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NaturalistaUY in Uruguay: a case of community science in Latin America from a critical perspective

NaturalistaUY en Uruguay: un caso de ciencia comunitaria en América Latina desde una perspectiva crítica

NaturalistaUY no Uruguai: um caso de ciência comunitária na América Latina a partir de uma perspectiva crítica

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ABSTRACT In recent decades, citizen science platforms have been developed worldwide. However, many of these initiatives focus on data collection in ways that are often disconnected from local realities. Historically, Latin America has adopted a distinct perspective. Given the growing popularity of iNaturalist in the region and the launch of NaturalistaUY in Uruguay, we ask: Can this platform be used to foster learning and generate knowledge that addresses the realities and needs of local communities? This paper presents a pioneering experience in Uruguay, aiming to situate data collection and knowledge generation in a socio-political context. Overall, we observed that iNaturalist attracts great interest due to its free, participatory, and community-driven approach. Although the platform's pre-established structure can be limiting in some respects, its community-oriented design enables collective engagement and appropriation.

Keywords: citizen science; participatory science; environmental education; iNaturalist.

RESUMEN En las últimas décadas ha habido un gran desarrollo de plataformas de ciencia ciudadana en todo el mundo.

Sin embargo, muchas de las experiencias con estas plataformas se centran en la colecta de datos de forma ajena a las realidades locales. América Latina históricamente parece posicionarse desde otro lugar. Frente al auge de iNaturalist en la región y al lanzamiento de NaturalistaUY en Uruguay, nos preguntamos si es posible utilizar esta plataforma para aprender y generar nuevos conocimientos que tengan como foco las realidades y necesidades de las comunidades locales. Este trabajo presenta una experiencia pionera en el país, que busca situar la recolección de datos y la generación de conocimiento en un contexto sociopolítico. Como observación general, vimos que iNaturalist despierta un gran interés debido a su carácter libre, participativo y comunitario. Si bien la plataforma presenta una estructura preestablecida, que puede convertirse en una limitación en algunos aspectos, su potencial comunitario permite una apropiación colectiva.

Palabras clave: ciencia ciudadana; ciencia participativa; educación ambiental; iNaturalist.

RESUMO Nas últimas décadas, houve um grande desenvolvimento de plataformas de ciência cidadã em todo o mundo. No entanto, muitas das experiências com essas plataformas se concentram na coleta de dados de uma forma estranha às realidades locais. Historicamente, a América Latina parece estar posicionada de uma perspectiva diferente. Frente ao crescimento da iNaturalist na região e ao lançamento do NaturalistaUY no Uruguai, nos perguntamos se é possível usar esta plataforma para aprender e gerar novos conhecimentos que se concentrem nas realidades e necessidades das comunidades locais. Este documento apresenta uma experiência pioneira no país, que busca situar a coleta de dados e a geração de conhecimento em um contexto sociopolítico. Como observação geral, descobrimos que a iNaturalist desperta grande interesse por ser uma plataforma de acesso livre, participativa e comunitária. Embora a plataforma tenha uma estrutura pré-estabelecida, que pode se tornar numa limitação em alguns aspectos, seu potencial comunitário permite a apropriação coletiva.

Palavras-chave: ciência cidadã; ciência participativa; educação ambiental; iNaturalist.

1. Introduction

Citizen science refers to public involvement in scientific research (Bonney *et al.*, 2009). Although the term is relatively recent, this form of participation in the generation of scientific knowledge has a long history (Miller-Rushing *et al.*, 2012; Pelacho *et al.*, 2021). Such initiatives often encompass varying levels of participant contribution to projects. In more "traditional" citizen science, local communities are typically engaged solely in data collection, while other tasks are managed by professional scientists (Hidalgo *et al.*, 2021; Danielsen *et al.*, 2021, 2022). In many cases, communities participate in generic, decontextualized activities that are disconnected from their immediate environment and needs. In these projects, participants contribute their data and knowledge while internalizing external priorities as their own (Ejarque *et al.*, 2021). By contrast, examples of locally based citizen science often occur in areas where communities maintain a close relationship with natural resources (Camino *et al.*, 2020; Reis & Benchimol, 2023) and assume a more significant role in project design and decision-making processes (Danielsen *et al.*, 2021).

In Latin America, there are over 30 terms used to describe citizen science experiences, each with subtle differences (Piland *et al.*, 2020). The most common include action research, participatory action research, participatory research, and collaborative research, alongside others such as participatory monitoring, participatory mapping, community monitoring, indigenous science, and peasant science. Notably, the term "citizen science" is relatively

uncommon in literature. A Google Scholar search for "citizen science" yields 206,000 results, whereas a search for "*ciencia ciudadana*" returns only 6,970 results (data accessed on May 25, 2024). According to Piland *et al.* (2020), citizen science initiatives in Latin America generally have a local focus and are characterized by two key objectives. On the one hand, they aim to inform decision-making, improve living conditions, and promote nature conservation. On the other, they seek to recognize and value the diversity of knowledge systems while reducing power imbalances in access to information.

