunas in the world and ranks among the top five Asian countries regarding the importance of its turtle conservation efforts; however, over 40% of Indian turtles are listed as either Endangered or Critically Endangered on the IUCN Red List (Singh et al. 2015). A rapidly growing human population, coupled with increasing exploitation of aquatic habitats, poses a significant threat to all riverine species, including turtles (Singh et al. 2015). Moreover, unregulated trade has led to a sharp decline in the populations of many turtle species, with habitat degradation also being a major factor in widespread declines (Gibbons et al. 2000). Without directed strategic conservation planning, a significant portion of turtle diversity could be lost over the next century (Buhlmann et al. 2009).

The Gangetic River system in Uttar Pradesh, India, supports 14 species of freshwater turtles (Table 1) in nine genera (Mital 2016). Despite the unique turtle diversity, no qualitative or quantitative baseline information exists on

species occurrence or abundance in different habitats in the state (Singh et al. 2009). Few scientific survey efforts have addressed the Terai region, the Gomti River, the Yamuna River, or Dudhwa National Park in the Upper Ganges River Basin (Basu 1993; Javed and Hanfee 1995; Rao 1998; Tiwari 2003). The riverine landscapes of the Ganga and its tributaries are important habitats for endangered freshwater turtle species; however, excessive riverbed farming all along the Ganga and its tributaries in western Uttar Pradesh has encroached on the riverbanks and destroyed the nesting and basking habitat of turtles (IIT Kanpur 2010), with the overlap of the egg-laying season of some freshwater turtles (i.e., Brown Roofed Turtle, *Pangshura smithii*; Three-striped Roofed Turtle, *Batagur dhongoka*; and Indian Tent Turtle, *Pangshura tentoria*) and the crop cycle of riverbed farming creating a conflict (Fig. 1). Riverbed farming and sand mining are the major causes of depletion in turtle populations in the region (IIT Kanpur 2010; Joy et al. 2020). Such activities lead to the loss of turtle eggs, which also are consumed by humans and feral and wild animals.

Table 1. Freshwater turtles found in Uttar Pradesh, India (Singh et al. 2009). Conservation status = IUCN Red List category, CITES Appendix (CITES 2024).

Taxon	Conservation Status	River(s)	References
Geoemydidae			
Three-striped Roofed Turtle (<i>Batagur dhongoka</i>)	CR, II	Ganga & Ramganga	Das et al. 2019
Red-crowned Turtle (<i>Batagur kachuga</i>)	CR, I	Ganga	Praschag et al. 2019a
Spotted Pond Turtle (<i>Geoclemys hamiltonii</i>)	EN, I	Ganga	Praschag et al. 2019b
Crowned River Turtle (<i>Hardella thurjii</i>)	EN, II	Ganga	Ahmed et al. 2021c
Tricarinate Hill Turtle (<i>Melanochelys tricarinata</i>)	EN, I	Ramganga	Horne 2020
Indian Black Turtle (<i>Melanochelys trijuga</i>)	LC, II	Ganga & Ramganga	Ahmed et al. 2020
Indian Eyed Turtle (<i>Morenia petersi</i>)	EN, II	–	Ahmed and Singh 2021
Brown Roofed Turtle (<i>Pangshura smithii</i>)	NT, II	Ganga & Ramganga	Ahmed et al. 2021b
Indian Roofed Turtle (<i>Pangshura tecta</i>)	VU, I	Ganga & Ramganga	Ahmed et al. 2021d
Indian Tent Turtle (<i>Pangshura tentoria</i>)	LC, II	Ganga & Ramganga	Choudhury et al 2021
Trionychidae			
Narrow-headed Soft-shelled Turtle (<i>Chitra indica</i>)	EN, II	Ganga & Ramganga	ATTWG 2000
Indian Flap-shelled Turtle (<i>Lissemys punctata</i>)	VU, II	Ganga & Ramganga	Rahman et al. 2021
Ganges Soft-shelled Turtle (<i>Nilssonina gangetica</i>)	EN, I	Ganga & Ramganga	Ahmed et al. 2021a
Peacock Soft-shelled Turtle (<i>Nilssonina hurum</i>)	EN, I	Ganga	Das et al. 2021

