



Turtle Diversity in Bardia National Park and Associated Forest Area in Nepal

Rabin Kadariya¹, Bishnu Prasad Shrestha^{2,3}, Shyam Kumar Shah^{2, 4}, Ajit Tumbahangphe¹, Umesh Paudel¹, and Rabin Bahadur K.C.¹

¹National Trust for Nature Conservation, POB 3712, Khumaltar, Lalitpur 44700, Nepal (rbn.kc80@yahoo.com)

²Department of National Parks and Wildlife Conservation, Kathmandu, Nepal

³Wildlife Ecology and Conservation, Wageningen University and Research (WUR), Droevendaalsesteeg 4, 6708 PB Wageningen, the Netherlands

⁴Agriculture and Forestry University, Bharatpur 44200, Nepal

Turtles have delayed sexual maturity, high juvenile mortality rates, and long adult lifespans with low natural mortality rates; however, these previously successful adaptations have rendered turtle populations vulnerable to new, potentially catastrophic threats posed by human exploitation- and devel-

opment-related pressures (Turtle Conservation Fund 2007). Globally, turtles are exploited indiscriminately, with no regard for sustainability (Turtle Conservation Fund 2007; BNP 2022).

In Nepal, the terrestrial and freshwater turtle fauna characteristic of the Indian Subcontinent is well supported by

