

# Motivational Factors Underpinning Long-Term Engagement of Citizen Scientists in Biodiversity Conservation

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## Abstract

This study explores the multifaceted factors that drive the sustained engagement of citizen scientists in biodiversity conservation efforts. Drawing from qualitative research and in-depth interviews, the paper investigates the intrinsic motivations and passionate connections that underpin the dedication of citizen scientists to nature preservation. The profound sense of purpose and personal fulfillment derived from active participation in conservation initiatives emerge as central drivers of their commitment. Furthermore, a sense of ownership over projects, bolstered by tangible evidence of impact, contributes significantly to their sustained involvement. This heightened commitment is reinforced by the social connections and community ties that citizen scientists develop within like-minded groups, providing emotional support and shared purpose. Additionally, the study highlights the role of personal growth and skill development as motivating factors. Engagement in biodiversity conservation leads to continuous learning, enabling citizen scientists to acquire new knowledge and expertise in data collection techniques and conservation strategies. This evolution of skills fosters a sense of achievement and competence, further fueling their dedication. Moreover, the impact of recognition and appreciation is examined. Acknowledgment from both the scientific community and the general public plays a pivotal role in affirming the importance of citizen scientists' contributions. Whether through publications, awards, or public acclaim, recognition enhances their pride and reinforces their motivation to persist in their conservation endeavors. This research contributes to a comprehensive understanding of the intricate web of motivations that drive citizen scientists to actively participate in biodiversity conservation over extended periods. By shedding light on these motivations, institutions and organizations can better design engagement strategies that cater to the diverse and dynamic needs of citizen scientists, ultimately fostering more effective and enduring contributions to the preservation of our natural world.

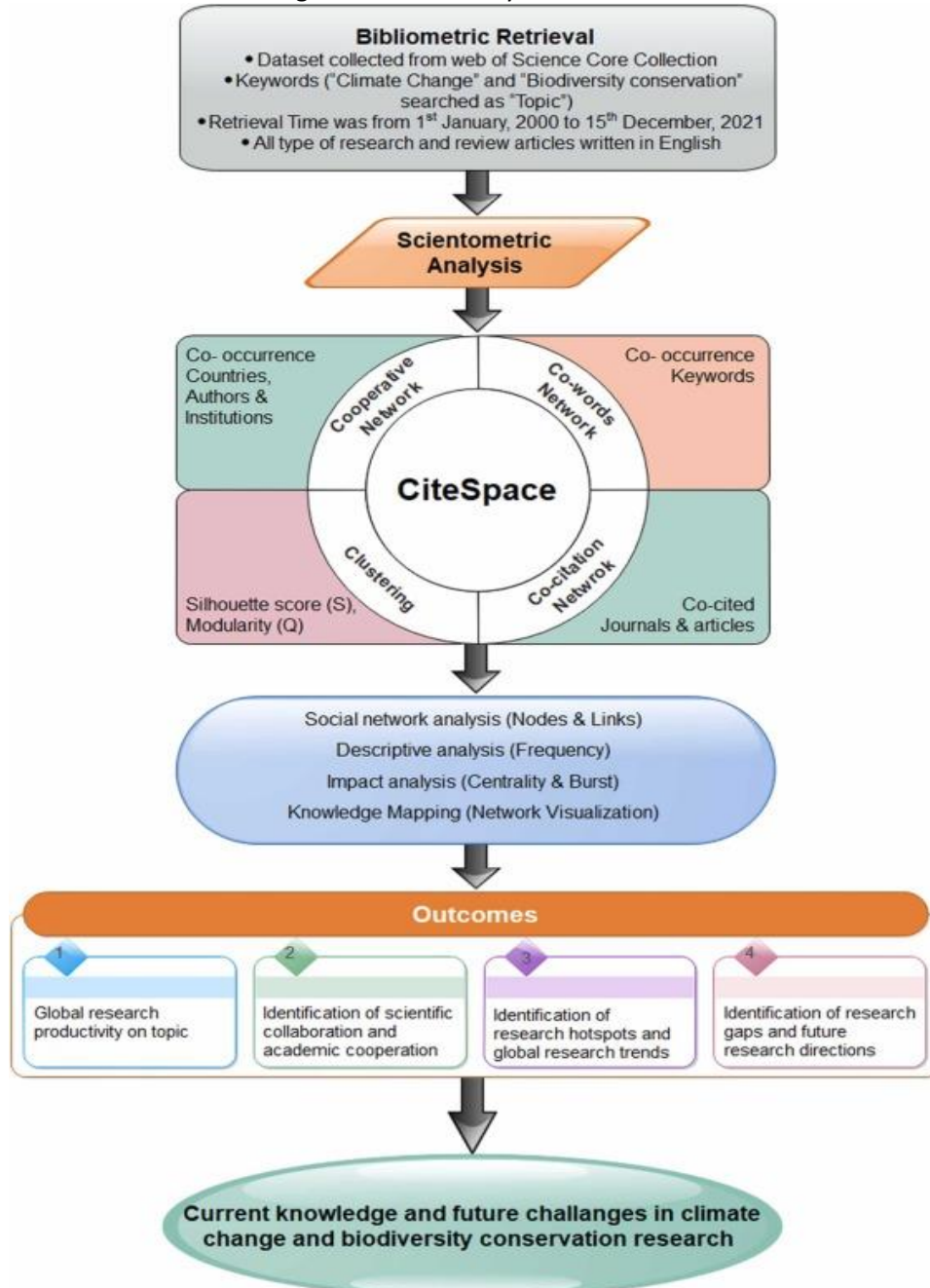
**Keywords:** Citizen scientists, intrinsic motivation, passion for nature, biodiversity conservation, sense of ownership, social connections, skill development

