



# Biodiversity Citizen Science in Meghalaya: Case Study of Potentials, Public Perceptions and Attitudes in the Eastern Himalayas

Joanica Delicia Jyrwa<sup>1\*</sup>, Garcia Pynkmenlang Fancon<sup>2</sup>, Nathaniel Bhakupar Dkhar<sup>3</sup>, Pynskhlemlang Rani<sup>4</sup>, Latasha Marak<sup>5</sup>, Sachen Sangma<sup>6</sup>, Befulstar Kshiar<sup>7</sup>, Blari Dashisha Lyngdoh<sup>8</sup>, Vayaneza Fancon<sup>8</sup>, Shatabdi Borgohain<sup>9</sup> and Eleazer Cheryl Marbanianang<sup>10</sup>

<sup>1</sup>State Environment Impact Assessment Authority, Shillong-793 001, India

<sup>2</sup>Earthtree Pvt Ltd, Umpling, Shillong-793 006, India

<sup>3</sup>Mu Gamma Pvt. Ltd. Environmental Services. Gurugram-122 002, India

<sup>4</sup>North Eastern Hill University, Umshing Mawkynroh, Shillong-793 022, India

<sup>5</sup>National Public School, Adabari, Nalbari- 781 126, India

<sup>6</sup>St Anthony's College, Shillong -793 003, India

<sup>7</sup>Pondicherry University, Chinna Kalapet, Puducherry-605 014, India

<sup>8</sup>Assam Don Bosco University, Tapesia campus, Sonapur- 782 402, India

<sup>9</sup>Alagappa University, Karaikudi-630 001, India

<sup>10</sup>North Eastern Regional Institute of Science and Technology, Nirjuli- 791 109, India

\*Corresponding Author Email: [joanica.jyrwa@gmail.com](mailto:joanica.jyrwa@gmail.com)

Received: September 20, 2025

Revision Submitted: January 25, 2026

Accepted: February 10, 2026

**Abstract:** Biodiversity Citizen Science (BCS) has emerged as an effective participatory approach for biodiversity monitoring and conservation, particularly in regions with limited formal data. This pilot study evaluates the potential of BCS in Meghalaya, a biodiversity-rich state in Northeast India, by examining public perceptions, attitudes, and participation patterns. Using a mixed-methods approach, data were collected through structured questionnaires, semi-structured interviews, and two biodiversity photography contests conducted under varying motivational conditions. A total of 94 participants contributed 1,690 biodiversity records across taxonomic groups and regions. Quantitative analysis using analysis of variance revealed that age ( $p = 0.030$ ), urban ecological orientation ( $p = 0.035$ ), and mental connection with nature ( $p = 0.020$ ) significantly influenced participation, whereas gender and education were not significant predictors. Qualitative findings highlighted emotional affinity, cultural ties, and curiosity as key drivers of engagement. Participation increased notably when incentives were introduced, although elevated engagement persisted beyond the incentive phase. The study demonstrates that BCS can effectively bridge traditional ecological knowledge and scientific documentation, fostering ecological awareness and inclusive conservation. These findings underscore the relevance of citizen science as a scalable tool for participatory biodiversity monitoring and policy-relevant conservation in the Eastern Himalayas.

**Keywords:** Biodiversity citizen science, Meghalaya, Eastern Himalayas, Biodiversity.

## 1. INTRODUCTION

Global biodiversity loss has reached catastrophic levels, posing unprecedented challenges to conservation science and environmental governance (McKinley et al., 2017). In response, citizen science (CS), the active participation of non-professional volunteers in scientific research—has emerged as a powerful tool for biodiversity monitoring (Conrad and Hilchey, 2011; Sullivan et al., 2014; Theobald et al., 2015). CS initiatives generate reliable ecological data at scales often unattainable by professional science alone (Chandler et al., 2017; Danielsen et al., 2014; Callaghan et al., 2025) and simultaneously enhance environmental awareness, social capital, and stewardship (McKinley et al.,

2015; Pretty and Smith, 2004; Voigt-Heucke et al., 2023).