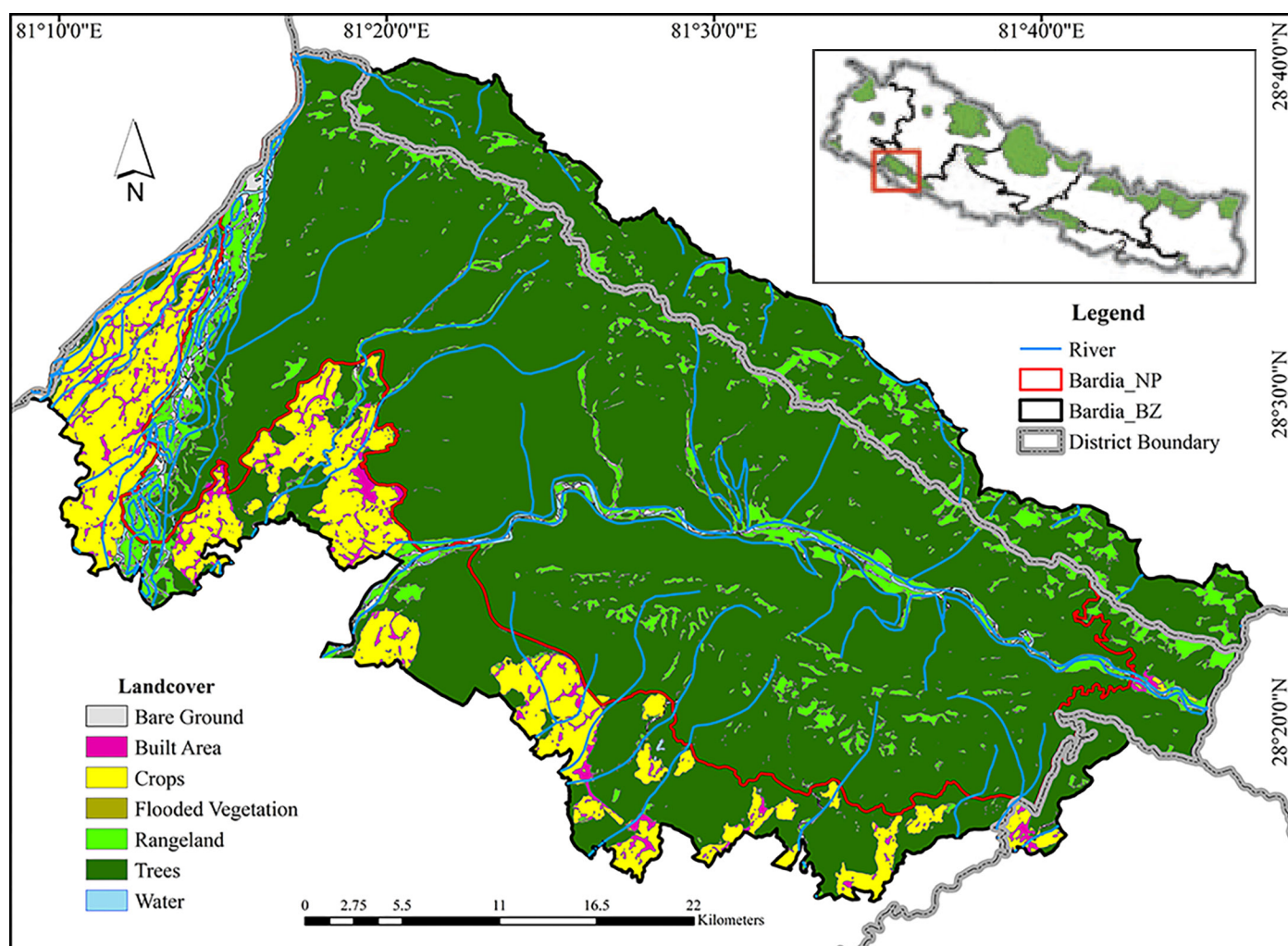


Figure 1. Map of Bardia National Park and buffer zone in Lumbini Province, Bardia District, Nepal, with landcover data as of 2022.

the wetlands and rivers of the Terai Region (Mitchell and Rhodin 1996). Three families (Geoemydidae, Testudinidae, and Trionychidae) are represented (Aryal et al. 2010; Bista and Shah 2010; Kästle et al. 2013). To conserve biodiversity in the Terai Region, six protected areas have been established; however, turtles and other reptiles have not received much attention or systematic research (Mitchell and Rhodin 1996; Schleich and Kästle 2002). The conservation of amphibians and reptiles depends on either their incidental presence in protected areas that have been established for other purposes or species-specific actions (Cogger 2003). Management of protected areas in Nepal is primarily devoted to the protection of large mammals, the gharial, and some endangered birds (Schleich and Kästle 2002). With the exception of Elongated Tortoises (*Indotestudo elongata*), Nepalese turtles are largely dependent on wetlands, which often are encroached by humans, with settlement, deforestation, pollution, and silt-

ation inevitably affecting turtle habitats and populations (Bhandari 1996). Turtles and their eggs also are hunted for food and traditional medicine (Shrestha 2000; Schleich and Kästle 2002; Shah 2004; Shah and Tiwari 2004; Aryal et al. 2010). Consequently, essential conservation management decisions require baseline information on the population status and distribution of turtles. We herein provide a checklist of the turtles recorded in Bardia National Park and associated forests.

Bardia National Park (BNP) (28.25–28.59, 81.17–81.75), with an area of 968 km², is in the southwestern lowlands of Lumbini Province, Bardia District, Nepal (BNP 2022). The Park, with an elevational range of 152 m asl in the south to 1,564 m (Banspani Ridge) in the north, has a high floral and faunal diversity with 839 species of flora and 667 species of fauna (BNP 2022). The climate is predominantly warm and temperate with dry winters and hot summers, veg-

