OPINION

Reimagining people's participation in the People Biodiversity Register through citizen science – a case of small mammal and bats from the Eastern Himalaya, India

Thangsuanlian Naulak and Sunita Pradhan

In theory, the mandate of The Biological Diversity Act, 2002 of India for the preparation of People Biodiversity Registers (PBRs) by the Biodiversity Management Committees is a participatory process that involves local communities. In practice, the PBR documentation is a hasty process of meeting deadlines where local communities are restricted to helping researchers in data collection. However, data from our field studies and from the citizen science platform showed immense potential to actively engage local communities in the PBR process. We envision a framework to integrate citizen science and PBR within the ambit of programmes 1 and 7 of the National Mission on Biodiversity and Human Well-Being.

The mammalian orders Rodentia, Scandentia, Eulipotyphla and Chiroptera combined make up about 70% of all classified mammal species worldwide[1]. In the Darjeeling–Sikkim Himalaya (DSH) landscape of India, small mammals and bats (SM&B hereafter) comprise about 60% of all mammal species recorded[2]. The ecological role of bats as pollinators and for pest control is well-documented. They play an important role in the socio-ecological systems by providing regulating services that are crucial for the production of food[3]. Insectivorous bats, in particular, are known to regulate at least 12 orders of insects[4]. Small mammals, on the other hand, are also important as they serve better to understand ecosystem and landscape processes because of their short life cycles, restricted spatial occupancy and their rapid response to environmental changes[5]. Although mammals are the most studied taxa in the Eastern Himalaya (India, Nepal and Bhutan (Khangchendzonga Landscape))[6], research on SM&B in the region is still lagging behind. This is perhaps due to the general perception of these species as pests, unlike their more charismatic mammalian cousins. The lag is also in part due to their nocturnal activity, cryptic behaviour and the logistical as well as taxonomic workload that comes entailed with studying these species.

This is also evidenced by the 22 People Biodiversity Registers (PBRs), accessed by the first author at the Sikkim State Biodiversity Board, prepared between 2019 and 2022 from different parts of this state. We found that there is negligible information on SM&B (format 28 and 30). Ashoka Trust for Research in Ecology and the Environment in collaboration with Sikkim University had also carried out surveys across 10 sites in the socio-ecological landscape of DSH from 2018 to 2022 for inventorying SM&B. We used Sherman® traps (7.62 × 8.89 × 22.86 cm) to capture small mammals, and mist nets (Ecotone 716/6; 2.5 m × 6 m; 16 mm × 16 mm) for bats. We recorded a total of 35 individuals representing 9 different species of small mammals from a sampling effort of 1028 trap nights (one trap night equals one Sherman trap for one night), while mist netting yielded a total of 56 individuals representing 12 species of bats from 65 trap nights (one trap night equals one mist net for one night). We posit that integrating biodiversity documentation of PBRs with multi-taxa citizen science platforms such as iNaturalist (https://www.inaturalist.org/home) is the way forward for expediting the documentation of biodiversity, reliable ratification of species identification, and ease of access to data for researchers and policy makers.

To understand the feasibility of using citizen science platforms to document SM&B, we obtained research-grade data from iNaturalist, an on-line multi taxa platform for mapping and sharing observations of biodiversity across the globe, through Global Biodiversity Information Facility for the Indian subcontinent and DSH. We found that as many as 223 mammal species, including 104 species of SM&B, have been recorded from 13,882 observations (as of November 2022) from the Indian subcontinent (https://doi.org/10.15468/dl.u2gv49). This is in stark contrast to the meagre 84 observations of 29 species of mammals, including 7 species of SM&B recorded from DSH (https://doi.org/10.15468/dl.qq2gfr). In addition, we employed a targeted approach using multimedia messaging platforms such as WhatsApp and forming interest groups to enable local communities to share images of SM&B present in the landscape. Thus, we recorded as many as six individuals representing six species of small mammals, validating our assumption of feasibility for documenting SM&B. Such targeted approach for documenting biodiversity using citizen science platforms in DSH has proven to be successful[7]. Pradhan *et al*.[7] have reported an exponential growth in the number of observations and species count of butterflies using a citizen science platform in the DSH landscape after targeted approach intervention.

The norm for the preparation of PBR is a process that is initiated by the Biodiversity Management Committees (BMCs) for documenting traditional ecological knowledge (TEK) at the grassroots level, i.e. Gram Panchayats. This process serves the purpose of documenting TEK through interviewing, involving mostly the older generation[8]. This not only alienates the younger generation from the process, but is also a missed opportunity due to the absence of a suitable platform for them to contribute. The digital era provides an opportunity for mobilizing the youth to enable them to participate in citizen science campaigns for the documentation of biodiversity. This would ensure a coherent and comprehensive PBR with the added benefit of transforming the citizens from bio-illiterate to bio-literate[9].

