ecsa | European Citizen Science Association

CONFERENCE // 2022
Citizen science for planetary health

PROCEEDINGS

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https://2022.ecsa-conference.eu

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WELCOME

The Museum für Naturkunde Berlin and the European Citizen Science Association welcome you to the fourth international ECSA Conference in Berlin. Four days of discussions, exchange and networking around the topic of **Citizen science for planetary health** – two approaches in science, society and policy that have the chance to transform society as well as science.
Thank you for joining our invitation to come to Berlin – we very much appreciate your effort especially in times of a pandemic. More than 400 international researchers, students, practitioners and policy makers have registered. The contributions to the conference – from keynotes, talks, interactive sessions and posters – promise high-level insights and discussions for the benefit not only for the fields of citizen science and planetary health but eventually also life on our planet Earth.
It takes many people to make such an event happen. We all have prepared thoroughly to make #ECSA2022 happen. It is also up to us now to make the most of it.
Enjoy reading through the abstracts and have a wonderful time in Berlin!

Conference Organisers

MfN - Susanne Hecker, Silke Voigt-Heucke, Kim Grützmacher, Julia Rostin
ECSA - Dorte Riemenschneider, Simona Cerrato

Scientific Conference Committee

The abstracts included in this volume were selected and evaluated by members of the Scientific Conference Committee (SCC). The conference organisers are grateful for their expertise, engagement and guidance.

The Scientific Conference Committee consisted of the following experts in the field of citizen science: Barbara Kieslinger, Claire Murray, Claudia Fabo Cartas, Daniel Dörler, Dilek Fraisl, Dorte Riemenschneider, Enrico Balli, Florian Heigl, Gertrud Hammel, Gitte Kragh, Jaume Piera, Johannes Vogel, Katharina Wabnitz, Katrin Vohland, Kim Grützmacher, Michael Eichinger, Muki Haklay, Rosa Arias, Sabine Wildevuur, Sally Reynolds, Silke Voigt-Heucke, Susanne Hecker, Susanne Tönsmann, Svetlana Klessova

The editorial deadline for this volume was 20 September 2022

INFORMATION ON THE ECSA CONFERENCE 2022

The ECSA Conference 2022 takes place from **October 5-8 in Berlin**, Germany. We invite researchers from all disciplines, scientists, practitioners, activists, funders, policymakers, non-governmental organisations, artists, and other interested citizens worldwide to reflect, discuss, and network on the topic of **Citizen science for planetary health**.

Conference topic

The concept of planetary health is based on the understanding that human health and human civilization depend on thriving natural systems and the sustainable stewardship of those natural systems. This demands not only knowledge and commitment of health and environmental sciences, but inter- and transdisciplinary efforts from all research fields and societal and political actors.

Planetary health has three challenges:

- Challenges to the imagination: over-reliance on GDP as a measure of human progress, failure to consider future health and environmental harms alongside current gains, and the disproportionate impact of these harms on the poor and people in developing countries.
- Research and information challenges: an increasingly molecular approach to human wellbeing that ignores the social and environmental context, a historical lack of transdisciplinary research and funding within the health community, and an unwillingness or inability to deal with uncertainty in the decision-making process.
- Governance challenges: how governments and institutions recognise and respond to threats, especially when faced with uncertainties, pooled common resources, and time lags between action and effect.

Citizen science could be one way to address these challenges.

Funding/Sponsoring

The conference is hosted and organised by the Museum für Naturkunde Berlin (MfN) in collaboration with ECSA. The Welcome Reception is co-organized by the German Citizen Science Platform 'Bürger schaffen Wissen' and is funded by the German Federal Ministry of Education and Research (BMBF). The conference will be complemented by a Satellite Symposium organised by the EU-funded project CS Track and ECSA and hosted at MfN.

MUSEUM FÜR NATURKUNDE | DINO HALL

	ECSA 2022 // Welcome Reception sponsored by Bürger schaffen Wissen
18.00	Admission of the conference participants with registration
18.30	General Director Johannes Vogel
	Words of welcome
18.35	Parliamentary State Secretary of the Federal Ministry of Education and Research Mario Brandenburg
	Welcoming address
18.45	Video message by Eckart von Hirschhausen, Gesunde Erde Gesunde Menschen
18.50	Transecology, Plenary lecture by Brigitte Baptiste, Universidad Ean, Colombia
19.20	**Citizen Science Market – Food & Drinks**

01. The German Citizen Science Plattform, Moritz Müller (Museum für Naturkunde Berlin) and Wiebke Brink (Wissenschaft im Dialog)
02. My thing – I am what I (don't) have, Viola Muster (ConPolicy Institute for Consumer Policy)
03. Changing Natures. Collecting the Anthropocene Together, Ulrike Sturm (Museum für Naturkunde Berlin)
04. On your marks! – Citizen Science in your city, Julia Lorenz (Museum für Naturkunde Berlin) and Florence Mühlenbein (Wissenschaft im Dialog)
05. IncluScience – Accessibility Data by and for Citizens, Marie Lampe and Sarah Krümpelmann (Sozialhelden e.V.)
06. GINGER – Exploring society together, Sophie Segler (University of Bremen)
07. Greetings & Kisses – Letters digital. Citizens receive love letters, Andrea Rapp (Technical University of Darmstadt) and Eva L. Wyss (University of Koblenz Landau)
08. SelEe – Researching rare diseases through citizen science, Andreas Khouri and Thomas Zerr (Hof University)
09. Researching housing quality in large housing estates with children and adolescents C/O: ——— , Karolin Fahl and Oscar Mehlitz (Technical University of Berlin)
10. UndercoverEisagenten – The bird's eye on permafrost change, Marlin Müller (DLR) and Pauline Walz (HeiGIT)

22.00	**Closing**

14.00 • 16.00	**UNESCO/Citizen Science and Open Science CoP (CSGP) workshop**
	**ECSA Working Groups	Meetings** Please register here in advance: **https://forms.gle/TvQ8ZN9a3xBwShMY7**
14.00 • 16.30	• **Citizen science for health** • **Agrifood** • **Air quality**
16.30 • 18.00	• **Empowerment, Inclusiveness & Equity** • **Learning and Education in citizen science** • **Storytelling and other arts**

The workshop and meetings will be held inside the Museum and it will not be possible to access independently. It is essential to be in front of the Museum 10 minutes before the start of the meeting. A staff member will accompany you to the assigned room.

Bürger schaffen Wissen
Die Citizen Science Plattform

BÜRGER FORSCHUNG
Wissenschaft für alle!

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

THE GROUP PHOTO WILL BE TAKEN DURING THE OPENING CEREMONY

LANGENBECK-VIRCHOW-HAUS

MUSEUM FÜR NATURKUNDE

	Audimax ▷ max n. of people 500	Bernhard v. Langenbeck max n. of people 90	Rudolf Virchow Room max n. of people 25	August Bier Room max n. of people 25		Event Hall max n. of people 60
08.00 • 08.45	Registration & Coffee | Foyer & Wandelhalle					
08.45 • 09.00	Words of Welcome					
09.00 • 09.30	**Planetary health, climate crisis and what we can do about it** **Sabine Gabrysch** Potsdam Institute for Climate Impact Research					
09.45 • 11.15	**Oral Session 1: Towards global sustainability for planetary health** Chair: Sabine Wildevuur **Martin Brocklehurst** Empowering Zero-Emission Citizens – Horizon 2020 Project AURORA **Alba de Agustin Camacho** Contribution of citizen science to the sustainable development of Small Island Developing States **H. Ulrich Hoppe** Between Exoplanets and Planetary Health: Viewing Citizen Science through the SDG Lens **Athanasia Orfanou** The role of sustainable waste management in the carbon	**Oral Session 2: Apps and Sensors** Chair: Rosa Arias **Zivko J. Zonta** Beyond software scale-up of citizen-science apps: the challenge of data reuse and fair acknowledgement of contributions **Gregoire Lois** AI in Citizen Sciences: can help but... **Kaori Otsu** Could AI replace human intelligence: a systematic review on citizen science **Minh-Xuan Truong** Nature through the AI lens: How scientists shape people's experience of natural environments in algorithmdriven citizen science	**Interactive Session 1: Governance of participation in Citizen Science for societal transformation** **Maria João Maia, Valeria** Arza, Patrick van Zwanenberg	**Interactive Session 2: Rethinking public services provision citizen science to support: public and environmental health services** **Anna Berti Suman, Nils Heyen, Marisa Ponti, Sven Schade**	09.55 • 10.55	**Oral Session 3: Motivation, Impact & Evaluation I** Chair: Sabrina Kirschke **James Sprinks** Assessing the impactof citizen science on planetary heath through governance, economy, environment, society, and science using the MICS platform **Jay Mulmi** Multidisciplinary approaches to the involvement and motivation of citizen scientists in research on disease vector monitoring in Uganda and DRC **Aaron Joshua Peltoniemi, Ohto Sabel** Learning and knowledge building in citizen science

▷ All sessions held in the Audimax will be streamed through the ECSA YouTube channel: https://www.youtube.com/c/ecsaeuropeancitizenscienceassociation

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	footprint of pilot cities: Presenting the CO2 calculator of COMPAIR **Claire Burnel** Tracing citizen science-based biodiversity indicators: uses, influences and contributions to environmental public policies **Stephanie Chuah** Mapping sand mining	**Linda See** Combining a Rapid Image Classification App with Artificial Intelligence through the Picture Pile Platform for Citizen Science			**Liubov Tupikina** City Nature Challenge: network methodology to analyze participation in citizen science activities across cities (CANCELED)
11.15 • 11.45	Coffee & Snacks				Walk'n Talk
11.45 • 13.15	**Oral Session 4: Citizen Science in Education and Schools** Chair: Alexandra Moormann **Zacharenia Daskalaki** Children as young researchers and intergenerational ambassadors of Citizen Observatories: A case study of a pedagogical use of Pl@ntnet within an environmental education project **Dusan Misevic** Promoting scientific literacy in evolution through citizen science **Heidi Ballard** "I'm technically a mini	**Oral Session 5: Pollinator Citizen Science** Chair: Dilek Fraisl **Miranda Bane** Growing pollinator citizen science across Europe **Poppy Lakeman Fraser** Cross-pollinating ideas for planetary health **Christina Bantle** The potential of citizens' biodiversity associations for addressing planetary health **Susan Karlebowski** Crop production success and pollinator diversity: Insights from a citizen science project in urban community gardens	**Interactive Session 3: Challenges, Strategies and Impacts of doing Citizen Science with Marginalised and Indigenous Communities: Towards a toolkit that can be applied in all contexts** **Dimitris Argyriou, Petra Benyei, Finn Danielsen, Rick Hall, Timothy C. Woods**	**Interactive Session 4: Co-designing solutions for the sustainability and governance of citizen observatories** **Sonia Liñán, Karen Soacha, Alex Amo, Blanca Guasch**	12.00 • 13.00 **Oral Session 6: Citizen Science Platforms I Global and National Hubs** Chair: Daniel Dörler **Floor Keersmaekers** Citizen Science at Universities: The Launch of a Citizen Science Contact Point at the Vrije Universiteit Brussel **Sarita Albagli** Civis: Brazilian Citizen Science Platform **Tomer Gueta** Israel Citizen Science Center - Establishment Perspectives

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	scientist now": Environmental Science Learning by Young People across Online and Field-based Community and Citizen Science **Maria Daskolia** Integrating citizen science in school environmental education within the European Cos4Cloud project: overall strategy and supporting actions **Claire Murray** SEEDS - Science by Teenagers for Teenagers **Kamel Labibes** Erasmus Maris: A Citizen Science initiative for secondary schools	**Natalia Ghilardi-Lopes** Citizen Science and pollinators of South America **Natalia Ghilardi-Lopes** Engaging beekeepers in citizen science: evaluation of a Brazilian initiative				**Sofia Mojica Baquero** The creation of Citizen Science Hubs in RPFOs. The UAB Citizen Science Hub pilot
13.15 • 14.15	Lunch Break				13.15 • 14.15	Walk'n Talk
14.15 • 15.45	**Oral Session 7: Monitoring the environment together: from practitioners to policy makers** Chair: Sabrina Kirschke **Gitte Kragh, Michael K. Poulsen** Mobilizing local communities and expedition	**Oral Session 8: Creating knowledge together: Diversity and Inclusion** Chair: Claire Murray **Katerina Zourou, Stefania Oikonomou** Citizen science for environmental and health issues in conflict zones	**Interactive Session 5: Air Quality an d Planetary Health** **Hester Volten, W outer Hendricx, Yen-Chia Hsu, Anna Mar ia Kotrikla, David Riallant, Teije Terhorst, Diana Varaden, Amber W outersen**	**Interactive Session 6: Citizen Social Science:Concepts, practices and experiences from the CoAct project** **Isabelle Bonhoure, Josep Perelló, Franziska Peter, Valeria Arza, Guillermina Actis, Teresa Wintersteller, Veronika Woehrer, Katja Mayer, Stefan Thomas**	14.30 • 15.30	**Oral Session 9: Technology and Tool Boxes** Chair: Jaume Piera **Lucy D. Robinson** Assessing ecosystems and natural capitalperspectives on an eDNA approach within the GenePools project

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	cruise passengers in the Arctic to address issues of planetary health **Maria J. Henao Salgado** Implementing citizen science in the flood early warning system of urban-mountainous catchments **Mariela Yevenes** Citizen science as a co-creative measure to water quality: Chemical data and local participation in a rural territory **Linda Mederake** Evaluating environmental policies with citizen science data? An example from the Plastic Pirates investigating plastic pollution of rivers **Matrona Pappa** Citizen observatories as educational tools in school environmental education: "My own private 1m²" and "Scenting around-the-walk the environmental odours' trail"	**Kris Bevelander** Inclusive health research feels good! **Barbara Heinisch** Linguistic and cultural diversity for planetary health **Ekaterina Egorova** Urban blue, place-bonding and planetary health knowledge: A citizen science project with temporarily displaced children **Tali Tal** Co-created citizen science in school: Serving the poor and the wealthy **Hacer Tercanli** Enhancing diversity and inclusion in Citizen Science – Potential future directions				**Janice Ansine** Creating the Cos4Cloud Tool Box & Evidence Hub - a resource for citizen observatories **Jacob Koglin, Nona Schulte-Römer** The Nightlights app – empowering young and old to create their own citizen science campaign **Julia van Calis** Developing a sensitive chatbot for citizens experiencing challenges in accessing health care
15.45 • 16.15	Coffee & Cake				15.45 • 16.15	Walk'n Talk

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LANGENBECK-VIRCHOW-HAUS

Audimax ▷ max n. of people 500

16.15 • 17.45

Oral Session 10: Healthy cities: resolving Human-Nature Conflicts through Citizen Science

Chair: Gitte Kragh

Mohammad Gharesifard
CitiMeasure - citizen science for smart and healthy European cities

Valentin Baumstark
A citizen science experiment on public lighting policies: a helpful step toward a 'dark infrastructure' at a local level?

Elisa Lopes da Silva
From Lisbon to the planet: environmental scales in tourism practices shaping the city

Claire Narraway
How good are gardens for wildlife? An analysis of the quality of wildlife friendly interventions in UK gardens

Nienke Beets
What's that weed on the street? – Motivation and attitude of participants in the 'Pavement plant' citizen science project

Bernhard v. Langenbeck max n. of people 90

Oral Session 11: Ethics & Policy: how do we strengthen social innovation with Citizen Science?

Chair: Claire Murray

Kirsten Vegt
Measuring together, trusting each other? Disagreeing stakeholders collaborate to measure air quality in a rural area in The Netherlands

Clara Schwindt
Understanding the loyalty of citizen scientists in biodiversity citizen science programs

Jacqueline Goldin
Keep the flow what has yarning got to do with citizen science

Guillermina Actis, Valeria Arza
Policy perceptions about the contribution of citizen social science on policy making: a case study on environmental justice

Aletta Bonn
Citizen Science to foster social innovation: Citizen Science Strategy 2030 for Germany

Rudolf Virchow Room max n. of people 25

Interactive Session 7: A Citizen Science project which contributes in improving the selective municipal waste collection system

Diana Reinoso

August Bier Room max n. of people 25

Interactive Session 8: Empowerment and innovation through co-creative youth citizen social science - An interactive session organized by the H2020 YouCount project

Reidun Norvoll, Julie Ridley, Ingar Brattbakk, Egle Butkeviciene, Cathrine Skovbo Winther, Sara Plassnig, Michael Søgaard Jørgensen

MUSEUM FÜR NATURKUNDE

Event Hall max n. of people 60

16.30 • 17.30

Oral Session 12: The future of our nutrition: food production and healthy soils

Chair: Katja Radon

Dominique Desclaux
From national participatory plant breeding projects to European multi-actor food living-labs: how to consider planetary health?

Pierre Ganault
Agroecological transition in schools for a better human and soil well-being: perceptions, potentials and commitments, the SOLALE-COLE project

Gülbanu Kaptan
Using citizen science to explore plant breeding and investigate food-chain transparency for novel breeding methods

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		Rachel Pateman Co-created citizen science in low- and middle-income country cities		
17.50 • 18.00	**Closing words**			
18.00 • tba	**Individual networking** The conference organisers will provide ideas and a list of restaurants			

BE/NL CS-Meetup @The Castle at 20.00

MUSEUM FÜR NATURKUNDE

	Event Hall max n. of people 60
	Chantal Gascuel-Odoux Healthy soils for a healthy planet. State of the art and perspectives for developing citizen science on soils in France
17.50 • 18.00	
19.00 • 21.00	Pubquiz @ The Tipperay

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LANGENBECK-VIRCHOW-HAUS

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08.00 • 08.45	Registration & Coffee | Foyer & Wandelhalle				
08.45 • 09.00	Words of Welcome				
09.00 • 09.30	**Plenary Talk: Citizen Science in the Global South** **Peter Elias** University of Lagos, Nigeria				
09.40 • 11.10	**Oral Session 13: Human Health: Patient Research, Epidemiology, & Foresight** Chair: Kim Grützmacher **Liselotte Rambonnet** Using passive citizen science to map the effects of COVID-19 litter on animal life **Josep Perelló** CoAct for Mental Health **John R. B. Palmer** Nowcasting UrbanVector Mosquitoes for Epidemiological Preparedness **Timo Faltus** Citizen Science in Medical and Health Science Projects - Legal Questions and Medico-Ethical Contradictions due to Participation	**Poster Session A1**	**Interactive Session 9: The wickedness of citizen science, law and planetary health: grappling with trust, democracy and representation** **Dick Kasperowski, Anna Berti Suman**	**Interactive Session 10: Peer-to-peer learning: citizen science and botanical gardens** **Stefano Martellos, Nienke Beets, Vito Emanuele Cambria, Sofie Meeus, Baiba Pruse**	
09.55 • 10.55					**Oral Session 14: Motivation, Impact & Evaluation II** Chair: Sabrina Kirschke **Berj Dekramanjian** Differences in the participant structure and motivation of an analog and a digital mosquito-related citizen science project **Alexandra Villarroel, Laure Turcati** Evaluating participatory science and research beyond their diversity. An example from a citizen observatory of urban environment **Barbara Kieslinger** Towards Principles for Co-evaluation in Citizen Science based on Experiences in Human and Environmental Health Research

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	Ria Wolkorte Citizen science for health in action: gaining insightin fatigue for people with rheumatoid arthritis **Claudia Robbiati** Exploring the impact of large-scale planetary health challenges on positive community health in Kenya				**Margarita Angelidou** Monitoring and evaluating the impact of university-led citizen science at institutional, urban, regional, and global level
11.10 • 11.45	Coffee & Snacks				Walk'n Talk
11.45 • 13.15	**Oral Session 15: Biodiversity Monitoring for Planetary Health** Chair: Gitte Kragh **Michael Pocock** Precision citizen science developing adaptive sampling through co-design for biodiversity monitoring **Natalia Ghilardi-Lopes** The Citizen Science Program at the National Institute of the Atlantic Forest (Brazil): results from 2019-2021 **Emu-Felicita Ostermann-Miyashita** Opportunities and challenges of citizen science for monitoring a recolonizing megaherbivore	**Poster Session A2**	**Interactive Session 11: How to measure engagement and behavioral change in a citizen science project?** **Pavel Kogut, Diego Casado Mansilla, Athanasia Orfanou, Celien Van Gorp, Maria Tsourma**	**Interactive Session 12: A hands-on workshop on plant conservation through storytelling and citizen science** **Andrea Isabel Troncoso Quilaqueo**	12.00 • 13.00 **Oral Session 16: Citizen Science Platforms II: Thematic Initiatives** Chair: Claudia Fabó Cartas **Thomas Lemmerz** OpenGeoResearch – A citizen science platform to collect geospatial research questions for planetary health **Daniel Mietchen** Interactions between citizen science and the ecosystem around Wikipedia **Elisabeth Heyne, Julia Tovote, Frédérique Chlous, Romain Julliard, Alicia Mansilla Sánchez, Mira Witte, Ulrike Sturm** Collecting the Anthropocene Together:

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	Benoit Fontaine Citizen science to mitigate the biodiversity crisis: lessons from Vigie-Nature, a long-term, large-audience biodiversity monitoring schemes network **Daniel Dörler** 7 years of ProjectRoadkill: A multi-stakeholder-approa-ch to improve amphibian conservation in Austria **Céline Liret** 'Objectif Plancton', a citizen science programme dedicated to coastal plankton				Developing a Participatory, Digital and Experimental Platform on Environmental Transformations **Katharina Kloppenborg** Personal Science Wiki
13.15 • 14.15	Lunch Break				Walk'n Talk
14.15 • 15.45	**Oral Session 17: Ways to preserve healthy oceans and fresh water** Chair: Jaume Piera **Macarena Marambio, Maria Vicioso** Observadores del Mar - A Marine Citizen Science Platform working for a healthy Ocean **Sabrina Kirschke** Groundwater monitoring through citizen science – A	**Poster Session B1**	**Interactive Session 13: How to plan for impact? Using logic modelling to orient participatory research on planetary health towards societal impact** **Mathieu Mahve-Beydokhti, Chiara Cardelli**	**Interactive Session 14: How can we build trust in citizen science data to inform policy decisions and action?** **Dilek Fraisl**	14.30 • 15.30 **Oral Session 18: Communication, Coordination & Storytelling** Chair: Enrico Balli **Mathias Becker** **Facilitating** Citizen Participa-tion in Scientific Agenda Setting through Participatory Storytelling and Multi-Per-spective Visualization

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	review of project designs and results **Ana Ilse Benavides Lahnstein** Science learning through marine community science in the Yucatan Peninsula **Alina Luna** Citizen Science as a key tool in integrated ocean and costal observing systems **Tania Jenkins** CoFish: co-creating a research project with fishers for sustainable lake fisheries!				**Anna Soßdorf** Why it matters to be heard – The Relevance of Science Communication and Recognition in Citizen Science Projects **Kai Nils Weeber, Nicolas Felipe Gutierrez Paez, Ohto Sabel Is it a match?** Motivations on citizen science volunteers and recruitment arguments in project descriptions **Sonia Liñán** A new theoretical engagement framework for citizen science projects using a multi-temporal approach to address long-term public engagement challenges
15.45 • 16.15	Coffee & Cake				Walk'n Talk
16.15 • 17.45	**Oral Session 19: Addressing Climate Change and advocating for Environmental Justice** Chair: Katrin Vohland **Naomi Saville** Catalysing Climate Change Advocacy amongst Rural Nepalese Youth through Citizen Science	**Poster Session B2**	**Interactive Session 15: DBU-ThinkCamp on Public Engagement for planetary health** **Kim Grützmacher, Susanne Hecker**		16.30 • 17.30 **Oral Session 20: Social Citizen Science and Humanities** Chair: Barbara Kieslinger **Manh Khoi Ngo** How monetary incentives potentially improve the recruitment of participants in citizen science: Results from a survey in Germany

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	Leticia Castro , Valerie Arza, Guillermina Actis Co-design process of a citizen-social-science platform for environmental justice in Buenos Aires, Argentina **Pia Viviani** Finding, measuring an improving heat hotspots using citizen science **Amaranta Heredia** Addressing the complexity of hydro-climate risk: The experience of the citizen observatory of Drought (Spain) **Melvine Otieno** Adapting to a changing environment: Inspirations from Eastern Africa **Marjan a Brkić** Citizen science as a powerful tool for climate action				**Cláudia Carvalho** Exploring methodological approaches for citizen science: sharing experiences from a pilot initiative in the social sciences **Michael Soegaard Joergensen** From civil society repair cafes to empowering repair citizen science **Sander Hermsen** Design Thinking in Citizen Science: using methods from participatory design to support citizens in shaping the research agenda
17.50 • 18.00	**Closing words**				
18.00	**Individual Networking:** the conference organisers will provide ideas and a list of restaurants				
19.00 • 1.00	Social Evening, Jung&Schönn by Raumklang				

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MUSEUM FÜR NATURKUNDE | HS 7 ADLERPORTAL

9.00 • 13.00 ca.	**Satellite Symposium The Nature of Citizen Science** organised by the CSTrack Project & ECSA • hosted by Museum für Naturkunde Berlin **Understanding the nature of Citizen Science in a rapidly changing world** The CSTrack project applies data analytics and web analytics on publicly available data and collect data through questionnaires and interviews with people who take part in citizen science activities. Data from more than 4500 projects on the web more than 1000 questionnaire from 30 European countries generated insights about citizen science and its impact in various areas during the past three years. The symposium is open to all interest conference participants. More info here: https://cstrack.eu/
13.00 • 14.00	Lunch, sponsored by CS Track
14.00	**Excursions** 01. BEhind-the-Scenes Tour at Museum für Naturkunde Meeting Point at 14:30, main entrance of the Museum für Naturkunde 02. Berlin Wall Walking Tour Meeting Point 14:30, S-Bahn Nordbahnhof 03. Nature Reserve "Storchenschmiede Linum" Meeting Point 14:30, Portal 5, Museum für Naturkunde Ending at 20.30 at Museum für Naturkunde

10.00 • 11.30	Citizen science for health
10.00 • 11.00	Citizen science networks
11.00 • 12.00	Combined European Citizen Science Platform and Citizen Science Networks
12.00 • 13.00	European Citizen Science Platform

The meetings will be held inside the Museum and it will not be possible to access independently.
It is essential to be in front of the Museum 10 minutes before the start of the meeting. A staff member will accompany you to the assigned room.

