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Review Article

Technological Approach for Biodiversity Conservation: Augmented Reality Based on Systematic Review

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ABSTRACT

Biodiversity and technology intersect in numerous ways, particularly in the realms of conservation and environmental management. Augmented reality (AR) is currently used in biodiversity conservation, improving awareness and understanding. Despite growing interest in AR applications, a comprehensive synthesis of evidence regarding its effectiveness and implementation in conservation contexts remains limited. We conducted a systematic literature review following PRISMA 2020 guidelines to evaluate AR applications in biodiversity conservation. The analysed literature was collected through a focused search in scientific databases (Scispace, Scopus, ACM, and Google Scholar). Data extraction focused on AR technology types, conservation application areas, target user groups, study designs, key findings, and biodiversity focus areas. From 723 initial records, 34 articles were found to meet the selection criteria after deduplication and two-stage screening. The results show that augmented reality (AR) interventions can significantly improve environmental knowledge, attitudes, and engagement. However, there is still limited evidence on their effectiveness in promoting behavioural change and supporting professional conservation practices. Future research should prioritise rigorous experimental designs, standardised evaluation metrics, and integration of AR tools into operational conservation workflows to fully realise the technology's conservation potential.

Keywords: Augmented, biodiversity, conservation, technology

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INTRODUCTION

Biodiversity means different types of ecosystems, which include a range and variability of animals, plants and

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microorganisms contained in them. It is not a fixed entity but always changes; it is enhanced by genetic variation included in the organism and can be reduced through biodiversity loss, extinction of species and habitat degradation (Hooper et al., 2005). Biodiversity also stabilises the environment through ecological functionality, and many species form functional diversity. The destruction of the environment and the extinction of biodiversity have become a very worrying issue. This threat to biodiversity is expected to continue and increase in the future if no serious action is taken by all stakeholders. Degradation and extinction of natural resources are affecting ecosystem services globally (Adla et al., 2022).

Technology and biodiversity intersect in numerous ways, particularly in the realms of conservation and environmental management. Today's technology plays an important role in all aspects, such as education (Haleem et al., 2022), video games (Karpova et al., 2021), tourism (Pratisto et al., 2022), biodiversity conservation (Pimm et al., 2015) and many more. This technology allows us to immerse ourselves in a man-made world that can be this world entirely or the result of human re-creation. It is also called an alternative world filled with computer-generated images and human responses (Hamad & Jia, 2022). The work presented in this article explores a face of the current state of technology and proposes new systems designed to enhance the appreciation of conservation by leveraging advanced interaction technologies for biodiversity. According to Al-Ansi et al. (2023), the use of Information Technology (IT) in the process of information delivery is experiencing rapid development. Currently, the latest technology used in the delivery of information is Augmented Reality (AR) technology, in which users can visualise historical objects in the form of 3D. AR has the advantage of being interactive and real-time, so that AR is widely implemented in various fields. AR provides a combined interaction between real and virtual environments that is something that cannot be done in other virtual environments. The uniqueness of AR is the ability to generate virtual objects or information in the real-world environment.

Augmented reality (AR) technology has emerged as a promising tool for building digital infrastructure for natural history collections, as it can provide an immersive and interactive environment for researchers and the public to access and explore specimens. Augmented Reality (AR) is one part of the Virtual Environment (VE), or what is commonly known as Virtual Reality (VR) (Hantono et al., 2018). AR gives users an idea of combining the real world with the virtual world seen from the same place. Augmented reality (AR) has three characteristics, namely interactive (increasing user interaction and perception of the real world), real-time, and 3-dimensional. An AR illustration diagram can be seen in Figure 1, where AR is a combination of the real world and the virtual world. Augmented Reality emphasises the real world, with virtual elements added to enhance and complete the real scene (Milgram & Kishino, 1994).

There are two augmented reality (AR) methods currently being developed, namely Marker-Based Tracking and Markerless AR. Marker-based tracking is AR that uses markers or two-dimensional object markers, that have a pattern that will be read by the computer via a webcam or camera connected to the computer. Figure 2 shows that markers are usually square black-and-white illustrations with thick black borders and a white background (Le et al., 2017).