In line with programmes 1 and 7 of the National Mission on Biodiversity and Human Well-Being (NMBHWB)[9], we propose that for listing of wild biodiversity (format 18 to 31), the State Biodiversity Board may organize multiple synchronized, state-level citizen science events for documenting different components of wild biodiversity with the help of relevant stakeholders (universities, colleges, schools, State Forest Department, BMCs, etc.). This will also help

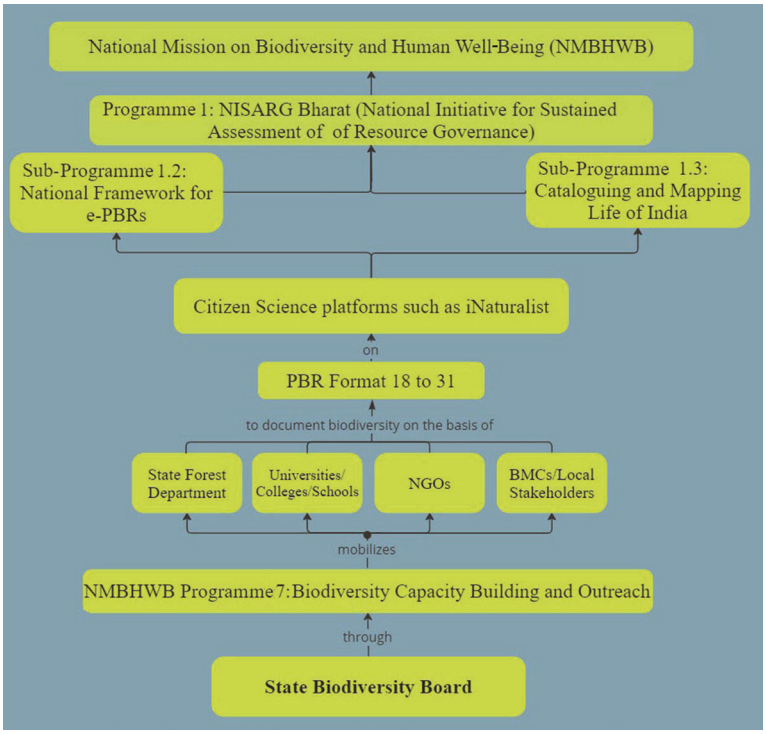

Figure 1. Framework for expediating biodiversity documentation through multiple state level synchronized citizen science events using People's Biodiversity Register formats.

the concerned authorities identify key players at different levels of administration based on their participation to help them in the preparation of the respective formats based on their interest. The data collected during these exercises could then be fed back into the PBR in the form of cataloguing based on area or pre-coded ID tags for different BMCs while uploading the images in citizen science platforms (Figure 1).

Our experience from actively documenting SM&B in the socio-ecological landscape not only provides information about species presence, but also gives insights into less-documented human–wildlife interactions vis-à-vis SM&B. As such, it is pertinent to enable the local communities to participate in the process of documenting biodiversity at large, and more so lesser known nocturnal species, to learn about their role in the ecosystem before discarding them simply as pests. The PBR process therefore should not merely be a means of fulfiling the obligations of the Biological Diversity Act, 2002, nor a means of meeting deadlines[10,11]. This active engagement of the local communities, especially the younger generation through citizen science and documenting biodiversity for PBRs will bring about a sense of stewardship for their local biological resources, create awareness and bio-literacy. Above all, this would help in the preparation of a knowledge repository by and of the local communities fulfiling the mandate of the Biological Diversity Act, 2002 and also address the United Nations Sustainable Goals 4.7, 12.2, 12.8 and 15.9 (ref. 9).

1. Burgin, C. J., Colella, J. P., Kahn, P. L. and Upham, N. S., *J. Mammal.*, 2018, **99**, 1–14.
2. Naulak, T. and Pradhan, S., *J. Threat. Taxa*, 2020, **12**, 16434–16459.
3. Ramírez-Fráncel, L. A. *et al.*, *Integr. Zool.*, 2022, **17**, 2–23.
4. Kunz, T. H., de Torrez, E. B., Bauer, D., Lobova, T. and Fleming, T. H., *Ann. N. Y. Acad. Sci.*, 2011, **1223**, 1–38.
5. Barrett, G. W. and Peles, J. D., In *Landscape Ecology of Small Mammals*, Springer, New York, USA, 1999, pp. 1–10; doi:10.1007/978-0-387-21622-5_1.
6. Kandel, P., Gurung, J., Chettri, N., Ning, W. and Sharma, E., *J. Asia-Pac. Biodivers*, 2016, **9**, 1–10.
7. Pradhan, A., George, R. and Dewan, S., *J. Threat. Taxa*, 2023, **15**, 22771–22790.
8. Basha, S. K., Sudarsanam, G., Parveen, D. and Verma, A., *Biodivers. J.*, 2012, **3**, 111–118.
9. Bawa, K. S. *et al.*, *Biol. Conserv.*, 2021, **253**, 108867.
10. Dutt, B., *The Peoples' Biodiversity Register, Meant to Empower Local Communities, is Leaving them Out*, THG Publishing Pvt Ltd, Chennai, 2020; https://www.thehindu.com/sci-tech/energy-and-environment/the-peoples-biodiversity-register-meant-to-empower-local-communities-is-leaving-them-out/article32869691.ece
11. Sharma, K., Vasudevan, S. and Deora, S., Can a People's Biodiversity Register contribute to conservation? *The Bastion: Development in Depth*, Bastion Media LLP, Delhi, 2021; https://thebastion.co.in/politics-and/environment/conservation-and-development/can-a-peoples-biodiversity-register-contribute-to-conservation/

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Thangsuanlian Naulak and Sunita Pradhan are in the Ashoka Trust for Research in Ecology and the Environment, Eastern Himalaya Northeast Office, Tadong, Gangtok 737 102, India; Thangsuanlian Naulak is also in the Wildlife Institute of India, Post Box No. 18, Chandrabani, Dehradun 248 001, India and Forest Research Institute (deemed to be University), P.O. I.P.E., Kaulagarh Road, Dehradun 248 195, India.*
**e-mail: thangsuanliannaulak@gmail.com*