Please register here in advance:
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ABSTRACTS

PLENARY TALKS

Transecology

Brigitte Baptiste

Brigitte Baptiste is a Colombian biologist graduated from the Pontificia Universidad Javeriana,with a Master's degree in Tropical Conservation and Development from the University of Florida. She is Doctor Honoris Causa in Environmental Management from Unipaz University and was recently awarded with an Honoris Causa degree in Law from the University of Regina.

She was the director of the Alexander Von Humboldt Biological Resources Research Institute for nearly 10 years and currently serves as the President of the Ean University, a higher education Institution focused on sustainable entrepreneurship.

She is considered an expert on environmental and biodiversity issues and is an important leader in gender diversity, being recognized for its participation at international congresses related to these topics. It has also been a reference in the achievement of important bridges between politics, academia and science and was chosen as one of the 25 world experts of the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) between 2016 and 2019.

Abstract

There have been many ways to understand ecology since the inception of the term at the end of XIX century. The use of ecology as a heuristic device has produced a very rich field of interpretative approaches not just in biology, but for businesses and firms, institutions, laws and many other highly relational domains. Ecology has also helped to understand the role of diversity in evolution and innovation, which is the reason behind the cultural struggle to consider sex, gender and care strategies as key devices for adaptation and finally, to build sustainabilty. Transformative change, an emerging buzzword in environmental and social studies is becoming part of a shared vocabulary with transgender studies and queer ecologies, perhaps a surprising result of the human growing awareness as shapers of the world, a role which may also need to accept new identities and ways of being.

Planetary health, climate crisis and what we can do about it

Sabine Gabrysch

Sabine Gabrysch is a medical doctor and epidemiologist with a focus on Global Health. She is Professor for Climate Change and Health at Charité – Universitätsmedizin Berlin and Department head at the [www.pik-potsdam.de/en] Potsdam Institute for Climate Impact Research (PIK). Guided by the transdisciplinary concept of planetary health, she aims to assess health and nutrition impacts of global environmental change and evaluate win-win solutions for the transition towards climate-resilient, sustainable and healthy food systems. She is a member of the German Advisory Council on Global Change (WBGU).

Abstract

Planetary health is about the health of humans and other living beings, of populations and ecosystems, and of the whole living planet Earth, appreciating the deep connectedness of all life. To face the challenges of heal-

th threats like climate change adequately, we need to reshape our way of living fundamentally. Currently, we are transgressing several planetary boundaries and getting close to dangerous tipping points in the Earth system. Reshaping our ways of life will require major shifts in our worldview, our relationship to nature, and our values. In her talk, Sabine Gabrysch will show the complex web of interrelations between ecosystems, climate and health and outline ways out of the planetary crisis if we join forces.

Citizen science approaches for advancing planetary health in Africa

Peter Elias

Peter Elias holds a Ph.D. in Geography from the University of Ibadan, Nigeria. He is a Senior Lecturer in the Department of Geography, and Team Lead, Lagos Urban Studies Group (LUSG), University of Lagos. He is a co-chair CODATA WDS Task Group and the West African Coordinator, Citizen Science Africa Association. His research interest is in Development Geography focusing on Urbanization, Environment, and Sustainable Development nexus. He has almost two decades of teaching, research, and consultancy experiences in science-policy-society and expertise in transdisciplinary research on sustainability, participatory data for the SDGs citizen science data, knowledge co-design, and co-production, and stakeholders' mapping and engagement.

Abstract

Large citizens of Africa depend mainly on the provisioning services of fast degrading and delicate ecosystems for lives and livelihoods. Given the rapidly increasing African population estimated at 4.4 billion by 2100 and the small environmental footprints, it is imperative to embrace sustainable approaches to addressing planetary health challenges (Ezeh, 2016). There are diverse citizen science approaches grounded in local knowledge, aspirations, and practices to advance planetary health in Africa which must be identified, documented, and promoted. This keynote paper gives a synopsis of local knowledge, aspirations, and practices of citizen science and how they are advancing planetary health in Africa. As an emerging subject in Africa, the keynote speech will dissect some citizen science perspectives on planetary health in Africa such as participatory data collection, collectives, self-help, and knowledge co-production. This will be followed by a brief history of citizen science in Africa including its growth and the conceptualization of the Citizen Science Africa Association (CitSciAf) in 2017. It will document and present some common citizen science practices in Africa. These citizen science practices shall include projects, activities, and case studies in agriculture and food security, ecology and environment, human health and medicine, public finance and governance, climate change and security, service and resilience, knowledge co-design and co-production, sustainability and the SDGs, participatory GIS, and gender inclusion and diversity. The keynote paper also highlights how these approaches are advancing planetary health and safeguarding ecosystem health for improved lives and livelihoods amid several challenges in Africa. Citizen science benefits for planetary health in Africa have been documented in climate action, biodiversity monitoring, natural habitat restoration and protection, disaster risk reduction and resilience building, forest management, environmental health, water and sanitation, and coastal environmental management. Increasing the awareness and capacity of citizen science to advance planetary health will boost the provisioning services of the ecosystems and safeguard human well-being in Africa. The keynote paper recommends that the African continent and indeed all friends of planetary health, globally, support a system that safeguards the long-term management of citizen science initiatives, identifies additional opportunities and solutions to all inhibiting factors, promotes and documents citizen science activities, supports data collaboratives, and mobilises resources for the growth of citizen science in Africa.

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Format: 10-minute presentation + 5-minutes Q&A each presentation.

Citizen science is increasingly being used in health-related research. For example, citizens can help track epidemics in real time, contribute to important scientific research about folding proteins, or explore questions such as how pollution and odours are affecting our health. In this session, we will focus on issues around data quality, methodologies and research results, and on how citizen science in health and biomedical research can be integrated into policy making.

Session 1:

Towards global sustainability for planetary health

Session chair: Sabine Wildevuur

Empowering zero-emission citizens – Horizon 2020 Project AURORA

Martin Brocklehurst

The AURORA project is a research project designed to illustrate how to empower citizens across the EU to make informed energy decisions and illustrate that if citizens act at scale they can make a major contribution to improving planetary health and drive carbon emissions down. Citizens who through their own choices are responsible for 30% of all carbon emissions, will monitor their individual energy behaviours. Using a mobile APP they will be able to plan their own journey to meet the Paris Climate Change targets, receive automated real time recommendations on what they can do to reduce both their carbon emissions and energy costs. They will also be offered the opportunity to become active "prosumers" to transform the energy system at large and democratise its governance through crowd funded local energy communities that will build ca 1 megawatt photovoltaic solar installations across 5 pilot sites. The scheme is targeting youth through 4 University based pilots and one Municipality from a socially deprived area to illustrate that the solutions will work for young and old alike. Participants will be able to offset part of their carbon emissions based on their own personal investment in the community schemes that are being designed so that everyone can take part. A unique personal labelling scheme will be offered to track and demonstrate their progress towards being zero carbon citizens. The global climate change crisis is the greatest disrupter of planetary health. This research will produce a route map to show how citizens can make a difference and increase pressure on Governments to move away from empty promises that fail to deliver. It is part of a major research effort to demonstrate that citizen science at scale can make a major contribution through the EU Green Deal to deliver the carbon reductions now so urgently needed across the planet.

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Contribution of citizen science to the sustainable development of Small Island Developing of States

***Alba de Agustin Camacho, Liesbet Jacobs, Mieke de Droog, Wim van Petegem**

Small Island Developing States (SIDS), located in the Caribbean Sea, the Atlantic, Indian, and Pacific Oceans, are recognized as a distinct group of developing countries for their vulnerabilities, isolation and relatively small size. These vulnerabilities for society, environment, and economy have

increased with the rapid anthropogenic transformation of natural processes. Additional challenges hampering their development is the lack of data, limited human capacity and the post-colonial knowledge dependency. To create resilient communities, recognition of local knowledge in decision making and designing applicable solutions is key. In these processes, citizen science brings societal and political actors together and offers the opportunity to conduct inclusive island research. In addition, citizen science can contribute to the United Nations Sustainable Development Goals (SDGs) by gathering monitoring data and defining indicators that respond to local realities. Although there is significant potential for citizen science to compensate for limited human and economic resources in developing countries, only few implemented citizen science projects in SIDS are reported. In this contribution, we present the results of a PRISMA scoping review of citizen science case-studies in SIDS. We investigated project design characteristics to understand how citizen science projects are implemented in SIDS context. Results show that most projects aim for productivity goals, with few prioritizing democratization goals, and some others combining both goals. None of the analyzed case-studies currently contribute to SDG monitoring, however, all of them could potentially support the SDG agenda. Many case-studies align with SDG 14 (Life below water), but projects covering topics such as health (SDG 3), and resilient cities and communities (SDG 11) are also reported. Additional insights into the contribution of citizen science to sustainable development were obtained from semi-structured interviews with NGOs, and governmental departments reporting on SDG monitoring. Presenting the results of this study, we contribute to the existing body of knowledge by showcasing characteristics of citizen science projects in SIDS and the potential for SDG monitoring. This expertise is key for understanding the role of citizen science in supporting the well-being of these communities and in reducing their dependencies.

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Between exoplanets and planetary health: viewing citizen science through the SDG lens

***H. Ulrich Hoppe, Cleo Schulten, Patricia Santos Rodriguez, Miriam Calvera Isabal, Reuma De-Groot, Yaela Golumbic**

Several contributions to recent research on citizen science (CS) address the interconnection of citizen science projects with Sustainable Development Goals (SDGs). This synergy between citizen science and the pursuit of SDGs as part of a planetary health strategy is certainly positive and desirable, yet it can be problematic if used as a generalised criterion for judging the quality and relevance of citizen science activities. The ongoing EU project CSTrack has developed computational methods and tools for analysing citizen science projects based on their manifestation in web spaces and social media. These include the automated analysis of project descriptions in terms of their semantic relation to research areas (RAs) and SDGs. Regarding RAs, we see a prevalence of multidisciplinarity (average of 3.34 RAs per project) in a sample of 218 citizen science projects taken from the Zooniverse platform. The dominant areas are "biodiversity & conservation" and "environmental sciences & ecology" followed by "remote sensing", "ornithology" and "astronomy & astrophysics". As to be expected, projects associated with the first two areas are "rich" in connections to SDGs, whereas this much less the case for "astronomy & astrophysics". Whereas classification systems for RAs rely on existing taxonomies of science, the inter-dependencies of SDGs are less explicit although there are plausible semantic proximities between SDGs, such as #3 (Good health and well-being) and #6 (Clean water and sanitation). We have analysed the co-occurrence of SDG associations for citizen science projects. Here, the most strongly connected clusters were 5-8-1 (Gender equality, Decent work and economic growth, No poverty) and 6-14-12 (Clean water and sanitation, Life below water, Responsible consumption and production). This indicates that the ways in which citizen science projects take up SDGs may deviate from a priori assumptions. The association of citizen science activities with SDGs is a sufficient criterion related to social benefit and societal relevance. However, there are legitimate areas of citizen science (like astronomy/astrophysics) that will not do well under the "SDG lens", although they are likely to have positive general effects on the understanding of

scientific methods and science education. It is important to bear this in mind when judging citizen science in connection to SDGs.

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The role of sustainable waste management in the carbon footprint of pilot cities: presenting the CO2 calculator of COMPAIR

***Athanasia Orfanou, Demetris Francis Lekkas, Eleftheria Klontza, Stergios Vakalis**

The overall carbon footprint of citizens is affected by several factors, but primarily by the electricity expenditure, the travelled distance, the consumption behaviour, and the municipal solid waste (MSW) management. The latter is the factor that can be altered by a significant percentage by the implementation of behavioural changes but also the integration of circular economy practices. Although waste recycling and recovery are widely applied strategies in the EU, the targets of Circular Economy have not been fully met. Characteristically, by 2050 more than 75% of MSW should be recycled and less than 10% should be disposed of in landfills. These targets have created a capacity vacuum in waste-to-energy (WtE) recovery practices and by 2050 the WtE industry should be expanded by 40 million tonnes per year in the EU. This present study has developed a CO2 citizen calculator for several European cities in the framework of the HORIZON project COMPAIR. COMPAIR, through citizen science, provides the citizens with tools for monitoring their impact on the environment, understanding it and altering it. Specifically, the Carbon Footprint Simulation Dashboard helps citizens to predict how future CO2 emissions can be decreased when daily habits are changing. This way, users are guided to choose more environmentally friendly options. The cities of Athens and Berlin have been used as pilots for presenting the preliminary results of the CO2 calculator and the role of sustainable waste management is discussed. Athens produces more than 2 million tons of municipal solid waste annually and their majority is disposed of in landfills. Calculations with the EPA's software LandGem simulate greenhouse gases (GHG) emissions higher than 100 million tonnes for a 100-year projection (112 Mt). For the same timeframe, WtE produces almost half the amount of GHG emissions (68 Mt). A similar analysis will be presented for Berlin and comparison will be made for the overall CO2 footprint of citizens by utilising the CO2 calculator of COMPAIR that will be presented for the first time. Population size along with consuming habits and sustainable waste management behaviour of citizens can reduce significantly the overall CO2 footprint, especially CO2 from landfilling.

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Tracing citizen science-based biodiversity indicators: uses, influences and contributions to environmental public policies

Claire Burnel

Protection of biodiversity, which is crucial to foster planetary health, heavily depends on the production and circulation of scientific data among public administrations. Yet, environment citizen science is now commonly described as a very efficient and reliable way to collect large-scale data about biodiversity. From these data, many indicators are produced which describe the evolutions of ecosystems under current global changes. These indicators are diffused in the media, and towards the national or international environment agencies and institutions. They offer a crucial source of data to inform both public opinion and guide public policy design. Yet, the way these indicators circulate in the administration and are used to design biodiversity policies is largely unknown. Our work contributes to fill this gap by studying the public trajectory of biodiversity indicators produced by the French contributory observatories Vigie-Nature, managed by the National Museum of Natural History (MNHN). The production of these indicators is directly funded by the French Ministry of Ecological Moreover, a dedicated agency (the National Biodiversity Observatory) was created in 2011 to assess and publish official biodiversity indicators, which the two Vigie-Nature indicators are a part of. In this context, our study focuses on the actual use of these indicators by policymakers: are they used to create and evaluate public policies for nature protection? If so, which policies are those? And if not, why do these indicators not succeed in fulfilling the role that is expected of them (that is, putting scientific expertise at the service

of political decision-making)? To answer these questions, we led a qualitative study through 20 semi-directed interviews with researchers, members of the National Biodiversity Observatory and members of the Ministry of Ecological Transition. This work first highlights the limited use of these indicators in public policy making. More precisely, we show that these indicators are mainly used as strategic tools for various stakeholders, which is far away from their intended purpose. We deduce from our data some possible levers for a better use of biodiversity indicators to design environment public policies.

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Mapping sand mining

***Pascal Peduzzi, Arnaud Vander Velpen, Stephanie Chuah, Josefine Reimer Lynggaard, Yaniss Guigoz, Denisa Rodila**

Sand and gravels are the most extracted solid material by humans. We are extracting about 50 billion tons per year, this is enough to build a wall 27 m high by 27 m wide all around planet Earth every year. Mixed with cement to make concrete, it is used for all our infrastructures, sand is also used for glass, for computer chips, or for land reclamation. Our entire development depends on this commodity. However, sand is produced over hundreds thousand years through a slow erosion process. This means that our use is far exceeding the renewable rate. Despite our dependency on sand, there is no global reporting on where sand is taken from and how much sand is being used. Why do we care? Sand mining reduces the protecting role of the beaches against sea level rise, storm surge or on the salinisation of coastal aquifers, it destroys the habitat for turtles, crabs or birds, as well as touristic development possibilities. In rivers, sand extraction changes the river flows, has impacts on fishes and biodiversity, can lead to more droughts or more floods, and triggers river banks erosion. Here we would like to discuss the potential of citizen science for mapping sand mining especially in beaches and rivers environment. Can citizen science bridge the data gap and help monitoring impacts from sand mining? Can we identify the locations, the volume, the environmental and social impacts from sand mining? How can we easily collect geolocation and fast impacts estimation of sand mining on beaches and rivers. How to motivate the citizen scientists community?

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Session 2:

Apps and Sensors

Session chair: Rosa Arias

Beyond software scale-up of citizen-science apps: the challenge of data reuse and fair acknowledgement of contributions

***Zivko Juznic Zonta, Roger Eritja, John R.B. Palmer, Frederic Bartumeus**

Started in 2014, the citizen science project Mosquito Alert (http://www.mosquitoalert.com) is now a mature near-real-time surveillance system of five targeted disease-vector mosquito species of concern in the EU. On a worldwide scale, citizen scientists can send via cellphones adult mosquito and breeding sites pictures, report biting activity (human-mosquito encounters) and recently, they can even send actual specimens to reference labs. Mosquito pictures are evaluated by entomological experts who provide feedback to participants, support public health agencies and feed deep learning classification routines. To date, more than 211,000 people have registered in the app, and the system has received 85,356 reports from 33,874 participants in 170 countries. This prolific production of mosquito occurrence records makes of primary importance the implementation of FAIR principles to optimise the reuse of data. Moreover, as the project scales up, there is a growing need to strengthen the network of experts and to credit their voluntary work. The Mosquito Alert project is an interesting case study of multi-party collaboration between citizens, experts, AI and health stakeholders. In this context, we present the new Mosquito Alert Data Portal, discuss approaches to collaborative multi-author data papers and GBIF

datesets, and offer lessons learned on how to set up a crediting system for a fair acknowledgement of contributions.

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AI in citizen sciences: can help but...

***Gregoire Lois**

Artificial Intelligence has proven to be an incredible enhancement in many sectors. In natural sciences, it appears to be astonishingly effective to help with identification of taxa based on pictures (iNaturalist, PlantNet, ...) or sound recordings (BirdNet, Vigie-Chiros for bats and bush crickets...). AI implementation hence appears as a promising tool to efficiently improve both the speed and accuracy of taxa identification in citizen science programs targeting biodiversity components. Nevertheless, applied to some biodiversity monitoring citizen science s programs that rely on standardised data collection which in turn depends on voluntary involvement. In this context, learning processes appear to be key components ensuring continuous recruitment and motivation of participants. Using AI to provide instant taxa identification without any added knowledge in terms of diagnosis could erode motivation. We end-up with a paradox where improvement of the identification process through AI implementation can have detrimental effects on participants' involvement in some citizen sciences' initiatives. Based on several experiences from French and other international citizen sciences programs, we will show how AI integration can be beneficial, mainly in the context of opportunistic data collection. Secondly, we will argue that, as empowerment of participants is key to recruit and emulate participation, AI has to be carefully integrated not to replace brainwork in identification, but to help participants doing so. The risk being the one that we observe on a daily basis where GPS has driven most users to struggle with paper road map use.

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Could AI replace human intelligence: a systematic review on citizen science

***Kaori Otsu, Joan Maso**

With the increasing presence in citizen science projects, technology has significantly contributed to the simplification of data collection and management in monitoring systems connected to web platforms and mobile applications. Traditionally, data collected by citizen scientists have been validated by domain experts or other citizens, using human intelligence for classification and identification. Nowadays such tasks can be partially or fully automated due to the recent advancement in AI technologies to improve efficiency and support detecting, training datasets and making predictions.

To identify current research achievements and gaps in the area of AI applied to citizen science data, we reviewed existing AI approaches to automate tasks in citizen science projects. Specifically, using the topic search (TS) by Web of Science: TS = ("artificial intelligence" AND "citizen science"), our systematic review filtered all papers published in English up to 2021. By extracting the key information from the resulted papers, selected parameters were summarized into a database.

Main findings include that the use of AI in citizen science has emerged and increased over the last decade, highlighting shifts in domain areas ranging from astronomy, medical and health to environmental science, and in AI methods from Machine Learning to Deep Learning.

Based on lessons learnt from the Cos4Cloud project, we could argue that AI may continue to refine citizen science platforms and applications by adding service features and functions available to all levels of users, however, the variability in accuracy among different algorithms and methods has been addressed in several papers. Some critics even argued that the trend of replacing human intelligence with AI may threaten knowledgeable experts as well as reduce motivation of contributing citizens.

Nevertheless, validation and decision-making by experts will continue to be required, depending on the complexity of the data analysis. Our review suggests that hybrid approaches of AI and expert knowledge are both complementary.

(This work has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 863463.)

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Nature through the AI lens: how scientists shape people's experience of natural environments in algorithm-driven citizen science

***Minh-Xuan Truong, René van der Wal**

Automated species identification algorithms are increasingly commonly embedded in ecological citizen science programmes. They complement or replace active individual learning previously done with identification keys or naturalist books. Yet, this mediation by artificial intelligence raises questions about the individual experience of using these tools compared to a traditional naturalist experience that implies a more extensive embodied and cognitive commitment. It also raises the question how environmental knowledge is acquired and what eco-citizen involvement can result from it. In this qualitative study, we interviewed 20 scientists in charge of or having taken part in a citizen science programme involving these algorithm-driven identification tools. We asked them about the process of creating their programmes, their motivations for using these algorithms and their thoughts on how they influenced participants' experience with the programme. An inductive content analysis allowed us to highlight that our interviewees did not blindly adopted fashionable technology, but carefully negotiated its deployment (or lack thereof), thereby considering diverse ways of individual empowerment through participation in their citizen science programmes; particular attention was paid to the way individuals acquire environmental knowledge, make the tools their own and use them in their eco-citizen implication. We also identified significant differences in perception regarding the future use of artificial intelligence in the short and long term in these programmes involving citizens.