Biodiversity Citizen Science (BCS) specifically empowers individuals to document species, monitor ecosystems, and engage directly with conservation efforts. With global biodiversity threatened by climate change, habitat loss, and unsustainable development, BCS offers a participatory framework that bridges data gaps while fostering ecological literacy and inclusive conservation (Kelly et al., 2020; Mason et al., 2025). Motivations for involvement often include learning, emotional connection to nature, and a desire to contribute to conservation goals (Tiago et al., 2017; Jansen et al., 2024). Digital platforms and mobile applications have expanded accessibility and

Available online: March 13, 2026

Published by: ©The Indian Ecological Society <https://indianecologicalsociety.com>. All rights reserved.

retention (Mason et al., 2025), while integration into classrooms demonstrates educational benefits (Kelemen-Finan et al., 2018).

In India, citizen science platforms such as the Indian Bioresource Information Network (IBIN) and the India Biodiversity Portal have expanded biodiversity documentation, particularly in underrepresented regions (Singh et al., 2018; Malhotra, 2018; Barve et al., 2023). In the Northeast, initiatives such as the North-East India Biodiversity Portal have shown how participatory approaches can rapidly enrich datasets (ATREE, 2016), despite Northeast India's exceptional biodiversity and cultural traditions of ecological stewardship (e.g., sacred groves, clan-managed forests), systematic studies of public perceptions toward BCS remain limited. We assessed the public attitudes toward BCS, identify factors influencing participation, and evaluate the role of intrinsic and extrinsic motivators in sustaining engagement.

## 2. MATERIALS AND METHODS

### 2.1. Study Area

Meghalaya, located in Northeast India, spans approximately 22,429 km<sup>2</sup> and shares borders with Assam to the north and Bangladesh to the south. Characterized by high annual rainfall, the state supports diverse ecosystems ranging from subtropical forests and sacred groves to limestone caves and high-altitude grasslands. More than 75% of its land is under forest cover, harboring rare and endangered species such as the clouded leopard (*Neofelis nebulosa*), hoolock gibbon (*Hoolock hoolock*), and numerous endemic orchids and carnivorous plants.

The population is predominantly composed of the Khasi, Jaintia, and Garo tribes, residing in Khasi, Jaintia and Garo Hills respectively, whose traditional practices emphasize sustainable resource management. Sacred groves exemplify indigenous ecological knowledge and community-based conservation. However, Meghalaya's biodiversity faces mounting threats from deforestation, unregulated coal mining, shifting agriculture, and infrastructure expansion, which contribute to habitat loss and ecosystem fragmentation. These pressures, coupled with shifting cultural values, highlight the urgency of participatory conservation strategies that integrate local knowledge with scientific approaches.

### 2.2. Methodology

This study employed an exploratory mixed-methods design to examine motivational drivers in a pilot biodiversity citizen science initiative. Quantitative indicators were combined with qualitative insights to

capture participation patterns and underlying motivations.

### 2.3. Sampling Frame

The study included 94 voluntary participants recruited through open calls disseminated via local and online networks. Participation was self-selected, informed consent was obtained prior to data collection, and no exclusion criteria were applied.

### 2.4. Study Variables and Data Collection

Data were collected in two phases using biodiversity photography contests:

1. a contest conducted without prior disclosure of incentives, and.
2. a contest conducted with prizes and recognition. These phases were designed as motivational probes rather than controlled experiments.

A structured questionnaire captured demographic variables (age, gender, education, rural–urban background) and psychological variables (mental connection with nature, perception of ecological balance, urban ecological orientation), measured using Likert-type scale items. Biodiversity submissions were compiled and categorized taxonomically. Semi-structured interviews were conducted with selected participants to capture qualitative insights into motivations and perceptions. Data collection occurred during and immediately following each contest phase.

### 2.5. Data Analysis

Quantitative data were analyzed using R software (version 4.3.2). Descriptive statistics and analysis of variance (ANOVA) were applied to assess the influence of demographic and psychological variables on willingness to participate. Qualitative interview data were analyzed using thematic coding.

### 2.6. Likert-scale instrument and measurement

Attitudinal and perception-based variables were measured using Likert-type scale items following standard social science survey practice (Likert, 1932). Statements were developed based on themes commonly used in citizen science and environmental psychology literature, including perceived importance of biodiversity documentation, ecological balance, urban ecology, climate change concern, and mental connection with nature.