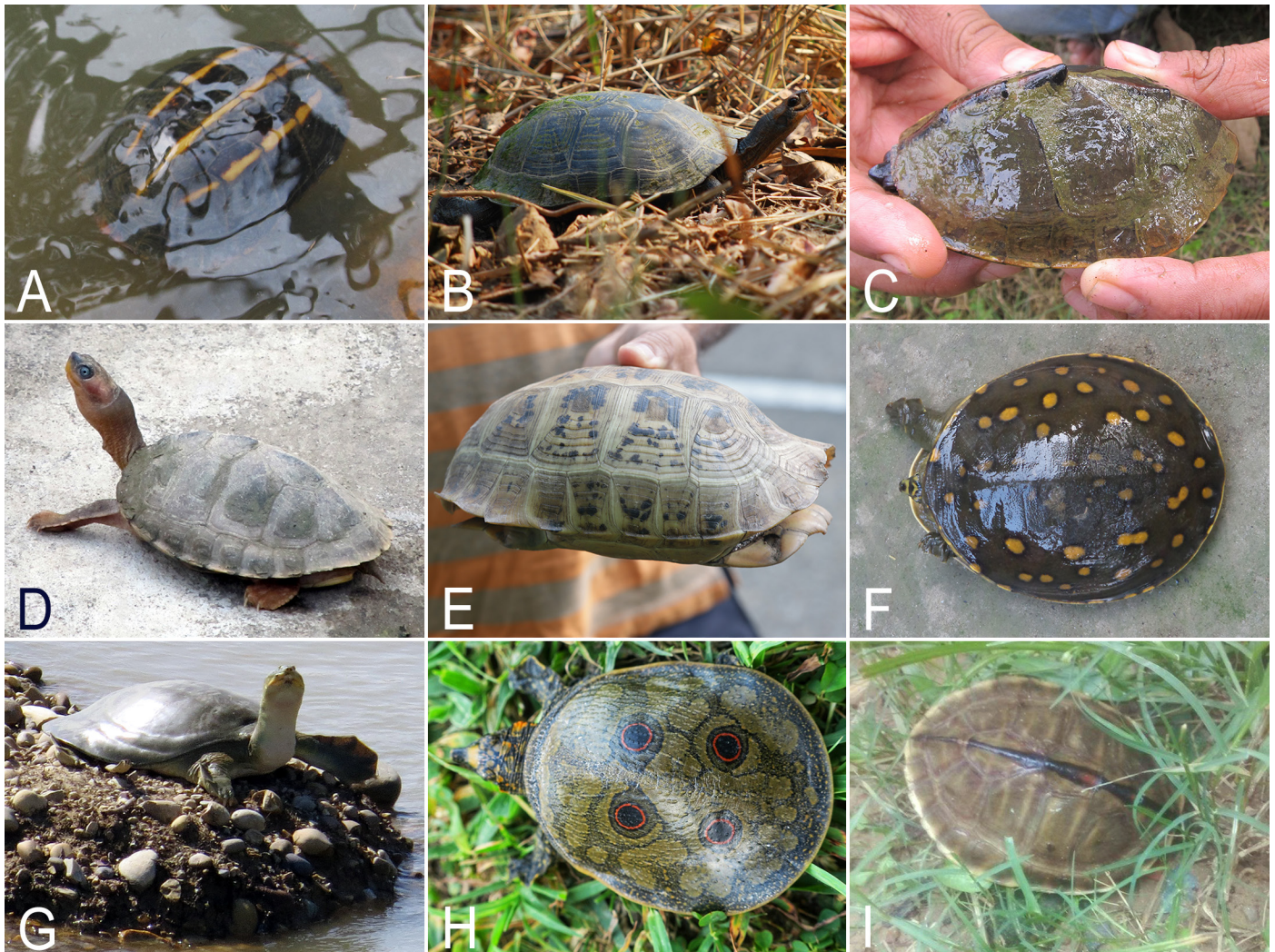


Figure 2. Species of turtles recorded in and around Bardia National Park and its buffer zone: (A) Tricarinate Hill Turtle (*Melanocheilus tricarinata*); (B) Indian Black Turtle (*Melanocheilus trijuga indopeninsularis*); (C) Indian Roofed Turtle (*Pangshura tecta*); (D) Indian Tent Turtle (*Pangshura tentoria flaviventer*); (E) Elongated Tortoise (*Indotestudo elongata*); (F) Indian Flap-shelled Turtle (*Lissemys punctata*); (G) Indian Soft-shelled Turtle (*Nilssonina gangetica*); (H) Indian Peacock Soft-shelled Turtle (*Nilssonina hurum*); (I) Pale-footed Roofed Turtle (*Pangshura smithii pallidipes*). Photographs by Rabin Kadariya (A, C–G), Anjali Mahatara (B, H), and Sandhya Dhakal (I).