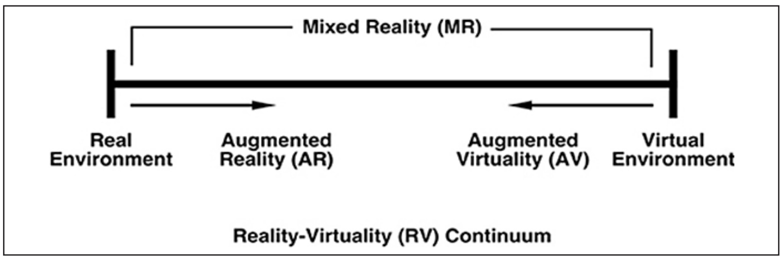
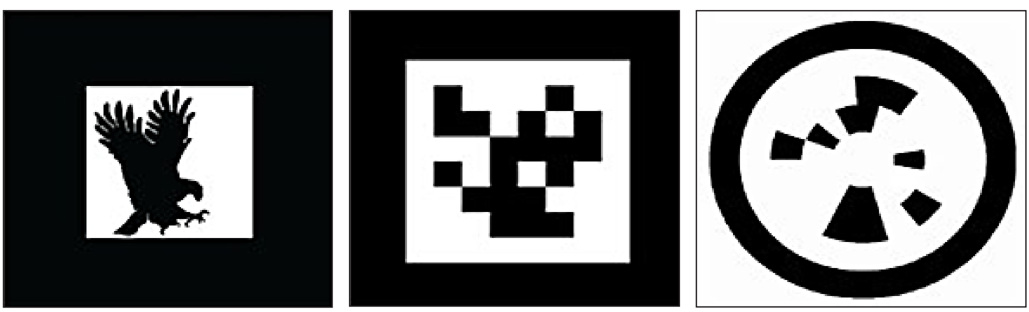


Figure 1. The Mixed Reality continuum (Milgram & Kishino, 1994)



(a) Template Marker (b) Bar-code Marker (c) Circular Marker

Figure 2. Marker-Based Tracking used for AR

According to Ingensand et al. (2018), Nature augmented reality (AR) project, which utilises a marker-based AR approach. This shows the nature elements and scans markers to reveal 3D models of different species, enhancing their understanding of biodiversity through interactive learning experiences. Additionally, BioSentiers, which is a mobile AR application, is designed to encourage children to learn about biodiversity during outdoor activities. AR technology can enrich the physical world with useful information and provide new and intuitive ways of interaction for users, where the information can be stored in the AR and reused wherever needed (Kumar et al., 2022). This application aims to create a connection between students and nature, motivating them to explore various species in their environment. These applications illustrate how AR can be effectively integrated into educational settings to foster engagement and enhance learning outcomes (Li et al., 2017).

Augmented reality (AR) technology plays a significant role in the advancement of biodiversity research. However, poor-quality data negatively impacts the accuracy of Augmented Reality (AR), resulting in inaccurate calculations, incorrect object recognition and unreliable virtual content, fundamentally compromising the ability of AR systems to create consistent and functional mixed reality environments (Belhaoua et al., 2014). From a technical point of view, it was the methodological uniformity of the examined studies, with many of them based on non-empirical procedures. This points to the necessity of more unconventional research methodologies such as qualitative or mixed-methods approaches to achieve a more comprehensive understanding of sustainability (Cosio et al., 2023; Pavlik & Bridges, 2013). Despite increasing interest and development in applications, the evidence for AR's effectiveness in conservation is still scattered across different fields, publication platforms, and locations. There has not been a systematic review that combines the various AR applications, technological methods, and results in biodiversity conservation. It is important to understand how AR is currently being used, identify gaps in evidence, and assess how it compares to traditional methods. This article will help direct future research, technology development, and conservation practices. Therefore, there is a need to establish digital infrastructure based on augmented reality technology to promote the conservation and scientific research of biodiversity.

To fill this gap, we systematically reviewed a total of 34 papers to discuss existing methods and areas of study, where we also pointed out current focuses and potential research directions for AR-based technology. We investigate the use of AR in environmental sciences and nature, expanding on previous studies by examining the range of contexts, such as education or conservation and identifying the impacts and effectiveness of AR applications on biodiversity monitoring, data collection, and conservation management tasks. Even though the scope may be expanded further, we restrict the review to gain a clearer understanding of the progress in the right field. This paper specifically aims to bring analyses into areas of application, technology and components in the current literature. Additionally, we present their applications in studies and reported results. We compile the findings to create a draft for a future research agenda to address gaps and explore new research prospects. This suggests a pressing need for clearer definitions and standardised guidelines in future research to ensure consistency and clarity. Specifically, we answer the following research questions in this article:

RQ1: What are the primary applications and technological approaches of AR used in biodiversity conservation?

