Shaping tomorrow's citizen science research infrastructure

A co-design experience

CAPS Conference 2025 | May 28, 2025 | Portland State University

Event overview

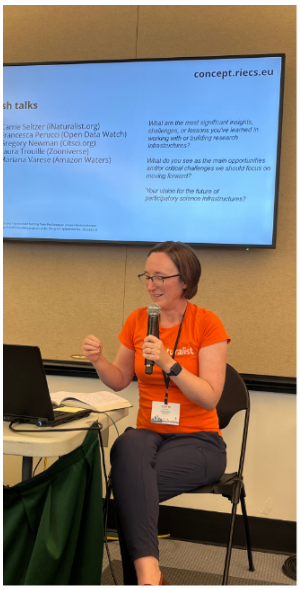
Conference for Advancing Participatory Sciences -CAPS- 2025
Date: Wednesday, May 28, 2025 at 4:00 PM
Location: Room 333, PSU Smith Memorial Student Union (Third floor)
Duration: 75 minutes
Participants: 5 speakers, 7 organizers, up to 50 participants

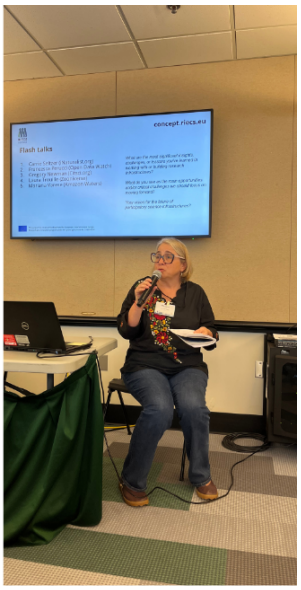
Methodology

The symposium employed a dynamic two-part format designed to maximize knowledge sharing and collaborative discussion:

Lightning talks panel (25 minutes): Five expert speakers delivered focused 4-minute talks addressing key insights, challenges, and visions for participatory science infrastructures. Each speaker introduced their platform, and covered significant lessons learned, main opportunities and challenges, and their future vision.

World café conversations (35 minutes): Participants engaged in structured small-group discussions around four thematic tables, each facilitated by RIECS consortium members with dedicated note-takers. The four focus areas were: **Technology and Interoperability, Governance and Ethics, Engagement and Inclusion and Policy Integration and Sustainability**.


concept.riecs.eu


concept.riecs.eu


concept.riecs.eu


SYMPOSIUM
SYMPOSIUM


SYMPOSIU


EXIT

Context: background and further actions

This symposium represents the inaugural event of its kind within the RIECS-concept project, as a first in-person event engaging the community. RIECS-concept **"Towards a Pan-European Research Infrastructure for Excellent Citizen Science"** is funded by Horizon Europe under the Horizon Research Infrastructures main programme, specifically under the topic consolidating and developing research infrastructures of European interest. The project aims to conceptualize a pan-European infrastructure for citizen science through activities planned until December 31, 2027. During this period, the consortium will organize multiple events designed to understand the challenges, opportunities, and needs of the citizen science community and other stakeholders while developing a comprehensive infrastructure model.

The main purpose of this event was to collect lessons learned and recommendations from infrastructures that have been operating for decades. Additionally, the symposium aimed to create and strengthen relationships with these established initiatives, as well as with the broader community of users, contributors, and supporters of these infrastructures.

The participants involved in this symposium brought diverse and extensive expertise to the discussions. They ranged from coordinators, funders, and managers of established citizen science platforms and infrastructures that have been operational for decades—including Zooniverse, CitSci.org, and iNaturalist—to experts and practitioners across various domains who utilize citizen science platforms, develop services, or contribute to infrastructure development, as well as citizen scientists and users of such platforms.

This symposium marks the first in person exchange in a planned series of events that will take various formats. Some will be dedicated workshops, while others will be integrated with established conferences such as the Citizen Science Conference CAPS 2025 and the European Citizen Science Association (ECSA) Conference 2026.

All inputs and insights collected from this event will directly feed into the project's challenges assessment, as well as inform other technical and organizational documentation throughout the RIECS-Concept project lifecycle. The consortium will systematically gather and analyze feedback from each event to build an understanding of the European citizen science landscape and infrastructure requirements, as well as its connections beyond Europe.