Participants indicated their level of agreement with each statement on a five-point Likert scale ranging from 1 (“Strongly disagree”) to 5 (“Strongly agree”). The instrument was designed for exploratory purposes rather than scale development or psychometric validation. Internal consistency and reliability testing were therefore not emphasized; instead, individual items were treated as

independent indicators and analyzed descriptively and inferentially as appropriate for pilot studies.

**3. RESULTS AND DISCUSSION**

**3.1. Participation and Biodiversity Records**

A total of 94 respondents participated in the survey, aged 11–47 years (mean age ≈ 24 years), with the majority falling in the 18–30 year age group. The sample was male-dominated (52.64%), with largely urban (46.8%), rural (42.5%), followed by semi urban (10.6%) residents. Education is predominantly undergraduate-level education or higher (73.4%), representing diverse academic backgrounds across science, social science, and professional disciplines. A total of 1,690 biodiversity submissions were received from across Meghalaya. The Khasi Hills recorded the highest number of submissions (n = 675), followed by the Garo Hills (n = 229) and the Jaintia Hills (n = 24). Across taxonomic groups, Insecta dominated submissions (n = 824), followed by Aves (n = 134), with additional records from Arachnida, Reptilia, Mammalia, Gastropoda, Nemertea, and Diplopoda (Fig. 1).

**3.2. Demographic and Psychological Predictors of Participation**

Analysis of variance identified three significant predictors of participation in biodiversity documentation: age (p = 0.030), urban ecological orientation (p = 0.035), and mental connection with nature (p = 0.020). Gender, education level, prior conservation experience, and political views were not significant predictors of participation (Table 1).

**Table 1.** Demographic and psychological predictors of participation in biodiversity documentation

Variable	Pr(>F)
Age	0.030
Gender	0.161
Rural–Urban (RuUrb)	0.341
Education	0.361
Prior Experience (Exp)	0.414
Participation History (Parti)	0.314
Ecological Balance (EcoBal)	0.335
Political Views (Poli)	0.597
Urban Ecological Orientation (UrEco)	0.035
Climate Change Concern (Cchange)	0.693
Mental Connection with Nature (Mental)	0.020
Future Orientation (Future)	0.150
Residuals	—

*Significant predictors are in bold (p < 0.05)*

**3.3. Participant Attitudes and Perceptions Towards Biodiversity Documentation**

Survey responses revealed strong positive attitudes towards biodiversity documentation. More than 70% of participants agreed that biodiversity documentation is important for maintaining ecological balance, that urban ecology should be incorporated into conservation planning, and that climate change affects mental well-being. Nearly all participants expressed willingness to participate in future biodiversity citizen science initiatives.

Likert-type scale responses were strongly skewed towards agreement and strong agreement across most statements, indicating a generally positive orientation towards biodiversity documentation and conservation-related themes (Figure 2). Neutral and negative responses were comparatively limited, suggesting low resistance or disengagement among participants.

**3.4. Engagement Patterns across Project Phases**

Engagement levels were lowest during the initial pre-phase, increased during the photography contest conducted without prior disclosure of incentives, and peaked during the incentive-based phase. Although participation declined after incentives were removed, engagement levels remained higher than baseline, indicating persistence of participation beyond purely extrinsic motivation (Figure 3).

**3.5. Participation Patterns and Taxonomic Bias**

The dominance of insect and bird records reflects widely observed patterns in biodiversity citizen science, where visually conspicuous and easily observable taxa are more frequently documented (Chandler et al., 2017; Sullivan et al., 2014). The uneven geographic distribution of submissions, with higher participation from the Khasi Hills, likely reflects differences in population density, accessibility, and exposure to environmental networks, as noted in other regional citizen science studies (Tiago et al., 2017).

**3.6. Psychological and Demographic Drivers of Participation**

The significant influence of age on participation aligns with previous findings indicating greater conservation engagement among older individuals (West and Pateman, 2017). The role of urban ecological orientation highlights the increasing relevance of urban environmental awareness in shaping conservation behaviours, particularly in rapidly urbanising landscapes (Voigt-Heucke et al., 2023). The association between mental connection with nature and participation reinforces evidence that emotional and psychological bonds with nature are key motivators in

citizen science engagement (Peter et al., 2019; Kelly et al., 2020).