In this text, we will prioritize the term community science, which we define as a collaborative research process in which a community works together to create learning opportunities and generate new knowledge. This process involves data collection, analysis, and interpretation, guided by ethical principles that emphasize consideration of the expectations and needs of all participants, as well as recognition of the contributions made by each party. Viewed in this way, community science is closely tied to critical environmental education efforts aimed at achieving environmental justice. Environmental education emerged in the 1970s in the Global North as a compensatory response to the environmental impacts of globalized capitalism (Sauvé, 2005; Foladori, 2018). This legacy is reflected in certain approaches that place the responsibility for environmental transformations - both positive and negative - on individuals, rather than on the productive systems that are the root cause of environmental problems (Loureiro & Layrargues, 2013; Layrargues & Lima, 2014).

During the 1970s and 1980s, Latin America was marked by military dictatorships, characterized by the strong organization of social movements that faced severe repression. During this historical period, popular expressions were largely rendered invisible and suppressed at all levels of social organization (Pesce, 2019). Following this dark era, the region witnessed a resurgence of interest in popular and community knowledge, with key figures such as Paulo Freire in Brazil (Freire, 1970, 2002) and José Luis Rebellato in Uruguay (Rebellato, 2000; Brenes *et al.*, 2009) leading the way. This gave rise to a more critical form of education, conceived from and for communities.

In particular, critical environmental education for environmental justice, within which we seek to situate community science, focuses on the environmental issues and conflicts that concern communities (Acselrad *et al.*, 2009; Machado & Moraes, 2019). In this context, environmental conflicts are understood as "sites of political dispute that generate tensions in the ways natural resources are appropriated, produced, distributed, and managed within each community or region" (Merlinsky, 2013, p. 40). Therefore, it is impossible to overlook the decline in biodiversity - as both a local and global environmental problem - as a product of relations of appropriation and dispossession in territories, with their most pronounced manifestations occurring in the world's most biodiverse regions, particularly in the Global South. It is in this context that community science, when approached through the lens of critical environmental education, can contribute to the generation of knowledge that is relevant to local communities. In this article, we will focus on an experience of this kind that has been developed in Uruguay.

We start from the premise that a country's ability to assess the state of its biodiversity and implement actions to promote its sustainable use

and conservation is fundamentally underpinned by access to information and knowledge about biodiversity, public participation in decision-making, and access to environmental justice (CBD/COP, 2022; CEPAL, 2022). In terms of access to biodiversity knowledge, Uruguay has one of the lowest levels of data availability in Latin America (Grattarola & Pincheira-Donoso, 2019), largely due to the fact that governmental and academic sources of primary biodiversity information in the country are not openly accessible. In an effort to address this issue, Biodiversidata (https://biodiversidata.org/), the Uruguay Biodiversity Data Consortium, was established in 2018. This initiative brings together more than 20 researchers and has made approximately 70,000 records publicly available to date (Grattarola *et al.*, 2019; Grattarola *et al.*, 2020a). Despite the efforts of this initiative, knowledge regarding which species are present in the country, where they have been observed, and how their distributions have changed over time remains largely inadequate.

Biodiversity monitoring particularly benefits from data derived from citizen science platforms, as these records often exhibit greater spatial and temporal resolution and coverage compared to data obtained through scientific collections (Chandler *et al.*, 2017). One limitation to the use of such tools often lies in access to the internet and technologies for recording observations. In this regard, Uruguay stands out as one of the Latin American countries with the best internet access and has made significant advancements in the field of information and communication technologies (International Telecommunication Union, 2021). Eight out of ten households in Uruguay have internet access (83.2%), 90.7% of the population owns a mobile phone, and 92.3% reside in areas covered by 4G/LTE networks (International Telecommunication Union, 2023). The expansion of access to mobile phones, tablets, and laptops, coupled with a growing public interest in biodiversity information, has led to a steady increase in the use of platforms for learning about, exploring, and documenting biodiversity. Currently, data sourced from citizen science platforms such as eBird and iNaturalist in Uruguay account for 92% of the biodiversity records available for the country on GBIF (GBIF.org, 2024), the world's leading platform for open and free access to biodiversity data.

In general, people continuously acquire and generate knowledge about biodiversity and ecological dynamics in the territories they inhabit, constantly producing insights on these matters. Although this type of knowledge is acknowledged by mainstream academic science under terms such as *local ecological knowledge* or *traditional ecological knowledge* (Berkes, 1993), these knowledge systems have historically been undervalued in comparison to the methodical and reductionist approaches characteristic of formal science (Gómez-Baggethun, 2009). They do not conform to the valuation frameworks established by the biological sciences or conservation biology, nor do they rely on the nature-culture dichotomy (Gómez-Baggethun, 2009). Instead, they represent an integrated way of interpreting and understanding the world around us.