RQ2: How does the use of AR-based tools compare to traditional methods in enhancing public engagement, awareness, and environmental education for biodiversity?

RQ3: What are the impacts and effectiveness of AR applications on biodiversity monitoring, data collection, and conservation management tasks?

To achieve its objective, recent papers on developed projects should be collected and reviewed based on a set of eligibility criteria. This paper specifically focuses on recent works addressing the mentioned issues, reviewing articles published between January 1, 2015, and December 31, 2025. Articles from 2026 are not included because the search and analysis were conducted in 2026, and including papers from the current year would result in incomplete coverage.

MATERIAL AND METHOD

This study uses the systematic literature review (SLR) method. This method is used to find and identify research information in a systematic and well-founded manner. According to Xiao and Watson (2019), systematic literature review (SLR) is a study that aims to search and analyse in a comprehensive, structured, no doubt and can be repeated in the next process. Therefore, the researcher uses this method as the main methodology of the study.

Protocol And Registration

In the collection of previous studies that use systematic literature reviews highlighting methodology, there are some guidelines or protocols that can be used to collect and ensure that the selection of previous studies is the most relevant. Literature selection was conducted according to the systematic review guidelines presented by Preferred Reporting Items for Systematic Reviews (PRISMA). Preferred Reporting Items for Systematic Reviews and Meta-Analyses is a protocol that can be used as a guide to present systematic literature highlights (Moher et al., 2016). The quality and quantity control of article selection is guided by the criteria in PRISMA. PRISMA was chosen as a guide because this guideline is able to control the quality and quantity of article selection in large databases such as Scopus and Google Scholar. These criteria consist of identification, acceptance and rejection of articles, qualification and evaluation of quality articles. All articles need to be evaluated so that the objective of highlighting this systematic literature can be achieved.

Search Strategy

The literature search strategy is determined starting with the guidance of the research question. Since this study focuses on the elements of environmental science, the keywords used are based on the theme of the research title. The literature search was conducted through the area of SciSpace, Scopus, Google Scholar and ACM Digital Library. The use of these databases is intended to facilitate literature search in a more organised and systematic way, as shown in Table 1.

Table 1
Search query

Database	Query
Scispace	"What are the primary applications and technological approaches of Augmented Reality (AR) used in biodiversity conservation?" "What are the impacts and effectiveness of AR applications on biodiversity monitoring, data collection, and conservation management?"
Scopus	"Augmented Reality" AND ("environmental education" OR "public engagement" OR "awareness") AND "biodiversity"
Google scholar	"Augmented Reality" AND ("biodiversity conservation" OR "wildlife conservation" OR "technology" OR "nature conservation"
ACM Digital Library	("Document Title": technology) AND ("Document Title": biodiversity OR "Document Title": augmented

Through these search queries and filtering, 300 works were obtained from SciSpace, 200 from Scopus, 157 from Google Scholar and 66 from ACM Digital Library. Ultimately, there are 223 titles from which the first-order duplications should be eliminated. 500 records are left once the duplicate entries are removed. During abstract screening, studies were excluded if they did not focus on augmented reality (AR) technology (215 articles), were unrelated to biodiversity conservation (128 articles), focused exclusively on technical AR development without conservation applications (85 articles), or examined virtual reality (VR) rather than AR (30 articles). Language filters were applied during the search phase. Publication type filters were applied during the initial search to minimise the articles findings such as journal articles, conference proceedings, theses, and technical reports.

Study Selection and Eligibility Criteria

According to Xiao and Watson (2019), a survey study in the form of criticism that involves the comparison of a body of literature requires the establishment of a solid set of criteria. Therefore, this study has set a few criteria that are included in Table 2. Among the criteria that have been set is the time period of the literature review, which must be from 2015. In addition, Figure 3 shows the screening process of the determination of the selection of literature, which must consist of journal articles, proceedings, books or theses. 458 works were excluded from the review because their primary focus was not on the use of AR technologies within biodiversity or environmental contexts. Among the excluded works, eight specifically focused on Virtual reality (VR) technology approaches to environmental and non-AR immersive technologies.