Therefore, to protect and propagate the population of threatened turtle species surviving in the Upper Ganga, the in-situ turtle conservation program was jointly initiated by the Uttar Pradesh Forest Department and WWF-India in 2012 with an approach of community (riverbed farmers) engagement in turtle conservation. The Ganga River system is one of the most densely populated landscapes in the world, and adverse effects of high human population density in terms of, for example, habitat degradation, pollution, poaching, and over-exploitation of the river and its inhabitants are inevitable (Geldmann et al. 2014). The community-led turtle program was envisioned to mitigate this situation. Further, the program received good support from the local community as they hold the River Ganga in high regard and feel proud if engaged in

conservation efforts for Ganga and its biodiversity. Also, the turtles are revered as one of the incarnations of Lord Vishnu, named Kurmavata in Indian mythology (Cobb 2005). This program gives us the opportunity of a soft entry point for stakeholders to engage in river and wetland conservation. Hence, it has turned the conflict between turtles and riverbed farmers into an opportunity for creating a model of harmonious co-existence. The program has demonstrated a model in which the community can advocate for the conservation of turtles in Hastinapur Wildlife Sanctuary. This model was later extended to lower sections of the River Ramganga (about 90 km of river between Moradabad to Shahjahanpur Districts) in 2015 and to the Upper Ganga Ramsar Site (an 85-km stretch of River Ganga from Garhmukteshwar to Narora Barrage) in 2017.

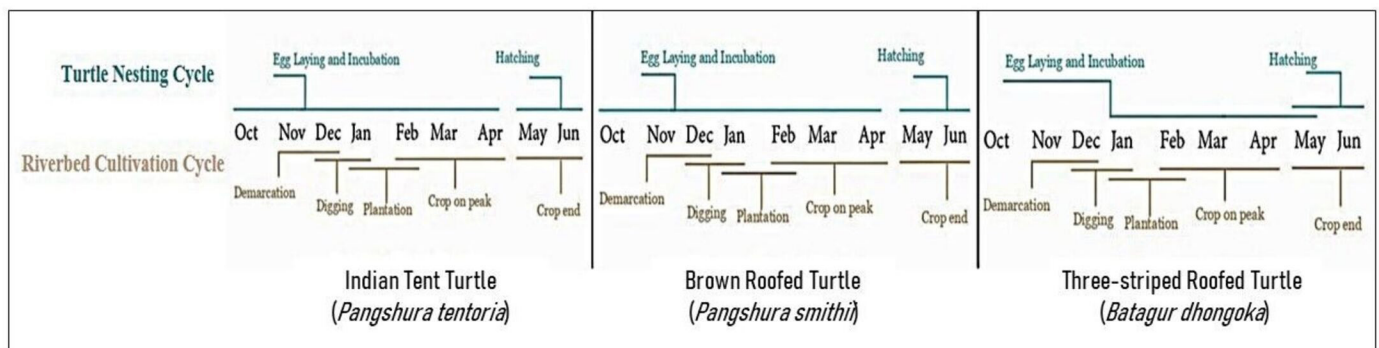


Figure 1. Overlap of turtle nesting seasons and riverbed agriculture cycles in the Upper Ganga and Ramganga River Basins.

We herein document the success story of on-ground action research and conservation for threatened species of freshwater turtles, a model that can be replicated in other rivers in India and beyond.

Material and Methods

Action research was carried out in the Upper Ganga River and River Ramganga. The objective of this work was to further understand the ecology of turtle nesting (through the mapping of critical nesting habitats and nesting seasons) to ensure the co-existence of people and turtles by reducing conflict between the turtle-breeding and crop cycles through community engagement, capacity building, awareness and outreach.

The program was implemented in the upper Ganga River between Bijnor Barrage (29.373799, 78.038230) and Narora Barrage (28.190858, 78.400187) from 2012 to 2021 and in the River Ramganga between Moradabad (28.894446, 78.744445) and Shahjahanpur (27.681709, 79.617783) from 2015 to 2021 (Fig. 2). The studied stretch of the Upper Ganga River is shallow with intermittent deep-

water pools (with depths to 10 m) and reservoirs upstream of Narora Barrage. The upper half of the river is legally protected as the Hastinapur Wildlife Sanctuary and the lower half of the river is in the Upper Ganga Ramsar Site. This stretch of river supports 12 species of freshwater turtles (Rao 1998). However, the studied stretch of the River Ramganga, which supports six species of freshwater turtles (Bogacki et al. 2023), is not in any Protected Area (PA) network. The major anthropogenic disturbances are destruction of nesting sites due to riverbed farming, fluctuating water levels, sand mining, and fishing.