However, leveraging this knowledge to defend territories is rarely considered valid within decision-making spheres or institutional participation spaces (Santos *et al.*, 2019). Individuals - and especially collective groups - must often develop their own technical capacities to employ "the language of science" (Skill & Grinberg, 2014). This "translation" of knowledge involves adopting the categories of academic science to justify their arguments or to

highlight the value of the places they inhabit according to hegemonically established codes, in order for their claims to be deemed legitimate. In this way, the deep connection to the land and the right to live in a healthy environment are diminished and devalued in favor of rallying around the protection of threatened or rare species - categories that are more readily accepted as valid arguments in institutionalized social participation spaces or within territorial disputes.

In Latin America, we are witnessing a continuous process of redefining -and in some cases dismantling - the boundaries between what constitutes science and what does not, as well as who is considered legitimate to practice science and who is not (Piña-Romero *et al.*, 2022). The Civil Association Julana (*Jugando en la Naturaleza*; http://julana.org/) exemplifies this approach. It seeks to contribute to building bridges that enable the convergence of diverse forms of knowledge. Among its objectives is the aim to amplify the voices and wisdom of communities affected by environmental changes, fostering dialogue, democratizing information, and striving to reduce power inequalities from an environmental justice perspective. It is within this unique framework of practicing community science that the collective has been working for over 15 years (Grattarola *et al.*, 2016; Bergós *et al.*, 2018; Chouhy *et al.*, 2019).

From the collaboration between Biodiversidata and Julana, and the richness of their respective initiatives, a new tool for Uruguay emerged: the NaturalistaUY platform, which is part of iNaturalist.

iNaturalist (https://www.inaturalist.org) is a global citizen science platform with two primary goals: connecting people with nature and collecting open, high-quality biodiversity data. To date, the platform hosts tens of millions of observations of hundreds of thousands of species from around the world. The iNaturalist international network includes 21 national nodes, nine of which are located in Latin American countries (Mexico, Guatemala, Costa Rica, Panama, Colombia, Ecuador, Chile, Argentina, and Uruguay). Since December 2021, Uruguay has had its own national node, NaturalistaUY, whose logo features a capybara (*Hydrochoerus hydrochaeris*) (see Figure 1). To date, more than 100,000 observations have been uploaded to NaturalistaUY, representing over 6,000 species and contributed by more than 3,000 participants. The data made available through NaturalistaUY have had significant impacts on research fields such as ecology and conservation (González *et al.*, 2023; Grattarola *et al.*, 2024a; Hagopián & Mailhos, 2021; Laufer *et al.*, 2021), as well as on territorial management (e.g., Park Rangers of the Laguna Garzón Protected Area; Grattarola *et al.*, 2023) and community-driven local initiatives (e.g., Wildlife Refuge Project; Carabio *et al.*, 2023).

The introduction of this new tool in Uruguay stems from the collaboration between Biodiversidata and Julana, placing us in a privileged position to define how we wish to promote its use. With this goal in mind, we organized the "Community Science Events with NaturalistaUY," as part of the project "NaturalistaUY: the iNaturalist community for Uruguay." The aim of this article is to share the experience of the first series of community events in Uruguay and reflect on the importance of conducting community science in Latin America from a critical perspective.

FIGURE 1 – Logo and identity of the iNaturalist site in Uruguay, NaturalistaUY.

2. Method

2.1. How NaturalistaUY works

NaturalistaUY gathers biodiversity information through a collaborative process. The platform allows users to upload photographs or sound recordings of any living organism, or traces of it, along with associated spatiotemporal metadata (location and date of the record). When a user uploads their observation, the platform provides an automated suggestion for the possible taxonomic identification of the organism being observed, based on previous records generated nearby. These suggested identifications are then reviewed by the user community, leading to a "community identification." An observation is considered "research-grade" when it includes location, date, a photo or sound recording, and at least two suggested identifications, with more than two-thirds of these agreeing on the species-level identification. This online community, which collaborates on identifications and data curation, includes participants from Uruguay, the region, and around the world.

The platform can also be used to explore records and taxonomic groups found in Uruguay and around the world. Users can search for species that have been recorded in their vicinity, identify those categorized as conservation threats, and determine whether they are native or non-native species. Additionally, it is possible to develop projects that group available observations based on various selection criteria, such as taxonomic group (birds, butterflies, fungi), geographic location (Uruguay, the department of Paysandú, Laguna Garzón Protected Area), or a combination of these variables (butterflies of Uruguay). Projects can also be designed for limited time periods, for instance, to gather records collected during the spring of the Southern Hemisphere, as is the case with the annual project "Gran Biobúsqueda del Sur" (Darski *et al.*, 2021).

2.2. Community Science Events with NaturalistaUY

To carry out the events, three locations were selected based on two key factors: areas with limited biodiversity data (according to Grattarola & Barreneche, 2021) and the presence of local groups focused on conservation and/or territorial defense, for whom this tool could prove useful. Most biodiversity data in Uruguay are concentrated along the coastal strip of the Río de la Plata and the Atlantic Ocean (Grattarola *et al.*, 2020b). Similarly, the majority of socio-environmental initiatives (70%) and environmental education projects are also found in

these regions (Mapeo de la Sociedad Civil, 2024). Therefore, when selecting the sites for the events, it was deemed important to explore areas far from the national capital and the southern coastal zone of the country.