Table 2
Eligibility criteria for study selection

Inclusion Criteria	Exclusion Criteria
Articles published from 2015 to 2024	Papers written in a language other than English
Full-text article	Exclude papers that focus exclusively on the technical development of AR algorithms and hardware without application in biodiversity.
Empirical (qualitative, quantitative, mixed-methods, design science) and conceptual articles related to the use of AR	Exclude papers focusing on broad environmental science themes

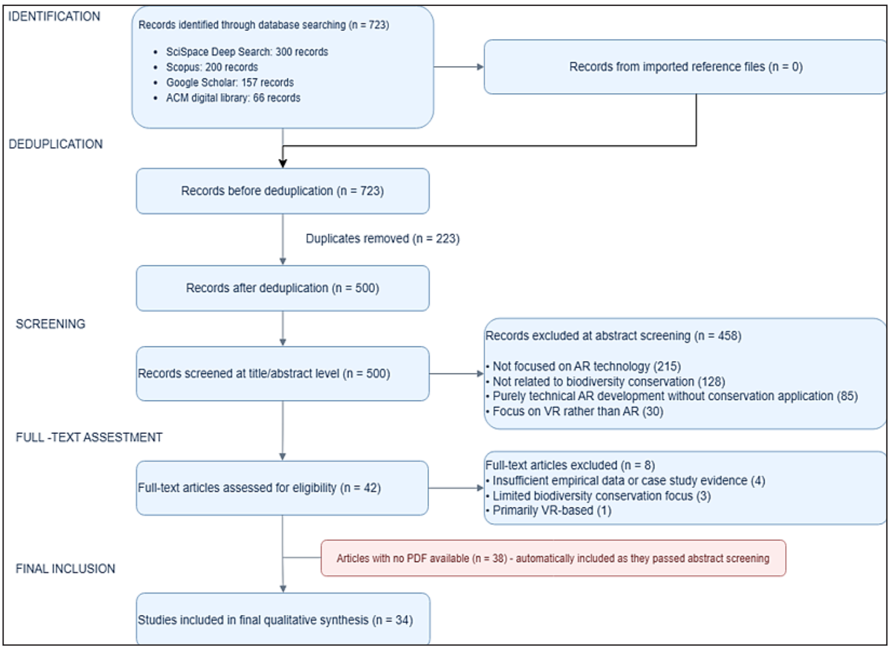


Figure 3. Screening process

Screening Process

A two-stage screening process was implemented following PRISMA 2020 guidelines. All unique records identified through database searches underwent title and abstract screening.

42 Records passing abstract screening underwent full-text assessment when documents were available. Unfortunately, eight articles were removed due to insufficient empirical data, limited biodiversity studied, and a primary focus on VR-based interventions. Given the above considerations, 34 studies met all eligibility criteria and were included in the systematic review for data extraction and synthesis. While the final number of works

may seem small, it is relatively large compared to the number of works studied in other reviews (Cosio et al., 2023), especially considering the specific time span that this review covers.

Data Extraction

According to Afifi et al. (2023), data extraction is carried out to facilitate and summarise the comparison of literature materials that meet the criteria that have been set. The instrument data of this study has been filtered according to the categories that have been compiled through the data extraction process. Among the categories set in this study are background, study issues or gaps, AR technology type, study design and method, biodiversity focus and study findings. After that, these categories were synthesised to give a clearer picture in producing a meaningful comparison, as shown in Table 3. Abstracts of each article were reviewed and evaluated based on the research questions that were formed at the beginning of the study.

Table 3
Data extraction for Augmented Reality (AR) in biodiversity conservation

Variable	Description	Indicators
AR Technology Type	Classification of augmented reality technologies and platforms used in the study.	Mobile AR (smartphone/tablet applications), Wearable AR (head-mounted displays), Location-based AR (GPS-enabled/ geospatial systems), Marker-based AR (image recognition, QR codes), Markerless AR (SLAM, environmental tracking), Game-based AR (gamification elements), Web-based AR.
Conservation Application Area	Application of AR in biodiversity conservation.	Environmental education, Public awareness and engagement, Species identification, Biodiversity monitoring, Data collection, Habitat mapping, Conservation management, Ecotourism, Citizen science, Research support.
Target User Group	Users of the AR application.	Students (primary, secondary, tertiary), Teachers/Educators, General public, Tourists/Visitors, Researchers/Scientists, Conservation professionals, Children, Policymakers
Study Design and Methods	Research design, methodology, and evaluation approach.	Experimental studies, Case studies, Design-based research, Surveys, Interviews, Focus groups, Usability testing, Observational studies, Mixed-methods approaches; sample size, instruments, and evaluation methods where reported.
Key Findings and Outcomes	Main results regarding the effectiveness and impact of AR interventions.	Learning outcomes (knowledge gain, conceptual understanding), Behavioral outcomes (engagement, conservation actions, donation behaviour), Usability outcomes (user satisfaction, ease of use, technical performance), Comparative outcomes (AR vs. traditional methods).
Biodiversity Focus	Biodiversity elements, taxa, or ecosystems addressed by the study.	Animals, Plants, Forest ecosystems, Wetlands, Marine ecosystems, Urban ecosystems, Endangered or threatened species, Local/regional biodiversity, General biodiversity concepts.