## Introduction

In recent decades, the concept of citizen science has emerged as a transformative force in the fields of biodiversity conservation and environmental education. This paradigm shift has not only expanded the scope of scientific inquiry but has also democratized the process of knowledge generation and environmental stewardship. Citizen science, which involves the active participation of non-professional individuals in scientific research and data collection, has redefined the conventional boundaries of scientific engagement by harnessing the power of distributed and participatory networks. This phenomenon recognizes that scientific exploration is not the sole prerogative of experts but can be enriched through collaborative efforts that draw upon the collective wisdom of diverse communities. As citizen science continues to gain traction, its technical underpinnings have evolved in parallel, aided by advancements in digital technologies. Online platforms and mobile applications have enabled the seamless engagement of volunteers, allowing them to contribute observations, gather data, and even participate in data analysis [1]. The role of citizen-scientists in data collection has grown beyond mere augmentation to active co-creation, with training and protocols ensuring data quality and consistency. Additionally, the wealth of data amassed through citizen science initiatives has prompted the development of specialized tools for data management, sharing, and visualization [2]. This technical sophistication not only facilitates the integration of citizen-generated data with traditional scientific research

but also underscores the credibility and reliability of findings derived from these collaborative endeavors. The emergence of citizen science as a technically robust and socially inclusive approach underscores its pivotal role in shaping the future of ecological research, environmental monitoring, and public engagement with science [3].

Figure 1. Biodiversity Conservation



Within the realm of citizen science, the intrinsic motivations that drive individuals to become active contributors have garnered considerable attention [4]. The allure of participating in meaningful conservation projects, connecting with nature on a personal level, and experiencing the satisfaction of making a tangible impact has been the driving force behind the sustained engagement of many citizen scientists. This deep-rooted intrinsic motivation speaks to the profound human-nature relationship that transcends cultural, societal, and geographical barriers [5].

This research article critically examines the intricate and multifaceted landscape of citizen science, with a specific emphasis on comprehending the psychological and sociocultural dimensions that intricately underpin its effectiveness as a potent tool for both biodiversity conservation and environmental education. While the tangible ecological results derived from citizen science initiatives are undeniably significant, an equally imperative avenue of investigation involves the meticulous analysis of the

human experience entrenched within these undertakings. Through a rigorous exploration of the psychological incentives that propel individuals to engage in citizen science, the societal and cultural factors that exert their influence, and the personal ramifications experienced by citizen scientists, a comprehensive understanding of the intricate mosaic of emotions, interpersonal connections, and personal development that shape their transformative journey begins to emerge. By delving deeply into these dimensions, this study endeavors to contribute to a more comprehensive appreciation of the profound symbiosis between citizen participation and the realms of science, conservation, and education [6].

While citizen science's contributions to advancing scientific knowledge are widely recognized, the emotional and cognitive dimensions of the participants themselves have often been overshadowed. Understanding the psychological underpinnings of citizen scientists' motivations and the sociocultural contexts in which they operate provides a comprehensive perspective on the phenomenon. By delving into these aspects, we can unearth valuable insights that enhance project design, engagement strategies, and long-term sustainability [7].