The community-led turtle conservation program in the Upper Ganga River and River Ramganga is based on a newly developed three-pronged approach that includes awareness and training of local riparian communities, rescue of turtle nests from cultivated riverbed sites, and onsite nest protection of vulnerable turtle nests (Fig. 3).

Awareness programs have been organized in the riparian villages to sensitize and engage the local people for the conservation of freshwater turtles in the area with an emphasis on onsite conservation of turtle nests in and near

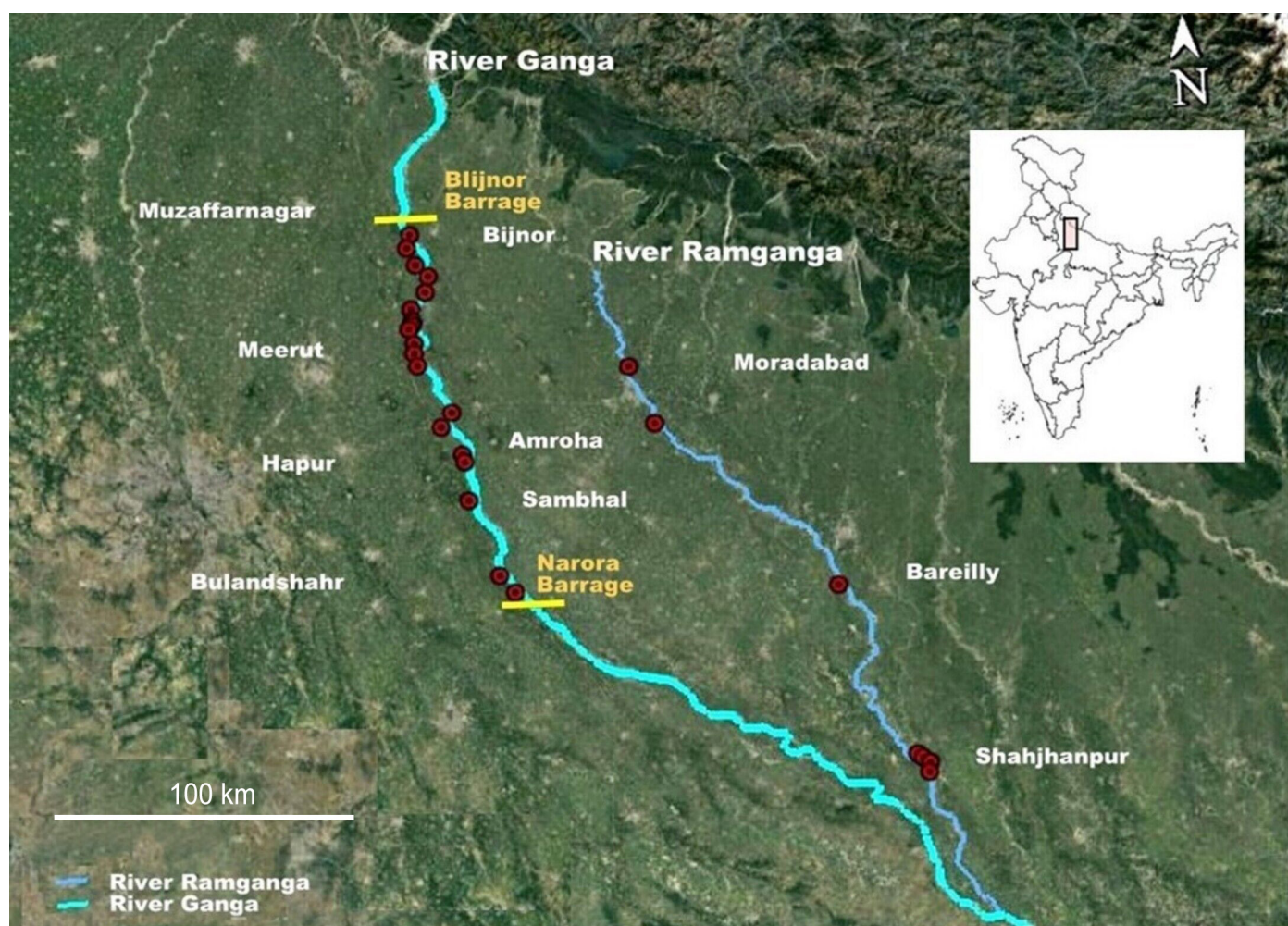


Figure 2. Map of the Upper Ganga and Ramganga River Basins showing the villages (red dots) involved in the community-led turtle conservation efforts.