Data extraction was performed for all 34 studies that fulfilled the inclusion criteria. The six variables listed above were systematically coded to facilitate quantitative summaries, cross-study comparisons, and qualitative synthesis of AR applications in biodiversity conservation.

RESULT AND DISCUSSION

Table 4 shows the AR Technology Types in Biodiversity Conservation Studies articles, with proper citations provided in the References section. Articles that did not meet the inclusion criteria were excluded. The analysis of the articles covers AR technology types, conservation application areas, target user groups, study designs, and biodiversity focus areas. The research question is coded as (RQ). The research questions in this article are, RQ1: What are the primary applications and technological approaches of AR used in biodiversity conservation? RQ2: How does the use of AR-based tools compare to traditional methods in enhancing public engagement, awareness, and environmental education for biodiversity? RQ3: What are the impacts and effectiveness of AR applications on biodiversity monitoring, data collection, and conservation management tasks?

Table 4
Study characteristic

Category	Subcategory	Number of Articles
AR Technology Type	Mobile AR	28
	Game-Based AR	18
	Location-Based AR	8
	Marker-Based AR	7
	Markerless AR	7
	Web-Based AR	3
	Wearable AR	1
Application Area	Environmental Education	30
	Public Awareness & Engagement	27
	Species Identification	11
	Ecotourism	7
	Citizen Science	5
Target User Group	Students	20
	General Public	14
	Tourists/Visitors	10
	Researchers/Scientists	6
Study Design	Experimental Studies	12
	Case Studies	11
	Design-Based Research	8

Table 4 (*continued*)

Category	Subcategory	Number of Articles
Biodiversity Focus	Animals/Fauna	19
	Plants/Flora	11
	General Biodiversity	10

Mobile AR applications dominated the technology landscape, with 28 studies involving smartphone- or tablet-based AR platforms. Game-based AR approaches were implemented in 18 studies, often integrated with mobile platforms to enhance engagement through gamification elements. Location-based AR, utilising GPS and geospatial data, was featured in 8 studies. Marker-based AR (image recognition, QR codes) and markerless AR (SLAM, environmental tracking) were each reported in 7 studies. Web-based AR appeared in 3 studies, while wearable AR (AR glasses, head-mounted displays) was minimally represented with only 1 study. The predominance of mobile AR reflects the widespread availability of smartphones and tablets, lower barriers to user adoption, and advanced development infrastructure for mobile platforms. Game-based approaches leveraged AR's interactive capabilities to create engaging conservation experiences, particularly for educational contexts. The limited representation of wearable AR suggests that head-mounted displays remain less accessible for conservation applications, though this may change as hardware costs decrease and form factors improve.

Environmental education was the most common application area (Al-Ansi et al., 2023), addressed in 30 studies. Public awareness and engagement initiatives were featured in 27 studies, often overlapping with educational objectives. Species identification applications appeared in 11 studies, supporting both educational and monitoring functions. Ecotourism contexts were explored in 7 studies, leveraging AR to enhance visitor experiences in protected areas and natural sites. Citizen science applications were reported in 5 studies, engaging public participants in biodiversity data collection. Biodiversity monitoring and data collection for professional conservation tasks were each addressed in 4 studies, representing a smaller but important subset focused on operational conservation workflows. Habitat mapping, conservation management, and research support applications were less frequently represented, each appearing in 2-3 studies. The application of studies in education and public engagement domains reflects AR's perceived strengths in creating immersive, interactive learning experiences. The relative scarcity of monitoring and management applications suggests that AR integration into professional conservation workflows remains an emerging area requiring further development and validation.