**3.7. Attitudes towards Biodiversity Documentation and Conservation**

The overwhelmingly positive attitudes observed among participants suggest a strong latent interest in biodiversity documentation and conservation. Similar trends have been reported in citizen science initiatives globally, where participants demonstrate high levels of environmental concern and willingness to engage when accessible platforms are provided (McKinley et al., 2017; Jansen et al., 2024). This indicates that limited participation in biodiversity monitoring may stem more from lack of

opportunity than lack of interest.

**3.8. Role of Incentives and Sustained Engagement**

The observed increase in participation during the incentive-based phase supports evidence that extrinsic motivators can effectively stimulate short-term engagement in citizen science projects (West and Pateman, 2017). Importantly, the persistence of participation beyond the incentive phase suggests the activation of intrinsic motivation, a phenomenon reported in other participatory conservation initiatives (Pretty and Smith, 2004; McKinley et al., 2015). This highlights the potential of short-term incentives to catalyse longer-term ecological engagement.

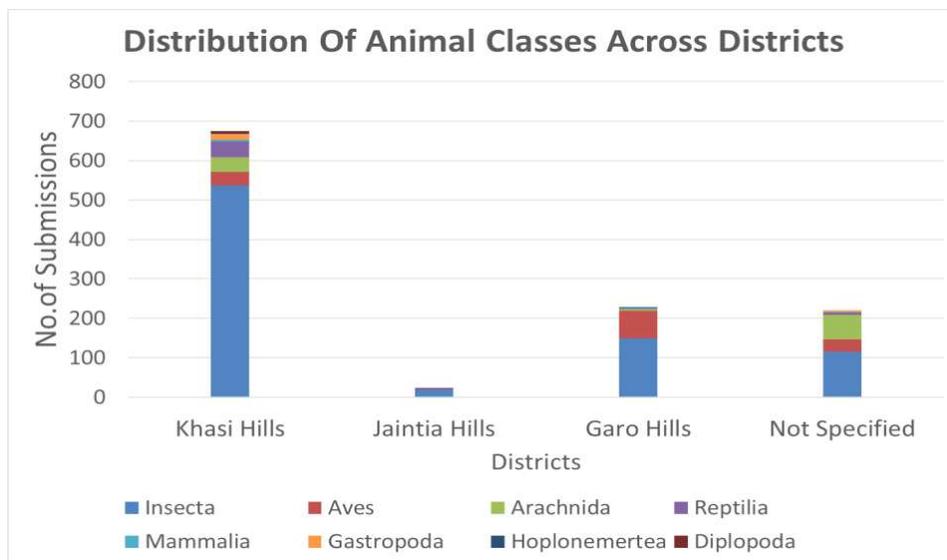


Figure 1. Distribution of animal classes across districts in Meghalaya

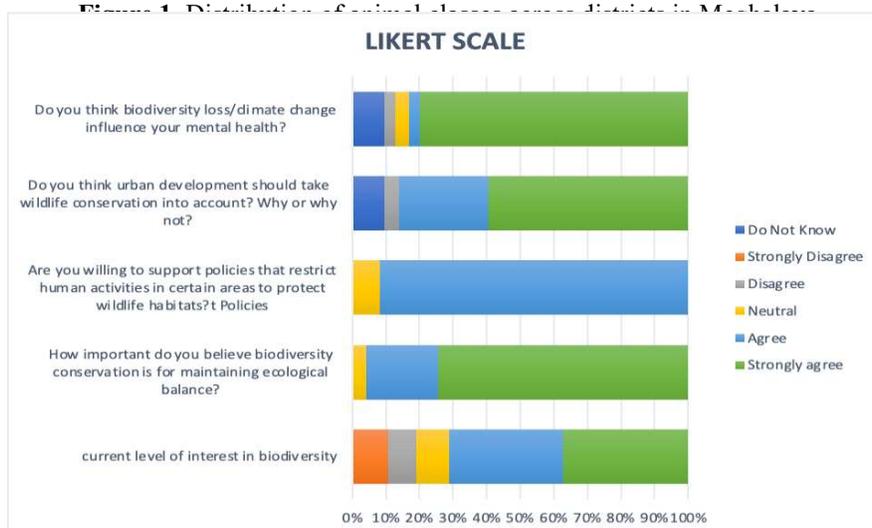
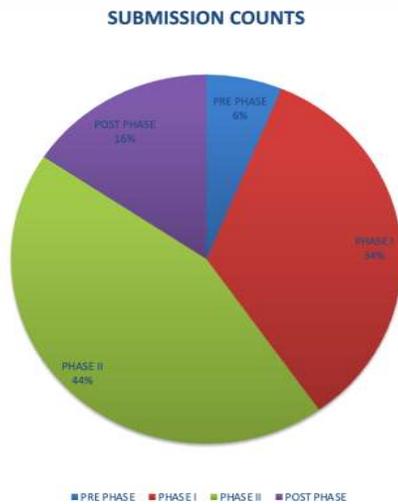