Table 1. Species of turtles recorded in Bardia National Park and its buffer zone with IUCN Red List assessments (IUCN 2022) and inclusion in CITES Appendices I, II, III (CITES 2021). Abbreviations: CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, and LC = Least Concern.

Species	IUCN Red List	CITES
Geoemydidae		
Tricarinate Hill Turtle (<i>Melanochelys tricarinata</i>)	EN	I
Indian Black Turtle (<i>Melanochelys trijuga indopeninsularis</i>)	LC	II
Indian Roofed Turtle (<i>Pangshura tecta</i>)	VU	I
Indian Tent Turtle (<i>Pangshura tentoria flaviventer</i>)	LC	I
Testudinidae		
Elongated Tortoise (<i>Indotestudo elongata</i>)	CR	I
Trionychidae		
Indian Flap-shelled Turtle (<i>Lissemys punctata</i>)	VU	II
Indian Soft-shelled Turtle (<i>Nilssonina gangetica</i>)	EN	I
Indian Peacock Soft-shelled Turtle (<i>Nilssonina hurum</i>)	EN	I
Pale-footed Roofed Turtle (<i>Pangshura smithii pallidipes</i>)	NT	II

etation is subtropical, with floodplain vegetation along rivers and Sal (*Shorea robusta*) forests on surrounding uplands (Steinheim et al. 2005). Most communities in the area raise livestock and depend on forest resources for forage, animal bedding, and fodder (Thapa et al. 2021; Dhakal et al. 2023).

From 2010 to 2023, we conducted extensive literature reviews supplemented by opportunistic sightings and conversations with local residents to compile information on turtles in the BNP and its buffer zone. We documented the presence of nine species (Table 1), most of which were found in agricultural fields near wetlands.

Previously, during surveys of protected areas in lowland Terai, Aryal et al. (2010) had recorded 13 turtle species from BNP, followed by 11 in Chitwan National Park, nine in the Koshi Tappu Wildlife Reserve, six in Shuklaphanta National Park, and two in Parsa National Park. We did not find three taxa, the Red-crowned Roofed Turtle (*Batagur kachuga*), Circled Indian Tent Turtle (*Pangshura tentoria circumdata*), and Narrow-headed Soft-shelled Turtle (*Chitra indica*), that were observed by Aryal et al. (2010) in BNP. However, we did find two species (*Indotestudo elongata* and *Pangshura tecta*) that were not recorded in BNP by Aryal et al. (2010). Several factors could account for those discrepancies. Differences in survey methodology and effort likely influenced detectability; our study relied on opportunistic field observations and local interviews over a longer period but in a less systematic timeframe. Also, temporal changes over the 13-year interval between studies may have resulted in population declines or local extirpations of some species.

Despite existing rules and regulations, local residents are unaware of the importance of turtles or the penalties for engaging in illegal activities. To conserve turtles, additional surveys (as indicated by the differing results between our work and that of Aryal et al. 2010), studies of reproductive cycles, analyses of genetic variation, implementation of captive breeding programs, and an increased community awareness are essential.

Acknowledgements

We thank the National Trust for Nature Conservation, Bardia National Park, and local partner organizations for their support. We are grateful to Sushila Mahatara, Anjali Mahatara, Sandhya Dhakal, the staff of the NTNC-BCP, Phiru Lal Choudhary, Khushiram Choudhary, Ramraj Choudhary, and the local community for help during field surveys. Special thanks go to Santosh Bhattarai for his constructive comments and suggestions.