This research article also aims to emphasize the critical nature of delving into the intricate and symbiotic interplay between human beings and their surrounding environment. Beyond the mere task of gathering data, citizen science assumes a multifaceted role, fostering not only the accumulation of information but also cultivating a deep-rooted sense of ownership, community engagement, and individual advancement among its participants [8]. Moreover, a meticulous examination of how recognition and genuine appreciation factor into the motivational dynamics of citizen scientists underscores the significance of according to due acknowledgment to their indispensable endeavors. This analysis underscores the multifaceted significance of citizen science in engendering a harmonious relationship between scientific pursuits, societal engagement, and environmental comprehension [9].

#### Research Questions and Objectives

Within this overarching framework, the research article aims to address the following key questions:

1. How do intrinsic motivations, such as the passion for nature and the desire for meaningful impact, influence the sustained engagement of citizen scientists in biodiversity conservation and environmental education projects?
2. What are the sociocultural dynamics within citizen science communities that contribute to participants' commitment and sense of belonging?

In pursuit of these objectives, a meticulous and exhaustive examination of existing literature will be undertaken. This critical review will encompass a wide array of scholarly works, thereby establishing a strong theoretical foundation for the research. In parallel, qualitative interviews will be conducted, enabling an in-depth exploration of the experiences, motivations, and perspectives of participants involved in various citizen science initiatives. These interviews will provide valuable insights into the underlying factors that drive individuals to partake in such endeavors and the personal transformations they undergo as a result [10]. Complementing the qualitative approach, quantitative surveys will be administered on a diverse range of participants engaged in citizen science projects. The quantitative data collected will be subjected to rigorous statistical analysis, allowing for a comprehensive understanding of patterns, correlations, and trends within the data. By integrating both qualitative and quantitative methodologies, this research aims to present a holistic and well-rounded perspective on the intricate interplay between citizen science, human-nature connection, and collective societal change [11].

The anticipated outcomes of this research endeavor are substantial. The insights gained from the literature review, qualitative interviews, and quantitative surveys hold the promise to shed light on the fundamental and often intangible bond that humans share with the natural world. Furthermore, by delving into the societal aspects that foster engagement in citizen science, this research aspires to uncover the social mechanisms that drive community participation and collaboration. Equally significant is the exploration of the psychological avenues through which citizen science serves as a catalyst for transformative change on both individual and collective levels. Ultimately,

the synthesis of these findings is poised to contribute to a deeper comprehension of the profound impacts of citizen science initiatives on human behavior, attitudes, and the broader society [12].

### **Psychological Motivations Behind Citizen Scientists' Continued Engagement in Biodiversity Conservation:**

In the realm of biodiversity conservation initiatives, delving into the intricate realm of psychological determinants that underpin enduring engagement and dedication among citizen scientists proves to be imperative. The multifaceted dynamics encompassing intrinsic motivation, social interconnectedness, and personal development warrant meticulous examination to comprehend their pivotal roles in fostering prolonged involvement. Intrinsic motivation, emanating from an individual's inherent proclivity, remains a cornerstone. The innate satisfaction derived from contributing to biodiversity preservation inherently fuels sustained commitment. Delving further, the interplay of social connections stands as another indispensable facet [13]. The cultivation of a sense of community, shared purpose, and collaboration not only instills a profound commitment but also fortifies the resilience of citizen scientists. Moreover, the expansion of one's skill set and personal growth within the ambit of such initiatives bears significance. The pursuit of knowledge, the acquisition of new competencies, and the development of a deeper ecological awareness collectively contribute to the perpetuation of engagement. In conclusion, deciphering the intricate interplay of intrinsic motivation, social bonds, and individual advancement unveils a comprehensive understanding of the psychological drivers that intricately weave the fabric of long-term commitment and devotion among citizen scientists in biodiversity conservation endeavors [14].

**Intrinsic Motivation and Passion for Nature:** In the realm of citizen science, intrinsic motivation assumes a fundamental and driving role in fostering the enthusiastic engagement of individuals who harbor a profound ardor for the natural world. An appreciable segment of participants enmeshed in citizen science undertakings can be characterized by their intrinsic motivation, which stems from an inherent yearning to establish a profound rapport with the environment. Simultaneously, this motivation propels them to effectually contribute to the safeguarding of the ecological realm. The wellspring of this intrinsic motivation can be traced back to an ingrained fondness for the environment and the gratification that emanates from active involvement in endeavors geared towards its conservation [15]. It is imperative to distinguish intrinsic motivation from its extrinsic counterpart, which encompasses external incentives like rewards or acknowledgment. The distinctive attribute of intrinsic motivation is its internal impetus, serving as an enduring force that perpetuates sustained commitment over protracted durations. This sustained dedication finds its genesis in the deep-seated sense of purpose and personal fulfillment that citizen scientists experience, cementing their steadfast allegiance to the noble cause of environmental preservation [16].