The planning of the events was co-organized between the various local groups or collectives and members of Biodiversidata and Julana. To this end, preparatory bilateral meetings were held, during which the discussions and agreements reached were documented in writing. This resulted in a shared document that was distributed to the collectives as a record of the planning process. The call for community participation was primarily led by the local groups, with an emphasis on being open to anyone interested within each locality. The three chosen locations for the events were Quinta del Horno (San José department), Humedal La Curtiembre (Paysandú), and Bella Unión (Artigas) (see Figure 2).

Each event was conducted over two consecutive days, divided into two work sessions on the first day and one session on the second day. The first session on Saturday focused on presenting the initiative and the team, establishing contact with local participants, their organizations, and interests, learning about their work, and visiting the sites where field data collection would take place. The session also highlighted the potential of NaturalistaUY and explored the expectations of the local groups regarding the tool. The second session involved training participants on how to use the platform, followed by a field activity to collect records at a site chosen by the local collective. On the second day, participants worked with the records collected during the previous day's event. This session aimed to demonstrate the potential of NaturalistaUY for the local community and, more specifically, for the objectives of the collective. There was also a reflective discussion on the activities carried out in relation to the groups' and individuals' initial expectations.

Throughout the sessions, a variety of activities were conducted, including playful dynamics, presentations, exchanges among all participants, field trips and data recording, as well as moments of reflection. The team that organized and implemented the initiative consisted of eight members, with at least five participating in each event to lead the activities. For each session, specific individuals were assigned to facilitate activities, while others took on roles such as photography, written documentation, and time management. Written documentation, recorded using a field notebook, was analyzed using qualitative methodology based on content analysis (Bardin, 1977). Participant reactions, opinions, comments, and even silences in response to the prompts were captured in a general, non-literal manner (Mendes, 2018). Additionally, discussions on emergent topics arising from participants' interests were documented. Each event had a dedicated project on the NaturalistaUY platform to compile the observations made at each location. Furthermore, through Biodiversidata's network of contacts, collective members were invited to contribute by adding identifications to the observations recorded during the events. For access to the session plans and presentation materials, see (Grattarola, Bergós, *et al.*, 2024b).

The events were an intentional and carefully planned process that required consideration of many aspects in advance. Each territory, community, and organization have its own particularities, history, aspirations, and utopias that guide their work. For