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Combining a rapid image classification app with Artificial Intelligence through the Picture Pile Platform for citizen science

***Linda See, Tobias Sturn, Santosh Karanam, Anto Subash, Ian McCallum, Steffen Fritz**

The Picture Pile web-based and mobile application allows for rapid classification by volunteers of different kinds of imagery, e.g., from satellites, drones, geotagged photographs and street view imagery. Picture Pile uses a simple process for data tagging whereby users view an image and then answer a question with yes, no or maybe by swiping the image to the right, left or downwards, respectively. An example of a question is: do you see evidence of deforestation, but any question with relevance to planetary health can be posed if the answer can be seen in the image. More recently, Picture Pile has been modified to allow users to classify data into categories (e.g., crop types) or along continuous scales (e.g., degree of wealth) so that additional types of information can be collected. Launched in 2014, we have run more than 15 different citizen science campaigns with Picture Pile to classify around 11.5 million images with the help of more than 4000 volunteers. These campaigns have covered many different areas of relevance to planetary health, including monitoring of the United Nations Sustainable Development Goals, from identification of deforestation to different types of land cover and human impact. The data generated can be used as training data for remote sensing classification algorithms, to validate or verify remotely sensed products, or to train computer vision algorithms to recognize features automatically. The Picture Pile Platform is the latest development, which allows any user to create their own 'piles' of imagery and run their own citizen science campaigns using the system. Whereas Picture Pile was initially designed for land use related applications, PPP can be used in any field where labelling tasks are required, e.g., in medicine, oceanography, geology, etc. This presentation will provide an overview of the current status of the Picture Pile Platform along with the data sharing model, the incentive system for participation, the machine learning component and the vision for how the platform will function operationally to aid the monitoring of planetary health in the future.

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Session 3:

Motivation, impact & evaluation I

Session chair: Sabrina Kirschke

Assessing the impact of citizen science on planetary health through governance, economy, environment, society, and science using the MICS platform

***Sprinks James, Luigi Ceccaroni, Sasha Woods, Stephen Parkinson, Uta Wehn, Luke Somerwill, Hannah Joyce, John Wheatland, Martin Janes, Marc Naura, Bruna Gumiero, Francesco Zaffanella, Balazs Kozak, Albert Scrieciu**

Planetary health refers to the health of human civilization and the state of the natural systems on which it depends. Citizen science has long been used as an approach to evaluate these issues, both in terms of the science produced, and the democratisation of the process to involve all stakeholders that have a vested interest. As such, citizen science has the potential to have an impact across a range of domains that directly or indirectly link to planetary health. However, whilst citizen science's potential to contribute towards planetary health is well documented, limitations exist when measuring the impact that citizen science has made. Despite multiple attempts across the literature, there remains no formal process by which to assess a citizen science project's impact and to accurately compare that impact with other projects, traditional science, or the status quo. In response, research has started to consider how best to link citizen science initiatives with their impact, including the MICS project (developing metrics and instruments to evaluate citizen science impacts). In doing so, MICS seeks to provide a citizen science impact assessment approach that is a flexible yet standardised methodology which individual citizen science projects can use, based on their unique resources, whilst generating comparable results across the citizen science landscape. Access is provided through the MICS platform (mics.tools), an online, open and free-to-use portal allowing citizen science practitioners to assess the impact of their activities. The MICS assessment approach comprises over 200 questions measuring the impact of citizen science, incorporating them into an interactive interface alongside additional guidance and recommendations for citizen science impact assessment. Launched in July 2022, the MICS platform and assessment approach is continuously evaluated regarding its suitability in assessing the impact of citizen science. The indicators and associated questions have been tested with a larger number of project coordinators from a diverse range of projects as part of the development of the MICS platform. In this work we present the findings of this process, helping to ensure that the MICS assessment framework is relevant to citizen science practices, and suitable for measuring their impact.

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Multidisciplinary approaches to the involvement of citizen scientists in disease vector monitoring and awareness raising in Uganda and DRC

***Jay Mulmi, Mercy Gloria Asephet, Katrien Pype, Jean DeBethel, Joule Madinga, Tine Huyse, Lies Jacobs, Caroline Michellier, Liesbet Vranken**

Schistosomiasis is a neglected snail-borne disease that affects over 200 million people worldwide. Chronic infection leads to serious damage to the intestinal organs, which can result in abdominal pain, liver fibrosis and infertility. Lack of safe water and sanitation leading to unhygienic water practices like open defecation, combined with limited knowledge or misconceptions are contributing factors to the spread of schistosomiasis. In addition to drug administration, targeted snail control and dissemination of information regarding the disease are therefore crucial for combating the disease. To address these issues, the ATRAP project involving senior scholars, Ph.D. and MA students from Uganda, DRC and Belgium in medicine, biology, sociology, anthropology and geography and local stakeholders have implemented a citizen science approach in Uganda and DRC. Members of the involved communities sample snail populations weekly at a fixed number of sites to infer transmission hotspots and raise awareness regarding safe water practices. Recruitment and retention of volunteers over extended periods are some of the persistent challenges in citizen science. Therefore,

it is pertinent for the success of any citizen science project to understand why people contribute time, energy and skills and why they (dis)continue. However, there is a lack of longitudinal studies on the motivation of citizen science participants. Citizen science as a practice is a fairly new concept in the Global South and the literature is therefore skewed towards cases in the Global North. Therefore, we want to study how we can adapt the existing citizen science frameworks to the context of Uganda and DRC, by assessing the motivations and experiences of the citizen scientists involved in the ATRAP project. A questionnaire survey with the central components of the volunteer functions inventory and the theory of planned behaviour was administered to participants of the Ugandan citizen science network. In the DRC, open-ended interviews and observations were conducted as part of an anthropological study, to better understand how ATRAP citizen scientists relate to academic stakeholders and funders. By combining the scientific background and analytical lenses of the authors, we will discuss the scientific and ethical challenges of incorporating citizen scientists in academic research in the Global South.

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Learning and knowledge building in citizen science

***Aaron Joshua Peltoniemi , Heli Kauppinen, Emilia Lampi, Joni Lämsä, *Ohto Sabel, Raija Hämäläinen**

Citizen science involves the participation of the public who serve as citizen scientists in scientific projects addressing, e.g., human health, air pollution, deforestation, endangered animals or water quality (Vohland et al. 2021). Citizen scientists can play a valuable role in achieving project goals such as sustainable development goals (SDGs), provided that the diverse forms of knowledge in citizen science projects are co-constructed and disseminated so that all stakeholders, citizen scientists and policymakers alike, can act accordingly. This highlights the importance of knowledge creation and its subsequent translation, i.e., putting theory into practice (Heinisch 2021). This is best achieved when citizen scientists maintain their participation in citizen science projects, which has been a challenge for many project initiators (Vohland et al. 2021). The length and quality of participation can be improved when citizen scientists perceive learning in addition to receiving the appropriate training (Roche et al. 2020). Nonetheless, current research on learning in citizen science remains largely undertheorized. In our short presentation, we will introduce the three types of learning (formal, informal, and nonformal) in citizen science as well as their typical settings. We will provide empirical evidence based on our survey with citizen scientists (N = 596) in Europe. It is hoped that our short presentation will allow educators, researchers, and policymakers in citizen science to better understand how the unique experiences of citizen scientists may be attributed to the different types of learning and their respective settings.

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City Nature Challenge: network methodology to analyse participation in citizen science activities across cities

***Liubov Tupikina, Katharina Kloppenborg, Frank Schlosser, Vadim Voskresenskii, Muki Haklay, Bastian Greshake Tzovaras**

Analysing patterns of engagement among citizen science participants can provide important insights into the organisation and practice of individual citizen science projects. There are various examples of citizen science projects and platforms: openstreetmaps, zooniverse and Alzheimer analysis projects where thousands of participants on volunteering basis are collecting and mapping the information. Methods from statistics and network science are of great importance to develop to better understand different types of user behaviour and user interactions to help the further implementation and organisation of community efforts. Using publicly available data from the iNaturalist community and their yearly City Nature Challenges (CNC) from 2017-2020 as an example; we showcase computational methods to explore the spatio-temporal evolution of this citizen science community that typically interacts in a hybrid offline-online way. In particular, we investigate the user types present in the community along with their interactions, finding significant differences in usage-behaviour on both the

level of engagement and the types of community tasks/roles and how they interact with the network of contributors. We expect that these computational analysis strategies will be useful to gain further understanding of other citizen science communities and projects. This work is based on work we did and documented in the paper openly available https://arxiv.org/abs/2112.02693. This is collaborative project from work between Liubov Tupikina, Frank Schlosser, Vadim Voskresenskii, Katharina Kloppenborg, Florence Lopez, Albrecht Mariz, Anna Mogilevskaja, Muki Haklay, Bastian Greshake Tzovaras.

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Session 4:

Citizen science in education and schools

Session chair: Alexandra Moormann

Children as young researchers and intergenerational ambassadors of Citizen Observatories: a case study of a pedagogical use of Pl@ntnet within an environmental education project

***Zacharenia Daskalaki, Maria Daskolia, Dimitris Gkotzos, Alexis Joly, Ángela Justamante Rodríguez, Karen Soacha**

The case study reported here presents an innovative pedagogical use of a Citizen Observatory, namely Pl@ntnet, to enhance citizen science through the direct involvement of students, as well as the engagement and participation of their families. The students had a dual role: as trainee "citizen scientists", collecting and uploading new data on plant biodiversity in an urban setting with the Pl@ntnet digital app, and as "ambassadors" of these practices and Pl@ntnet, by inviting their parents not only to inform them about their study but also to act as supporters of their efforts and as co-investigators. In this way a true "opening to the community" of citizen science is achieved, coming not only through educating young students in the principles and practices of citizen science, nor due to the knowledge transfer from school to their families, but also because children and their families become partners who contribute together to a citizen science project. The paper presents the design and implementation of an environmental education project that involved Greek primary school students aged 6 to 7 years old and their parents. The students visited along with their teacher the National Garden of Athens, a large urban green space in the heart of the Greek capital, to map environmental paths, to observe, take photographs of and record plants with Pl@ntnet, to look up their origin and scientific name on Pl@ntnet, and to create a phytology alphabet. The aim of the educational project was to foster intergenerational participation in and through citizen science, and to simultaneously develop the environmental and digital literacy of both children and their parents and promote community action under a common goal.

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Promoting scientific literacy in evolution through citizen science

***Dusan Misevic, Miriam Brandt, Alexandra Magro, Quentin Groom, Claire Narraway, Tania Jenkins**

A scientifically engaged citizenship is a prerequisite for achieving planetary health. Many of the complex global challenges humanity is facing, such as human health, food security, biodiversity loss, and the impact of climate change are linked to evolutionary processes. Yet, evolution is generally poorly understood by civil society and many misconceptions exist. Citizen science, which has been increasing in popularity as a means to gather new data and promote scientific literacy, is one strategy through which people can learn about evolution. Despite the potential, very few citizen science projects exist to improve scientific literacy in evolution. The EuroScitizen COST Action (euroscitizen.eu) is a transdisciplinary effort to unite diverse stakeholders to promote scientific literacy and engagement with respect to the science of evolution. In the context of this four year project, we have

developed a guide on how to design and evaluate citizen science projects to improve scientific literacy in evolution. In this talk, we make the case for incorporating evolution education into citizen science, define key learning goals in the context of evolution, and suggest opportunities for designing and evaluating citizen science projects in order to promote scientific literacy in evolution

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"I'm technically a mini scientist now": environmental science learning by young people across online and field-based community and citizen science

Ana Benavides Lahnstein, *Heidi Ballard, Maryam Ghadiri Khanaposhtani, Julia Lorke, Annie Miller, Sasha Pratt-Taweh, Jessie Jennewein, Victoria Burton, Lucy Robinson, Christothea Herodotou, Maria Aristeidou, Lila Higgins, Grant Miller, Greg Pauly, Rebecca Johnson

With current growth in community and citizen science (CCS) as a means to address the challenges of improving planetary health, we address the gap in empirical research on how the design of diverse biodiversity-focused community and citizen science projects may foster science learning and agency in participants. We investigate how youth (aged 10 to 13) manifested environmental science learning and agency across community and citizen science projects led by three different natural history museums (NHMs) in California and in the UK. We conducted a multiple-case study of three community and citizen science settings based at each of the 3 NHMs: a) short-term field-based BioBlitz events, b) longer-term field-based monitoring projects, and c) fully online community and citizen science (Zooniverse). We qualitatively analysed surveys and interviews with youth for all cases, in addition to ethnographic fieldnotes for field-based cases and user log file data for the online case. We found that through participating in community and citizen science scientific practices, some youth expanded their understanding and use of scientific practices and topic-specific knowledge, developed their identity with environmental science, and, in each community and citizen science setting whether short-term, longer-term, or online, we found youth demonstrating agency with science. We found that the specific scientific practices offered in the projects, tasks that required group work, and other design features influenced science learning in universal (across all settings) and specific ways associated with specific setting features. We provide specific ways that design features and settings of projects fostered certain environmental science learning aspects more than others, presenting insights for project design that targets young people's engagement with scientific practices, science learning, and agency as a foundation for change.

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Integrating citizen science in school environmental education within the European Cos4Cloud project: overall strategy and supporting actions

***Maria Daskolia, Dimitris Gkotzos, Anna Trigatzi, Matrona Pappa, Zacharenia Daskalaki, Maria Pliota, Naya Grillia, Ioannis Konstantinidis, Janice Ansine, Jaume Piera**

Citizen science aims to familiarise citizens with scientific knowledge and research, promote scientific literacy and empower them as citizens through their engagement in scientific processes and decision-making on issues affecting their local communities. Many citizen science initiatives and projects in Europe and internationally use a range of mechanisms, technologies and practices to engage citizens in collecting data and observations on the environment and diverse environmental problems, thereby contributing to the 17 Sustainable Development Goals (SDGs) for a healthier planet. In its own perspective, environmental education supports teaching and learning processes aiming at cultivating values and competencies for environmental and civic literacy and empowering young people for democratic participation with a view to shape their living conditions for a more sustainable future. This paper presents the framework of principles and practices designed and deployed by the Environmental Education Lab of NKUA within the European project Cos4Cloud to support the integration of citizen science in school environmental education. Starting from the premise that developing synergies between citizen science and environmental education is not only possible and compatible thanks to their many

commonalities, but also for the benefit of education and all collective efforts for a more sustainable and healthy planet, we elaborated a strategy to assist such an integration. The strategy consists of a number of interlinked, mutually reinforcing categories of actions, including: the training of teachers and other educational stakeholders; the co-creation of educational scenarios and training materials; building communities of learning and practice; establishing a national thematic network; designing, implementing and evaluating school-based educational activities; and research into learning and participation in the context of all of the above. The methodology is outlined and specific examples of how the strategy has been implemented so far are illustrated.

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SEEDS - Science by teenagers for teenagers

Claire Murray

Teenagers are creative, innovative, and curious. They have access to an amazing number of resources online and through their family and friends, but still, many of them are struggling to live healthy lifestyles. People often try to help, but a key point here is that interventions to support the teenagers are usually top down. Researchers tell them what to do and how to do it. But what happens when we flip this on its head? What if teenagers are in charge of picking ways for themselves to be healthy? That's what is happening in the **S**cience **E**ngagement to **E**mpower a**D**olescent**S** (SEEDS project), where we do science by teenagers for teenagers. The SEEDS project is exploring how teenagers can increase their engagement in Science, Technology, Engineering and Maths and improve their health through citizen science. Our project runs between 2021-2022 and runs across schools in Greece, the Netherlands, the UK and Spain with over 1,000 participants. Teenagers are experts of their own behaviour, so they have a lot to contribute to research questions and experiments about their daily lives and choices in snacking, physical activity and in their interest in STEM. In SEEDS, teenagers have helped define the research questions, co-created the experiments to explore these questions through Makeathon events and actually carried out the experiments themselves in interventions, with support from relevant stakeholders in their lives. This talk will share the lessons learnt from the SEEDS project, the teenage scientists' results and their perspectives and how the outputs from their work are already feeding into policy and into future research activities.

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Erasmus Maris: a citizen science initiative for secondary schools

***Kamel Labibes, Pascal Deltenre, Tuur Heylen, Pieter Van Heetvelde, Goele Wynen, Steven Vreysen,Sonia Mohan, Guillaume Martel, Inge Vanderhoeven, Alejandro Garcia, Wendy Fonteyn, Carolina Doran, François Jost, Joan Carles Cuenca, José Miguel Sanchez Gonzalez, Diana Saura, Emmy Pequeur, John Seghers, Håkan Emteborg, Robert Koeber**

Citizen science projects have an added value in educational settings of providing unique opportunities for students to be part of scientific projects, and thus an increasing number of schools are engaging in such initiatives. Erasmus Maris is a European initiative launched in 2018 which aims to provide a framework for the design and run of EU-wide scientific studies co-created by teachers of upper secondary schools (age 15+) within the scope of preserving the marine environment. The Erasmus Maris concept encompasses three main phases 1. The co-design of a citizen science study to be implemented at an EU-wide scale 2. The implementation of pedagogical and scientific activities carried out both within the schools and their nearby aquatic environment (rivers, lakes or seas) 3. The organisation of an inclusive transnational event called **Erasmus Maris Week**. The goal of the Erasmus week is to allow cross communication between schools from different countries to exchange their experiences and discuss their data and results with scientists. During the Erasmus Maris week, a scientific campaign related to the chosen theme is organised on-board a sailboat. The sailboat is used as a combined motivation factor and tool to acquire the eight key competences laid out in the European framework for lifelong le-

arning. The theme of microplastic pollution was chosen to be used as a proof of concept. The European Commission's Joint Research Centre (JRC) is providing dedicated microplastics reference materials and support to implement quality procedures that improve confidence in test results. Two EU-funded pilot projects were launched so far to understand the challenges before replicating activities on a larger scale. Within the ongoing second pilot project, the consortium is developing: a) assessment methods that can be implemented in secondary schools' chemistry labs; b) guidelines on how to include citizen science in secondary school curricula through the European framework for key competences for lifelong learning; c) a strategic roadmap for implementing EU-wide scientific campaigns with contributions from school managers, scientists and other relevant stakeholders in Europe. In this contribution, the authors will show the progress and obtained results thus far.

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Session 5:

Pollinator citizen science

Session chair: Dilek Fraisl

Growing pollinator citizen science across Europe

***Miranda Bane, Michael Pocock**

Declines in pollinating insects threaten biodiversity, agriculture, and ecosystem services globally. Collaborative responses and solutions are required. The SPRING project aims to establish a scientifically robust and sustainable EU Pollinator Monitoring Scheme (EU-PoMS) that will provide a series of indicators, capable of detecting any significant changes in the abundance of pollinators across the whole of the EU. The proposed scheme relies heavily on citizen scientist participation in conjunction with professionals. Some EU countries already have a strong baseline of citizen science and pollinator recording, enabling swift adoption of EU-PoMS. Others currently have very little citizen science capability. To help understand and address this disparity, we surveyed the opinions of 322 researchers and practitioners with experience of pollinators and citizen science. Respondents provided knowledge from across 35 European countries on the factors that support effective pollinator citizen science as well as the barriers to success. Our findings clearly demonstrate the variability in citizen science capacity across EU countries, relevant to pollinators but applicable to citizen science more generally. We show how cultural, scientific, and political factors impact capacity and reveal general trends in citizen science across Europe. Crucially, in collating expert experience of the gaps and barriers we expose the specific challenges faced in different countries and regions. Thus, we suggest priorities for capacity building and pathways to success. Our findings are supporting the development and roll-out of the EU Pollinator Monitoring Scheme, addressing the global challenge of pollinator decline. They can also contribute to the effective deployment of citizen science more generally to tackle planetary health challenges.

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Cross-pollinating ideas for planetary health

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The X-Polli:Nation programme cross-pollinates ideas and approaches across international boundaries for pollinator citizen science. Pollinators are a vital element of a healthy ecosystem, contribute directly to food security and taking part in citizen science can be beneficial to mental and physical wellbeing. Here we shall discuss the unique insights that this X-Polli:Nation programme can deliver for planetary health practice. The network brings together a partnership of ecologists, technologists, educators and young people across the UK and Italy to create a package of resources around the ci-

tizen science cycle (learn, record, plant, communicate) with the aim to support **people, pollinators and practice. People**, specifically students, shape the development of interactive AI enabled technologies for pollinator identification at interactive workshops and use these to develop the knowledge and skills required to collect data, enhance habitats and gain confidence to become passionate pollinator stewards in their local communities. **Pollinators** are recorded through a simple citizen science survey (aligned with the EU Pollinator Initiative and the UK National Pollinator Monitoring Scheme) and schools use innovative digital tools to receive pollinator species-specific planting recommendations for creating diverse floral resources to support these vital insects in local spaces. Citizen science **practice** is advanced by adapting and integrating existing web-based technologies for new audiences, species and countries, supporting our long-term vision of creating a global pollinator monitoring network. Here, we discuss the challenges and opportunities that arise from such a cross-disciplinary, resource-efficient approach, how we adapt the resources to ensure they are appropriate for the cultural, linguistic and ecological contexts of different countries, how we ensure that the science is not just translated but shaped by students and how we adapt an online learning offering in the face of a pandemic. We are keen to explore opportunities to work more closely with planetary health researchers as we enter a new phase of X-Polli:Nation.

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The potential of citizens' biodiversity associations for addressing planetary health

***Christina Bantle, Emilia Sinkeviciute**

The citizen science project Urbanität und Vielfalt (U&V, translating to "urbanity and diversity") enables citizens of four German towns, including Berlin, to get practically involved in the conservation of regional, endangered wild plants. In addition to pursuing ecological goals, the project Urbanität und Vielfalt aims at increasing participants' awareness of the value of biodiversity. Both in science and in public communication, biodiversity is usually discussed along three levels: genetic, species and ecosystem diversity. Since its start in 2017, the project Urbanität und Vielfalt has been accompanied by an external, formative evaluation in which the project participants have been asked about their associations with the term 'biodiversity'. The open question has been adopted from the German Nature Awareness study in which the answers are categorised deductively along the three levels of biodiversity. In contrast, as part of the Urbanität und Vielfalt evaluation more than 900 responses from project participants were analysed inductively, allowing new topics to emerge. Results showed that 'health' was one of the concepts that project participants associated with biodiversity. They further often brought up the topic of human behaviour, regarding both the loss of biodiversity and its preservation. Another topic emerging from the inductive analysis was people's visual-emotional perception of biodiversity. These topics and thus citizens' own constructs of biodiversity are neglected when focusing on genetic, species and ecosystem levels. As the results of the inductive analysis give an insight into the way citizens relate to biodiversity, they can provide valuable suggestions and guidance on how to address citizens on the topic of biodiversity while linking it to planetary health. The project Urbanität und Vielfalt is funded under the Federal Programme on Biological Diversity by the German Federal Agency for Nature Conservation with funds from the Federal Ministry for Environment, Nature Conservation and Nuclear Safety.

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Crop production success and pollinator diversity: Insights from a citizen science project in urban community gardens

***Susan Karlebowski, Monika Egerer, Ulrike Sturm**

Biodiversity is an essential component of planetary health by providing food and promoting well-being, among other benefits. Current research shows that urban community gardens in particular are important habitats for pollinating insects, as cities may provide important resources for insects due to their small-scale structures and reduced use of pesticides. At the same time, they are important places for urban residents to experience urban nature. Thus, gardens have an important significance for planetary

health. There, gardeners act as habitat managers through their gardening practices – but often without being aware of their role.The aim of this research project therefore was to investigate the relationship between the behaviour of the gardeners, pollinator diversity in the gardens and crop production success. For this we combined citizen science with ecological research: Gardeners of 30 community gardens in Berlin and Munich, Germany, were asked to observe the pollination of their plants over the course of the growing season. On their selected tomato, pumpkin and/or pepper plants, they documented when their plants (1) flowered, (2) were pollinated (closed flowers), and (3) had fruits. They also measured the size of the fruit upon harvest. At the same time, researchers documented the management of the gardens (plant diversity, ground cover) and the wild pollinators in the gardens three times each over the summers of 2020 and 2021. We investigated: 1) how are pollination services (i.e. turnover of flower to fruit) of common garden crops influenced by pollinator diversity and garden environmental features? 2) how is crop production success (i.e. yes/no) influenced by pollinator diversity and garden environmental features? and 3) what are the limitations of citizen science data in pollination research? With our approach we emphasise the power of citizen science to gain new scientific knowledge but also to empower people to act for biodiversity and planetary health. In our presentation we will focus on the chances and limitations of our approach to apply citizen science in pollinator research and the understanding of urban food production.