Integral to the effectiveness of citizen science endeavors is the unswerving ardor for the natural world, which impels individuals to actively partake in such undertakings. This profound connection to the environment not only underscores their impetus but also establishes the cornerstone of their involvement in conservation endeavors. This ardency becomes interwoven with the inherent drive that suffuses their engagement, creating a mutually beneficial relationship that reinforces their resolve. By harnessing this fervor and harmonizing it with scientific objectives, citizen scientists direct their vitality and eagerness toward tasks encompassing data collection, analysis, and other pursuits that substantially contribute to comprehending ecosystems and devising conservation methodologies. This inherent drive, deeply embedded in their affection for the natural realm, bolsters their commitment, assuring the constancy and efficacy of their contributions across time. Intrinsic motivation functions as a potent driving force that sustains the dedication of citizen scientists to their crucial role in environmental conservation. Unlike external incentives, such as material rewards or acknowledgment, intrinsic motivation stems from an internal yearning to connect with nature and actively partake in its safeguarding [17]. The gratification and sense of accomplishment



garnered from such engagement create a self-reinforcing loop, wherein the fulfillment of personal values becomes synonymous with the act of participating in conservation endeavors. This intrinsic motivation transcends fleeting external factors and operates as a robust underpinning for enduring commitment, ensuring that the ebbs and flows of external circumstances do not compromise the resolve of citizen scientists. As a result, their actions remain steadfast, firmly rooted in their genuine passion for nature and their unwavering desire to contribute to its preservation [18].

The commitment displayed by citizen scientists towards environmental conservation finds its foundation in their intrinsic motivation and profound passion for nature. These individuals are not swayed by external incentives; rather, their unwavering desire to forge a deep connection with the natural world and actively contribute to its preservation drives them [19]. This genuine ardor for the environment serves as the propelling force behind their involvement, and their active participation stands as a concrete manifestation of this internal drive [20]. This interplay of personal values, environmental concern, and active engagement forms a potent amalgam that fuels their sustained dedication. This dedication remains steadfast even in the face of challenges or the absence of tangible rewards, as the inherent gratification derived from answering their inner calling serves as a resolute anchor to the cause. This underscores the enduring and paramount role of intrinsic motivation in the realms of citizen science and environmental safeguarding.

**Sense of Ownership and Impact:** Citizen science is a burgeoning field where individuals from diverse backgrounds actively participate in scientific projects, contributing their time, effort, and expertise to collect data and engage in conservation efforts. A noteworthy outcome of such involvement is the development of a profound sense of ownership among these citizen scientists towards the projects they dedicate themselves to. Unlike traditional passive participants, citizen scientists witness firsthand the tangible impact of their data collection and conservation endeavors. This direct link between their actions and observable outcomes cultivates a heightened commitment within them. The more they observe the positive consequences of their contributions, the deeper their dedication grows. This phenomenon is rooted in psychology, as the sense of ownership becomes a catalyst for increased engagement [21]. Furthermore, as citizen scientists experience the positive transformation of their environment due to their collective actions, their self-efficacy receives a substantial boost. Self-efficacy, a psychological concept introduced by Albert Bandura, refers to an individual's belief in their ability to accomplish tasks and effect change. Engaging in citizen science provides ample opportunities for participants to witness their contributions leading to measurable changes in biodiversity preservation. This, in turn, enhances their self-efficacy beliefs. The notion that they can influence and shape their surroundings in a meaningful manner becomes more than just theoretical; it becomes a lived reality. This heightened self-efficacy contributes to a positive feedback loop, where increased confidence encourages greater involvement and dedication to the cause [22].