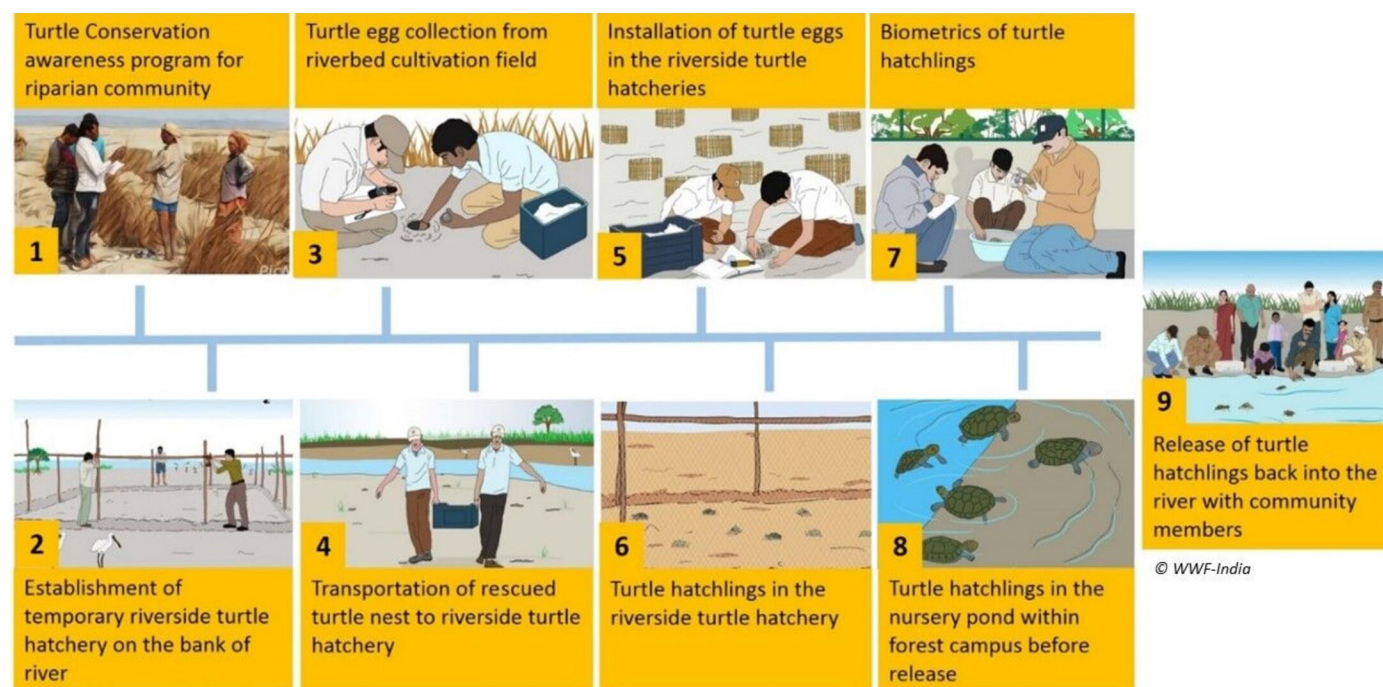


Figure 3. Stepwise process of turtle-nest rescues from cultivated fields along the riverbed.

agriculture fields. Participants in different onsite training programs were briefed about the identification of the turtles that are commonly found in the Upper Ganga Basin and the ecological importance of the turtles. Community members also were briefed about the process to be followed when they found turtle nests in their fields and how to protect them.

Field surveys were conducted along the riverbanks in the study areas during October–November (start of nesting season) to locate potential nesting habitats. The number of trial nests dug by female turtles on the site is considered a critical criterion for identifying potential nesting habitat. To assess sites for hatchery placement, we collected several environmental variables including height of the riverbank (m), distance of selected sites from the riverbank (m), composition of the substrate (sandy/sand-clay/clay), river width (m), evidence of nests disturbed by predators or intact), nesting tracks, and anthropogenic disturbances (fishing, mining, and human structures).