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Citizen science and pollinators of South America

***Natalia Ghilardi-Lopes, Eduardo Zattara, Kayna Agostini, Tiago Francoy, Francisco Fontúrbel, Betina Blochtein, Sheina Koffler, Filipi Soares, Celso Barbiéri, Antônio Saraiva**

Human activities that alter natural environments, causing shifts in land use, agrochemical contamination, habitat fragmentation, unsustainable exploitation of environmental resources, and global climate change, among others, pose threats to most living beings inhabiting our planet. Among them are pollinators, several groups of animals that visit flowering plants to obtain resources and promote pollination, the movement of pollen to stigmas within or between flowers, which is crucial to the production of seeds and fruits in many plants. Seeds and fruits are important for our survival and can generate employment and income for many people. Plants and pollinators, therefore, provide us with ecosystem services, and if we want our planet to be sustainable in the long term, it is fundamental we care about their conservation. Public involvement in pollinator monitoring and conservation is a key strategy to generate the additional scientific knowledge needed to support pollinator-friendly management and conservation actions. With a focus on South America, the book *Citizen science and pollinators of South America* addresses pollinator diversity and examples of ongoing citizen science projects in the region. With chapters written collaboratively by 60 authors (52 academic scientists and 8 citizen scientists), it is divided into three sections: Section I introduces the concept of ecosystem service (chapter 1), presents how to plan urban environments to make them more friendly to pollinators (chapter 2) and discusses species that are not native to South America countries and the ecological problems they cause (chapter 3); Section II covers the main pollinator groups occurring in South America and the characteristics that can be used to identify them (chapters 4 to 9); Section III explains the reader how to become a citizen scientist (chapter 10), and provides examples of pollinator-oriented citizen science projects currently underway in South America (chapters 11 to 18). This book was published in Portuguese and Spanish in an open access format (https://doi.org/10.4322/978-65-86819-20-5.100001.pt and https://doi.org/10.4322/978-65-86819-21-2.100001.es) and was produced with the support of the SURPASS2 project - Safeguarding Pollinators and Pollination Services (https://bee-surpass.org/), an international collaboration between Argentina, Brazil, Chile and the United Kingdom.

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Engaging beekeepers in citizen science: evaluation of a Brazilian initiative

Sheina Koffler, *Natalia Ghilardi-Lopes, Bruno Albertini, Celso Barbiéri, Jailson Leocadio, Tiago Francoy, Antonio Saraiva

Most citizen science projects with bees focus on producing knowledge and awareness on bee conservation and the importance of pollinators. Successful initiatives around the globe involve apiculture (the keeping of honeybees) and beekeepers. However, meliponiculture (the keeping of stingless bees) is an expanding activity in the tropics, creating opportunities to involve stingless beekeepers in citizen science projects. In Brazil, the project "cidadãoasf" was developed as part of an outreach course, where participants were asked to monitor bee flight activity and submit data to an online platform. The protocol consisted in recording the nest entrance and providing detailed information regarding the nest, place, time, and climate conditions. Also, after watching the recordings, participants counted the bees in activity. This counting step is also a validation process as other citizen scientists are invited to count other participants' videos. The platform was launched in February 2021 and included both course participants (three editions) and long-term participants which were monitoring bees monthly. Currently, the platform exhibits 3,544 flight activity recordings performed by 500 citizen scientists and 8,062 counts (mean of 2.3 counts per recording). Despite most citizen scientists sending recordings were course students, nearly half of the data (48%) were collected by long-term participants (19%), revealing low retention but high engagement in the project. Citizen scientists rated the project positively (mean rank = 9.5 of 10, n = 61) in an online questionnaire. Positive factors included: a) taking part in a participatory project (approximation with science, motivation for new investigations, being able to assess bee nests, share experiences, and access data); b) producing relevant data (reliable, large-scale, and with potential to contribute to beekeeping and bee conservation); c) disseminating knowledge; and d) project structure (platform and training support). On the other hand, negative factors were: a) lack of communication and engagement activities; b) platform usability; and c) social distancing (all activities were online). The medium-term evaluation provided indicators and guidelines for project improvements, such as increasing community engagement, platform revision, and planning of face-to-face activities when possible. Future steps include analysing the data and discussing the results with the citizen scientists.

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Session 6:

Citizen science platforms I: global and national hubs

Session chair: Daniel Dörler

Citizen science at universities: the launch of a citizen science contact point at the Vrije Universiteit Brussel

Carina Veeckman, *Floor Keersmaeker, Karel Verbrugge, Eline Livemont

Citizen science activities have been emerging at universities for several years. However, the latest trend is that universities are starting to launch citizen science hubs, or centres, as a central platform for citizen science within the institution. This trend has emerged from a bottom-up movement whereby efforts and learnings of individual scientists are getting concentrated, and/or from a top-down approach whereby institutional change and new policies are being introduced in support of citizen science. In most cases, the purpose of these initiatives is to advocate the embedding of citizen science at the university, liaison with (inter)national initiatives and to support researchers through training programmes. In the case of the Vrije Universiteit Brussel, the launch of a central citizen science contact point is supported by the research council policy plan of 2021-2024. This plan outlines the ambition 'to make and grow VVrije Universiteit Brussel UB more than ever into an urban engaged university that takes its scientific and social responsibility seriously'. In fall 2022, a central support centre will be launched as part of the Science Outreach Office of the Vrije Universiteit Brussel. The already existing Science Outreach Office brings science from the Vrije Universiteit Brussel to the general public through community engagement

research and learning. During the presentation, the process for setting up the contact point will be presented to the audience. The set-up has been prepared and organised in several co-creation phases with central Vrije Universiteit Brussel departments and individual researchers: (i) the development of training materials 'start to citizen science @ Vrije Universiteit Brussel, (ii) the organisation of a project call with seed money in summer 2022 and (iii) the organisation of workshops for internal vision building for citizen science at the Vrije Universiteit Brussel. The workshops were organised around several topics including the definition of quality criteria for citizen science, development of policies and executive plans to collaborate with other internal departments and, finally, the definition of the main services of the contact point according to the BESPOC model of the LIBER citizen science Working Group. The presentation aims to present its main challenges and lessons learned so far, and to inspire other universities to adopt citizen science methods for research.

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Civis: Brazilian citizen science platform

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The paper presents the development process of CIVIS, a Brazilian citizen science platform, by the Brazilian Institute of Information in Science and Technology (IBICT), based on the open-source framework of the EU-Citizen. Science platform. CIVIS' objective is to offer infrastructure, tools, resources, and content to contribute to: disseminating and supporting citizen science projects and initiatives; the adoption of participatory research methodologies; and diffusing the understanding of citizen science concepts and uses in the country. CIVIS is considered a milestone in the creation of a Brazilian infrastructure focused on citizen participation in the research process. The platform intends to give visibility to the various initiatives and contribute to the creation of a wide community of learning, innovation, and collaboration for citizen science. In addition to adapting the original code and developing applications tailored to its objectives and local needs, the project's main challenges lie in: (1) responding to the diversity of questions and contexts of on the ground citizen science initiatives and projects in Brazil; (2) develop and offer infrastructure and protocols for managing citizen data, considering both FAIR and CARE principles; (3) promote inclusiveness of vulnerable and at risk communities and social groups impacted by the increasing socio-environmental and health emergency situations; and (4) leverage institutional, financial, and human resources for its long-term sustainability.

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Israel Citizen Science centre – Establishment perspectives

Tomer Gueta, Nirit Lavie-Alon, Yaela Golumbic, Alon Sapan, Tamar Dayan

Citizen science in Israel has been slowly yet steadily growing over the past decade, with a few dozens of active projects focused mainly on biodiversity and environmental science. Initiated by a variety of organisations (e.g. NGOs, universities, and private initiatives), projects often operate independently of each other and receive no national level support. This restricts the sharing of knowledge and experiences, limits the efficient allocation of resources, and thus prevents projects from reaching their full potential. To address this challenge, In early 2021, the Steinhardt Museum of Natural History began developing the Israel Citizen Science Centre to offer technical, scientific, and methodological support to existing and new initiatives. In addition to promoting FAIR data, the centre will ensure data and research results are available to the public, stakeholders, and policymakers. Our goal in this presentation is to share the insights gained through our comprehensive co-design planning process, and support others considering similar processes. Upon the centre's initiation, four key themes were defined: technology, science, social, and management, which collectively incorporated 19 modules of development, including data standards, taxonomic support, and collaboration. Next, a think-tank was formed for each theme, engaging a wide spectrum of citizen science stakeholders (practitioners, academics, policymakers, technologists, educators, science communicators, etc.). Through multiple meetings, cross-input between themes and in-depth expert interviews, a comprehensive characterization of

stakeholders' needs and suggested solutions was produced. For example, following a lengthy review of available citizen science platforms and services, the technology working group chose the Living Atlas as the main technological infrastructure that would integrate data with other platforms already established in Israel, such as iNaturalist and eBird. Building on the characterization outputs for each theme, a detailed work plan was developed including the definition of the goals, structure and activities of the centre. The process of co-designing the centre's goals and vision has been invaluable in establishing relationships with stakeholders and understanding their many perspectives and needs. The Israel Citizen Science Centre will strive to foster sustainable technological, scientific, and social facets, to forge stronger foundations for the centre.

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The creation of citizen science hubs in RPFOs. The UAB citizen science hub pilot

***Sofia Mojica Baquero, Begoña Miñarro Vivas, Xavier Ariño Vila,**

INCENTIVE's central mission is to navigate European research organisations towards achieving lasting institutional change through the successful implementation of citizen science. The project aims to achieve this via the creation of citizen science hubs in four universities: University of Twente (NL), Autonomous University of Barcelona (ES), Aristotle University of Thessaloniki (EL) and Vilnius Gediminas Technical University (LT). These hubs are virtual and/or physical spaces where citizens, stakeholder groups and scientists join forces for stimulating and supporting excellent citizen science in line with RRI principles. By creating these hubs, the project accelerates the transition of these institutions towards more inclusive, open and democratic innovation and scientific governance. This process is occurring over three years and is currently in the pilot phase. The 10-min presentation will consist of a brief introduction of INCENTIVE; and the presentation of the UAB citizen science hub pilot, covering not only the co-creation process of the citizen science hub, but also the set up phase and the planned activities to be implemented during the pilot phase of the project.

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Session 7:

Monitoring the environment together: from practitioners to policy makers

Session chair: Sabrina Kirschke

Mobilising local communities and expedition cruise passengers in the Arctic to address issues of planetary health

***Gitte Kragh, Michael K. Poulsen, Lisbeth Iversen, Ted Cheeseman, Finn Danielsen**

Our knowledge of the status and trends in the environment and natural resources in the Arctic is limited, making decisions related to planetary health difficult. One challenge is how to reach remote, uninhabited wilderness areas in order to obtain much-needed data and this is where expedition cruises can play a crucial role. Here, citizen science enables valuable data and information to be generated from local and outside sources of knowledge. This talk presents a citizen science pilot programme of environmental monitoring by Arctic expedition cruises in Svalbard and Greenland during 2019, conducted to understand the potential this kind of environmental monitoring may have and to identify suitable approaches for enhancing data collection, management, and knowledge sharing. Four citizen science projects were piloted: two biodiversity projects, one environmental and one meteorological project. Biodiversity monitoring and recording through the eBird and Happywhale platforms were by far the most popular projects in the programme, reflecting the interests of expedition cruise participants and highlighting the need to consider participant motivation and preferences in the design of such programmes. Furthermore, observations are more likely to be used by decision-makers in the Arctic if records are analysed and interpreted with a view to informing decision-making processes and if the findings are communicated to decision-makers in appropriate formats. An intermediary organisation that can facilitate the dialogue and knowledge transfer between citizen science programmes, scientists, and decision-makers is essential to ensuring that data actually enter the decision-making processes. Mobilising

visitors, staff, and local communities can make a significant contribution to better environmental decision-making and strengthen efforts to address issues of planetary health in the Arctic.

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Implementing citizen science in the flood early warning system of urban-mountainous catchments

***Maria J. Henao Salgado, Jeannette Zambrano, Leonardo Alfonso, Jorge J. Vélez**

The urban basin of the Manizales stream in Manizales (Colombia) is at high hydro-geomorphological risk due to the exposure of vulnerable elements (homes, buildings, and infrastructure) in areas with a high probability of flood events, landslides, and torrential rains. Consequently, an automated Flood Early Warning System (EWS) was designed and implemented. However, such Early Warning System is challenging to implement since it includes significant uncertainties due to the complex characteristics of flash floods in mountain streams. An innovative approach that could be noticeably beneficial is the integration of participatory approaches within the automatized Flood Early Warning System. A community-based Early Warning System is in place, but it is not integrated into the current flash flood hazard protocol of the Manizales stream. This study aims to achieve a strategy to incorporate citizen science (participatory research) into an existing automated Flood Early Warning System. The existing community-based Early Warning System incorporating citizen science improves the efficiency of the warnings issued. The methodology consists of four phases. The first phase is to collect the information from the study areas, the target communities, and the flood-risk protocols of the Flood Early Warning System established in the Manizales stream. The second phase is to quantify and define citizen science in the participatory protocols of the Flood Early Warning System and flood-risk management and implement it. The third phase compares the collected data by citizens and the observed data collected via the hydro-meteorological monitoring network. Finally, the last phase concludes the results obtained and the quality and precision of the collected data by citizens and their roles by doing participatory monitoring and possible improvements. Indicators derived from participatory monitoring that complement the data obtained from the hydro-meteorological stations will be included, a step towards better decision-making tools and improvement of the efficiency of the integrated system. Advantages of the integration of the community-based Early Warning System in the flash flood hazard protocol are minimising the false alarms and including hydrological behaviours that have not been modelled accurately. On the other hand, it can increase awareness among the communities living near the water streams, effectively reducing their exposure and flood risk.

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Citizen science as a co-creative measure to water quality: chemical data and local participation in a rural territory

***Mariela Yevenes, Helen Pereira, Rafael Bermudez**

It is becoming increasingly clear the threat to the use of natural landscapes and persistent droughts are affecting the water quality of rural communities. The socio-ecological fit emerges as an aid to advance in the search for solutions to environmental problems in rural communities. Consequently, between May 2016 and September 2021, an interdisciplinary study of Community-based Water Quality Monitoring (CWQM) was implemented at a coastal catchment at the Ñuble region, Central-Chile, Central Chile. The objective of the study was to involve participation of local communities in initiatives to control the water quality of various parameters (pH, total iron (FeT), alkalinity as CaCO3, hardness (Ca2+ and Mg2+), sodium (Na+) and potassium (K+), water temperature, sulphate (SO42-) chloride (Cl-) and nitrate (NO3-)) in groundwater, share local knowledge and to apply co-creative measures for improving water conservation. In situ chemical data were also analysed in the laboratory to check data quality. PHREEQC hydro-geochemical model is used to characterise hydrogeochemical parameters of groundwater and known about hydrogeochemical processes related to water quality. High levels of NO3- and FeT are

recorded in 75% of the groundwater samples, mainly when water scarcity is higher during the summer. According to Chilean standards, nitrate levels exceed the maximum permissible limits for drinking water. A type of mainly Ca (Mg) –HCO3-, carbonated water was recorded with Ca2+, Na+, Mg2+, HCO3- as dominant ions. This study demonstrates the opportunity of a rural community group to help fill spatial data gaps in water quality monitoring and reassess water quality protection, especially considering the decrease in water availability in the region. Therefore, the community together with researchers can respond with an early alert system to water quality to collaborate with the implementation of rural drinking established on a community-based water quality monitoring. Moreover, to prioritise the level of urgency of rural water, minimise water pollution and improve the perception of the water and the resilience of their social ecological system.

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Evaluating environmental policies with citizen science data? An example from the Plastic Pirates investigating plastic pollution of rivers

***Linda Mederake, Tim Kiessling, Mandy Hinzmann, Sinja Dittmann, Dennis Brennecke, Marianne Böhm-Beck, Katrin Knickmeier, Martin Thiel**

Global plastic pollution endangers planetary health, with devastating impacts on ecosystems, wildlife, and human health. Accordingly, plastic leakage has recently been judged by Persson and colleagues in Environmental Science & Technology 56(3) to have exceeded the safe operating space for humanity as part of the planetary boundary for novel entities. Against this background, more and more legislation has been adopted in the past years to address this urgent environmental problem. W The policies in question range from measures to tackle sea-based sources of (marine) plastic pollution to circular economy and waste policies. Regulatory approaches include controlling the intentional use of microplastics in cosmetics and washing products as well as the production and sale of plastic bags and other single-use plastic items. It is in this context that the EU adopted Directive 2019/904 on the reduction of the impact of certain plastic products on the environment, usually referred to as the Single-Use Plastics Directive. The Directive targets several single-use plastic items most commonly found at European beaches. In 2019, the citizen science youth project "Plastic Pirates" started to collect data about the single-use plastics pollution of riversides with the aim to evaluate the potential benefit of the Single-Use Plastics Directive to significantly reduce litter at riversides. Since then, 18,000 schoolchildren and their teachers have sampled, classified, and quantified thousands of litter items – proving that this kind of evaluation of the benefits of a certain policy is only possible with a citizen science approach. First results of a scenario analysis based on the sampling data indicate the possibility of moderate improvements due to the ban of certain single-use plastic items under the Directive. However, many sources of riverine litter are not sufficiently addressed, such as cigarette butts and plastic packaging of snack products, frequently consumed at riversides.

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Citizen observatories as educational tools in school environmental education: "My own private 1m²" and "Scenting around-the-walk: the environmental odours' trail"

***Matrona Pappa, Maria Daskolia, Anna Trigatzi, Alexis Joly, Rosa Arias, Jaume Piera**

The case study reported here explores a challenging idea of integrating citizen observatories as educational tools in school environmental education. We present two environmental educational activities ("My own private 1m²" and "Scenting-around-the-walk: the environmental odours' trail"), designed to engage primary school children with two citizen observatories, Pl@ntNet and OdourCollect, in experiencing and learning of a local wetland. The activities endorse a post-humanist/new-materialist approach building on children's encounters with their more-than-human environments and the intrinsic value of nature, while exploring biodiversity and environmental quality and highlighting the threats to it in a time of heightened ecological awareness. The children developed an enriched

science-sensorial experience of their environments based on their mediated and immediate observations and explorations of the more-than-human elements of the world. Aligned with post-humanist lines of thought, we argue that technology is not only a tool, but becomes an important non-human agent in experiencing and learning 'childhoodnature'. Using the digital apps of the two citizen observatories, Pl@ntNet and OdourCollect, the children sensed ecologically, became aware of and engaged in their local environments while they also developed scientific and environmental literacy and gained hands-on experience of active citizenship. We argue that this approach offers a new perspective on citizen science, linking it to theories of embodied learning, viewing nature not as a value-free 'object' but as a complex 'living ecosystem', the big picture of which requires more and diverse perspectives to draw on. We analyse the rationale behind the two activities and present their implementation and evaluation.

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Session 8:

Creating knowledge together: Diversity and Inclusion

Session chair: Claire Murray

Citizen science for environmental and health issues in conflict zones

***Katerina Zourou, Stefania Oikonomou**

Air quality data and monitoring is among the oldest and most popular forms of citizen science (Schäfer et al., 2020). Serving in many environmental justice projects, air quality citizen science projects enhance the role of citizens in decision making to consider future health and environmental harms, including for low-income citizens or citizens in developing countries. Case studies in several locations (O'rourke, & Macey, 2003; Ottinger, 2010; Schlosberg & Collins, 2014; Mahajan, Chung, Martinez, Olaya, Helbing, & Chen, 2022) demonstrate the complexities of decision making based on citizen-driven air quality data. The decision-making mechanism becomes more complex in conflict zones. Much more than the "unwillingness or inability to deal with uncertainty" in dealing with research and information challenges from citizen-led data (ECSA 2022 conference call), roles of various actors, both on the ground and connected remotely through remote sensing and open source data collection, merit special attention. Therefore, the aim of this presentation is twofold: first, it is to map citizen science projects in conflict zones by taking the Ukrainian war as case study. Collection of examples is ongoing (Zourou, 2022). Second, to discuss opportunities and threats in civil society-citizen cooperation in environmental and health data gathering and analysis in situations of armed conflicts. The situation puts health and environmental conservation organisations in a difficult position, given that "when collaborating with de facto power brokers to carry out their activities, [this] could lead to accusations of partisanship" (Schulte to Bühne, H., Weir, D. 2022). In this context, the intermingling between environmental and health issues in conflict zones and planetary support (through remote sensing, open data and digitally supported crowd initiatives) sheds light into the role of citizen science and other forms of citizen engagement for action taken by the generations to come.

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Inclusive health research feels good!

Esther Kamerman, *Kirsten Bevelander

Introduction citizen science projects reach certain segments of society. Citizen science and science communication is often inaccessible for people with low literacy skills or (mild) intellectual disabilities. Their lives and experiences differ significantly from the general population while they could provide a valuable contribution and insights to the project. However, they are often detached from scientific projects or feel left out. This stu-

dy addresses how 'inclusive health research' – an ultimate form of citizen science for health – can contribute to the perception of science. Methods In this exploratory study, we conducted several interviews with citizen scientists with mild intellectual disabilities while they worked on their own health science projects. As a 'co-researcher' and in collaboration with a scientific researcher, they chose their own topic, research questions, methods, strategy of analysis and forms of science communication. Results The study provides insights about which forms of involvement and science communication fit different types and topics of health related citizen science. Feelings and emotions play an important role in how citizen science and science communication is perceived. Discussion co-creation and inclusive research can serve as a point of leverage for citizen science and science communication. When underserved audiences experience scientific activities, they feel and communicate an increased value and accessibility to science.

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Linguistic and cultural diversity for planetary health

Barbara Heinisch

Linguistic and cultural diversity are, besides biodiversity, crucial elements of planetary health. Although both natural diversity and human diversity are intertwined, linguistics has received only scant attention in the planetary health debate. Languages provide different perspectives on our world. Therefore, linguistic diversity is an asset as part of the cultural heritage of language communities and may help to develop sustainability practices through seeing the world through a different lens. Therefore, citizen science endeavours in linguistics can play a role in making visible linguistic diversity and local (traditional) ecological knowledge enshrined in languages (including dialects). Local communities usually know their environment, including the landscape and its change over time as well as the local flora and fauna. This knowledge (and the culture in which it is embedded) can help achieve or maintain a sustainable lifestyle. Here, different angles need to be addressed to cover the entire spectrum of sustainability, ranging from (ecological, ethnobotanical or folk) knowledge, environmental ethics, language, traditional practices, to cultural sovereignty and self-determination. In citizen science, language is often considered an obstacle, either when translating project contents into another language or when researchers communicate with members of the public, where the use of disciplinary academic language and general language, including terminologies, collide. However, language is the major means of transmitting and constructing knowledge. Therefore, this talk addresses the relationship between traditional knowledge, language and the environment as well as the influence of citizen science in linguistics on the development of a sustainable lifestyle. This is based on the assumption that languages provide access to cultures, including beliefs, values and (sustainable) ways of thinking and living. Citizen science can help preserve linguistic diversity and cultural diversity, investigate the relation to biodiversity and illustrate biocultural diversity. Only resilient systems can adapt to change, and resilient systems are characterised by diversity, including linguistic diversity.