The sense of ownership and amplified self-efficacy experienced by citizen scientists play a pivotal role in reinforcing their firm belief that their contributions bear significant weight within the broader context of biodiversity preservation. As these individuals engage in their scientific pursuits, they witness the tangible impact of their endeavors on the preservation of diverse species and ecosystems. This firsthand observation of their efforts culminating into meaningful outcomes not only validates their contributions but also fosters a profound sense of responsibility towards the environment. In parallel, the collective nature of citizen science initiatives enhances the effect of individual contributions. Collaborating with fellow participants and witnessing the synergistic outcomes of their combined actions underscore the notion that even seemingly small-scale endeavors can yield substantial changes when aggregated. This emergent narrative serves as a testament to the potency of collective action, propelling citizen scientists to perceive themselves not as peripheral figures but as indispensable elements within a larger framework dedicated to upholding biodiversity. Consequently, this shift in perspective from isolated efforts to integral

components nurtures a heightened commitment to the cause, as well as a comprehensive comprehension of the intricate interplay between their activities and the overarching objectives of ecological stability [23].

It is worth noting that the transformation in perspective elucidates a more profound sense of purpose among citizen scientists. Armed with the understanding that their contributions are influential, these individuals are more inclined to dedicate themselves wholeheartedly to their roles as stewards of biodiversity. The conviction that their meticulous data collection, observation, and analysis reverberate throughout the ecological domain impels them to delve deeper into their undertakings [24]. As they decipher the complexities of various ecosystems and species interactions, their activities take on a newfound significance that extends beyond the mere accumulation of information. This purpose-driven approach serves as a driving force behind their continuous engagement and sustains their dedication to the cause. Furthermore, the realization of interconnectedness within the realm of biodiversity preservation underscores the multifaceted impact of citizen scientists' actions. As they delve into their projects, these individuals grasp the intricate web of relationships that govern the delicate balance of ecosystems. By observing how a change in one element can trigger a cascade of effects, citizen scientists become acutely aware of the far-reaching consequences of human intervention. This heightened awareness not only informs their scientific practices but also influences their broader decision-making processes, prompting them to adopt more environmentally conscious lifestyles. Consequently, the ripple effect of their involvement extends beyond the confines of their scientific endeavors, contributing to a more holistic approach to ecological sustainability [25].

**Social Connections and Community:** Being part of a community of like-minded individuals plays a crucial role in providing substantial motivation for citizen scientists. The presence of such a community fosters an environment where individuals driven by similar interests and objectives can converge, thereby bolstering their collective determination to contribute to scientific endeavors. These communities facilitate the establishment of relationships that extend beyond a mere affiliation, offering emotional support, a sense of camaraderie, and a shared purpose [26]. Engaging in discussions, sharing insights, and collaborating on projects within these communities not only amplifies the participants' knowledge base but also nurtures their commitment to the field. The emotional connections formed within these social networks create a reservoir of encouragement, often resulting in a positive feedback loop that reinforces their enthusiasm for sustained involvement [27].

The significance of these social interactions and bonds cannot be overstated. The act of collaboration and the exchange of ideas within the community not only enrich the individual's understanding but also drive a sense of belonging. This interconnectedness cultivates an environment where the successes and challenges of one member resonate with others, fostering empathy and a collective determination to overcome obstacles. The emotional support derived from these interactions acts as a buffer against the potential discouragement that can arise when navigating the complexities of citizen science endeavors. Through shared experiences and the empathy of fellow community members, participants find a reliable source of reassurance that fuels their motivation and resilience. Furthermore, the shared sense of purpose that flourishes within these communities is a driving force that propels citizen scientists forward [28]. The knowledge that their contributions are part of a greater collective effort instills a heightened sense of responsibility and dedication. This communal purpose not only elevates the individual's commitment but also encourages them to view their involvement as integral to the advancement of scientific knowledge. As a result, the synergy of shared purpose and the collective aspiration for progress fuel a continuous cycle of motivation. Each accomplishment, no matter how modest, contributes to the overarching mission of the community, further solidifying the participant's dedication and inspiring them to sustain their active engagement. In the context of citizen science, the interplay of social dynamics and the shared sense of purpose generates a self-reinforcing cycle that underpins continued participation. The community's positive

influence on motivation is not solely unidirectional—it is a reciprocal relationship [29]. The more deeply individuals invest in the community, the more pronounced the motivational benefits become. As the individual's commitment strengthens, so does their inclination to contribute actively to discussions, projects, and initiatives. This virtuous cycle creates a positive feedback loop where heightened involvement leads to increased motivation, which, in turn, fuels even greater engagement. This mutually reinforcing process becomes an essential driver in propelling citizen scientists to overcome challenges, remain dedicated to their pursuits, and make enduring contributions to the realm of scientific discovery [30].