For target user group characteristics, students and general public audiences show a predominance of educational and engagement applications, which featured in 20 studies and comprise primary, secondary, and higher education levels, while the general public was addressed in 14 studies, often through museum exhibits, public installations, or mobile applications. Tourists and visitors were targeted in 10 studies, particularly in ecotourism and protected area contexts. Researchers and scientists were the intended users in 6 studies, focusing on AR tools for field research and data collection.

Experimental designs were employed in 12 studies, including randomised controlled trials and quasi-experimental studies comparing AR interventions to control conditions or alternative approaches. Case studies were conducted in 11 studies, providing in-depth descriptions of AR application development and deployment in specific conservation contexts. Design-based research approaches were utilised in 8 studies, involving iterative cycles of design, implementation, and evaluation. Sample sizes varied widely, from small-scale pilot studies with fewer than 30 participants to larger evaluations with over 200 participants. Many studies employed convenience sampling with student populations, limiting generalisability to broader audiences. The variety of methodological approaches reflects the multidisciplinary nature of AR conservation research, drawing from education research, human-computer interaction, conservation, and environmental studies. However, the limited number of experimental studies with adequate sample sizes and control conditions constrains causal inference regarding AR effectiveness.

According to Table 4, Animals and fauna were the most common biodiversity focus, featured in 19 studies, including mammals (apes, elephants, endangered species), birds, marine life (coral reefs, marine species), amphibians, and invertebrates. Plants and flora were addressed in 11 studies, including endangered plants, trees, endemic species, and herbarium collections. General biodiversity concepts without specific taxonomic focus appeared in 10 studies, emphasising ecosystem diversity, species richness, and conservation principles. The taxonomic and ecological diversity of biodiversity focus areas demonstrates AR's versatility across conservation contexts, which indicates broader applications.

This systematic review synthesised evidence from 34 studies on Augmented Reality applications in biodiversity conservation, revealing a rapidly evolving field with significant potential and notable research gaps. The most significant findings of this systematic review are shown in Table 5. Collectively, the evidence demonstrates strong potential for AR to support environmental education and public engagement, while simultaneously revealing critical gaps in behavioural impact and operational conservation applications.

Table 5
Key findings on the effectiveness of AR for biodiversity conservation

Outcome Domain	Overall Evidence	Representative Findings
Knowledge and Learning	Strong	AR improved biodiversity knowledge, species recognition, and conceptual understanding.
Environmental Attitudes	Strong	AR increased conservation awareness and positive attitudes toward biodiversity protection.
Engagement and Motivation	Strong	Interactive and gamified AR experiences enhanced participation and user engagement.
Nature Connectedness	Moderate	Outdoor and location-based AR applications strengthened users' connection with nature.
Behavioural Change	Limited	Few studies measured actual conservation behaviours; evidence remains inconclusive.
Monitoring and Conservation Management	Limited	AR showed potential for field data collection and visualisation but lacked rigorous evaluation.
Usability and User Experience	Strong	Most studies reported high usability, satisfaction, and positive user experiences.

Across studies, AR consistently demonstrates strong effectiveness in improving biodiversity knowledge, species recognition, and conceptual understanding. These cognitive gains are closely accompanied by positive shifts in environmental attitudes and conservation awareness. According to Chen et al. (2023), Mercier et al. (2025), and Nahdiya et al. (2024), participants demonstrated enhanced species identification skills, improved understanding of ecological concepts, and better retention of conservation information compared to baseline or control conditions. In parallel, AR-based interventions, particularly those incorporating game mechanics and interactive storytelling, show strong evidence of increased engagement and motivation. These outcomes suggest that AR is particularly effective as an educational and participatory tool, where immersive and interactive features enhance attention, learning retention, and user involvement (Poluakan et al., 2024; Tran & Khoa, 2025). Emotional engagement was particularly pronounced in game-based AR applications that incorporated narrative and character-driven content (Harrington et al., 2019; Ibrahim et al., 2022).

AR applications consistently demonstrated high levels of user engagement, as measured by time on task, interaction frequency, task completion rates, and self-reported enjoyment. Gamification elements, interactive challenges, and immersive visualisations sustained motivation and encouraged exploration (Nahdiya et al., 2024). Engagement was identified as a critical mediator of learning and attitudinal outcomes(Chan et al., 2019). Most studies report high levels of user satisfaction and positive user experience, indicating that current mobile-based AR systems are both accessible and well-received by diverse user groups (Abidin et al., 2023; Safitri et al., 2025; Wu et al., 2024). The dominance of smartphone and tablet platforms contributes significantly to this accessibility, enabling scalable deployment without requiring specialised hardware.