Literature Cited

- Aryal, P.C., M.K. Dhamala, B.P. Prasad, M.K. Suwal, and B. Rijal. 2010. Species accounts and distribution of turtles with notes on exploitation and trade in Terai, Nepal, pp. 29–38. In: *Proceedings of the First National Youth Conference on Environment (NYCE-I)*, Kathmandu, Nepal. <<https://caron.org.np/brochure/publications/Paperturtle.pdf>>.
- Bhandari, B. 1996. *An Inventory of Nepal's Terai Wetlands*. IUCN Nepal, Kathmandu, Nepal.
- Bista, D. and K.B. Shah. 2010. Diversity and status of the turtles in Ghodaghodi Lake Area. *Journal of Natural History Museum* 25: 366–373.
- BNP (Bardia National Park Office). 2022. *Management Plan of Bardia National Park and its Buffer Zone. FY 2079/80-2083/84 (2022/23-2026/27)*. Department of National Parks and Wildlife Conservation, Ministry of Forests

- and Environment, Government of Nepal, Thakurdwara, Bardia, Nepal. <https://dnppwc.gov.np/media/publication/Management_Plan_of_Bardia_National_Park_and_Its_Bufferzone_2022.pdf>.
- Dhakal, S., S. Rimal, P. Paudel, and A. Shrestha. 2023. Spatio-temporal patterns of livestock predation by leopards in Bardia National Park, Nepal. *Land* 12: 1156. <https://doi.org/10.3390/land12061156>.
- Cogger, H.G. 2003. *Encyclopedia of Reptiles, Amphibians and Fishes*. Fog City Press, San Francisco, California, USA.
- Kästle, W., K.R. Rai, and H.H. Schleich. 2013. *Field Guide to Amphibians and Reptiles of Nepal*. ARCO Nepal e.V., München, Germany.
- Mitchell, J.C. and A.G.J. Rhodin. 1996. Observations on the natural history and exploitation of the turtles of Nepal, with life history notes on *Melanochelys trijuga*. *Chelonian Conservation and Biology* 2: 66–72.
- Schleich, H.H. and W. Kästle (eds.). 2002. *Amphibians and Reptiles of Nepal: Biology, Systematics, Field Guide*. A.R.G. Gantner Verlag, Ruggel, Lichtenstein.
- Shah, K.B. 2004. Ethnozoology of the turtles in Nepal. *Journal of Institute of Science and Technology*, Tribhuvan University 13: 19–30.
- Shah, K.B. and S. Tiwari. 2004. *Herpetofauna of Nepal: A Conservation Companion*. IUCN Nepal, Kathmandu, Nepal.
- Shrestha, T.K. 2000. *Herpetology of Nepal. A Field Guide to Amphibians and Reptiles of Trans-Himalayan Region of Asia*. Steven Simpson Natural History Books, Norwich, Norfolk, UK.
- Steinheim, G., P. Wegge, J.I. Fjellstad, S.R. Jnawali, and R.B. Weladji. 2005. Dry season diets and habitat use of sympatric Asian elephants (*Elephas maximus*) and greater one-horned rhinoceros (*Rhinoceros unicornis*) in Nepal. *Journal of Zoology* 265: 377–385. <https://doi.org/10.1017/S0952836905006448>.
- Thapa, S.K., J.F. de Jong, N. Subedi, A.R. Hof, G. Corradini, S. Basnet, and H.H.T. Prins. 2021. Forage quality in grazing lawns and tall grasslands in the subtropical region of Nepal and implications for wild herbivores. *Global Ecology and Conservation* 30: e01747. <https://doi.org/10.1016/j.gecco.2021.e01747>.
- Turtle Conservation Fund. 2007. *A Global Action Plan for Conservation of Tortoises and Freshwater Turtles. Strategy and Funding Prospectus 2002–2007*. Conservation International and Chelonian Research Foundation, Washington, D.C., USA. <https://turtleconservationfund.org/wp-content/uploads/2008/02/tcf_action_plan.pdf>.