**Personal Growth and Skill Development:** Engagement in biodiversity conservation presents an avenue for substantial personal growth and the acquisition of valuable skills for individuals actively participating. Those who undertake the role of citizen scientists within this sphere stand to amass a plethora of newfound knowledge spanning diverse aspects of the environment. This knowledge encompasses not only the species and ecosystems under scrutiny but also delves into the intricate interplay of multifaceted factors that exert influence upon them. Such involvement mandates a comprehensive comprehension of data collection techniques, entailing the mastery of methods for meticulous observation, accurate recording, and rigorous analysis [31]. Consequently, individuals engaged in biodiversity conservation augment their technical acumen and analytical prowess, as these activities demand a disciplined approach to handling data, conducting assessments, and deriving meaningful insights. The cumulative result is the cultivation of a skill set that extends beyond the boundaries of ecological awareness, fostering the development of adeptness in data management, critical thinking, and problem-solving. Thus, participation in biodiversity conservation not only contributes to the preservation of natural heritage but also equips individuals with a toolkit of proficiencies essential for addressing the complex environmental challenges of our time. The engagement of citizen scientists in conservation initiatives involves an ongoing and dynamic process of learning that profoundly shapes their sense of accomplishment and capability. As these individuals immerse themselves in various aspects of conservation, including data collection, analytical tasks, and input into conservation methodologies, they directly witness the concrete outcomes of their endeavors. This firsthand experience of contributing to positive environmental outcomes significantly reinforces their determination to sustain their active participation [32].

Central to this sustained motivation is the recognition of personal advancement and the development of expertise, both of which are visibly reflected in the outcomes they achieve. The accumulation of specialized knowledge and the honing of skills become instrumental factors propelling their continued engagement. The process of acquiring this specialized knowledge transforms into a potent driving force, compelling them to persist in their roles as citizen scientists. The journey of continuous learning embarked upon by citizen scientists becomes a nexus of empowerment. As they delve deeper into conservation efforts, their growing familiarity with scientific methods, data interpretation, and strategic contributions fosters a genuine sense of empowerment. The tangible impact they exert within the conservation landscape becomes a testament to their efficacy, instilling a profound sense of purpose and accomplishment. Furthermore, the act of engaging in biodiversity conservation engenders a dynamic cycle of growth. As citizen scientists dedicate themselves to this cause, they not only accumulate theoretical knowledge but also garner practical insights into real-world challenges and solutions. This exposure broadens their perspective and cultivates adaptability as they learn to address unexpected complexities. The capacity to adapt and learn within the context of conservation nurtures a heightened sense of resilience, a crucial attribute for both personal development and effective participation in tackling environmental issues.

The phenomenon of empowerment derived from observing the progression of personal growth and the refinement of expertise over time plays a pivotal role in reinforcing enduring engagement. In the realm of citizen science, individuals who participate in biodiversity conservation activities are propelled by a sincere ardor for both the

preservation of biodiversity and the trajectory of self-enhancement. This inherent impetus sets their involvement apart from mere superficial engagement, establishing a level of commitment that perseveres over an extended duration [33]. As these individuals bear witness to the tangible impact of their contributions resulting in favorable environmental outcomes, the cycle of self-development and proficiency advancement perpetuates, thus engendering a reciprocal correlation between their evolving adeptness and the efficacy of their endeavors in the realm of conservation. This mutually reinforcing relationship underlines the pivotal role of personal growth in bolstering the effectiveness of citizen scientists' conservation undertakings, substantiating a sustained dedication to both the cause and their own progress.

**Recognition and Appreciation:** Recognition and appreciation hold significant importance in the realm of citizen science, encompassing both the scientific community and the general public. The continued engagement of citizen scientists relies heavily on the acknowledgment they receive for their contributions. This dual recognition serves as a catalyst in sustaining their commitment and validating the efforts they invest in various scientific endeavors [34]. The recognition can manifest in diverse ways, ranging from scholarly publications that cite their work, prestigious awards that highlight their impact, to public acknowledgments that resonate on a larger scale. This multifaceted recognition not only instills a profound sense of pride within citizen scientists but also acts as a driving force propelling them to persistently partake in scientific undertakings. It validates their role as valuable contributors and reinforces the idea that their work is integral to the advancement of scientific knowledge [35].