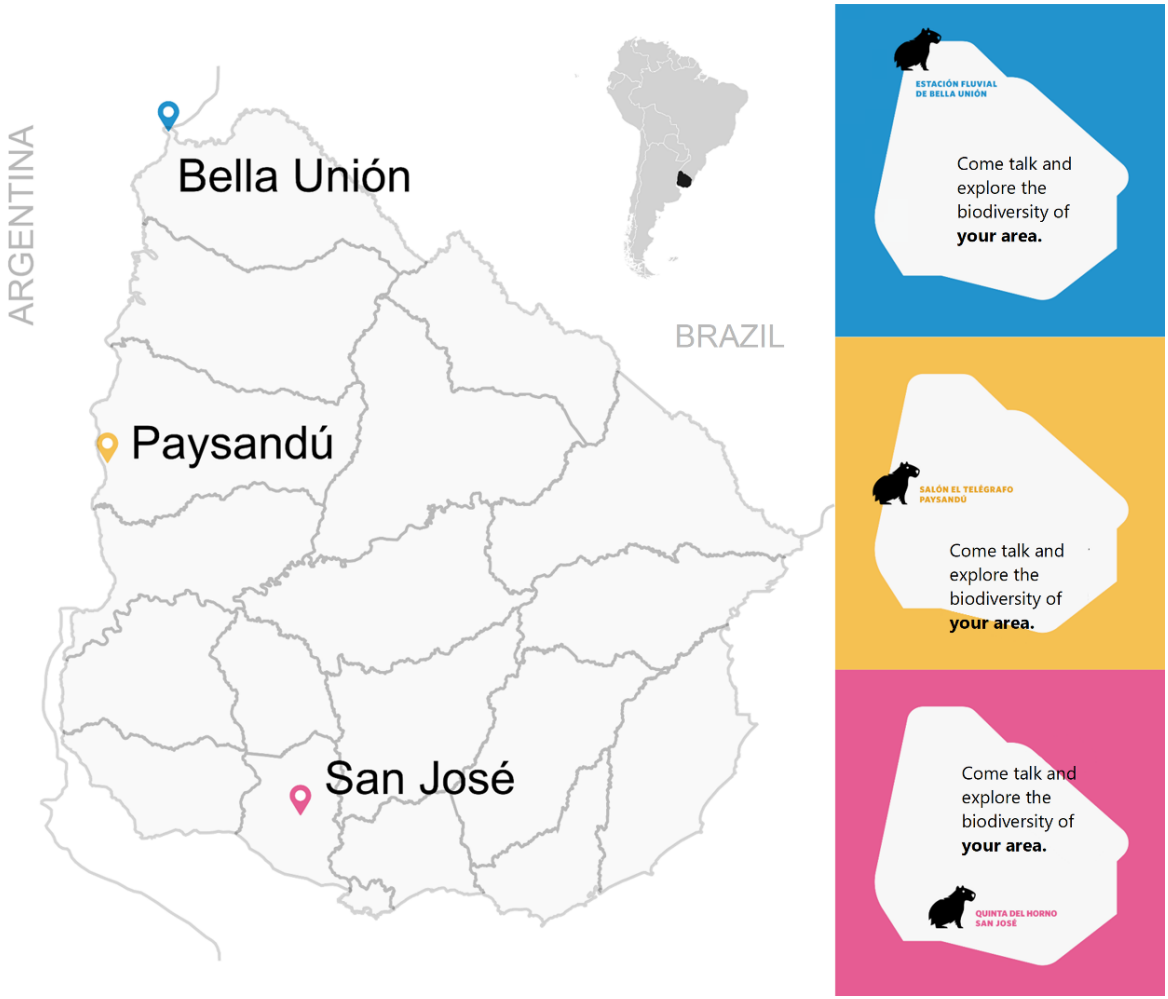

FIGURE 2 – Locations where the community science events with NaturalistaUY were held in May 2022, as part of the project 'NaturalistaUY: the iNaturalist community for Uruguay'. In blue, Bella Unión (Artigas department); in yellow, Paysandú (Paysandú); in pink, San José de Mayo (San José). Uruguay is subdivided into 19 departments at the subnational level.

this reason, it is important to emphasize that while our methodology provides a foundation, it is not entirely replicable (repeatable or copyable), as each event generated unique outcomes shaped by the participants, their experiences, and the collective sharing of those experiences. We firmly believe that it is essential to think from situated stories and narratives, to learn from the unfolding events, and to create anew from them, as has been proposed by various critical approaches to community engagement (Haraway 2019).

3. Results

The three events were held in May 2022 (see Table 1, Figure 3). Through interactions with the collectives - both prior to and during the events - the history of each location was shared, the connection of the collectives to the sites and their areas of interest were explored, and discussions were held regarding how NaturalistaUY could contribute to enhancing the impact of the collectives in their respective fields of action.

Below, we outline the characteristics of the locations where the events took place, based on the aspects highlighted by the co-organizing organizations. We also provide insights that emerged during the workshops through interactions with participants, as well as key points that stood out during the sessions.

3.1. San José: Quinta del Horno

In San José de Mayo, the capital of the San José department, 36,743 people reside (National Institute of Statistics, 2011). The city is located at the intersection of major national routes that connect Montevideo (the country's capital) and the eastern regions with the western border and northern parts of the country. In the area, two local collectives, Ubajay and San José Más Verde, work collaboratively. Members of these groups expressed their interest in establishing an urban reserve in the riverside forest along the Mallada stream, which forms one of the boundaries of the urban fabric of San José, located behind a site known as Quinta del Horno. The name derives from a nearby brick kiln, and the site also features a historic house constructed in the early decades of the 19th century. Owned by the local municipal government, the building was declared a historical monument in 1990. The two local organizations have identified threats to the stream's ecosystem and are coordinating efforts to improve the health of the stream and its surrounding environment. For instance, they aim to reverse the invasion of exotic species such as the ash tree (*Fraxinus sp.*) and Chinese privet (*Ligustrum sinense*) to restore the native forest. While the building's heritage status extends to the surrounding land, granting the riverside forest along the Mallada stream a protective designation that mandates "no alterations," activities detrimental to the stream's condition persist despite its protection under the Departmental Territorial Planning Guidelines. Consequently, the collectives' efforts have also focused on advocating for the restoration and preservation of Quinta del Horno as a public space for the enjoyment of the entire community.

The event was attended by 11 participants aged between 30 and 61, including 6 women, 6 individuals with training in biodiversity-related topics, and 4 with roles linked to education. Several attendees were not affiliated with the organizing collectives and joined with diverse motivations. For instance, some educators came with a professional interest: to expand their knowledge so they could share it with the educational communities at their respective institutions. During the activity, it became evident that perceptions of the riverside forest varied significantly. Some local residents - who did not participate in the event - referred to the area dismissively as "a swamp." This perspective sparked reflections, leading to the consideration that such views might stem from a lack of awareness about the site's history or an absence of

TABLE 1 – Community science events with NaturalistaUY were conducted in May 2022 in three localities across Uruguay, as part of the project 'NaturalistaUY: the iNaturalist community for Uruguay.' For each event, the following details are provided: the locality and department, the specific site, and the date of the records uploaded to NaturalistaUY. Additionally, the co-organizing collective(s), the number of participants in attendance, and the total number of records collected during the sampling day are indicated.