Based on hatchery-site-selection surveys, temporary riverside turtle hatcheries were established along the rivers. The size of a hatchery depends on the number of nests it contains; as a general practice, nests were placed 1 m apart from each other. Hatcheries were fenced with silk fishing nets (mesh size = 4 cm) to protect them from predators like jackals and stray dogs. Each year, two field assistants safeguarded the nests and hatcheries throughout the egg-laying and hatching season.

Field teams rescued nests from the riverbed based on the information received from farmers between October and April of each nesting season. These rescued nests were

transferred to the nearest riverside turtle hatchery. Precautions were taken to maintain the natural orientation of the eggs while transferring them to the hatchery. Eggs were gently collected in transportation boxes, arranged in 2–3 layers, and covered with moist natal sand. During collection, data were collected on nest temperatures, nest depths and widths, distances from water, and clutch and egg sizes.

Eggs were placed in a hatchery immediately after transportation. Pits similar to natural nests were excavated and eggs were placed maintaining the natural orientation. Nests were placed 1 m apart to avoid the spread of bacterial infections from neighboring nests. Each nest was flagged with the following information: date of excavation of nest, date of egg placement, clutch size, and turtle species.

Hatcheries were guarded around the clock until turtles hatched in June to ensure maximum hatching success. Nests were fenced individually so hatchlings were not confused with those from other nests in order to accurately track hatching success.

Hatchlings were kept in specially-designed nursery ponds with a water-filtration system and a transparent fiber roof. During rearing, turtles were fed per a prescribed dietary chart developed by the Veterinary College of SVP Agriculture University, Meerut. Ponds and perimeters were maintained throughout the process. Keepers sanitized their feet using potassium permanganate (KMnO_4) and wore gloves before entering the premises to feed turtles or to clean the pond.

The riparian community, especially the riverbed farmers, were encouraged to monitor and conserve turtle nests in their agricultural fields, ensuring a sense of ownership and

Table 2. Details of the rescued nests and community engagement in the Upper Ganga River and the Ramganga River. Contributors = number of persons providing information about nests in the riverbeds. Number of villagers = number of villagers participating in the meetings.

Year	Number of Nests	Eggs Collected	Eggs Hatched	Hatchlings Released	Number of Contributors	Number of Meetings (Number of Villagers)
Upper Ganga River from Bijnor Barrage to Narora						
2012–13	31	128	118	118	11	4 (90)
2013–14	54	578	532	532	33	12 (215)
2014–15	57	457	419	419	38	9 (152)
2015–16	67	546	501	501	35	10 (188)
2016–17	63	456	414	414	41	9 (162)
2017–18	141	971	823	635	98	17 (304)
2018–19	97	810	328	328	44	25 (250)
2019–20	87	519	453	453	52	6 (142)
2020–21	139	767	712	712	103	11 (138)
Ramganga River from Moradabad to Shahjahanpur						
2014–15	8	102	82	82	5	1 (18)
2015–16	3	28	21	21	2	1 (12)
2016–17	11	34	20	20	8	2 (28)
2017–18	11	145	79	79	7	2 (16)
2019–20	48	231	187	187	36	3 (43)
2020–21	11	56	28	28	7	1 (12)

stewardship for conservation of biodiversity. During the program, WWF-India and the Uttar Pradesh State Forest Department ensured that farmers gave the eggs found on their farms for placement in the safe enclosures of riverside hatcheries. Farmers also were motivated to secure nesting habitats along the River Ganga in Hastinapur Wildlife Sanctuary (Table 2). Turtles have religious significance and some of the local population also worship the River Ganga, which facilitated their involvement in the conservation efforts.

Results and Discussion

While the number of nests across the last 10 years may not look substantial, the support the initiative has garnered across the social hierarchy of riparian communities has been commendable (Table 2). Riverbed farmers are now willingly leaving hotspots of turtle nesting habitat in ‘as-is’ condition and are not engaging in farming in those areas (Fig. 4). In fact, the conservation of turtle habitat is critical for survival and proliferation of turtles in the river. Over the years, the initiative has evolved from mere rescue of vulnerable turtle nests and release of hatchlings to securing the key nesting

habitats and onsite nest protection by engaging actively with the local communities (Fig. 5).