The acknowledgment and recognition of citizen scientists' contributions by the scientific community hold paramount significance in terms of both credibility and integration within the realm of scientific discourse. The involvement of citizen scientists in various scientific endeavors has gained substantial momentum in recent years, as these individuals, who lack formal academic training, actively participate in data collection, analysis, and even hypothesis formation. However, the acknowledgment of their efforts by established researchers and institutions goes beyond mere validation; it confers an elevated level of legitimacy upon the entire field of citizen science. Citations of citizen scientists' work in peer-reviewed publications not only validate the rigor and quality of their contributions but also serve as a testament to the expanding scope of scientific collaboration [36]. The formal recognition provided by such citations reinforces the idea that the insights garnered through citizen scientists' efforts are not limited to amateur pursuits but contribute meaningfully to the broader scientific landscape. This recognition, therefore, propels citizen scientists beyond the realm of enthusiastic hobbyists, positioning them as valuable contributors to the generation and dissemination of knowledge. Furthermore, this integration of citizen scientists' work into the scientific discourse cultivates a sense of purpose among these individuals. As their efforts are acknowledged and their work cited, citizen scientists are driven by the realization that their endeavors transcend personal interests and become integral to the advancement of scientific understanding. Consequently, their motivation is bolstered, leading to increased dedication and a sustained commitment to their chosen fields of study [37].

Importantly, the recognition of citizen scientists' work engenders a collaborative synergy between these non-professional contributors and traditional researchers. This symbiotic relationship enables a dynamic exchange of perspectives, methodologies, and insights. Citizen scientists, often engaged in data collection on a large scale due to their diverse locations and accessibility, offer a unique vantage point that augments the depth and breadth of scientific inquiry. In return, established researchers provide guidance, validation, and expert analysis, enhancing the accuracy and interpretation of the collected data. Simultaneously, recognition from the general public acts as a motivational force that fuels citizen scientists' dedication. When the broader community acknowledges and celebrates their contributions, it generates a shared sense of accomplishment that resonates beyond scientific circles. Public recognition highlights the accessibility and relevance of science to the masses, inspiring others to engage in



scientific pursuits. Furthermore, public acknowledgment underscores the democratization of science, emphasizing that valuable insights can emerge from all segments of society. Awards dedicated to citizen scientists hold a prominent position as a pinnacle of recognition, symbolizing the highest form of acknowledgement for their substantial contributions and unwavering dedication to the field of scientific inquiry [38]. These awards extend beyond mere accolades; they represent beacons of inspiration for countless aspiring citizen scientists who seek to make their mark in the realm of scientific exploration. Through the act of honoring exceptional achievements, these awards play a crucial role in reinforcing the fundamental concept that citizen science is not only a laudable pursuit but also a profoundly impactful one. The recognition bestowed upon these individuals serves to underscore the significance of actively engaging non-professional enthusiasts in the multifaceted processes of scientific investigation and discovery [39].

Furthermore, the establishment of such awards resonates with a broader purpose: to elevate the collective understanding of citizen science's role in advancing human knowledge. These honors, often accompanied by rigorous evaluation criteria, cast a spotlight on the remarkable efforts that citizen scientists undertake. By doing so, they challenge the conventional boundaries of scientific contribution and illuminate the potential for valuable insights to emerge from unexpected sources [40]. Through their recognition of outstanding citizen science endeavors, these awards foster a profound shift in the prevailing perception of scientific progress – one that acknowledges the diverse and inclusive nature of knowledge generation. Moreover, the significance of these awards extends beyond the immediate recipients and reverberates throughout the scientific community and society at large. They serve as emblematic examples of how collaboration, passion, and dedication can lead to transformative contributions. As their stories are shared and celebrated, these honored citizen scientists become ambassadors of change, inspiring others to embark on their own journeys of discovery and innovation [41]. The awards stand as a testament to the notion that one's formal training or professional background should not be a prerequisite for meaningful scientific participation. By recognizing and celebrating citizen scientists, these awards offer a counterpoint to the notion of exclusivity that has historically surrounded scientific endeavors [42].