Locality (department)	Location	Date	Local Collectives	Participants	Records
San José de Mayo (San José)	Quinta del Horno	May 7–8, 2022	Ubajay and San José Más Verde	11	197
Bella Unión (Artigas)	Rincón de Franquía*	May 14–15, 2022	GruPAmA (*Grupo para la Protección Ambiental Activa*)	13	85
Paysandú (Paysandú)	Humedal la Curtiembre*	May 21–22, 2022	Paysandú Nuestro, GENSA (*Grupo Ecológico Naturista Sanducero*) and *Amigos de los Humedales*	13	230

LEGEND: (*) Due to flooding in the Uruguay River at the time of the events, the locations for the hands-on tool trials in Paysandú and Bella Unión had to be changed.

FIGURE 3 – Photos from the community science events with NaturalistaUY conducted in May 2022 in three localities across Uruguay, as part of the project 'NaturalistaUY: the iNaturalist community for Uruguay'. (a) Recording data via the iNaturalist app in Paysandú. (b) Discussion session on the expectations of the collectives regarding NaturalistaUY in San José. (c) Reviewing records uploaded to the platform with participants from the locality of Paysandú. (d) Field excursion to document observations on the platform in the locality of Bella Unión. More photos are available at https://www.flickr.com/photos/biodiversidata.

personal and familial connections to the place. This discussion prompted insightful conversations about access to information and public knowledge regarding biodiversity. Participants recognized the potential of sharing records among local residents and highlighted the capacity of NaturalistaUY to foster a community-based network for biodiversity documentation and engagement.

3.2. Bella Unión: Rincón de Franquía

The city of Bella Unión, located in the Artigas department in northern Uruguay, has a population of approximately 12,200 inhabitants (National Institute of Statistics, 2011). Historically, it has been a region characterized by vast expanses of land dedicated to sugarcane production, an activity exclusive to the Artigas department. The productive dynamics and the social and union organization surrounding sugarcane production lend this region distinct characteristics. Rincón de Franquía, the northernmost protected area in Uruguay, is adjacent to Bella Unión. It lies at a triple geopolitical border: to the east, it borders Brazil along the Cuareim River, and to the west, it borders Argentina along the Uruguay River. Thanks to the efforts of the local NGO Grupo para la Protección Ambiental Activa (GruPAmA) based in Bella Unión, the area was declared a Departmental Reserve by the Bella Unión Municipality in 2011 and was incorporated into the National System of Protected Areas in 2013 (Decree No. 121/013, 2013). Founded in 2004, GruPAmA is primarily composed of individuals from Bella Unión. In organizing the event, the group's main objectives were to engage young people with nature and the protected area, promote biodiversity observation, and generate resources to strengthen the proposal for a transnational protected area. The focus was on documenting nature for its intrinsic value and using the information as an educational tool for conservation purposes. Some participants in the event (both members of GruPAmA and external individuals) had prior experience using citizen science platforms, particularly eBird.

The event was attended by 13 participants aged between 19 and 64, including 4 women, 9 individuals with training in biodiversity-related topics, 4 with roles linked to education, and 2 high school students. The event focused on the available knowledge about the biological diversity in the protected area, with NaturalistaUY being recognized as a key tool for documenting the region's richness and promoting its conservation. Discussions covered the sharing of information, species locations, and the fact that it is not always justified to make such data public, particularly in the case of sensitive species, although it was noted that sharing knowledge often enables more than it compromises. In this regard, the camera and the act of recording were seen as gateways to discussing broader topics. The playful potential of NaturalistaUY was highlighted, along with its appeal for both individual and collective learning. Emphasis was also placed on how the platform allows people to engage with biodiversity observation without requiring expertise in the field. The national border context also influenced the conversations, with topics ranging from the proposed trinational biological corridor for the area to the rising river waters that bring "things" (referring to animals from other regions) from Brazil and Argentina, sparking curiosity about these occurrences.

3.3. Paysandú: Humedal La Curtiembre

The city of Paysandú, the capital of the Paysandú department, is one of the three most populous cities in Uruguay, with approximately 113,000 inhabitants (National Institute of Statistics, 2011). Located in the northwest of the country on the border with Argentina, the national boundary is marked by the Uruguay River. Near the northern edge of the urban area lies the La Curtiembre stream, which flows into the Uruguay River. Its name originates from the former presence of an animal hide processing plant on one of its banks. At the mouth of the stream where it meets the Uruguay River, a wetland known locally as the Humedal de La Curtiembre forms. The presence of the now-defunct industry caused significant pollution in both the stream and the wetland, leading to the area being heavily stigmatized by the local population. In this context, displaced individuals and those struggling to access housing settled in the area, living under conditions of flood risk and lacking essential services. Amid these challenges, the organizations Grupo Ecológico Naturista Sanducero (GENSA), Paysandú Nuestro, and Amigos de los Humedales have joined forces to revalue and protect this wetland space. These groups have identified a range of threats to the wetland and the conditions for its enjoyment, which have intensified over the past four decades. In addition to the contamination caused by the industrial activity, further pressures emerged in the 1980s, including the construction of a road that disrupts the wetland, recreational vehicle traffic across the area, solid waste disposal, the presence of pets that disturb local wildlife, and vegetation-altering management practices carried out by the departmental government, among others. More recently, large-scale urban development projects have been proposed in the area; however, both the organizations and the general public have received only partial information, limiting their ability to influence decisions. In response, the organizations have mobilized with two primary goals: to prevent actions that negatively impact the wetland and to advocate for protective measures through the designation of the area as an urban reserve.