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Urban blue, place-bonding and planetary health knowledge: a citizen science project with temporarily displaced children

Ekaterina Egorova

Environmental citizen science often looks to engage local communities in long-term projects, which is explained by the scientific value of longitudinal datasets resulting from the consistent monitoring of the environment. We suggest expanding our view of environmental citizen science, and exploring the impact that short-term projects can have on groups that might have stayed outside of environmental citizen science till now – for example, children from temporarily displaced families. Engaging such children in citizen science can address both their wellbeing and planetary health more generally. Indeed, the wellbeing of refugees and asylum-seekers is closely linked to the level of bonding with place, which, in turn, correlates positively with spending time in the urban green, as well as

engaging in local initiatives (Thomas et al., 2021). Environmental citizen science combines both of these aspects; moreover, it has the potential to affect environmental knowledge and values, raising awareness about planetary health. The project "Water Rangers Twente" ran in a Dutch town (Almelo) for four weeks in summer 2022, and engaged children from displaced families (age group 9-14) into the collection of data on urban blue spots — both water quality samples, as well as qualitative observations related to the attractiveness of the areas for recreation . Generally, the project was designed in a way that highlighted children's competence and autonomy, and encouraged the exploration of the area. The presentation will report on the key aspects of the project, going into more detail about the preliminary findings about the project impact. The latter was assessed through focus groups and sketch mapping sessions, , shaped around the theoretical constructs related to spatial knowledge, place-bonding, environmental values and planetary health. References. 1. Albers, Thomas, et al. "The Role of Place Attachment in Promoting Refugees' Well-Being and Resettlement: A Literature Review." International Journal of Environmental Research and Public Health 18.21 (2021): 11021.

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Co-created citizen science in school: serving the poor and the wealthy

***Tali Tal, Nirit Lavie Alon, Lavi Oren, Hila Shefet-Barkae**

Often, citizen science (CS) is introduced to schools and teachers serving higher socio-economic status (SES) populations, where innovations, student-centred teaching and problem-based learning are welcome. What happens in rural schools or those serving populations with high-poverty or marginalised communities? In this presentation, we focus on two educational citizen science projects, initiated by highly committed teachers, one teaching in an affluent community and the other in a low socio-economic status one. The two projects were part of our Taking Citizen Science to School (TCSS) centre that fosters meaningful science learning through citizen science. The projects: (1) The Irises project and (2) the endangered species engaged middle school students in ongoing field work within walking distance from school. The students collected and interpreted data, before and during the blooming season and collaborated with ecologists from two environmental organisations who helped in identifying the topics to investigate, in consulting regarding protocols for data collection and who met with the teachers and their students. The motive of 'project 1' teacher was her interest in field work and in providing, to her honour students, an engaging framework for the mandatory inquiry-project in 8th grade. The teacher of 'project 2' was concerned about the limited resources the school allocated to under-achieving classes (8th grade) and was looking for ways to use the outdoor learning environment instead of labs and computers. Despite the differences between the classes, the research team had similar questions regarding students' learning outcomes in the context of the collaborative co-created socio-economic status projects. Have the students' acquired conceptual knowledge in ecology? And in what ways did the socio-economic status projects enhance interest in and engagement with the environment? Our findings show that 'project 1' students increased their interest in science and in the environment and demonstrated high commitment through activism acts to protect the endangered Irises that involved the community and ended in relocation of the tubers. In a comparing 'project 2' students to two comparison classes, we found evidence for improved ecological knowledge and improved attitudes toward the environment. Finally, we wish to highlight the importance of bottom-up co-created socio-economic status to science and environmental education.

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Enhancing diversity and inclusion in citizen science – Potential future directions

***Maximilian Neßmann, Minh Anh Tran, Hacer Tercanli, Sjoerd de Vries, Josep Perelló, Kirsten van Dam, Nicole Bedoya**

Many citizen science projects are designed around environmental justice issues with the potential of working with marginalised groups (Lewenstein, 2022). However, studies show that marginalised groups in society

continue to stay as outsiders in citizen science projects as they are least likely to participate (Pateman et al, 2021; Spier et al, 2019). Thus, higher socio-economic status and a higher level of education correlate with the likelihood of participation (Lewenstein, 2022). Research from the US also suggests a bias of available data toward the white middle- and upper-class (Pandya & Dibner, 2018). Paleco et al (2021) elaborated in a literature review on the need to expand the diversity of participation in citizen science projects. In regard to medical citizen science projects, Fiske et al. (2019) raise the question of which literacy forms are required. Even so, they do not specify how marginalised groups can be empowered, activated, and 'be heard'. The focus in the literature remains rather limited to financial barriers when participating. The literature agrees that capacity building is crucial, however there is a gap in how to design appropriate capacity-building programs. Citizens bring different forms of already existing knowledge and skill sets to projects that could result in differing strengths and requirements for such programs (Hermoso et al, 2021). In our study we conduct as part of the Erasmus+ Cooperation Partnership project "Digital citizen science : Network, transfOrm, groW", we aim at presenting a better understanding on the competences and capabilities that are needed now, and in the future in order to enhance diversity and inclusion in CS. Further, we develop future digital capacity building formats in achieving such inclusion. Our findings will be drawn from mixed method research that is built upon "Horizon Scanning" methodology, detecting future signals of change in citizen science. We gather input from among researchers and practitioners of citizen science, representatives of public and non-governmental organisations, and citizens as non-professional scientists in the context of Europe.

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Session 9:

Technology and Tool Boxes

Session chair: Jaume Pierra

Assessing ecosystems and natural capital: perspectives on an eDNA approach within the GenePools project

***Lucy Robinson, Jessica Wardlaw, Katy Potts, Katie Clark, Vashti Gwynn, Helen Rees, Tom Jenkins, Ben Price, Phil Davison, Paul Woodcock, Harriet Knafler**

Planetary health requires thriving natural systems, and innovative DNA technologies can provide new ways of assessing and understanding these systems, incorporating microscopic and microbial diversity alongside the more traditionally recorded plant, animal and fungal groups. In this presentation, we share innovative citizen science methods of understanding freshwater systems, the natural capital they represent, and their ecosystem function. The UK Government has committed to leave the environment in a better state for future generations, and has launched the Natural Capital and Ecosystem Assessment (NCEA) - a science innovation and transformation programme which spans land and water environments. It has been set up to collect data on the extent, condition and change over time of England's ecosystems and natural capital, and the benefits to society. This programme will highlight the value of managing natural capital, transform the way the UK government makes decisions and policy, and ensure government bodies invest in environmental reforms that achieve maximum benefit. Citizen science forms a key part of this ambition. GenePools is a pilot project within the NCEA, which uses a citizen science approach to collect and process water samples from garden ponds for environmental DNA (eDNA) analysis – genetically sequencing every organism that lives in, or has used, the pond. Across three cities, 150 ponds have been sampled and sequenced. Alongside the research outcomes of better understanding pond ecosystem function and value as natural capital, and the benefits and limitations of eDNA technology at scale, we also explore approaches to visualising and

presenting complex genetic data back to citizen scientists. We incorporate social sciences research exploring the impacts of participating on people's science understanding and critically, their sense that they can take action to enhance the natural capital of the freshwater systems they have control over (i.e. on their own land). We share these lessons, with an ambition to scale the project in future. A collaboration between government, a museum, academia, commercial DNA labs and citizen scientists, we share our varied perspectives on the potential of this approach for ecosystem assessment for planetary health and for impactful collaboration between society, academia and policy.

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Creating the Cos4Cloud Toolbox & Evidence Hub - A resource for citizen observatories

***Janice Ansine, Rachel Redford, Maria Daskolia**

Cos4Cloud (https://www.cos4cloud-eosc.eu/) is a European project focused on boosting citizen science technologies by providing user-centred services for citizen observatories. This project includes the development of the Cos4Cloud Toolbox and Evidence Hub, an online repository of training materials, education and capacity building resources; user guidelines and handbooks as well as the sharing of best practice and case studies all supporting citizen science observatories. This presentation introduces the Cos4Cloud Toolbox and Evidence Hub, part of the work led by The Open University (OU), and will highlight the range of resources to be made available and other future developments. The OU is a leader in distance learning and using innovative educational technology and applies this to citizen science. The presenter will demonstrate this core output from the project, and how it aims to deliver Cos4Cloud project objectives facilitating a legacy for networking and citizen science knowledge management processes across organisations, people and initiatives. A summary of the development process will be included which was conducted to better understand and differentiate the scope for this resource space and gather best practice in this area. This includes a review of toolkits / toolboxes relevant to citizen science which helped to guide the design framework. Highlights of key features will identify and place the Toolboxand Evidence Hub within the citizen science landscape identifying differences and synergies with other relevant European citizen science and open science hubs, clearly defining its place as a repository supporting citizen observatories. The Cos4Cloud ToolBox and Evidence Hub is being created using OU's free open educational resources collaborative platform OpenLearn Create (https://www.open.edu/openlearncreate/)..

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The Nightlights app – Empowering young and old to create their own citizen science campaign

***Jacob Koglin, Christopher Kyba, *Nona Schulte-Römer, Georg Sulzer**

Citizen science will have a greater chance to contribute to planetary health if citizen scientists are empowered to collect high-quality data. In our Nachtlichter (Night lights) project, campaigns organised by local volunteers in several dozen cities played a key role in recruiting and training participants. Nachtlichter is a co-designed project: citizen scientists and researchers at the GFZ German Research Centre for Geosciences developed an app to count light sources along street segments – from illuminated windows and advertising signs to street lamps and traffic lights. Our goal was to better understand the anthropogenic sources of artificial light emissions, which can negatively affect the day-and-night rhythm of life on Earth, and often consume more energy than necessary. The Nachtlichter project was a success: in autumn 2021, over 200 citizen scientists counted and classified nearly a quarter of a million artificial light sources in public streets and squares. They classified every light visible from public spaces over a total area of 22 square km in 33 different cities and towns, mainly in Germany but also internationally. The majority collected data in the course of locally organised campaigns in which the leaders had frequent direct contact with the scientific team at GFZ over about half a year. However, to our surprise, several participants also counted lights over large spatial scales independently, without guidance or discussion with us other than viewing our

online training materials. In our presentation, we outline our co-designed communication strategies and data collection tools that empowered participants to collect Nachtlichter data independently. Additionally, our youngest independent campaigner will present his experience with the Nachtlichter app. He was only 12 years old when he classified 6900 light sources in his neighbourhood entirely on his own initiative, and without prior contact with the project other than through our web materials.

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Developing a sensitive chatbot for citizens experiencing challenges in accessing health care

***Julia van Calis, Jenneken Naaldenberg, Nadine Bol, Christine Liebrecht, Geraline Leusink, Kirsten Bevelander**

Introduction For citizens with communication or cognitive impairments (e.g., people with low (health) literacy skills, intellectual disability (ID) or Autism Spectrum Disorder (ASD), etc.) who live independently, it is challenging to find answers to their specific health needs and receive appropriate health care. A sensitive chatbot or 'virtual assistant' (SVA) that tailors the responses to individual needs of users may help in supporting them. To avoid a mismatch between the needs of people in vulnerable positions and the SVA, we conduct and 'inclusive research and development project'. Our study investigates the added value of co-design and citizen science in technology development and the implementation process. Methods The project uses a citizen science approach, meaning that the SVA's target group is closely involved during the entire project – from the grant application, throughout the research and development cycle to the dissemination of our findings and implementation of our end product. The citizen scientists are people with low (health) literacy skills, ASD or mild ID and act as consultants and co-researchers, enabling the SVA to take into account the challenges underlying the complexity of different living situations. We co-design the SVA following the Design Thinking Method and conduct interviews, focus groups and user experience tests. Results Since the project started on June 1st 2022, preliminary findings of our inclusive research project are presented: a) co-design techniques appropriate for (technological) citizen scientist projects with people having special needs, b) insight into functionalities, language use and modalities for sensitive virtual assistant with unique artificial intelligence (AI) dialogue technology, and c) care and welfare issues of people that experience challenges in health care. Discussion The methods and techniques by which we collaborate with citizen scientists together with our findings contribute to fundamental knowledge in the field of inclusive research and design, citizen science and chatbots, being relevant to a wide range of disciplines. In the end, the SVA can increase the empowerment and contribute to more effective care of people in vulnerable positions, which can ultimately reduce health disparities.

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Session 10:

Healthy cities: resolving Human-Nature Conflicts through citizen science

Session chair: Gitte Kragh

CitiMeasure - Citizen science for smart and healthy European cities

***Mohammad Gharesifard, Irene Vivas Lalinde, Brooke Flanagan**

Cities and towns in Europe are home to more than 70% of Europe's population. Planetary health in cities highly depends on joint action of stakeholders in urban environments, systematic change in actors' behaviour towards sustainable, healthy, and smart practices, as well as change in policies. CitiMeasure (2021-2023) is a European-funded project that aims to support the application of citizen science initiatives to create smart, sustainable, and inclusive European cities. The project has brought together the experiences and expertise of 19 European cities and 21 organisations, universities, and networks in addressing challenges with design and implementation of citizen science initiatives in urban environments. Adopting a

co-creation approach and building on collective intelligence of its working group members, CitiMeasure have developed three distinct products that help cities and citizen science initiatives tackle common challenges related to planetary health in cities, namely (digital) inclusion, behaviour and policy change, and comparability of initiatives. The products of the Digital Inclusion and Behaviour & Policy working groups are two sets of guidelines that help cities and citizen science initiatives better understand and tackle these issues. The Comparability working group has produced an interactive tool that helps users identify and connect air quality monitoring initiatives across Europe. The CitiMeasure guidelines and interactive tool are currently being tested in pilot real-life case studies. The project also raises awareness of the importance of citizen measurement initiatives and capitalises on the results and tools of similar citizen science projects by creating an online European Knowledge Centre with a repository of good practices. The audience of this presentation will learn about the CitiMeasure project and its aims, as well as the prototype guidelines and tools co-created by the CitiMeasure working groups. They will also receive first hand insights from piloting the CitiMeasure products in selected case studies in cities such as Barcelona, Milan, Roeselare, and Bobigny.

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A citizen science experiment on public lighting policies: a helpful step toward a 'dark infrastructure' at a local level?

***Céline Pelletier, *Emmanuelle Gonzalez*, Baptiste Bedessem, Anne Sourdril, Romain Julliard**

Mosaic is a research unit from the French National Museum of Natural History which is specialised in producing data through citizen science methodology. In this project, our objective is to assist local administrations (mainly municipalities) in collecting structured data (based on protocols/guidelines), often combining observations based on basic human skills with data enriched with valuable information that only each individual participant can provide. Such data are then shared among participants, and interactions such as comments, validation, complementation, are encouraged and organised. This process leads to high value data, empowers participants and helps building structured, engaged and persistent communities of participants. Since February 2021, Mosaic is a partner of the ISEED project (Inclusive Science & European Democracies) in which we developed a new citizen social science platform, called Participatory Sciences Obscurity & Territory (SPOT) for two French volunteering municipalities (Libourne, 25,000 inhabitants, and Melesse, 6,000 inhabitants). Both municipalities defend a project of reducing urban light at night, to both reduce energy consumption and favour biodiversity. In this context, the aim of the experiment is to use tools from citizen science to help municipalities create an informed and data-based dialog with citizens on the impacts and desirability of public lighting. From April 1st to June 30th 2022, inhabitants are invited to follow a scientific protocol to discover obscurity and its psychological impact. This protocol, created with researchers, encourages them to go outside, to remain static for 3 to 5 minutes in the dark, in different circumstances, and to focus on what they observe and feel. They share their experiences and questions with other participants on the website, using a pseudo. They are then encouraged to deliver their recommendations for a future lightning policy anonymously. The support for or against public light extinction by other participants is visible and one can change his recommendations accordingly until the last day. After the end of the experiment, municipalities will make decisions based on the conclusions and analyses of citizen participation. Research work is carried out to evaluate the project and understand participation dynamics through the data produced during these three months.

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From Lisbon to the planet: environmental scales in tourism practices shaping the city

***Elisa Lopes da Silva, Susana Fonseca, Frédéric Vidal**

Lisbon's urban space is transforming rapidly. What part has tourism played in this process? In social sciences, constructivist approaches view tourism as one more element in the making of the city and the diversity of tourism practices as a strategic observation point of urban life. In turn, environmen-

tal activists regard tourism as a resource-demanding activity with high impact on both local and planetary health: from the local infrastructure necessary to accommodate the flow of tourists to the direct consumption of resources (products and services) by tourists during their stay, as well as the greenhouse gas emissions associated with long journey travelling (air travel, cruise ships). This is relevant for a city like Lisbon, which, since the early 2000s, has become one of Europe's fastest growing destinations. Our short presentation will explore ways of dwelling and mobility that grew in the Lisbon city centre and its relation to environmental issues at micro and macro level. This is a citizen science project carried out through a collaboration between CRIA (Research Network Center in Anthropology) and ZERO (Sustainable Earth System Association). This research combines different forms of citizen participation. ZERO, an environmental NGO, mobilised its members and activists, who live or work in the city of Lisbon, to participate in different research steps (definition of working questions, fieldwork, interpretation of results). Local residents, traders, university students and city council policymakers are also involved in different research tasks (focus groups, guided tours). The data gathered by participants is analysed and published in an academic blog (https://civtur.hypotheses.org). The involvement of various types of participants and collaborations aims to overcome potential limitations of citizen science, regarding different research paces and citizen availability. This is a pilot investigation conducted under the COESO project (Collaborative Engagement on Societal Issues - EC-H2020-SWAF) which aims to develop and share collaborative science in the context of Social Sciences and the Humanities.

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How good are gardens for wildlife? An analysis of the quality of wildlife friendly interventions in UK gardens.

***Claire Narraway, Daniel Hayhow, Tristan Pett**

Wildlife is in decline due to factors including increased urbanisation, intensive agriculture, pollutants, and climate change. Access to quality greenspace both provides much needed habitat to support urban wildlife and increases nature connectedness, reduces stress and improves health outcomes for people. Private gardens make up about 30% of greenspace in urban areas. Encouraging people to manage their private greenspace for wildlife could play an important role in reversing species decline by vastly increasing the percentage of quality habitat in urban areas and connecting patches of public greenspace such as parks. Whilst studies have looked at the distribution of wildlife friendly resources in gardens across the United Kingdom, and conservation efforts provide a wealth of resources on how to effectively manage private greenspace to support wildlife, little is known about the success of these campaigns in creating quality habitat for wildlife. Here we address this knowledge gap by asking 1500 citizen scientists from across the United Kingdom to answer a questionnaire detailing what actions they have taken for wildlife in their private greenspace and the quality of those interventions. The wildlife actions explored are extensive including leaf and log piles, bee hotels, bird feeders, vegetation, and the use of pesticides. Quality is determined by alignment with the factors that, according to the literature, make the intervention more likely to be used by wildlife and result in positive outcomes for their health or reproductive success. Results will explore the most common mistakes made when installing wildlife interventions, which interventions most commonly occur together, and provide suggestions for improving educational resources and identify opportunities to maximise benefits of private greenspace for wildlife and the people who manage and enjoy it.

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What's that weed on the street? Motivation and attitude of participants in the 'Pavement plant' citizen science project

***Nienke Beets, Paul Keßler, Anne Land-Zandstra**

The plants in our environment are often overlooked and underappreciated. This plant blindness can be explained by a lack of interest in and focus on plants in education in favour of animals. The Pavement plant project strives to reduce plant blindness by having participants notice, get to know and appreciate the most underrated plants growing right on their doorstep,

through citizen science. Participants register their observations and use learning tools such as an online photo library, posters, mobile apps and books to identify plants in an accessible way without many barriers. Plant distribution data is then used to determine species richness and biodiversity of local urban flora. The aim is to ultimately inform local policy makers to promote greener and climate proof cities. In order for a citizen science project to be successful it is important to understand who is participating and what their motivations are. Addressing these motivations may help attract and retain participants and also determines how people participate in the project. In addition, plant blindness, and the role citizen science can play to reduce this, are not yet well understood. Therefore, we conducted an online survey in April 2022 on motivation and attitude towards urban flora with 254 participants above age 16. Preliminary results show that participants include people ages 16 to 86 (mean = 56 yrs). Secondly, 61% of participants have no prior nature volunteer experience. Participants with and without nature volunteer experience will be compared to map differences and similarities in motivation and attitude. The overall strongest and most common motivations were nature related and activist, e.g. feeling connected to nature and wanting to protect the environment. In addition, participants' attitude towards urban flora is very positive. They most strongly consider urban flora to be natural as opposed to unnatural and important for nature as a whole. Our results will inform further development of the Pavement Plant project and similar projects that focus on identification of plants and the impact of citizen science on the reduction of plant blindness.

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Session 11:

Ethics & Policy: how do we strengthen social innovation with citizen science?

Session chair: Claire Murray

Measuring together, trusting each other? Disagreeing stakeholders collaborate to measure air quality in a rural area in The Netherlands

***Kirsten Vegt, Janneke Elberse**

In recent years, the number of environmental citizen science initiatives in which citizens use sensors to measure their environment increased significantly (eg. citizen sensing). In rural/agricultural areas, livestock farming is a source of environmental concern. In such areas air pollution and odour annoyance are major sources of worry. These sources raise health concerns among residents, which in turn often create tension and distrust between them and farmers. This citizen science project is situated in an area with intensive livestock farming in the Netherlands. The National Institute of Public Health and Environment (RIVM) worked together with three stakeholders, namely: (1) residents of the area who are worried about air quality and/or experience odour annoyance, (2) livestock farmers in the area and (3) the municipality. We investigated whether low-cost sensors were suitable to measure several air quality components and if results could facilitate dialogue between stakeholders. One of the aims was to research whether stakeholders with different needs and interests who measure together, would develop more trust and understanding towards each other. Before and after the air quality measuring phase, we conducted a survey on mutual trust and understanding in both participants and non-participants in the area, as well as semi-structured interviews with participants. Preliminary results indicated that measuring air quality and odour annoyance together didn't create more trust between farmers and their neighbours. The local government did seem to be trusted a bit more by residents after the project. Furthermore, this study provided insight on important elements that created trust in the scientific process and data by the stakeholders involved, such as: the process supervisors' independence, the approachabi-

lity and expertise of the scientists and learning about the scientific process and the associated uncertainties.

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Understanding the loyalty of citizen scientists in biodiversity citizen science programs

Baptiste Bedessem, *Clara Schwindt, Anne Dozières, Colin Fontaine

Loss of biodiversity constitutes one of the biggest threats to planetary health. Out of its impact on the richness of life on earth, it affects the spread of infectious diseases and makes it more difficult to grow food. Citizen science can be a key component to a better understanding of this loss from a scientific perspective. It may also raise people's awareness and knowledge regarding environmental issues. Through their participation, citizen scientists continuously improve not only their science literacy, but also the quality of the collected data. Participation also furthers public engagement towards the environment and increases the chances of management changes in favour of biodiversity. Moreover, sustained and long term participation offers continuous data sets, which are required to analyse the complex natural systems and the impacts of our landscapes and management practices on them. All these elements point to the importance of building loyal and active citizen scientist communities. Yet, the epistemological, social and organisational conditions which foster a sustained and long-term individuals' participation in biodiversity citizen science are still poorly known. In this study, we compare 17 contributory science programs, attached to the National Museum of Natural History in France, in terms of citizen scientists' recruitment and retention. These observatories, which have gathered more than 140,000 participants over 30 years, target different groups like naturalists, farmers, green space managers, students and the general public. They focus on several taxonomic groups (birds, bats, insects, snails, earthworms, and plants) in the whole French territory. The main strength and originality of our study lay on the size of this sample base. Indeed, this pool of long-term programs with different organisational and scientific features allows us to lead a comparative analysis to identify the levers and obstacles to sustained and long-term participation. We then could consider as explanatory variables both management dimensions (size of the management team, intensity and forms of communication), scientific aspects (difficulties of the protocols, kinds of species or taxa under study), and socio-demographic features (age, gender, income, geographical location). Our conclusions will be useful to design future successful contributory science programs.