This report is published with the intention of being reused in other contexts, contributing to the broader citizen science community's knowledge base and supporting similar initiatives across different regions and domains. The findings and recommendations contained within this document are designed to be adaptable and applicable beyond the immediate scope of the RIECS-Concept project, fostering wider collaboration and development in the citizen science infrastructure space.

Symposium in a nutshell

Key lessons learned

Transcending boundaries: Global platforms like iNaturalist demonstrate that biodiversity and expertise transcend political boundaries, making audacious "all taxa globally" approaches more effective than fragmented, region-specific solutions.

Trust is the foundation: Building trust between state and non-state actors emerged as the primary challenge, requiring established principles including data sovereignty for indigenous peoples and citizen control over data usage.

Sustainability requires long-term commitment: Successful platforms need staying power and longitudinal data collection capabilities, emphasizing the importance of sustainable funding models and institutional stability.

AI integration must be ethical: As citizen science increasingly integrates AI, platforms must balance efficiency gains with ethical considerations, transparency, and meaningful human engagement.

Inclusion demands intentional design: Effective inclusion requires targeted, community-specific engagement strategies and technology that serves as an enabler rather than a barrier.

Main recommendations for the future

For infrastructure development:

- Develop modular, interoperable and sustainable systems that allow project-level customization while maintaining shared services and standards
- Implement robust data provenance tracking to ensure scientific reproducibility and proper attribution
- Create flexible access points accommodating multiple levels of digital literacy, from paper-based workflows to advanced web interfaces
- Build in peer interaction and mentorship capabilities to foster community building
- Structural funding strategies for sustainable infrastructures

For governance and ethics:

- Establish adaptive ethics frameworks that can evolve with technology while maintaining core values
- Ensure diverse institutional representation across different sectors and geopolitical regions
- Implement clear data governance with transparent communication about usage, ownership, and ethical boundaries
- Include civil society organizations alongside official actors in governance structures

For policy integration:

- Create standardized data sets aligned with the indicators of multilateral agreements and frameworks, such as the Sustainable Development Goals (SDGs) and the Global Biodiversity Framework (GBF), as well as relevant local, national and regional targets depending on the context and in line with the project and participant goals, while maintaining equity and accessibility
- Build effective mechanisms to facilitate communication and understanding of citizen science data by policymakers. Develop sustainable funding mechanisms and legal frameworks supporting long-term efforts
- Establish clear pathways for citizen science data to inform policy decisions

For engagement and inclusion:

- Implement recognition and compensation systems that address funding barriers affecting under-resourced communities and early-career participants through stipend models that build trust via reciprocal, non-exploitative relationships.

- Foster intergenerational collaboration networks that leverage retirees' available time and experience as mentors while creating structured spaces for bidirectional knowledge exchange between youth and elders through peer-learning frameworks.

- Build horizontal peer-to-peer communication channels that enable direct participant-to-participant communication and community building within and across projects through collaborative structures with shared tools that bridge institutional gaps.

- Ensure cultural sensitivity and multi-language support by developing comprehensive training programs adapted for national, regional, and local contexts while integrating social dynamics support and providing clear participation pathways with orientation resources and human support for sustained newcomer engagement.

Lightning talks summary

Carrie Seltzer (iNaturalist.org)

Represented iNaturalist, now operating as a US-based independent non-profit. Emphasized the power of network effects in citizen science, demonstrating how global collaboration transcends political boundaries. Highlighted the platform's "audacious approach" of covering all taxa globally, which has proven more effective than fragmented, geographically specific initiatives.

> "Biodiversity knows no political boundaries, and expertise is assured across boundaries. Taking this audacious approach of all taxa globally has actually worked well for iNaturalist."

Francesca Perucci (UNSD)

Shared insights from establishing the Collaborative on Citizen Data, emphasizing the critical challenge of building trust between state and non-state actors. Outlined 13 established principles including data sovereignty for indigenous peoples and citizen control over data. Advocated for creating open data platforms that make citizen science data AI-ready and accessible.

> "The number one challenge for us was building trust because citizen data is co-created by multiple actors in society, but it's very difficult to ensure trust between state and non-state actors."