The event was attended by 13 participants aged between 27 and 65, including 7 women, 7 individuals with training in biodiversity-related topics, and 8 with roles linked to education. The workshop was marked by discussions surrounding the current and future challenges facing the area. In this context, NaturalistaUY was identified as a valuable tool to complement and systematize the biodiversity surveys already conducted by the groups, with the understanding that the data collected could be used to highlight the area's conservation significance and to defend it against the encroachment of real estate developments on the wetland, among other threats. Additionally, it was recognized that these records could be used in the design of signage or other outreach initiatives.

4. Discussion

Over the past 15 years, there has been a growing global development of citizen science platforms worldwide, enabling individuals without formal scientific training to participate in scientific research (Liu *et al.*, 2021). However, many of the experiences surrounding these platforms focus on data collection without adequately considering

local realities (Hidalgo *et al.*, 2021). Historically, Latin America has sought to position itself from a different standpoint, emphasizing critical perspective (Piland *et al.*, 2020). With the rise of the global citizen science tool iNaturalist in the region, we question whether it can be leveraged to learn and generate new knowledge that centers on the realities and needs of local communities. This paper presents a pioneering experience in Uruguay that combines community science with critical environmental education to "situate" (Haraway, 2019, p. 22) data collection and knowledge generation within a sociopolitical context.

4.1. What components of community science and critical environmental education were present in the events?

The approach to the events was grounded in both the theoretical and practical foundations of critical environmental education. Methodologies that encouraged the participation of all individuals were employed, and attendees were invited to reflect on the context in which the events took place. Special emphasis was placed on contributing to the strengthening of communities within the framework of ongoing processes that the groups were experiencing. For this reason, the events did not focus solely on teaching the use of NaturalistaUY but rather on understanding the goals and experiences of the groups in their respective territories, with the aim of evaluating how this tool could support their work. In fact, the number of records generated was not considered a measure of success. Instead, the events sought to highlight other forms of learning and exchange; for instance, the idea that biodiversity records created by local populations on a free and community-driven platform can enhance social participation in the generation of collective knowledge and improve everyone's access to biodiversity data.

The de-generalization of the practice allowed different reflections and challenges to emerge at each event. The Bella Unión group demonstrated a stronger focus on conservation, particularly centered on monitoring and understanding a protected area, as well as engaging the community in these initiatives. This was the event where younger participants were more involved, aligning with one of the organizing team's objectives. In contrast, the events in San José and Paysandú were more influenced by the underlying environmental conflicts in these localities, with the Paysandú case standing out in this regard. There, a greater sense of group cohesion was observed, with collectives having deeper and longer-standing roots in the area. This highlights the significant contribution of situated community science, as opposed to classical citizen science, which tends to be generalizing and often repeats practices without contextualizing them.

Both the planning and execution phases of the events were carried out with a critical, participatory, and justice-oriented perspective (Acselrad *et al.*, 2009; Machado & Moraes, 2019). During the planning stage, this approach was evident in the criteria for site selection, the nature of engagement with co-organizing groups, and the adaptation of the proposal to local dynamics, among other dimensions. During the events themselves, it was reflected in the working dynamics, the horizontality and openness to listening, the topics addressed, and the adaptation of the activities to the emerging concerns of the participants, among other aspects. In both stages, there was also constant discussion

about data collection, data processing, and decision-making based on these processes, questioning the detached and non-democratic ways in which these activities often occur.

The creation of spaces for exchange and discussion also enabled the emergence of interests and potential uses of the platform that had not been previously considered by the organizing team. For instance, there was significant interest in how the platform could contribute to biodiversity education by making knowledge accessible for educational purposes.

4.2. What other experiences exist in Latin America?

In the region, there are various examples of situated experiences that have utilized iNaturalist. One notable case is the Mariposas Azules group, active on the Cerro del Topo Chico in Nuevo León, Mexico (Muñoz, 2019). When the hillside was suddenly cleared to make way for a motocross track, residents of Nuevo León voiced their concerns to environmental authorities. However, they were told that for their complaints to be considered, they needed to demonstrate both the ecological importance of the affected area and the presence of protected species. In response, the local group, led by Janet Guardiola, which was already using iNaturalist to document observations in the area, mobilized to gather more data and conduct a comprehensive biodiversity inventory of the site. They subsequently filed a formal complaint with the authorities, supported by a detailed list of species. This effort not only revealed the presence of several conservation-priority species but also identified, for instance, that the area served as a roosting site for monarch butterflies (*Danaus plexippus*). After a lengthy administrative process, the complaint ultimately succeeded in halting the clearing, allowing local residents to continue enjoying the hill and its biodiversity.