As part of the program, the team has worked closely with riverbed farmers to build support for turtle conservation. This long-standing sustained engagement with the community has ensured their active participation, promoted local pride, and evoked a sense of ownership of the program. The people that joined the initiative for turtle conservation are now helping us with other species; many of them, for example, are now associated with the citizen science-based monitoring of Ganges River Dolphins (*Platanista gangetica*) in the Upper Ganga.

The program initiated in one riverbank village along the Ganga River in Meerut District with the help of 11 farmers in 2012 has grown to reach 30 villages in seven districts (Bijnor, Muzaffarnagar, Meerut, Amroha, Hapur, Sambhal, and Bulandshahr) with 221 active Ganga Mitras (Friends of the River) along the Ganga River helping in the conservation of turtles by identifying vulnerable turtle nests and securing nesting and basking habitats. Similarly in the River Ramganga, the program that was initiated in one village of Bareilly District with the help of 5 farmers in 2015 has



Figure 4. Photographs of the same location near Makhdumpur Village showing the change in land use as a result of the awareness and community conservation initiative. Photographs by the authors.

now expanded to seven villages in three districts (Moradabad, Bareilly, and Shahjahanpur).

The District Ganga Committees (DGCs) of the area have been engaged in the program through regular updates of progress and capacity building. As an outcome of this engagement, the DGC of Shahjahanpur (River Ramganga) has come forward and is now taking responsibility for hatchery construction and upkeep and rearing of turtle hatchlings; in effect, the DGCs are implementing the community-led turtle conservation program on their own.

Between 2012 and 2021, 520 people of the local riparian community in the Upper Ganga and Ramganga Rivers helped rescue over 828 turtle nests from riverside farms. Of the 5,828 eggs in these nests, 4,529 hatched and survived — a success rate of 77.7% (Table 2). Following rearing in the nursery ponds during the flood season, hatchlings were returned to their respective rivers for the winter. Since turtles are poikilothermic, winter food needs are lower, making it easier for them to adapt to their new surroundings. The released hatchlings included 1,945 Critically Endangered Three-striped Roofed Turtles (*Batagur dhongoka*), 1,292 Near-Threatened Brown Roofed Turtles (*Pangshura smithii*), and 1,480 Indian Tent Turtles (*Pangshura tentoria*), which are listed as being of Least Concern (Fig. 6).

Ganga Mitras are groups of interested citizens (villagers, farmers, students, government officials, and elected representatives) who voluntarily work toward the conservation of rivers, wetlands, species, and their habitats.