Gregory Newman (CitSci.org)

Co-founder of CitSci.org, emphasized three key principles: understanding "who's doing what where" to avoid reinventing wheels, maintaining sustainability for the long game, and balancing custom flexibility with standardization. Advocated for moving from data collection to action measurement and integrating forecasting and modeling capabilities.

> "Be sustainable. Every platform needs to be in it for the long game and willing to do what it takes to have staying power as research infrastructure because the power is in longitudinal spatial temporal information."

Laura Trouille (Zooniverse)

Represented Zooniverse, operating for 18 years with over 500 projects launched. Highlighted the importance of equal partnership between universities and public engagement institutions. Discussed infrastructure choices that enable scale, including their project builder platform that increased project launches from 3 to 40+ per year. Addressed AI integration as both opportunity and challenge.

> "AI and citizen science are very intertwined now. How do we do this responsibly and ethically, knowing that efficiency and engagement goals can be in tension with each other?"

Mariana Varese (Amazon Waters Alliance)
Presented the Amazon Waters Alliance that includes a fish observation database, covering three-quarters of Amazon sub-basins with over 130,000 observations. Emphasized the challenge of balancing data safety with accessibility, highlighting the tension between hosting data in well-established international repositories versus maintaining data sovereignty within Amazon countries.

> "What keeps this moving and meaningful over these nine years is the clients and users, which are the data generators - the local indigenous and local communities and fisher associations. If everything fails, that cannot fail."

World café table summaries

Technology and interoperability

Moderators: Jaume Piera & Karen Soacha

Summary

The technology discussions revealed that citizen science platforms have distinct strengths and should work in synergy rather than compete. Key challenges include improving data provenance tracking, developing attribution tools for collective contributions, and ensuring AI integration remains transparent and ethically grounded. The group emphasized the need for open algorithms with proper documentation and metadata standards.

Main highlights

- **Data provenance as cultural and technical dimension:** Data provenance encompasses both scientific traceability and recognition of personal/collective histories behind observations.
- **Interoperability experiments:** Active initiatives between platforms like CitSci and Zooniverse provide valuable insights into shared challenges around authentication, attribution, and data sharing.
- **AI integration challenges:** Tensions around data ownership and transparency when algorithms are trained on collective human effort but applied independently.

Ideas discussed

Participants emphasized the need for developing shared infrastructure modules that enable both technical and social interoperability across platforms. This includes creating unified sign-up tools and data access mechanisms that allow users to seamlessly work across different citizen science environments. The group discussed implementing natural language interfaces to reduce entry barriers for participants with varying technical backgrounds, making citizen science more accessible to broader communities.

A significant focus was placed on establishing comprehensive metadata standards for models and algorithms, ensuring transparency in how data is processed and by whom. The discussions highlighted the importance of building federated repositories similar to GBIF

that facilitate data and model sharing while maintaining proper attribution. Participants stressed that all algorithms used in citizen science should be open and well-documented, with clear tracking of data processing to maintain transparency and trust.

The conversation also addressed the critical need to preserve knowledge diversity through comprehensive provenance tracking. This goes beyond technical requirements to encompass the cultural and personal histories behind observations. Participants discussed designing platform-as-a-service models with mature interoperability mechanisms that allow different projects to benefit from shared infrastructure while maintaining their unique characteristics and requirements.

Further topics addressed

- IoT sensor integration
- Biomedical model transfer learning
- Benchmark development

Governance and ethics

Moderators: Franziska Stressmann

Summary

Governance discussions centered on establishing ethical frameworks that can adapt to technological evolution while protecting participant rights. Key themes included data sovereignty for indigenous communities, balancing usability with safety, and ensuring diverse representation in governance structures. The group emphasized the importance of community-controlled data platforms and inclusive decision-making processes.