Another noteworthy example is the Social Appropriation of Knowledge Center at Colombia's Humboldt Institute. Its goal is to promote more inclusive biodiversity research and conservation processes that contribute to decision-making at the local level. The Center focuses on developing participatory biodiversity inventories and monitoring efforts using platforms such as iNaturalist and eBird (Arias *et al*., 2019). Among its initiatives is the project "Bioblitz in Eight BiodiverCities," carried out in various regions of the country, from the Caribbean to the Amazon. Carolina Soto Vargas, one of the project leaders, has highlighted the crucial role of female leadership in each locality, which extends beyond the scope of the projects themselves (iNaturalistMx, 2025). A particular case arose when the team faced an armed strike while conducting registration activities. The leaders of the initiative managed the socio-environmental conflict situation by prioritizing self-care and the safety of others, without losing their commitment to local stakeholders. Situations like this underscore the importance of adopting a holistic approach when working in the field with a platform such as iNaturalist.

A final exemplary experience is that of Ellky Areta Paredes, an Official Tourism Guide in Lurín, Peru. Her work focuses on ecotourism and promoting the interpretation of cultural and natural heritage through responsible and sustainable tourism activities. Areta Paredes has emphasized how the use of iNaturalist has enabled her to learn about

the biodiversity of her region, knowledge that she incorporates into her tours to foster a meaningful connection between visitors and the environment (iNaturalistMx, 2025). She highlights the ease of taking a photograph, uploading a record, and obtaining an identification using the platform, which has enhanced the experience of the people she guides. Building on this learning, she has developed various educational materials, including a guide to local dragonflies, children's stories that explore the region's biodiversity, and playful activities designed to help participants understand the ecological relationships of insects in the wetland, among other resources.

4.3. What potential does the tool hold?

Although the NaturalistaUY platform has a predetermined structure, with certain limitations regarding the extent to which it can be reformulated, the ways in which it can be utilized can take on a community-oriented form and be collectively appropriated. This is due to the following reasons:

1) Scientific training is not required to use the information available on NaturalistaUY and generate scientifically-backed outputs. Specifically, while the identification of records is conducted within a formal scientific system, no such training is necessary to access the available data and, for example, create a species list for an area of interest.

2) The platform does not differentiate between users who assume different roles - such as observation or species identification - thereby fostering a horizontally structured virtual community.

3) This tool facilitates the integration of different generations and enables young people to engage with these issues by contributing their skill and enthusiasm for using new technologies.

4) The platform fosters interaction among individuals and groups within a virtual community that is built within the platform itself, enabling the expansion of contact networks and strengthening connections between groups in the territory.

In this particular experience, as the collectives themselves reported, the events allowed them to access a new tool that enhances the work they were already carrying out. The possibilities enabled by the platform - especially when users adopt open licenses for their records - allow these groups to take ownership of the information and apply it in various ways according to their interests. Within the context of environmental conflicts and participatory spaces where these collectives are engaged, classical science remains the highly valued and accepted language. In this regard, due to its accessibility, NaturalistaUY enables the use of this technical language to support the arguments put forward by the collectives.

NaturalistaUY represents a democratization in the generation and use of scientific and technical information related to biodiversity. While we recognize the need to rethink this situation, understanding that other forms of valuation should be considered equally valid, for as long as this condition persists, it is crucial for grassroots collectives to be able to assert themselves within these spaces. To further enhance the accessibility and democratization of the tool, it is necessary to continue adapting it to local terminologies - for instance, by updating the common names of species - and to promote the widespread use of technology. In some cases, the

latter remains a barrier, despite Uruguay's broad access to technology and the internet.

5. Conclusions

The use of iNaturalist (and in our case, specifically NaturalistaUY) in community-based projects sparks significant interest. Although the platform has a fixed structure that may present limitations in certain aspects, its community-oriented potential enables collective appropriation. Citizen science could evolve into a practice of community science by incorporating a critical environmental education perspective. We believe that Uruguay provides fertile ground for this approach; however, it is essential to situate it within reflective processes while maintaining a critical view of data collection.

Currently, we do not know the specific objectives driving the use of NaturalistaUY, why individuals are recording observations in Uruguay, how the data is being utilized, or whether individual or collective uses predominate. As the tool becomes adopted by more people, as the national community continues to grow, as greater participation in the local curation of information increases, and as more collectives take ownership of the platform, we will likely see more use cases emerging from within communities rather than being externally imposed. Moving forward, we encourage the development of experiences where data collection serves as a tool rather than an end in itself.

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