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Keep the flow: what has yarning got to do with citizen science

Jacqueline Goldin

We go to a very remote rural setting in the Hout Catchment, Limpopo, South Africa, where citizen scientists are using low cost appropriate technology to monitor water in their wells. Here, we are keenly appreciative of the work of Ingold (2015, 2017) on knotting and entanglements and the meshwork metaphor of Klenk (2018) which helps us grapple with a complex socio-political environment and ideals of planetary health – in particular, the idea of human health, healthy partnerships and better stewardship of natural resources, in this case groundwater. Through the lens of feminist philosophy and an ethics of care our attention is on difference and diversity, proposing that work on citizen science has not yet made these links quite explicit nor emphasized why indeed an ethics of care and feminist thinking is at all relevant to citizen science. The idea of yarning reminds us of the entanglement of individuals, institutions and the environment. It reminds us too of the entanglement of disciplines – in particular the way in which art and science intertwine. This Keep the Flow presentation, captures the dynamic and emancipatory notion of water literacy, the human right to know and knowledge democratisation. As these ideas are brought to life this adds value to understanding the transformative and emancipatory aspect of citizen science. We see our work on yarning and entanglement sitting well with ideas of justice and the politics of difference as well as a pedagogy of discomfort and its ethical implications on authentic learning spaces, allowing for a far more robust lens through which to measure the emancipa-

tory and transformative potential of citizen science. We refer to the work of Jadallah and Ballard (2021) on sociocultural learning theory and present innovative methodologies, such as storyboards, participatory monitoring and evaluation, participatory mapping and other visual cues to communicate science to citizens and the emotions and notions of transformation to scientists. Our work advocates for a bridge between art and science.

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Policy perceptions about the contribution of citizen social science on policy making: a case study on environmental justice

Guillermina Actis, Valeria Arza

This paper discusses the results of an ongoing interactive exercise to explore policy perspectives on the use of citizen social science knowledge in policy making. Although there are some relevant and recent guidelines informing how citizen science initiatives contribute to environmental policy (e.g. EC, 2018; Cohen & Doubleday, 2021), the study of such connections in the milieu of social sciences is still missing. We carry out this exercise with policy makers working for the sanitation of a heavily polluted basin in Argentina where 1.8 million people live in highly vulnerable conditions. The territory's governance involves different political jurisdictions, normally administered by different political parties. Sanitation policies have been difficult to advance and existing plans have very limited citizen participation. A citizen social science initiative jointly promoted by an academic team and a civil society organisation with judicial experience in the basin, along with communities who are promoting transformative actions in the territory, co-designed a digital platform for citizens to share experiences on key areas for environmental justice. These data open several opportunities for policy making (e.g. cost effective monitoring of water quality, democratic approaches to natural areas conservations, etc.) but there are several challenges and reservations that need to be addressed (e.g. on data quality, the politics of participation, etc.). We study the potential to tighten connections between citizen social science knowledge and sanitation policy making using a Q-methodology, which allows the identification of the social perspectives on a topic (McKeown and Thomas, 2013). Based on a literature review we identify two theoretical dimensions for analysing the interaction between policy making and citizen science: i) policy instances in which interactions can take place and ii) the mechanisms of interaction. With these dimensions we build a stratified sample of 52 'statements' characterising challenges and opportunities. We invited policy makers with managerial responsibility in the basin sanitation to build hierarchies of agreement and disagreement with those statements. We present preliminary results on policy perceptions regarding the use of citizen knowledge in policy decisionmaking, which will inform different strategies to improve the potential of citizen social science.

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Citizen science to foster social innovation: citizen science strategy 2030 for Germany

***Aletta Bonn, Thora Herrmann, Wiebke Brink, Susanne Hecker, Christin Liedtke, Matthias Premke-Kraus, Silke Voigt-Heucke, Julia von Gönner**

"We will integrate citizen science and perspectives from civil society more strongly into research." This sentence in the German government coalition contract signals that citizen science is part of a modern research landscape and can foster social innovation. *The white paper citizen science strategy 2030 for Germany* aims to strengthen citizen science in society and science in order to expand its innovation potential for science, society and policy. Based on results of an online survey in autumn 2020, the *White Paper Citizen science strategy 2030 for Germany* was developed in an open, participatory process over a period of 18 months. It involved 219 people from 136 organisations employing different participatory formats with 50 working group meetings, a public online consultation, 2 public dialogue workshops, 2 writing workshops, 5 evening discussions and submission of position papers by institutions. The Strategy derives future visions for 2030 and designates 94 recommendations for 15 areas of action on how citizen science can contribute to important goals from policy, society and science. Importantly, recommendations are targeted at 6 key actor groups, such as

researchers and their institutions, government agencies, citizens as well as funders. Areas of action include topics such as health and medicine or novel technologies and artificial intelligence, as well as integration in policy or education. Now the Strategy needs to move to implementation.

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Co-created citizen science in low- and middle-income country cities

Rachel Pateman

The world's population is increasingly urban. While this presents opportunities for sustainable development, rapid, unplanned growth can also lead to environmental degradation and pollution which in turn can damage residents' health and wellbeing. Furthermore, vulnerable communities within urban developments can often be invisible in official datasets and their needs and perspectives excluded from decision-making. As part of the Stockholm Environment Institute's (SEI) City Health and Wellbeing Initiative, we piloted co-created citizen science methods in two rapidly developing secondary cities, Nakuru in Kenya and Udon Thani in Thailand, to address these challenges. Our aims were to identify issues of importance to residents in these cities, including those from vulnerable groups, and to work with them to design and implement citizen science projects to understand these issues and work with key stakeholders to begin to address them. In this presentation we will share an overview of the methods used in these pilot projects and the outcomes of these projects both for participants and for decision-making in these cities. We will also draw on evaluation of these projects as well as a systematic review of citizen science in low- and middle-income country cities and interviews with citizen science project leaders to highlight the opportunities and challenges that come from using citizen science approaches in these contexts, which differ in many ways from experiences in the global north. Our learning from these and other citizen science activities will be incorporated into a SEI Guide to Citizen Science which will form part of our Toolkit of Participatory Approaches for residents and stakeholders in low- and middle-income country cities. Our aim for this toolkit is to empower residents, including those who are often excluded from these discussions, and other stakeholders to use participatory methods to understand and tackle issues affecting their health and wellbeing and that of their cities.

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Session 12:

The future of our nutrition: food production and healthy soils

Session chair: Katja Radon

From national participatory plant breeding projects to European multi-actor food living-labs: how to consider planetary health?

***Dominique Desclaux, Paolo Annicchiarico, Luca Colombo, Katrine Ejlerskov, Fruzsina Szira, Mariateresa Lazzaro, Attila Králl, Allison-Marie Loconto, Zsofia Perényi, George Carlsson, Rachel Arnould, Jean-Francois Tedesco, Maria Carlota Vaz Patto, Kristel Moinet, Maria Rosário Bronze, Judit Feher, Dóra Drexler, Inger Bertelsen, Teresa Pinto Correia, Monika Messmer, Marco Barzman, Francesca Galli, Gregori Akermann, Christophe Cotillon, Yuna Chiffoleau**

The story begins at least 20 years ago: organic farmers in France, Switzerland, Italy, Portugal, Hungary, Denmark, and Sweden were looking for crop varieties adapted to their environment. Researchers have been collaborating with farmers in each country via local participatory plant breeding programs. The impact of genotype by environment interactions (GxE) was mainly studied on yield. The term "environment" initially included climate, soil type, cropping system and bio-aggressors. Then, farmers were increasingly interested in on-farm processing of their own harvest and became peasant-millers, peasant-bakers, peasant-pasta-makers, peasant-processors. The E of GxE was enlarged to components related to processing, marketing and regulations. Today, farmers, food processors, chefs, stu-

dents, citizens, researchers, and other actors of the food system are moving from localised participatory research projects to building a European citizen science dynamic based on living-labs. The opportunity is offered by the UE "DivinFood" project 2022-2027. Orphan species, alternative cropping systems, peasant and artisanal processing processes and conditions for fair value sharing are at the heart of research in order to promote healthier diets, healthier planet via notably more sustainable food systems. In Divinfood, 9 living-labs are now active in 7 countries and the first aim is to involve each citizen in the new definition of E: what does the environment represent for everyone? How to take into account planetary health? Which indicators? Which measurement methods? How to consider the cultural, economic, and societal components of the environment? Similarly, the impact of GxE is considered not only on yield or food quality but also on biodiversity, ecosystem services, benefits and costs. How to also reach indicators on this? Citizen consultations and prospective studies are starting to take place in each living-lab. These indicators also serve as the basis for building an inter-country citizen science community. This is the beginning of this project and the interest is precisely to propose at time T0 an initial mapping of the setting up of each living lab: how do we go from fairly small local collectives involved in participatory research to the creation of European interconnected living-labs?

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Agroecological transition in schools for a better human and soil well-being: perceptions, potentials and commitments, the SOLALECOLE project

***Pierre Ganault, Christian Reynaud, Manon Bodin, Veronique Agnese, Morgane Arietta-Ganault, Mirabelle Antoine, Apolline Auclerc, Guillaume Bagnolini, Nicolas Becu, Anne Blanchart, Paolo Campo, Alix Cosquer, Paola Dias, Anne-Cécile Vain, Pierre Leglize, Quentin Vincent, Stephanie Manenq, Nathalie Fromin**

Biodiversity and its interactions with people are essential to the health of both ecosystems and humans. Re-appropriation of spaces by citizens, through (for instance) the creation and maintenance of collective urban gardens, is a transformation that allows people to interact with nature and biodiversity. However, such re-appropriation is not trivial, and the determinants of citizen commitment are poorly understood. With the project SOLALECOLE, we developed a methodological approach to co-co-construct citizen science projects around urban agroecology in pilot middle school classes at two sites (Montpellier and Nancy, France). We worked together with actors from the civil society, teachers and students, using soil science, environmental psychology, education science, and participatory simulation to collectively explore participants' motivations and their limitations in pursuing and sustaining the agroecology initiatives. We ran pre and post evaluation (survey and drawing) to assess the students' knowledge, perception and interactions with soils and its biodiversity, through the complete process. We developed agroecology projects specific to each school, using serious games co-designed by the students. SOLALECOLE intends to precisely describe the involvement of the various partners (scientists, facilitators, teachers, students) and their positioning (perception, interests, capacities) for the project. The methodology is intended to be widespread and applied in various contexts to further improve consideration of soil and soil-human interactions into education curricula, while improving soil health and protecting its biodiversity in urbanised areas. SOLALECOLE is supported by the French initiative CO3: a knowledge co-construction device for the ecological and solidary transition.

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Using citizen science to explore plant breeding and investigate food-chain transparency for novel breeding methods

***Gulbanu Kaptan, Huw Jones, Edgar Meyer, Joshua Weller, Baruch Fischhoff**

Post-Brexit, the UK government introduced a bill to the Parliament to pave the way for gene-edited plants to be grown for food in England. Gene editing is a laboratory technique that results in genetic changes equivalent to those used in conventional plant breeding, and introduced as a more controlled and targeted method that results in rapid genetic changes with the poten-

tial to help produce abundant and healthy food with less negative impact on the environment. Previous research has shown that (1) the implementation and continued use of novel food technologies depend on public acceptance of the technology, and that (2) successful implementations require participatory approaches fostering 'science-in-society' relationships. In line with these findings, we apply a citizen science approach that requires active involvement of volunteers in research. This is both contributory and collaborative for improving the knowledge of citizen scientists on traditional and novel plant breeding methods, and using their input to suggest mutually acceptable policies, moving forward. We collaborate with 69 UK volunteers in this study. We apply citizen science by sharing subject-specific information about traditional and novel plant breeding methods gradually with deliberative, participatory, and transparent approaches supported by short activities and focus groups. We aim to integrate the outcomes of this study with a stakeholder engagement study with UK stakeholders (e.g., plant breeders, retailers, government agencies) that elicits their views on successful integration of gene editing into the UK food system. We expect the outcomes to reveal the differences and overlaps in citizen scientists' and stakeholders' mental models, therefore, influence stakeholders' views and decisions on successful integration of gene editing into the UK food system. In addition, we expect to use citizen scientists' input to suggest mutually acceptable policies, moving forward such as (no)labelling of gene-edited foods in the UK.

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Healthy soils for a healthy planet. State of the art and perspectives for developing citizen science on soils in France

***Chantal Gascuel-Odoux, Philippe Loiseau-Dubosc, Appolline Auclerc, Lionel Ranjard, Sophie Raous, Christopher Roturier, Joëlle Sauter, Ludovic Serin**

Along with the development of citizen science, more and more initiatives on soils are emerging. Soils are key components of ecosystems and original objects regarding citizen science. They are invisible and quite unknown, but touchable and experiments can be developed. Because they integrate multiple impacts of human activities, soils are increasingly taken into account in public policies (agroecology, biodiversity, food, climate). While physical, chemical and biological information collected to qualify soils provides the researcher rich and original data, it also embarks the citizen on a rich journey of discovery. This presentation will share i) an inventory and an analysis of the projects in France, based on a survey of the project leaders, regarding properties, land use context, co-building, ii) lessons learned from a workshop mixing scientists and non-scientists involved in these projects. The 20 projects identified, all fairly young, are mostly on soil biology, on agricultural soils. They are mainly driven by research, but established with diverse partners, most often involved in only a part of the project (collecting soil data). Co-building protocols, interpretation and feedback to non-scientists are still underdeveloped. The questionnaire will be used and adapted at a European level in an EJP SOIL project. All resources are available online (https://www.afes.fr/actions/recherches-participatives/). This first workshop on soil citizen science could increase exchanges between projects to create a network on this topic.

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Session 13:

Human Health: patient research, epidemiology & foresight

Session chair: Kim Grützmacher

Using passive citizen science to map the effects of COVID-19 litter on animal life

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During the COVID-19 pandemic, the usage of single-use face masks and gloves increased rapidly, all over the world. As a result, the number of

this personal protective equipment (PPE) littering the environment also skyrocketed. The finding of a dead fish entrapped in a single-use glove by Dutch citizen scientists kickstarted our research into the effects of this newly introduced and very recognizable single-use COVID-19 litter on animal life. To improve our knowledge of the impact of PPE on all animal life we actively searched online on social and news media for reports of interactions like entanglement and ingestion. Also, PPE was being used as nesting material by birds with the risk of getting entangled. The first 28 interactions were published in an academic paper. After publication, we continuously updated the overview and also encouraged the public to share their observations via our website www.covidlitter.com. We are currently analysing the results and at this moment the updated overview contains 86 interactions between animals and PPE. Preliminary results show that most of the observations concern birds (n=54) or mammals (n=23). Most of the observations are entanglements (n=37) and most were seagulls (n=11) or dogs (n=10). Observations were mainly shared by volunteers like amateur photographers, nature visitors, and wildlife rescuers. In our study, we will further explore any patterns arising in the data, biases, and the possibilities of using social media as an additional data source for research. We will also research the motivations of volunteers who shared observations. This form of "passive" citizen science, where data is gathered from open access sources such as social and news media, shows that even without knowing, people can become citizen scientists. Our study improves our knowledge about the effects of newly introduced single-use products on animal life. This can help to inform important stakeholders like policymakers and industry, who are involved in the introduction of single-use plastic products in the society. Also, it contributes to our knowledge of passive citizen science and the potential of using online social and news media for research purposes in this age of information.

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CoAct for mental health

***Josep Perelló, Isabelle Bonhoure, Franziska Peter, Bàrbara Mitats, Assumpta Mateu, Quiona Giménez**

The EU CoAct project has been exploring Citizen Social Science with a research and innovation set of research and innovation actions. One of these actions is focussed on social support networks in mental health which envisions mental health care in holistic and communitarian ways just as planetary health and ECSA conference envision. The WHO constitution states: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." Social support networks thus refer to the social and emotional environment of people, to their networks of relationships. Having a social and affective environment is a key element in the mental health recovery process. There is little knowledge about how social support networks work in mental health care provision. To better learn about how social support networks work, we have co-designed the so-called CoAct for Mental Health research which has included the creation of a digital conversation in a Telegram chatbot. The chatbot contains 222 microstories written by more than 30 co-researchers (persons with mental health problems and family members) and hundreds of chatbot participants are responding whether you have been living a similar experience or whether someone from your own environment has been living a similar experience. We will also share the experience of how co-researchers have also actively contributed in the interpretation of the data collected by the chatbot and how this data from hundreds of participants mostly based in Catalonia can help to reinforce these networks. We will finally share the effort on how to transform results into collective actions and policy recommendations in the Catalonia context. For this, we have counted on the Knowledge Coalition effort with more than 60 organisations engaged. Finally, the presentation will close with a general discussion on how similar strategies could be used in other Citizen Social Science projects.

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Nowcasting urban vector mosquitoes for epidemiological preparedness

***John R.B. Palmer, Roger Eritja, Isis Sanpera-Calbet, Tomas Montalvo, Joao Encarnaçao, Antonios Michaelakis, Israel Molina, Frederic Bartumeus**

This presentation will explain how citizen science can be combined with novel technologies and traditional mosquito surveillance to gain valuable insights about urban disease-vector mosquitoes for neighbourhood-level control and public health interventions. We will describe an ongoing study and operational platform that brings these three data streams together in near real-time to estimate the spatio-temporal distribution of tiger mosquitoes (Ae. albopictus) at resolutions sufficiently fine-grained to facilitate day-to-day decision-making by public health authorities. The system combines expert-validated mosquito reports from citizen scientists, an AI-driven networked smart-trap system, and traditional mosquito traps. The citizen science reports, sent through the Mosquito Alert system, offer unprecedented and inherently scalable geographic and temporal coverage, but they are dependent on the sampling behaviour of citizen scientists. This limitation can be overcome by combining them with the smart trap system, which uses machine learning to continuously classify and count mosquitoes as they enter the traps, offering extremely high temporal resolution, and with the traditional mosquito traps, which can be placed in targeted locations to fill gaps in spatial resolution. By modelling the three data streams with urban land cover and weather patterns, the integrated platform estimates the spatio-temporal distribution of Ae. albopictus exposure risk, providing public health authorities with a near-real-time vector exposure index mapped daily at 20m resolution, as well as short term forecasts and historical visualisations. This makes it possible to more effectively reduce the risk of mosquito-borne disease while minimising environmental harm. Already operational in Barcelona, the system offers a clear example of the powerful ways in which citizen science can be leveraged for planetary health.

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Citizen science in medical and health science projects - Legal questions and medico-ethical contradictions due to participation

Timo Faltus

In medical research and health science research, as in other fields, new research approaches are developing within the context of citizen science. In this context, in addition to research projects previously carried out by professional, institutionalised researchers, projects are becoming established in which the research question is carried out with the participation of, or exclusively by, individuals who do not come from the professionalised, institutionalised research environment. On the one hand, such citizen science projects with their inclusive approach may also provide new therapeutic approaches by considering patient interests that have not been sufficiently considered so far. On the other hand, these participatory approaches as well as the projects completely outside the traditionally professional and institutionalised scientific community confront medicinal law, medical device law, data protection law, and patent law with new issues. In the case of these new issues, it is questionable to what extent the existing legal framework, which has been developed as legal basis for the professionalised, institutionalised science and research, adequately regulates (medical research and health science research) citizen science projects according to their opportunities and risks. In particular, the presentation shows where criminal law problems may arise for medical citizen science projects. Based on this, the presentation shows which aspects need to be considered in the project design to ensure that the researchers involved do not make themselves liable to criminal prosecution. The presentation also explains the requirements that data protection legislation imposes on medical citizen science projects. In addition, the presentation demonstrates the extent to which citizen science projects with a medical, health science, or epidemiological research approach require a professional ethics review by an institutionalised ethics committee. Finally, the presentation explains where citizen science projects, especially those with an Open Science approach, come into conflict with the goals of patent law and what practical significance these conflicts have for the realisation of therapeutic approaches for the general public.

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Citizen science for health in action: gaining insight in fatigue for people with rheumatoid arthritis

***Ria Wolkorte, Lieke Heesink, Michelle Kip, Monique Tabak, Hendrik Koffijberg, Christiane Grünloh**

Through living with and managing their symptoms daily, patients become experts on their own condition. Their expertise can guide the scientific process, and contribute to scientific knowledge. Within the TOPFIT Citizenlab a national participatory citizen science project with people with rheumatoid arthritis was initiated in January 2021 in The Netherlands. The project consists of 5 phases. (1) people with rheumatoid arthritis created a list of research topics, and ranked them; fatigue was chosen as the main topic (2) Co-designing a research question regarding fatigue (3) Setting up a research protocol for measuring symptoms of fatigue and possible associating factors. The protocol consists of a 21-day, 2 minute, digital crowdsourcing questionnaire. (4) Collection of data through a platform designed in co-creation with people with rheumatoid arthritis (5) Interpretation of the analysed results together with people with rheumatoid arthritis. To ensure not only relevance on a group level but also on an individual level, people with rheumatoid arthritis can see a visualisation of their symptoms through participating in this study. This supports insight on an individual level on a complex issue such as fatigue. In the various phases people were involved in different roles, starting as co-thinkers and growing into a role as partners. Different methods such as surveys, interviews, focus group discussions, co-creation sessions were used. The group was in constant communication through email and were updated on the progress of the project through public summaries. During the project there was a need to decide upon prerequisites of the project, such as collaboration and desired roles, the consent procedure, and data sharing policy after the project (ie. placing data in repositories according to the FAIR principles). This was done in partnership with the people with rheumatoid arthritis. Relevant stakeholders such as patient organisations and rheumatologists were involved as advisors in phases of the project when relevant. The collaboration, where both people with rheumatoid arthritis and researchers contributed their respective expertise and experience, resulted in scientifically sound, relevant and feasible research leading to new scientific knowledge. Furthermore, this approach contributed to insight into prerequisites for collaboration, community building, data sharing, and ethics on citizen science for health.

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Exploring the impact of large-scale planetary health challenges on positive community health in Kenya

***Claudia Robbiati, Chloe Wood, Winnie Chelagat, Iregi Mwenja, Aloyce Odhiambo, Emma Ogden, Martha Gutteridge, Des Tan, Laura Peters, Geordan Shannon**

We live in a globally connected world, as such, small-scale systems of community health become connected-in and connected-out to large-scale planetary health systems challenges. Rapid and substantial global environmental degradation is catalysing a series of local environmental changes which affect the diverse and complex network of resources communities draw on to achieve positive health. Crucially, the very communities dealing with the consequences of global environment change rarely have a stake in the decision-making process to design and sustain health agendas aligned to local priorities and resources. Inclusion of communities would integrate their extensive knowledge of local phenomena to enable the development of tailored interventions that can systematise and increase local capability to mobilise local resources effectively.

We engaged different groups of community members across three diverse field sites in Kenya in Baringo, Siaya, and Nakuru counties and applied a resourcefulness-based approach to explore community concepts of positive health and how they are influenced by planetary health threats. We used a mixture of qualitative (78 FDGs), participatory (67 activities including cognitive mapping, community timeline and mapping, tree diagrams, patient's journey, walking interviews), and data-driven approaches.

Our mixed-method approach, with emphasis on systems-thinking, was able to capture the pathways by which large-scale planetary health challenges simmer through the inter-connected global systems and reach small-scale community systems of positive health. Communities provided informa-

tion-rich insights into both how their systems of positive health have both become steadily impacted over recent decades, and how cyclical events such as seasonal change dramatically shift the availability, importance, and agency they have over their systems of resources for health. Community positive health, community identity and vision were described as strictly dependent on the local natural resources available and affected by their depletion. The multiplicity of local environmental and climate changes like droughts, lack of clean water, floods, deforestation, overfishing, land grabbing, and pollution are hampering the communities' journeys to positive health.
A further inclusive knowledge-building process will be completed to co-produce a validated toolkit and measurement framework to crowdsource data for priority-setting, decision-making and support the use of local resources to anticipate and mitigate planetary health threats.