Several studies measured augmented reality (AR) impact on nature connectedness wheres the subjective sense of relationship with the natural world. Results indicated that AR experiences, particularly location-based outdoor games, enhanced nature connectedness among participants (Pimentel, 2021). Play-related enjoyment was identified as a key factor mediating this effect; AR can enhance nature connectedness, particularly in outdoor and location-based implementations (Pimentel, 2022). By anchoring digital information to real-world environments, AR facilitates situated learning that strengthens users' psychological and perceptual relationship with nature. This distinguishes AR from fully virtual technologies, as it preserves physical context while augmenting ecological interpretation (Lawton et al., 2020).

Evidence for behavioural change was mixed. Several studies reported increased behavioural intentions to engage in conservation actions, such as reducing plastic use, supporting conservation organisations, or participating in citizen science (Abidin et al., 2023; Chen et al., 2023; Pimentel, 2021). However, actual behavioural outcomes were rarely measured, and one rigorous experimental study found no evidence that augmented reality AR gaming encouraged donation behaviours, highlighting an intention-action gap (Sandbrook et al., 2015)

de Oliveira et al. (2022), Pimentel (2021), and Imran and Shahid (2025) reported that few studies quantitatively evaluated augmented reality (AR) impact on monitoring accuracy, data quality, or task efficiency compared to traditional methods. The available evidence was primarily descriptive, focusing on feasibility and user acceptance rather than performance metrics. The limited evidence base for AR in professional conservation workflows represents a significant gap (Fol et al., 2025; Imran & Shahid, 2025). Most studies focused on proof-of-concept demonstrations or small-scale pilots rather than operational deployments with rigorous evaluation (Fol et al., 2025; Xu et al., 2025). Future research should prioritise comparative effectiveness studies, standardised performance metrics, and integration with established monitoring protocols.

Usability assessments generally indicated positive user experiences, with high satisfaction ratings and ease-of-use scores. The EduPARK mobile augmented reality (AR) game achieved excellent usability (SUS score 85.8) among younger students and good usability (SUS score 70.9) among older students (Pombo & Morais Marques, 2018). However, some studies noted technical challenges, including tracking instability, device compatibility issues, battery drain, and learning curves for first-time AR users (de Oliveira et al., 2022; Syiem et al., 2024; Voutos et al., 2023). User experience is mediated by factors such as digital literacy, prior technology experience, and contextual appropriateness. Designing AR experiences that balance screen engagement with direct nature observation is an important consideration for outdoor conservation applications (Guzman et al., 2024).

CONCLUSION

This systematic review provides a comprehensive synthesis of Augmented Reality applications in biodiversity conservation, revealing a dynamic and promising field with significant potential to enhance conservation education, public engagement, and professional practice. AR technology, particularly mobile and game-based platforms, demonstrates consistent positive effects on biodiversity knowledge, environmental attitudes, and user engagement. Conservation educators, outreach professionals, and technology developers should consider augmented reality (AR) as a viable tool for enhancing biodiversity education and public engagement. Mobile AR platforms offer accessible, scalable solutions that can be deployed across diverse contexts with relatively low barriers to adoption. Game-based approaches are particularly effective for sustaining engagement and motivation. However, practitioners should maintain realistic expectations regarding behavioural outcomes and complement AR interventions with social supports, structural changes, and behaviour change strategies. By blending digital information with physical environments, AR creates opportunities for immersive learning, enhanced engagement, and decision support that complement traditional conservation approaches. As the evidence base matures and technology evolves, AR has the potential to democratise conservation knowledge, connect diverse audiences with biodiversity, and support more effective conservation action in an increasingly digital world.

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LIST OF ABBREVIATIONS

3D	:	Three-Dimensional
ACM	:	Association of computing machinery
AR	:	Augmented reality
GPS	:	Global Positioning System
IT	:	Information technology
PRISMA	:	Preferred reporting items for systematic reviews and meta-analyses

QR	:	Quick Response
SLAM	:	Simultaneous localisation and mapping
SLR	:	Systematic literature review
SUS	:	System Usability Scale
VE	:	Virtual environment
VR	:	Virtual reality

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