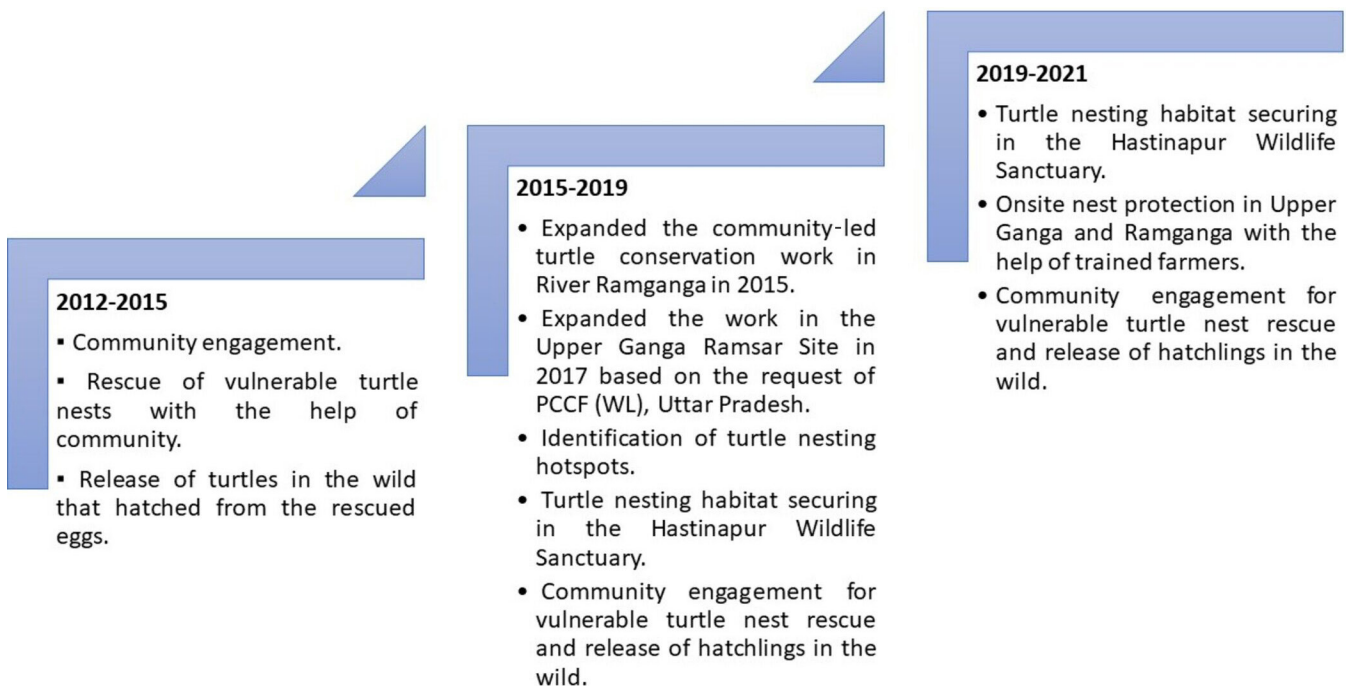


Figure 5. Timeline of the community-led turtle conservation program in the River Ganga and Ramganga Basins from 2012 to 2021.

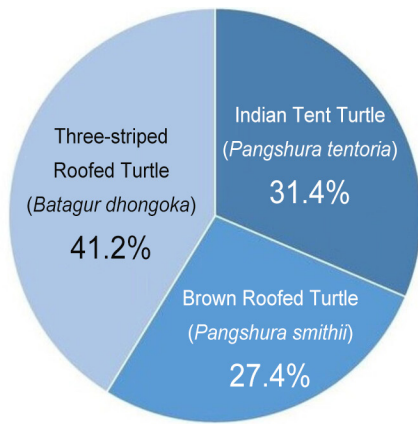


Figure 6. Percentage composition of the turtle species rescued and released in the Ganga and Ramganga Rivers.

Since the start of the program, 710 riparian community members in 37 villages have been engaged in the conservation of freshwater turtles in selected stretches of the River Ganga and Ramganga; of these, 221 have contributed information on vulnerable turtle nests between 2012 and 2021.

A large majority (91%) of turtles lay their eggs within 40 m of riverbanks in the Upper Ganga River (Fig. 7). However, these sandy banks have been traditionally used for riverbed cultivation. Since the awareness program for onsite turtle nest protection and securing of nesting habitat was initiated in 2018 along the River Ganga, 44 riverbed farming families in Makhdumpur Village of Hastinapur Block, Meerut, Uttar Pradesh, came forward and voluntarily left their sandy land within 40 m of the riverbank free of cultivation (Figs. 4, 8). In a 2020 assessment, 31 of 44 riverbed farmers were surveyed and consistently reported that the long-time association with the conservation initiative motivated them to adopt zero-risk measures for turtle conservation. Because the vacated patches

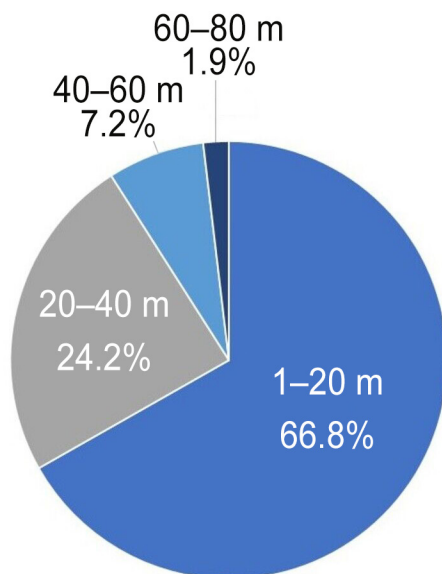


Figure 7. Distances of rescued turtle nests from the river banks.