## Conclusion

The findings of this research shed light on the intricate web of factors that drive and sustain citizen scientists' engagement in biodiversity conservation projects. The deep-seated intrinsic motivation rooted in a passion for nature emerges as a cornerstone, propelling individuals to actively contribute to environmental initiatives. The significance of this intrinsic motivation cannot be understated, as it fuels a sense of purpose and personal fulfillment, forming the bedrock of long-term commitment to conservation causes. The concept of ownership in the realm of citizen science plays a pivotal role in cultivating and maintaining the engagement of individuals involved in various projects. The sense of ownership that citizen scientists develop over the projects they participate in serves as a catalyst for their enduring commitment [43]. This sense of ownership arises from the understanding that their contributions, often in the form of data collection efforts, directly impact the initiatives aimed at biodiversity preservation. As they witness the tangible outcomes and effects of their data collection endeavors, their self-efficacy is reinforced, solidifying the notion that their individual actions possess significance within the broader context of preserving biodiversity [44]. This ownership aspect takes on greater significance when considered in conjunction with the social component that characterizes many citizen science projects. The underlying principle of fostering a community-driven approach to scientific endeavors is highlighted as a critical determinant of sustained engagement. Within the framework of these projects, robust relationships are formed among participants, creating a network that provides emotional support, a sense of camaraderie, and shared objectives. These interpersonal connections and shared experiences collectively contribute to strengthening the participants' commitment to the cause. The recognition that they are part of a larger community working collaboratively toward a common goal reinforces

their dedication, fostering a positive feedback loop that perpetuates continuous involvement. The provided passage highlights the comprehensive advantages associated with active participation in biodiversity conservation, supported by research [45]. In addition to its evident contribution to environmental preservation, engaging in such conservation efforts has been found to yield a multitude of positive outcomes for citizen scientists. Notably, individuals involved in these activities experience personal growth and an enhancement of their skill set. Through hands-on involvement in biodiversity conservation, these citizen scientists gain valuable knowledge and expertise, which in turn, significantly augment their sense of accomplishment and competence. This acquisition of new skills and knowledge doesn't merely remain static; rather, it perpetuates a continuous cycle of learning and improvement. This cyclical process acts as a motivational impetus, as participants not only invest in their own self-development but also find themselves wholeheartedly dedicated to a cause that transcends personal boundaries. The synergy between personal growth and environmental stewardship is thus underscored, portraying how engagement in biodiversity conservation can serve as a dynamic platform for fostering both individual advancement and a greater collective purpose [46].

The significance of recognition and appreciation cannot be understated in its role as a pivotal factor influencing the longevity of engagement among citizen scientists. The acknowledgment received by citizen scientists from both the scientific community and the general public plays a fundamental role in validating their efforts and establishing a sense of pride in their contributions. This validation serves as a powerful motivator, driving these individuals to sustain their involvement over time. The recognition takes on diverse forms, ranging from formal publications that highlight their work to prestigious awards that commend their dedication. These acknowledgments not only provide a tangible testament to their accomplishments but also serve as a source of inspiration for continued commitment. One crucial aspect of recognition is the endorsement provided by the scientific community. When established researchers and professionals acknowledge the work of citizen scientists, it affirms the legitimacy of their contributions. This endorsement fosters a deeper connection between citizen scientists and the broader scientific endeavor, encouraging them to maintain their active participation. Simultaneously, recognition from the general public reinforces the notion that citizen scientists' efforts are valued by society at large. This public acknowledgment generates a sense of belonging and reinforces the importance of their work, motivating them to remain engaged and dedicated. Formal publications serve as a concrete manifestation of recognition, enabling citizen scientists to share their findings and insights with a wider audience. These publications not only contribute to the advancement of scientific knowledge but also offer a sense of accomplishment to those involved [47]. Additionally, awards granted to citizen scientists recognize their commitment and dedication. These accolades validate their efforts in a tangible manner, boosting their morale and inspiring them to continue their endeavors. Public acknowledgment further solidifies the role of recognition in sustaining citizen scientists' engagement. When their work is highlighted through media coverage, public talks, or community events, it emphasizes the importance of their contributions. This spotlight reinforces their dedication and motivates them to persevere through challenges, knowing that their work is making a meaningful impact [48].

The broader implications of these findings extend to the realm of citizen science projects and environmental initiatives. Understanding of the intricate interplay between intrinsic motivation, ownership, community, personal growth, and recognition provides a comprehensive framework to design and nurture such initiatives. By capitalizing on these factors, project organizers can develop strategies that not only attract but also retain engaged participants, ultimately contributing to more effective and impactful biodiversity conservation efforts. In essence, this research underscores the underlying pillars that uphold the foundation of citizen science engagement and offers actionable insights for fostering and sustaining participation in environmental initiatives.

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