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Session 14:

Motivation, impact & evaluation II

Session chair: Sabrina Kirschke

Differences in the participant structure and motivation of an analog and a digital mosquito-related citizen science project

***Berj Dekramanjian, Nadja Pernat**

Developments in mobile communication technology and the scalable improvement of online data sharing methods have in recent years fostered participation in mobile-based citizen science projects. Coinciding with the escalation of environmental degradation and the diffusion of invasive species due to the climate crisis, projects focusing on monitoring its adverse effects and on the preservation of natural resources have attracted growing numbers of citizen scientists and researchers alike. The progression of the field in regards to its previously established methods increases the importance of accounting for and identifying possible shifts. Participant background, behavior, and engagement could vary between digital projects and ones that depend on direct physical submissions of data. The study analyses demographic and motivational factors amongst the citizen scientists participating in passive mosquito surveillance in two different sets of programs. The study aims to examine the distinctions in attitude and intent of participants of both projects, through analysing survey results, as well as conducting open answer sentiment analysis. The objective of this study is to further strengthen projects' ability to recruit and maintain engagement, by identifying the characteristics of potential participants and clarifying calls to action that would be more effective in drawing them. Two of the most popular and successful mosquito monitoring projects in Europe, the Spanish 'Mosquito Alert' and the German 'Mückenatlas' have been used, as each uses a different approach for collecting similar data. Mosquito Alert (MA) is a fully digital project while in contrast, Mückenatlas depends on physical samples of species that are submitted through the postal service. The study had 410 responses in total, confirming before analysis the comparability of the two populations, it analyses categorical variables, Likert scale motivational factors and performs both text and sentiment analysis on open-ended questions. The results provide insight into recruitment and communication strategies and in addition showcase how differences in design can impact participant diversity.

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Evaluating participatory science and research beyond their diversity. An example from a citizen observatory of urban environment

***Alexandra Villarroel, *Laure Turcati, Renaud Debailly, Asma Steinhausser**

"Science Ensemble" (meaning "science together") is a network of participatory science and research and their project leaders are from the Sorbonne University Alliance (ASU), a group of several institutions including the Sorbonne University and the National Museum of Natural History - Fran-

ce. The currently 42 projects of that network are quite diverse in terms of disciplines. More than half of them are devoted to biodiversity, but there are also projects on music, health, languages, history and heritage. Their territorial roots are also quite varied, though most of them are conducted in metropolitan France. Science Ensemble monthly workshops highlight the need to work on evaluation, as quantitative data, usually used to evaluate research programs, did not reflect the richness of PSR projects. Three workshops were organised in 2020 to address this topic from three points of view: the one of researchers in the humanities and social sciences; the one of funders of research programs, whether or not focused on participatory science and research; and the one of project leaders. These workshops confirm that evaluation is an issue for all participatory science and research landscape including funders and that indicators for these complex, multi-actor, transdisciplinary and long-term projects are still challenging to define. Based on these exchanges and diversity of points of view, we collectively built an evaluation grid structured around two main subjects. 1) indicators related to project management in participatory mode (methods and tools for participation; consistency with scientific objectives, data collected and participation; data access and ownership…) and 2) impact indicators (on the production of scientific knowledge; on education, skill development; about society…). Our work based among others on the ECSA Citizen science 10-principles and our objectives were to provide project leaders with a guide to self-assessment, but also to highlight for funders the diversity of impacts of participatory science and research, both before the launch of a project and throughout its life. Our presentation will detail the co-constructed evaluation grid and illustrate its application to PartiCitaE, a citizen observatory of urban environment. PartiCitaE defined urban environment as all the parameters impacting human well-being in cities and aims at building a shared and scientific knowledge of it.

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Towards principles for co-evaluation in citizen science based on experiences in human and environmental health research

***Barbara Kieslinger, Katja Mayer, Teresa Schäfer, Stefanie Schürz**

Citizen science is a form of participatory science. Often, people engaging in a scientific process are personally affected by the research and its outcomes: In participatory health research patients get engaged, hoping for outcomes that are beneficial for their health. In participatory environmental projects peoples' engagement is often motivated by reduced quality of life due to pollution, climate change etc. In both health and environmental research, participatory approaches have seen a significant increase lately. When people dedicate efforts to scientific activities that relate to their personal or environmental health, they should also be involved in defining what they expect as outcomes, linking to changes in their personal lives and society at large. So why not define how such expectations could be measured and what evidence could look like in a participatory way? While we speak about participatory science that considers participation throughout the research process it seems that evaluation and impact assessment are often left to scientists or professional evaluators. We suggest co-evaluation as a participatory approach that opens feedback channels for project stakeholders across the full research cycle. In our contribution we show how co-evaluation was implemented in three cases of citizen social science around topics of human and environmental health, and how these experiences led to the writing of a whitepaper on co-evaluation in citizen science. The cases vary greatly in context, research objective and methodology, but for co-evaluation we have identified common issues, such as the fluid roles of participants or the importance of expectations management. When citizens engage in scientific activities that suggest change, the constraints of individual projects have to be reflected transparently, just as we need to define strategies of ownership of the process and results, beyond the project. Along a set of principles we discuss key aspects of co-evaluation, such as transparency, ownership and reflexivity. The principles are intended to guide the participatory approach to project evaluation and to sharpen the focus for impact assessment. Particularly in participatory health research, we have

learned how important feedback channels are across project boundaries. Co-evaluation principles can help to consciously create and anchor such channels.

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Monitoring and evaluating the impact of university-led citizen science at institutional, urban, regional, and global level

***Margarita Angelidou, Christos Politis, Elli Roma-Athanasiadou**

In this paper we present the Monitoring and Evaluation (M&E) Framework which was developed under the leadership of Q-Plan International in order to closely monitor, evaluate, and assess the performance, outcomes, and impacts of the activities of INCENTIVE. INCENTIVE is a 3 year European Commission Horizon 2020 programme (GA 101005330), in which Q-PLAN, along with four European Research Performing & Funding Organisations (RPFOs) and ECSA, are partners. The four RPFOs participating in our consortium are: Autonomous University of Barcelona (Spain); University of Twente (the Netherlands); Aristotle University Thessaloniki (Greece); and Vilnius Gediminas Technical University (Lithuania). In terms of methodology, the key pillars of the Monitoring and Evaluation framework were co-created with key stakeholders from the partner RPFOs in the context of a dedicated co-creation workshop. In sequence, Q-PLAN engaged in the design of a full fledged Monitoring and Evaluation framework with evaluation objectives, the methodology to be followed for data collection, the indicators to be monitored, the tools (questionnaires) for data collection and the periodicity of data collection. We then organised a digital workshop with the participation of 27 M&E experts, who gave us valuable feedback for validating our approach and fine-tuning the selected tools and indicators. The complete version of the INCENTIVE Monitoring and Evaluation framework includes more than 100 indicators to measure progress towards three main objectives: (i) grounding Responsible Research and Innovation (RRI) in society; (ii) transforming how RPFOs create impact and interact with their surroundings; and (iii) advancing sustainable development at the local, regional, and global levels. The indicators' configuration was based on (i) the output of previous Horizon 2020 projects funded by the European Commission, such as MoRRI, SUPER_MoRRI, and MICS, (ii) the report from the Expert Group on Policy Indicators for RRI, and (iii) feedback received from INCENTIVE consortium partners and field experts.

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Session 15:

BioDIV monitoring

Session chair: Gitte Kragh

Precision citizen science: developing adaptive sampling through co-design for biodiversity monitoring

***Michael Pocock, Tom August**

One benefit of citizen science for biodiversity monitoring is the wealth of records submitted from people from when and where they choose. These data are used for local, regional and national assessments of 'natural capital' to support decision-making for people and nature by policy-makers. However, although all records are valuable, they are not equally valuable: it can be argued that we don't need simply more records, we need records that are more informative. Therefore incentivising recording from places and habitats that are less well-recorded is valuable; especially if these are selected to optimally improve the data used for modelling, such as in regional natural capital accounting. Interviews in our project revealed that this also aligns with motivations of wildlife recorders (both expert and newcomers) to make records that are valuable. Here, we show how adaptive sampling in citizen science is being developed in the DECIDE Project. We have developed a tool to help people decide where to record butterflies and moths, based on identifying areas with public access where model outputs have greatest uncertainty. 'Nudges' for where to go

are provided via data visualisations and bespoke suggestions. Crucially this was developed through a process of co-design with interviews, focus groups and feedback supporting the rapid iterations of the Tool development (through 'fail-fast' development). We are confident that this targeted sampling approach, with its mutual benefits to volunteers and data users, will become increasingly important for effective, impactful monitoring of the environment through citizen science for the benefit of our planetary health.

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The citizen science program at the National Institute of the Atlantic Forest (Brazil): results from 2019-2021

***Natalia Ghilardi-Lopes, André Barreto-Lima, Andresa Guimarães, Juliana França, Eduardo Alexandrino, João Victor Lacerda, Cássio Zocca Zandomenico**

Located in a biodiversity hotspot that has more than 8,000 endemic species, the National Institute of the Atlantic Forest (Instituto Nacional da Mata Atlântica - INMA) promotes research and scientific dissemination about the Atlantic Forest. INMA's citizen science program, started in 2019, aims to: 1) produce knowledge about biodiversity and environmental quality in the mountainous region of Espírito Santo through citizen science protocols; 2) recruit and train citizen scientists to apply the protocols; 3) organise a biodiversity database with the participation of program volunteers and 4) evaluate individual learning outcomes of project participants. Currently, INMA's citizen science program has six projects that together engaged 1,052 employees and gathered information on more than 150 species (amphibians, birds, aquatic invertebrates, primates and reptiles) of the Atlantic Forest, including some threatened, in 50 municipalities in the state of Espírito Santo (Southeast Region of Brazil). The projects` profiles on Instagram are: @aves.usando.pulseiras, @monitoramento.participativo, @projetoromeligenous, @cantoriadequintal, @macaconomato and @norastrodosrepteis. The protocols of these projects can be replicated to other locations, making INMA a pioneer and multiplier centre in Brazil. The challenges imposed by the Covid-19 pandemic, in relation to public engagement, made it possible to expand the scope of the CC at INMA to the existing data on the CC online platform (iNaturalist) and at the Professor Mello Leitão Biology Museum. The public participating in the projects was diverse, requiring the planning of different engagement strategies. Currently, contributory-type projects predominate, in which citizen scientists collaborate only with data collection. The development of other types of citizen science, the accessibility of data and the assessment of motivation, learning and engagement are aspects to be improved in the future.

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Opportunities and challenges of citizen science for monitoring a recolonizing megaherbivore

***Emu-Felicitas Ostermann-Miyashita, Christian Kiffner, Hendrik Bluhm, Hannes König, Tobias Kümmerle, Nina Gandl, Leonie Weltgen, Sophia Hibler, Frank-Uwe Michler**

Thanks to continuous and dedicated conservation efforts, some wildlife species are now returning to former habitats in Europe after decades of absence. While this is welcomed by many, some stakeholders fear potential conflicts, as the landscape has been increasingly human-dominated during the absence of the wild animals. Moose (Alces alces) is one of these returning species to Germany, with unique challenges: 1) it is a species with extremely low density (assumption by experts are 6 – 20 individuals in Germany), 2) lack of a systematic monitoring to guide evidence-based wildlife management and 3) high mortality in an occurrence of a traffic accident, due to the large body size of the moose. While some of the moose's characteristics pose challenges, their size and the fact that they are active during the day time, are excellent traits for monitoring methods applying citizen science. Based on data provided by three independent citizen science approaches: App, Mail/Email report, and a homepage for reporting moose presence in Brandenburg State (Germany) we aimed to (1) compare the efficacy of the three citizen science approaches (in terms of

reports and quality of evidence), (2) analyse temporal patterns of verified moose presences, (3) describe the demography of the moose population, and (4) assess if moose sightings aligned with predicted habitat suitability models. In addition, we used a questionnaire survey to (5) gauge the willingness for citizen science approaches among citizens and to identify preferred options for citizen science methods. Our findings were 1) moose sighting significantly increased during the years of 2017-2019 and 2) also showed a seasonal trend with sightings increasing in late summer. 3) In more than 90% of the cases, the moose were sighted alone, and 4) half were reported to be males, 20 % females and 30% as unidentifiable. 5) More than 90% of participants were ready to report a moose (contribute to moose monitoring), but 6) almost 40% answered that they were only ready to contribute, if the duration of the monitoring was less than three minutes, 7) which indicated that it is crucial to make the monitoring process as simple and as quick as possible.

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Citizen science to mitigate the biodiversity crisis: lessons from Vigie-Nature, a long-term, large-audience biodiversity monitoring schemes network

***Benoît Fontaine, Olivier Billaud, Nicolas Deguines, François Duchenne, Adrien Gelle, Gabrielle Martin, Anne Dozières**

In the context of global changes impacting biodiversity through habitat destruction and global warming, citizen sciences represent an opportunity to assess the responses of biodiversity to these changes, to measure the efficiency of mitigation measures, to raise awareness in the society and impulse behavioural changes among citizens. In order to achieve these biodiversity conservation goals, participatory schemes must reach a large audience over a long period. Several key conditions must be fulfilled: protocol and sampling plan should be adapted to the targeted audience; user-friendly online tools need to be designed; animation of the network of volunteers must be provided. With several case studies illustrating success and failure stories, we will show how a set of schemes targeting various types of participants, from school children to skilled naturalists, and from urban gardeners to farmers, may achieve biodiversity conservation goals which would hardly be reached without the contribution of volunteer citizens. These case studies will be linked with Vigie-Nature, the French main network of biodiversity monitoring participative schemes, with more than 10,000 participants. We will show how data collected by skilled naturalists and protected area managers allow to assess the efficiency of protected areas; how photographers have fed a database to measure insect phenology changes related to climate warming. We will also illustrate that farmers using simple protocols in their fields provide data showing the impact of conventional vs. organic farming on insect community temporal trends, and that citizen science programs represent the best way to measure the impact of global warming on common species. Eventually, we will deal with the impact of biodiversity monitoring schemes participation on participants themselves, and show how taking part in these schemes trigger biodiversity-friendly behaviours among participants.

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7 years of Project Roadkill: a multi-stakeholder-approach to improve amphibian conservation in Austria

***Daniel Dörler; Maria Peer, Johann G. Zaller, Helfried Scheifinger, Silke Schweiger, Gregor Laaha, Gernot Neuwirth, Thomas Hübner, Florian Heigl**

Amphibians are in decline on a global scale. In Austria all amphibian species are protected under conservation law. In Project Roadkill, citizen scientists have been working together with researchers from the University of Natural Resources and Life Sciences Vienna for 7 years to get an overview of the roadkill situation in Austria. A special research focus in this project is also on amphibians. Collaborations with NGOs and Museums in amphibian conservation to ensure data flow from science to practice and two recently published papers exemplify the possibilities of a long-term citizen science project for both research and species conservation. Many amphibian species are massively threatened by roadkill every spring, as the amphibian migration to the spawning waters often le-

ads over roads. Timely construction of temporary protective measures is therefore very important. In an investigation together with three other citizen science projects (naturbeobachtung.at, Herpetofauna, Phenowatch) coming from three different institutions (NGO, museum and public agency), it could be shown that phenological events (in this specific case the blossoming of goat willow and apricot) can serve as an easily observable and reliable indicator for determining the right time to install protective measures in Austria. Amphibians were also (indirectly) affected by the first Covid 19 lockdown in spring 2020. We investigated the impact of the first lockdown in Austria on the reporting behaviour of the citizen scientists involved in the Roadkill project. The results show that the number of reported roadkills in 2020 during the lockdown weeks decreased significantly compared to the average number of reported roadkills in 2016-2019, especially for those species that become active in early spring after hibernation, such as many amphibians. In our presentation, we will trace how the roadkill project has evolved through the collaboration of various stakeholders, ultimately leading to these two publications. These developments in the last 7 years also exemplify how citizen science projects can contribute directly and indirectly to planetary health.

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'Objectif Plancton', a citizen science programme dedicated to coastal plankton

***Céline Liret, Marine Le Moal, Mathilde Cadier, Cyril Gallut, Cécile Klein, Martin Plus, Philippe Pondaven, Nalani Schnell, Laura Schweilbold, Marc Sourisseau**

'Objectif Plancton' is based on collaborative scientific research and long-term monitoring of planktonic communities in coastal ecosystems. Set up by Océanopolis, this citizen science programme involves people from scientific research, civil society, and scientific mediation. Understanding the mechanisms that control the dynamics of coastal planktonic biodiversity is essential for predicting and anticipating their responses to global changes, and the impacts on ecosystem services. 'Objectif Plancton' aims to understand the mechanisms underlying the small-scale spatial variability of plankton communities in coastal areas, i.e., why one species and not another is present at a certain place and time of the year. The objectives are to obtain a synoptic view of their distribution, long-term monitoring, temporal variability of their diversity, and to monitor fish larvae and their relationship with plankton composition. To achieve these objectives, citizen involvement (recreational boaters, fishermen, etc.) is essential, as they are the ones who collect at sea the samples necessary for the study. The scientific activities of 'Objectif Plancton' focus on the diversity and dynamics of planktonic communities on a spatial, seasonal, and multi-annual basis, as well as on the functioning of biogeochemical cycles in coastal ecosystems. Data are collected by sea users, who take samples simultaneously at different locations in the same ecosystem, three times a year. Three coastal sites are studied: the bays of Brest, Lorient and Concarneau (Brittany, France). The analysis of data collected over the last three years estimates correlations between environmental variables (currents, salinity, high nutrient concentrations) and high phytoplankton biomasses, or the presence of species. Scientists inventory them and determine which ones predominate in each of the three study sites. 'Objectif Plancton' is unique! As far as we know, there is no series of observations and process studies that simultaneously address the issue of small-scale spatial variability and temporal dimension (infra-annual and multi-annual). This citizen science programme will contribute to create new links between science and society, and to predict changes in coastal ecosystems that feed an economy linked to tourism, aquaculture, and fishing. Discussions are in progress with Quebec to implement 'Objectif Plancton' in the Gulf of St. Lawrence.

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Session 16:

Citizen science platforms II: thematic initiatives

Session chair: Claudia Fabó Cartas

OpenGeoResearch – A citizen science platform to collect geospatial research questions for planetary health

Stefan Herlé, *Thomas Lemmerz, Alexandra Weber, Larissa Böhrkircher, Gunnar Ketzler

Research questions regarding the relationship between mankind and the planet inhabit a spatial dimension. Thus, the three global challenges of planetary health often manifest in local characteristics, which are multi-variant and region-specific. To tackle the challenges of research and information about planetary health on a regional level, citizen science may help collect questions, find answers, and disseminate knowledge. The platform OpenGeoResearch provides the possibility of information and knowledge exchange between researchers and interested citizens. In the project, citizens become human sensors, which share research data in the form of geospatial research questions or specific local knowledge. This citizen science approach might help generate new regional research topics, gather answers and data, as well as gain and disseminate regional knowledge. Citizens encounter various questions during, e.g., hikes, walks, or everyday life: Are rainbows predictable? Why can we find Saharan dust in Central Europe? OpenGeoResearch offers a smartphone application that can be used to collect and report geospatial research questions instantly. These can be annotated with descriptions, user-defined tags, photos, and the location to provide background information and a spatial context. The platform collects and visualises the regional questions on a map in a browser-based application. Here users, such as experts, scientists, or citizens, may explore the posed questions with all their information, provide answers or discuss questions using comments. Hereby, the project addresses all kinds of geospatial research questions. A growing team of experts from the geosciences such as geology, geography, climatology, and urban planning tries to give insights into possible answers. However, the community may also answer questions or provide additional local knowledge. OpenGeoResearch follows the ECSA principles of citizen science. It aims at the participation of citizens to find new research fields, but also to give feedback and subsequently to involve citizens in conducting research projects. Moreover, the project offers a platform to pass on information gained from past research projects to the public. Since the platform uses open standards, the collected questions are publicly and interoperable accessible. The project is part of Germany's "Wissenschaftsjahr 2022 - Nachgefragt!".

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Interactions between citizen science and the ecosystem around Wikipedia

Daniel Mietchen

Wikipedia formed the nucleus of the Wikimedia ecosystem of open knowledge websites. This session will provide an introduction to the citizen science aspects of this ecosystem. Wikidata (https://www.wikidata.org) is a multilingual collaborative platform that democratises data curation similar to how Wikipedia democratised the curation of encyclopaedic information. It is tightly integrated with all language versions of Wikipedia and its sister sites, and it collects, reuses and provides structured public domain data across all areas of knowledge from all around the world. Wikidata meets the requirements of the FAIR principles to make data findable, accessible, interoperable and reusable, and it allows people to collaborate who do not share a common language. With about 25,000 volunteer contributors each month that collaborate openly, Wikidata blends open science and citizen science approaches. The human contributors are aided by hundreds of automated or semi-automated tools that perform repetitive tasks at scale, based on community-agreed standards. Together, they have aggregated over 13 billion RDF triples on the platform that can be queried via a dedicated SPARQL endpoint and other means, which aids in quality control of the database content and workflows, and facilitates knowledge discovery within the corpus. Thanks to a combination of extensive examples, help pages, tutorials, user interface design and other mechanisms, this endpoint

is gentle to users across various skill levels for the SPARQL query language. This way, Wikidata also democratises access to and participation in the Semantic Web. The software underlying Wikidata is Wikibase (http://wikiba.se/). It is open source and openly licensed, which allows anyone to run semantic databases that are interoperable with Wikidata and other Wikibase instances. By default, Wikibase instances come with a SPARQL endpoint of their own that is modelled after the Wikidata one. Besides Wikidata and Wikibase, there are multiple layers of citizen science activities taking place in other Wikimedia projects, e.g. the identification of species, historic personalities or buildings as well as the transcriptions of documents or the location of historic maps.

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Collecting the Anthropocene together: developing a participatory, digital and experimental platform on environmental transformations

Elisabeth Heyne, *Julia Tovote, Frédérique Chlous, Romain Julliard, Alicia Mansilla Sánchez, Mira Witte, Ulrike Sturm

"The Anthropocene feels different depending on where you are" (Gabrielle Hecht) The state of the planet, the human access to natural resources, and the relationship between planetary and human well-being are different at different places on Earth. Beyond that, how these things are perceived and assessed is different depending not only on geographic but also on social standing within a society. Our project "Changing Natures" assumes that there is a broad social knowledge of the interconnectedness of humans and the Earth. We think that in the Anthropocene an intensive exchange between society and science is needed to diversify the narratives and imaginaries for this interconnectedness and to activate options for action that they contain. In the joint project between Museum für Naturkunde Berlin and Muséum national d'Histoire naturelle Paris we connect different perspectives of two museums, interdisciplinary scientists and, in particular, the voices of citizens. Our aim is to explore the cultural, local, and multi-perspective knowledge of human impact on nature. Therefore, we invite different communities to contribute to a new kind of collection representing their perspective on environmental transformations. Together, we developed an online platform that enables collecting in a participatory process based on a citizen science approach. The trilingual platform (German, English, French) allows participants to submit objects from the past, which they feel personally connected to and that tell us stories of past experiences of nature. Comments, data enrichment and linking between contributions and objects enables a growing online community to experience the entangled, decentralised network of humans and nature in the Anthropocene in a new polyphony. Based on the data of the shared experimental collection, we aim to further explore the following questions: How can participatory science formats help to create spaces for mutual learning in the face of the environmental challenges of the present? Whose perspectives need to be represented within scientific discourse and specifically in natural history collections of the future? How do we motivate communities to share their perspectives? In our talk, we will present the online platform, first contributions by participants and give insight into our plans for future developments and reflections.