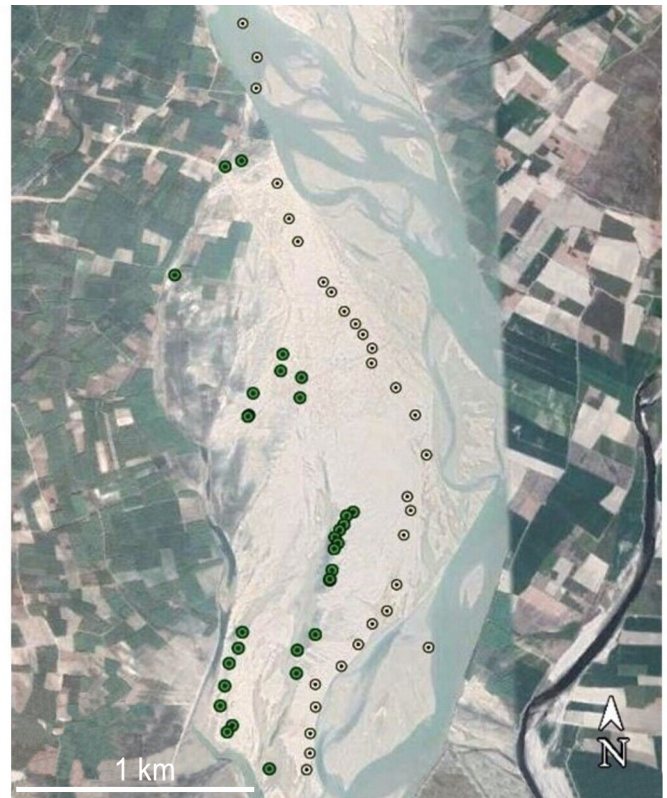


Figure 8. Locations of cultivated fields in relation to the river near Makhdumpur Village. Locations in 2017–2018 are indicated by white dots; locations in 2018–2019 by green dots.

of riverbed were small, the farmers reported that this posed no or very minimal risk to their livelihoods.

Four riverbed farmers were awarded by the senior forest officials of Uttar Pradesh Forest Department for their contributions to the turtle conservation program in Hastinapur Wildlife Sanctuary in 2019. Additionally, the findings of a survey to assess agricultural practices of the riverbed farmers in Hastinapur Block revealed intensive use of chemical fertilizers, with farmers having little to no knowledge of the use of micronutrient and effective irrigation methods for saving water. To address this and to benefit the contributing farmers, science-based training on the Package of Practices (PoPs) on sustainable agriculture has been provided with help from Krishi Vigyan Kendra, Hastinapur.

The community-led turtle conservation program illustrates how riparian communities can contribute to conservation. While riparian farmers used to discard turtle nests found in their farms, the initiative led to farmers taking care of the turtle nests and providing information to the Uttar Pradesh Forest Department and WWF-India. They also help the field teams in translocating these nests to riverside hatcheries.

This initiative has demonstrated a model of community-based conservation in which the community voluntarily supports species and habitat conservation in the Upper Ganga and Ramganga Rivers. This is a unique initiative, in which

the community has freed land previously used for riverbed farming for the nesting and basking of freshwater turtles without incentives or benefits, although not planting crops on the 40-m x 5-km strip of riverbed does reduce the likelihood of crop submergence due to frequent water-level fluctuations.

A few farmers have taken the initiative to personally help us save many vulnerable nests. They have spread the message of conservation through their community and motivated fellow citizens to join the initiative. The outstanding contributions of these role models of conservation have been recognized by the UP forest department and WWF-India with non-monetary awards.

The community-led turtle conservation work was impacted by the COVID-19 lockdown due to restrictions on travel and engaging with people, but field teams based at different riverside hatcheries continued their services with the help of the local community while following all COVID-19 guidelines of the Ministry of Health, Government of India.

This program could be expanded to cover more stretches of the River Ganga and its tributaries in the state of Uttar Pradesh and beyond. Since local community members in the Upper Ganga and Ramganga River have been aware and trained in turtle nest protection, the next step is to focus on onsite turtle nest protection, with the long-term sustainability of this program in the hands of local leadership. Therefore, DGCs in the riparian corridors are prepared to facilitate the gradual takeover of the program by the DGCs with technical support from the Uttar Pradesh Forest Department and WWF-India.

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