Main highlights

- **Adaptive ethics frameworks:** Need for living documents that evolve with technology while maintaining core values as foundation
- **Data sovereignty and safety:** Critical importance of participant control over data, and segmented data access models
- **Digital access as privilege:** Recognition that digital infrastructure limitations create barriers to participation, especially in rural and indigenous communities
- **Diversity of organisations in governance:** Fundamental consideration for longevity should be ensuring the diversity of participating institutions across sectors, organizational types, and geopolitical regions

Ideas discussed

The governance discussions centered on implementing technology-embedded governance mechanisms that support decentralization while maintaining accountability. Participants explored creating sophisticated tier-level systems for data viewing and management permissions, allowing different stakeholders to have appropriate access levels based on their roles and relationships with the data. The group emphasized the importance of establishing strong connections with human rights institutions to ensure data principles and safety protocols align with international standards. Establishing a diversity of institutions in governance that will outlast potential geopolitical changes, funding changes, and evolving research frameworks was also highlighted.

A key theme was developing flexible privacy frameworks within datasets that can accommodate different participant preferences and cultural contexts. Some individuals may want to share their data openly for maximum impact, while others may prefer restricted access or anonymization. The discussions highlighted the need for governance structures that can exist outside traditional National Statistical Office systems while maintaining meaningful integration with official data ecosystems.

Participants stressed the importance of including civil society organizations as equal partners alongside official actors in governance structures. They discussed the principle that ethics frameworks should be established before governance mechanisms, not as an afterthought. The group favored starting with small, stable, and useful systems that can grow organically rather than beginning with large, unwieldy structures that may be difficult to manage. The conversation also addressed practical challenges around licensing enforcement and the need to develop alternative protection mechanisms for sensitive or culturally significant data.

Further topics addressed

- Geopolitical stability considerations
- International vs. local data control tensions
- Licensing enforcement challenges
- Organizational survivability

Engagement and inclusion

Moderators: Kai-Ti Wu & Francisco Sanz

Summary

Engagement discussions highlighted the tension between scientific output requirements and meaningful community participation. The group identified strategies for building inclusive participation including compensation models, peer mentorship networks, and multiple access points for diverse digital literacy levels. Emphasis was placed on horizontal relationships among participants rather than top-down approaches.

Main highlights

- **Targeted community engagement:** Effective inclusion requires focus on specific communities with local leader empowerment.
- **Technology as enabler:** Digital literacy barriers necessitate flexible participation options including paper-based alternatives.
- **Intergenerational collaboration:** Retirees represent valuable resources with time and experience to support other participants.

Ideas discussed

The engagement discussions explored innovative approaches to participant recognition and compensation, moving beyond traditional academic acknowledgment to establish stipends or compensation models that genuinely value participants' time and contributions. The group envisioned creating rich intergenerational spaces where youth and elders can engage in meaningful knowledge exchange, leveraging the time and experience that retirees often possess while benefiting from the digital fluency and fresh perspectives of younger participants.

Participants emphasized the importance of developing comprehensive training programs that operate across national, regional, and local levels, recognizing that each level has different capacities and power structures. The discussions highlighted the need for building robust in-platform communication channels that facilitate peer interaction and mentorship, moving away from traditional top-down dissemination models toward horizontal relationships among participants that foster genuine community building.

A significant focus was placed on accessibility and inclusion, with discussions about providing multi-language support and culturally sensitive design that respects diverse ways of knowing and participating. The group explored designing interfaces that accommodate multiple levels of digital literacy, from paper-based workflows for those

with limited tech access to advanced web interfaces for more experienced users. They emphasized creating simple, intuitive onboarding processes specifically designed for first-time users without scientific backgrounds, ensuring that citizen science becomes truly accessible to all members of society regardless of their educational or technical background.

Further topics addressed

- Intergenerational support networks
- Recognition and compensation mechanisms
- Privacy and data ownership concerns
- Public vs. private school participation disparities

Policy integration and sustainability

Moderators: Dilek Fraisl & Fermín Serrano

Summary

Policy discussions revealed the importance of demonstrating concrete impact through successful examples to engage policymakers. Participants emphasized the need for clear data visualization, transparent quality standards, and standardized datasets aligned with global methodologies, such as those used for SDG indicators. The group stressed the importance of maintaining equity and accessibility even as standardization increases.