Figure 2. Distribution of participant attitudes and perceptions towards biodiversity documentation measured using Likert-type scale item



**Figure 3.** Engagement levels across project phases showing intrinsic and extrinsic motivators

**4. CONCLUSION**

This exploratory case study demonstrates that Biodiversity Citizen Science is a viable and transformative approach for participatory conservation in Meghalaya. Empirical findings reveal that age, urban ecological orientation, and psychological affinity with nature significantly influence willingness to participate, while factors such as gender and education are less predictive in this context. The emotional and cultural connections to nature may transcend formal education in shaping engagement with biodiversity documentation. The study highlights the capacity of BCS to bridge traditional ecological practices, such as sacred grove conservation with modern scientific documentation. By positioning communities not merely as beneficiaries but as co-creators of ecological knowledge, BCS strengthens stewardship, enriches biodiversity databases, and fosters inclusive governance. Importantly, this is one of the first independent, youth-led citizen science initiatives in Northeast India. It underscores the role of young leaders in re-grounding ecological awareness in a region where human–nature connections are at risk of dilution. Future research should expand longitudinal tracking of citizen engagement, integrate digital innovations, and institutionalize citizen science within local governance structures. By doing so, BCS can evolve into a cornerstone of participatory conservation in biodiversity-rich yet vulnerable landscapes.

**Authors' Contributions**

JDJ conceptualized the research, analyzed the data, and

wrote the manuscript. GPF collected data and led data management and compilation. PR, BK, SS, LM, BL, and VF conducted interviews and collected data. SB co-wrote the manuscript, and NBD co-conceptualized and supervised the entire research, finalized the draft and helped in funding opportunities.

**Acknowledgement**

The authors are grateful to the One Million Leaders in Asia (OMLAS) Fellowship Programme for the financial and technical support. Most of the authors are from the Indian Youth Biodiversity Network- Meghalaya Chapter and are grateful to the Global Youth Biodiversity Network-India Chapter for providing a platform and strong support and encouragement.

**Conflict of interest**

The authors declare no conflict of interest related to the research, authorship, or publication of this article. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**REFERENCES**

Ashoka Trust for Research in Ecology and the Environment (ATREE). (2016). *North-East initiative: Citizen science for documenting biodiversity*. Project report. Ashoka Trust for Research in Ecology and the Environment, Bengaluru, India.

Barve, V., Barman, N., Basu Roy, A., Patwardhan, A., & Chowdhury, P. (2023). Diversity India meets: Pioneering citizen science through collaborative data mobilization. *Biodiversity Information Science and Standards*, 7, e112163.

Callaghan, C.T., Winnebald, C., Smith, B., Mason, B.M., & López-Hoffman, L. (2025). Citizen science as a valuable tool for environmental review. *Frontiers in Ecology and the Environment*, 23(1), e2808.

Chandler, M., See, L., Copas, K., Bonde, A.M., López, B.C., Danielsen, F., Legind, J.K., Masinde, S., Miller-Rushing, A.J., Newman, G., Rosemartin, A., & Turak, E. (2017). Contribution of citizen science towards international biodiversity monitoring. *Biological Conservation*, 213, 280-294.