Main highlights

- **Personal relationships matter:** Most effective policy engagement occurs through building one-on-one relationships with receptive officials
- **Bridge roles essential:** Need for intermediaries between citizen scientists and policymakers to prevent data misinterpretation
- **Sustainability challenges:** Funding structures often don't reflect the true scope and complexity of citizen science projects

Ideas discussed

The policy integration discussions emphasized the critical importance of developing clear, actionable recommendations for policymakers that translate complex citizen science data into concrete policy guidance. Participants explored creating sustainable funding mechanisms through innovative legal frameworks, drawing inspiration from examples like California's recent legislation that establishes long-term financial support for citizen science initiatives. The group stressed the need for data visualization tools that can communicate scientific findings in accessible, compelling ways that resonate with policy audiences who may not have technical backgrounds.

A key focus was building robust feedback loops that ensure participants understand how their data contributions translate into real-world policy decisions and impacts. This addresses a common frustration where citizen scientists invest time and effort but never learn about the outcomes of their work. The discussions highlighted the challenge of ensuring that data standardization efforts, while necessary for policy integration, don't inadvertently exclude small communities or marginalized groups from meaningful participation in the process.

Participants recognized the urgent need for creating bridge mechanisms between citizen science data and policymakers to prevent misinterpretation of data and ensure that scientific nuance is preserved in policy applications. They discussed developing transparent data quality standards that build trust with policy users while addressing practical concerns about the gap between local community priorities and national or global data frameworks. The conversation also emphasized establishing robust interoperability standards that maintain citizen science data in the public domain, ensuring broad accessibility while respecting participant rights and community sovereignty over their contributions.

Further topics addressed

- Legal frameworks supporting long-term efforts
- Funding-complexity misalignment issues
- Regional vs. national integration challenges
- Skeptical policymaker conversion strategies

Organizing team

Fermín Serrano (Ibercivis), Franziska Stressmann (ECSA), Francisco Sanz (Ibercivis), Kai-Ti Wu (ECSA), Dilek Fraisl (IIASA & CSGP), Jaume Piera (CSIC & RICAP) and Karen Soacha (CSIC & RICAP)

Acknowledgements

The organizing team and RIECS-Concept consortium acknowledge that this report and the valuable ideas contained within are thanks to the significant contributions of the symposium speakers as well as the participants of the World Café tables who generously shared their insights, experiences, and recommendations for conceptualizing the future pan-European citizen science research infrastructure. The collaborative spirit and knowledge sharing demonstrated during the symposium exemplifies the community-driven approach that will be essential for the success of RIECS-Concept.

Documentation control

Version: 1.0
Created by: Karen Soacha (ICM-CSIC)
Contributors: Fermín Serrano (Ibercivis), Francisco Sanz (Ibercivis), Kai-Ti Wu (ECSA), Dilek Fraisl (IIASA & CSGP), Jaume Piera (CSIC & RICAP), Franziska Stressmann (ECSA)
Symposium participants: Symposium attendees from multiple institutions and organizations
Symposium speakers: Carrie Seltzer (iNaturalist.org), Francesca Perucci (UNSD), Gregory Newman (CitSci.org), Laura Trouille (Zooniverse), Mariana Varese (Amazon Waters Alliance)

How to cite:
RIECS-Concept Consortium, Soacha, K., Serrano, F., Sanz, F., Wu, K.-T., Fraisl, D., Piera, J., & Stressmann, F. (2025). *Shaping tomorrow's citizen science research infrastructure: A co-design experience - CAPS 2025 Symposium Report*. RIECS-Concept Project. https://concept.riecs.eu

Project information

RIECS-Concept
Grant Agreement ID: 101188210

European Commission Support: This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101188210. The content of this publication is the sole responsibility of the authors and does not necessarily reflect the views of the European Commission.

About RIECS-Concept: RIECS-Concept is a collaborative project involving 13 institutions aimed at conceptualizing a new type of Research Infrastructure dedicated to excellent citizen science across Europe. This effort is aligned with the European Strategy Forum on Research Infrastructures (ESFRI), developing a strategic roadmap for European Research Infrastructure investment priorities.

Report compiled following the Symposium "Shaping Tomorrow's Citizen Science Research Infrastructure: A Co-Design Experience" held at Portland State University, May 28, 2025 as part of the Conference for Advancing the Participatory Sciences CAPS 2025.