Conrad, C.C., & Hilchey, K.G. (2011). A review of citizen science and community-based environmental monitoring: Issues and opportunities. *Environmental Monitoring and Assessment*, 176(1-4), 273-291.

Danielsen, F., Jensen, P.M., Burgess, N.D., Altamirano, R., Alviola, P.A., Andrianandrasana, H., & Yonten, D. (2014). A multicountry assessment of tropical resource monitoring by local communities. *Bioscience*, 64(3), 236-251.

Jansen, M., Beukes, M., Weiland, C., & Blumer, M. (2024). Engaging citizen scientists in biodiversity monitoring: Insights from the WildLIVE! project. *Citizen Science: Theory and Practice*, 9(1), 6.

Kelemen-Finan, J., Scheuch, M., & Winter, S. (2018). Contributions from citizen science to science education: An examination of a biodiversity citizen science project with schools in Central Europe. *International Journal of Science Education*, 40(17), 2078-2098.

- Kelly, R., Fleming, A., Pecl, G.T., von Gönner, J., & Bonn, A. (2020). Citizen science and marine conservation: A global review. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 375(1814), 20190461.
- Malhotra, R. (2018, November 15). *Citizen science projects take flight*. Nature India. <https://www.natureasia.com/en/nindia/article/10.1038/nindia.2018.139> (accessed on 15/01/2026).
- Mason, B.M., Mesaglio, T., Heitmann, J.B., Chandler, M., Chowdhury, S., Gorta, S.B.Z., & Richardson, A.J. (2025). Naturalist accelerates biodiversity research. *Bioscience*, 75, biaf002.
- McKinley, D.C., Miller-Rushing, A.J., Ballard, H.L., Bonney, R., Brown, H., Cook-Patton, S.C., & Soukup, M.A. (2017). Citizen science can improve conservation science, natural resource management, and environmental protection. *Biological Conservation*, 208, 15-28.
- McKinley, J., Pretty, J., & Smith, D. (2015). Environmental awareness and citizen engagement. *Journal of Environmental Studies and Sciences*, 5(2), 235-248.
- Peter, M., Diekötter, T., Kremer, K., & Höffler, T. (2019). Biodiversity citizen science: Outcomes for the participants. *People and Nature*, 1(2), 176-190.
- Pretty, J., & Smith, D. (2004). Social capital in biodiversity conservation and management. *Conservation Biology*, 18(3), 631-638.
- Quadrat-Ullah, H. (2025). Enhancing biodiversity education and outreach for conservation awareness and environmental stewardship. *Advances in Environmental and Engineering Research*, 6(2), 016.
- Singh, P., Padalia, H., & Rai, I.D. (2018). Citizen science for biodiversity monitoring in India: The Indian Bioresource Information Network (IBIN). *Current Science*, 114(6), 1224-1230.
- Sullivan, B.L., Aycrigg, J.L., Barry, J.H., Bonney, R.E., Bruns, N., Cooper, C.B., Kelling, S. (2014). The eBird enterprise: An integrated approach to development and application of citizen science. *Biological Conservation*, 169, 31-40.
- Theobald, E.J., Ettinger, A.K., Burgess, H.K., Debey, L.B., Schmidt, N.R., Froehlich, H.E., & Parrish, J.K. (2015). Global change and local solutions: Tapping the unrealized potential of citizen science for biodiversity research. *Biological Conservation*, 181, 236-244.
- Tiago, P., Ceia-Hasse, A., Marques, T.A., Capinha, C., & Pereira, H.M. (2017). Spatial distribution of citizen science projects for biodiversity: Implications for conservation. *Biological Conservation*, 208, 73-86.
- Voigt-Heucke, S.L., Müller, M., & Rostin, J. (2023). How citizen science projects contribute to urban biodiversity monitoring and conservation frameworks: A German case study. *Citizen Science: Theory and Practice*, 8(1), 30.
- West, S., & Pateman, R. (2017). Recruiting and retaining participants in citizen science: What can be learned from the volunteering literature. *Citizen Science: Theory and Practice*, 2(1), 15.