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Personal science Wiki

***Katharina Kloppenborg, Bastian Greshake Tzovaras, Mad Price Ball**

The capacity of people to address their own health issues is typically constrained by their access to institutional support and how well those institutions understand and meet their needs. One way to meet these needs independent of institutions is the practice of personal science, a form of citizen science in which individuals use empirical methods to answer their own personal questions. Practitioners typically try to find insights into or solutions for personal issues, frequently related to their health or well-being. Examples of personal science include the management of a chronic condition, mental health but also weight-loss or productivity increases. This type of self-observation and reasoning requires a number of skills, including phrasing of a research question, designing a research protocol

as well as collecting and analysing data. While personal science typically remains a largely individualistic practice, practitioners often have similar questions, and require similar skills. In recent years, a number of personal science communities – in which practitioners share their experiences and skills through forums, virtual and in-person meetings – have emerged. Despite this, research finds that practitioners tend to start their projects from scratch as there is no common knowledge base that summarises the community's knowledge up to now. To address this issue, we are engaged in a participatory, user-centred design process, which resulted in the Personal Science Wiki. This platform, available under https://wiki.openhumans.org, is a virtual space and ongoing project towards building a peer-produced, common knowledge base for and with the personal science community. Practitioners can share their projects and those of other self-researchers, and iteratively create a shared body of knowledge on self-research topics and tools. Through the collective approach to adding and updating information the wiki method removes maintenance bottlenecks present in prior, more editorialised efforts. Beyond that, a semantic extension to the wiki allows linking content in order to improve findability and accessibility of information. We are continuously adding content, collecting and integrating community feedback, and invite anyone interested to consult and add to the wiki, in order to build a valuable source of knowledge for this emerging community.

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Session 17:

Ways to preserve healthy oceans and fresh water

Session chair: Jaume Piera

Observadores del Mar - A marine citizen science platform working for a healthy ocean

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Observadores del Mar is a marine citizen science platform launched in 2012 with the aim to enhance understanding on the conservation and health status of marine ecosystems. At present, the platform hosts 17 different projects that gather information to contribute to improve our knowledge on marine biodiversity, track the impacts of human activities in the marine ecosystems and promote the conservation of the marine environment and endangered species. The projects in the platform Observadores del Mar cover information on different taxa such as corals, jellyfishes, crustaceans, fishes, seaweeds, seagrasses, seabirds, molluscs, sea turtles; besides three projects focused on marine litter. The platform relies on a web interface designed to facilitate data entry and enhance data validation by scientific teams behind the projects. Beyond the web tools, Observadores del Mar has been also very active in promoting citizen science events, training sessions for recreational divers, schools, and general public, and provides information on the rationale, protocols and materials for each project. Currently Observadores del Mar has more than 3,700 volunteers, almost 400 entities

(including more than 40 schools) and 95 scientists from more than 40 research institutions and universities. Almost 17,000 observations have been already collected resulting in the publication of more than 50 scientific papers, communications, and presentations. The major findings have been new records of introduced and invasive species, expanding distribution of marine species, tracking the spread of the nobel pen shell mortality outbreak in the Mediterranean, tracking of mass mortality events, and monitoring microplastic concentration in the beaches. Almost 10,000 observations have been transferred to open databases (e.g.: EMODNet & Banco de Datos de la Naturaleza), as well as some data has been transferred to public administrations in order to contribute to management and action plans at different levels. Therefore, Observadores del Mar is providing reliable and relevant scientific information while allowing citizens to collaborate and get involved in marine sciences facilitating the interaction among different stakeholders aiming to work for a healthy ocean. In this presentation the main results and lessons learnt during the 10 year journey will be shared.

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Groundwater monitoring through citizen science – A review of project designs and results

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Planetary health depends on sufficient quantity of water and good water quality. However, diverse drivers and pressures such as climate change, population growth, urbanisation, agricultural production, and industrial uses result in water scarcity and poor water quality on a global level. This particularly applies to groundwater which is often used for agricultural irrigation purposes in water-scarce regions and is polluted by nutrients and pesticides. Against this background, better-integrated management of groundwater resources is needed. The implementation of management approaches relies, however, on detailed data on water levels and water quality parameters and on the public's engagement in designing and implementing sustainable management plans. Research and practice increasingly call upon citizen science to increase data quantity, affect citizen learning, and ultimately impact problem-solving. But while citizen science is increasingly prominent in freshwater monitoring, less experience exists regarding citizen-based monitoring of groundwater resources. What is the effect chain of citizen science projects in the field of groundwater? And how is this chain of effects influenced by actual project design? Based on a systematic review of 26 citizen-based groundwater monitoring activities, we analyse (i) the design of citizen science projects, including their general project characteristics, institutional characteristics, citizen characteristics, and forms of interactions, as well as (ii) their results, including their data outputs, outcomes on citizens, and impacts on problem-solving along 23 sub-codes. Results indicate that projects mainly have positive results on data quantity and quality, partly influence the citizens themselves, and, on limited occasions, contribute to groundwater-related problem-solving. Information on project design characteristics is, however, scarce and mostly hints at the relevance of specific process mechanisms such as training and feedback, while characteristics of citizens and institutions seem to be of less relevance. For future research, we suggest groundwater-related citizen science projects to more rigorously report on project design and the characteristics of citizen scientists, in particular. Such reporting will allow for rigorous quantitative analyses of the effects of project design on results in various groundwater monitoring settings.

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Science learning through marine community science in the Yucatan Peninsula

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The presentation features the science learning outcomes of young people (15 to 18 years old) who took part in a marine community science programme focused on beach-cast seaweed in the Yucatan Peninsula of Mexico. It presents an international knowledge exchange between museum-based

community science practitioners and experts in marine biology, human ecology, environmental and science education, and natural resource management. The team coordinated a community science parallel of the "Big Seaweed Search" (a UK-based initiative that invites community members to record the abundance and distribution of 14 beach-cast seaweed species) in two field sites on the Yucatan Peninsula, adapting the science and educational methods as advised by the local team. While seaweeds are part of innovative solutions to environmental challenges (IPCC, 2022), in the Yucatan Peninsula, macroalgal abundance (e.g., Sargassum) can also stress the coastal environmental and socioeconomic systems of local communities (Arellano-Verdejo et al., 2021). The adapted programme "Ciencia en acción. Ciudadanos navegando en el arribazón [Science in action. Citizens sailing in beach-cast seaweed]" seeks to improve the capacity of local young people and their communities to face socio-environmental challenges by generating and sharing knowledge about beach-cast seaweed. To meet the programme goals, at each site, community scientists join a week-long workshop (8 h), facilitated by a team of biologists, an oceanographer, and educational researchers, followed by guided fieldwork over two sessions or more and across three climatic periods. Through pre- and post-questionnaires and post-participation interviews of two cohorts (n= 9; n=9, one from each field site), we examined their prior and new knowledge about macroalgae, science inquiry knowledge, and community science. Preliminary results indicate that although participants' disciplinary knowledge about macroalgae shows simple conceptual changes, their perceptions about beach-cast seaweed, science, and nature shifted to more informed and positive views. Some youth cohorts became aware that beach-cast seaweed includes various more species and these provide ecosystem services. We present specific aspects of science learning and collaborative learning enhanced by the programme, which can promote participation in science and eco-citizenship (Sauvé, 2010) towards the pro-environmental awareness of communities in support of our planetary systems' health.

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Citizen science as a key tool in integrated ocean and coastal observing systems

***Alina Luna, Jaume Piera, Sonia Liñan, Karen Soacha, Xavier Salvador, Carlos Rodero, Ana Álvarez**

Data quality is the key element in Ocean & Coastal Observing Systems to provide reliable measurements for developing evidence-based environmental policies. The H2020 MINKE project (Metrology for Integrated marine maNagement and Knowledge-transfer nEtwork) focuses on all data quality dimensions related to metrological factors. The project proposes a new vision in the design of marine monitoring networks, integrating two dimensions of data quality, namely accuracy and completeness, as the driving components of quality in data acquisition. The ideal data quality approach sets a scenario that maximises the required dataset's accuracy and completeness in all stations. However, this ideal case is unviable because of the implicit cost of deploying and maintaining such a high-completeness (dense) network of sampling stations with high-accuracy and usually expensive instruments. Within this new model, MINKE proposes to obtain data fusion results where all the stations are measured, mixing a few high-level data coming from advanced instrumentation plus a considerable amount of low-cost data coming from citizen observatories and fablabs. The development of the participatory activities in MINKE will be promoted throughout free access to the MINKA citizen observatory, a cloud-based platform that allows creating specific projects, managed by the own communities of volunteers, to monitor marine target species or coastal areas of interest. MINKA will offer as well a virtual access to participatory monitoring networks based on low-cost sensor technologies and courses providing the communities with the use of open hardware and software solutions; and networking and consultation activities will be conducted work with citizen scientists to generate specific datasets that are of interest to the citizen science community and that are useful targets as for example marine litter monitoring methodologies. MINKE's new vision will be framed within a quintuple helix model of innovation, incorporating the natural environmental context (ocean health), civil society (NGO, makers community, social media and citizen science platfor-

ms), academia, industry and governments as the factors involved in monitoring the network design.

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CoFish: co-creating a research project with fishers for sustainable lake fisheries!

***Tania Jenkins, Bastiaan Ibelings, Bruno Strasser**

The stewardship of sustainable aquatic ecosystems is central to planetary health. In the CoFish project (cofish.net), we focus on the issue of sustainable lake fisheries. Lakes, as semi-closed systems, are particularly vulnerable to human-induced pressures and the last century has seen large-scale declines and changes in both the genetic and species diversity of lake fish. However, as a complex and societally relevant problem, the sustainability of fish stocks needs the collaboration of diverse groups of stakeholders ranging from fishers to managers and anglers. Professional fishers and anglers have important experiential knowledge relative to the sustainability of lake fish populations, however, they are often not involved directly in the design of scientific research projects. CoFish is a co-created citizen science project funded by the Swiss National Science Foundation (2021-2024). The goal of the project is threefold: i) to invite fishers and scientists from Lake Geneva to develop together a participatory research project on the sustainability of fish populations; ii) to compare the learning outcomes for scientists and fishers; iii) to compare the learning outcomes for fishers involved in the co-creation of the research to those only involved in data collection. In this talk, we will present the approach we have developed through a series of co-creation workshops and the next steps of the research project. We will touch upon the challenges and lessons learned so far and look forward to reflections on the benefits and challenges that others have faced in designing and evaluating citizen science projects that aim at societal impact.

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Session 18:

Communication, Coordination & Storytelling

Session chair: Enrico Balli

Facilitating citizen participation in scientific agenda setting through participatory storytelling and multi-perspective visualisation

Jasminko Novak, *Mathias Becker, Ksenia Koroleva, Kalina Drenska

The choice of topics for scientific research and science funding commonly happens without citizen participation. Enabling citizens to effectively participate in the selection and definition of research questions is an important but difficult challenge in citizen science research. That requires approaches that can connect different epistemic and social contexts and support collaboration between heterogeneous stakeholders. This is particularly important in the context of planetary health that requires transdisciplinary, transformative research engaging different societal actors. We present a method and open-source tools for supporting citizen participation in scientific agenda setting in a dialogical format that address these requirements. We also report evaluation results from online workshops with citizens and scientists. The developed approach supports citizens in contributing questions, problems and ideas to science in a structured process through short narratives ("problem stories") inspired by participatory design. These mimic the structure of scientific questions enriched with contextualization in citizens' personal and societal experience. Their creation is facilitated in different formats: from moderated participatory design workshops to asynchronous contributions through a structured chatbot. An interactive knowledge map visualises citizen contributions automatically grouped into topics through a machine learning algorithm (controllable by the moderator). The map allows scientists to explore citizen inputs, to connect them to existing research topics (collaborative tagging, links), to provide comments to citizens, to add new insights and suggest new research directions. Based on scientists' contributions citizen inputs are grouped by related research topics. The map can then be explored by different actors from the citizens' or

from the scientists' perspective, while showing the relationships between them. This multi-perspective visualisation communicates the results of the process to all participants by visualising and connecting the different perspectives. Science policy-makers can also explore the citizens' and scientists' contributions, identify relations to existing research and identify new, cross-disciplinary research topics or ideas for new funding programmes. Results of the experimental evaluation in test workshops with citizens and scientists (62 participants) show that the developed approach can stimulate "high quality" citizen contributions, the discovery of connections between different epistemic contexts (citizens, scientists) and facilitate participatory approaches to scientific agenda-setting and science communication.

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Why it matters to be heard – The relevance of science communication and recognition in citizen science projects

Anna Soßdorf, Laura Ferschinger

The Fridays for Future movement (FfF) has drawn a lot of public and academic attention in recent years. So far, some international and national studies have been undertaken to understand the organisation and mobilisation of the movement as well as the activists motives from different perspectives. Drawing on the literature on social movements as well as climate science communication various theoretical and methodological approaches have been applied (de Moor et al. 2020; Haunss et al. 2021; Mucha et al. 2020; Rucht 2019; Sommer et al. 2019; Wahlström et al. 2019). Based on a citizen science project with Fridays for Future activists in Germany, we analyse the relevance of two aspects that seem to be important for a successful citizen science project. On the one hand, it is essential to apply a thorough science communications strategy to the project continuously. On the other hand, it is important to acknowledge and recognize the volunteer work of citizen scientists. In this talk, we want to discuss examples of how science communication can be a tool for recognition in citizen science, which in turn can drive citizen scientists' motivation and participation in citizen science projects. For this we draw on knowledge and experience we gathered while conducting a research project with citizen scientists as well as from data we gained in interviews with our coresearchers. On this basis, we are able to show how activist motivation developed over time and which communication activities and tools had a relevant effect on the perceived recognition as well as on the long-lasting motivation level within the group of citizen scientists. With this presentation we connect to the third of the challenges of planetary health: In order to understand how civic actors, society, and institutions are responding to threats and insecurity posed by climate change as well as how they unite within movements like FfF to respond to these challenges it is important to get access to these people and organisations. We learned that access to and knowledge about these groups is more feasible when people and their contributions are recognized and acknowledged.

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Is it a match? Motivations on citizen science volunteers and recruitment arguments in project descriptions

***Kai Nils Weeber, *Nicolas Felipe Gutierrez Paez, *Ohto Sabel, Raija Hämäläinen**

Since citizen science projects rely on voluntary participants, it is relevant what motivates people to engage in those projects. Most research literature before takes only participation in one specific citizen science project or a specific science field into account. Therefore, we analyse how important motivational factors among self-related and social-related gratifications (Nov et al., 2010) for citizen science volunteers in general are. In addition, previous studies rarely considered that citizen science participation underlies also recruitment communication managed by project organisers, despite its importance for a successful work with volunteers (Shields, 2009). Consequently, this leads to the question how well motivational arguments in project recruitment match the motivational structure of citizen science participants. Previous literature shows a variety of 12 different motivational factors for citizen science participation like topic interest, social recognition, or contribution to scientific research, connected to different project

topics or features (Lampi et al., 2020). These factors, in turn, can be attributed to more large-grained motivational categories regarding more social-oriented arguments like altruistic contribution, joining a community, or social interaction, as well as more self-oriented arguments like enjoyment or project reputation (Lee et al., 2018; Nov et al., 2011). Our study may provide orientation with this broad selection of motivations, finding out the most relevant ones over a broader sample of projects. Data has been collected by quantitative triangulation. 980 citizen science volunteers answered a survey about the 12 motivational factors for participating. They had access to the survey by social media posts or email invitations sent to people in charge of projects. Data regarding motivational arguments in recruitment come from quantitative content analysis of 367 project descriptions of the website Zooniverse. The importance of motivations in both volunteering and recruitment are inspected with descriptive statistics and bar charts. Further comparisons use binomial tests and ANOVA contrasts. Results show that participants mainly take part in citizen science projects because of collective motives, enjoyment and a need for knowledge-gain. Analogously, enjoyment and collective ideals are also substantial arguments in citizen science project descriptions. Triangulation of both data might indicate in which regard citizen science organisers meet volunteers' motivation and where they could make improvements.

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A new theoretical engagement framework for citizen science projects using a multi-temporal approach to address long-term public engagement challenges

***Sonia Liñán, Xavier Salvador, Andrea Comaposada, Laura Sanchez, Ana Álvarez, Jaume Piera**

To date, despite the global acceptance of the need for effective citizen engagement as one of the most important steps for the success of citizen science programs, there is a lack of a common theoretical framework for recruitment and most projects rely on intuition or trial and error to develop their engagement strategies. Effective citizen science engagement needs theoretical models of participation and the concurrent action of different actors to implement the model. Besides, citizen observatories are evolving towards infrastructures with technical but also social components to ensure long-term engagement. We have developed and tested an engagement model for citizen science projects using a novel approach that combines different strategies and theoretical models that have been proven efficient in other disciplines such as human behaviour change and persuasion. Our model is based on four pillars that are interconnected and feed each other: theoretical engagement frameworks for behavioural change; social design for citizen observatories; strategies for maintaining volunteer motivation; and strategies to increment the ability of volunteers. The proposed model integrates all the actors of the Quintuple Helix framework of Innovation: the academic community (that provides the data curation and a technological support though a citizen observatory), an enabling community formed by the government and the industry (that facilitate access to a local community and provide field support to overcome participatory barriers), the citizens providing the data, and the natural and social environment. Specifically, we have implemented and tested this model and we provide a case study of a marine citizen science project that monitors urban beaches since 2018:UrbamarBIO. Furthermore, together with the proposed model, we provide specific tools that will help managers to design tailored strategies to overcome the specific engagement challenges of their citizen science project.

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Session 19:

Addressing climate change and advocating for environmental justice

Session chairs: Katrin Vohland

Catalysing climate change advocacy amongst rural Nepalese youth through citizen science

***Naomi Saville, Aishworya Shrestha, Bhawak Pokhrel**

Problem: Nepalese children are already severely impacted by climate change and stand to suffer more as impacts worsen over time, yet efforts to engage youth on climate change issues are lacking. Citizen science has the potential to educate young people by enabling them to analyse how their environment is reacting/contributing to climate change. Aim: to test a citizen science approach to increasing climate-change awareness amongst Nepalese teenagers, so as to catalyse youth advocacy for climate change mitigation and adaptation. Methods: We engaged grade 7-9 school students from two climate change-affected rural municipalities of Nepal: Patarasi and Naya Gaun, in Jumla and Kavre districts respectively. The areas differ in terms of agroecological zone (mountains/hills), distance from Kathmandu (3 days/2-3hours), mobile phone and internet access (poor/adequate), and food insecurity and under-nutrition (severe/moderate). We localised citizen science 'apps' for use on tablets or mobile phones using Open Data Kit, OSM Tracker and iNaturalist. Data collection covered: (i) dietary diversity and anthropometry of children, adolescents and adults; (ii) geolocation of waste management (rubbish dumps/bins), water sources and public amenities; (iii) details of landslides, floods, extreme weather events, and crop pests/failure (geolocation and/or photos); (iv) local plants, insects, birds and other organisms captured via photos/videos/audio; (v) a customised 'plant atlas' to record crops, wild plants and the pollinator types visiting them. We provided briefing on climate change issues and maps, trained students and teachers how to collect data using the apps and supported them to gather information on tablets. We created easy-to-understand visualisations of the data and showcased them to the children, explaining the links to climate change in each case. After the data interpretation, participants shared their experiences, learnings, challenges, and recommendations through Focus Group Discussions. Qualitative data were transcribed and translated and analysed using a Thematic Framework. Findings: Undernutrition, poor dietary diversity and consumption of unhealthy highly processed foods accompany decreased production of traditional crops. Climate change impacts include extreme weather events, flash floods, landslides, drought and failed crops. Inappropriate waste management and unregulated land/road development exacerbate the problems. Students enjoyed learning about their environment and were inspired to lobby to promote climate-change mitigation/adaptation.

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Co-design process of a citizen-social-science platform for environmental justice in Buenos Aires, Argentina

***Leticia Castro, *Valeria Arza, *Guillermina Actis**

The Matanza Riachuelo Basin (MRB) is a heavily contaminated area that runs along the southern peripheries of the city of Buenos Aires with 1.8 million people living in highly vulnerable conditions. This paper presents the co-design process of a citizen social science digital platform for environmental justice carried out with communities in the MRB in the midst of the Covid-19 pandemic during 2020 and 2021. Environmental justice is based on a fair treatment and participation and involvement of people affected by environmental issues in the development and implementation of environmental policies (EPA, 2021). In the MRB this is not guaranteed; there is a greater concentration of environmental dangers on the less privileged and there is very limited participation in sanitation decision making. An academic team in alliance with a civil society organisation with long judicial experience acting on behalf of MRB communities jointly promoted transdisciplinary activities to co-design ¿Qué Pasa, Riachuelo? (QPR) https://mapaqpr.farn.org.ar/. This is a citizen-driven data digital platform that organises existing information and enables opportunities for sharing experiences to build collaborative maps. The platform seeks to support

the communities in their collective actions to promote transformation towards environmental justice in the MRB, particularly in relation to the platform's current themes: water quality, conservation of natural areas and resettlement and redevelopment plans. Fifteen workshops were organised with 51 co-researchers from the MRB community in 2021 following an understanding of co-design as the application of collective creativity across the whole span of a design process (Sanders, 2008). Using participatory techniques inspired in design thinking for social innovations (Keane et al., 2014) the main purposes of the workshops were to collect potential uses and expectations regarding QPR and to improve the data-collection tool for each theme. The paper describes two main aspects of the co-design process. Firstly, the ethical approach for promoting and managing participation, which includes the administration of informed consents and expectation management. Secondly, the creation and organisation of collaborative spaces, included virtual ones. We present the main activities carried out in those spaces, the outcomes achieved and also the main challenges.

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Finding, measuring and improving heat hotspots using citizen science

***Pia Viviani, Nana von Felten, Thomas Bartoschek**

Where does the ice cream melt the fastest? Which places do people avoid in summer and where do they go to cool off? What is the impact of heat islands on daily life? Residents and scholars of five communities in Switzerland measure the air temperatures in frequently visited places in August 2022 and look for solutions to improve conditions at the hottest spots. Equipped with the mobile temperature sensor "senseBox", volunteers measure the air temperatures while walking the dog, on their way to work or school and collect and share this environmental geodata as open data. As a result of the project, ideas for the creation of pleasant and cool public places are developed together by residents and local authorities. The phenomenon of so-called heat islands in densely built-up communities is occurring more frequently, more intensively and for longer periods. Sealed surfaces absorb solar radiation and heat up the surrounding area. As a result, temperatures in these areas are several degrees higher than in surrounding green spaces. These surfaces also fail to cool down sufficiently at night. Heat islands are not only unpleasant for the population, but also a health burden. In 2021, the Swiss canton of Aargau published online urban heat island maps, which are used to model the current climatic situation for the entire canton. These climate maps are the central planning basis for heat-adapted settlement development. In addition, a "Guide to heat-adapted settlement development" is provided. This provides municipalities and planners with a modular work aid with concrete examples and many practical tips. But where to start? What are the most important recreational areas for residents of the individual communities? And how does the temperature behave in exactly these places? The climate maps do not show the exact temperatures under a tree or directly at an intersection. With the project "3-2-1-heiss!" ("3-2-1-hot!") we offer the municipalities of Aargau a simple and accessible approach to the topic of heat in the settlement area by making the residents part of the solution and empowering them through the citizen science approach.

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Addressing the complexity of hydro-climate risk: the experience of the Citizen Observatory of Drought (Spain)

Pilar Paneque, *Amaranta Heredia, Regina Lafuente, Jesús Vargas

The risk of drought is of the utmost complexity. Within the current context of climate change, something we know is that drought will increase in frequency and intensity. Knowledge about the drought hazard (the physical component of the risk) has progressed a lot; however, our understanding of vulnerability (the socio-institutional component) is not on par. The Citizen Observatory of Drought has been created as a social collaborative project of citizen science in order to address the complexity of this risk, to reduce the consequences that it generates and to boost the urgent hydrological transition that different territories must face, especially in southern Europe and the Mediterranean. It integrates technologies of geographical

information and social research techniques in order to: 1) improve the knowledge that citizens have about the risk of drought and the scarcity of water in Spain, as well as possible solutions (online geovisor and active communication); 2) deepen our knowledge of the social perception and public opinion of the Spanish society on topics related to climate change, water uses, drought management and measures for a fair hydrological transition; 3) develop a deliberative proposal that incorporates an informed debate between citizens and experts in an attempt to reach a consensus, in line with programs of participation in science (citizen jury and civic lottery), and; 4) elaborate recommendations for the public administrations responsible of water management, including measures that have been approved by citizens in order to decrease the risk of drought, with the goal of promoting the integration of citizen science in the development of strategies and in the decision-making processes, as well as to stimulate communication and trust between society and public institutions. The Citizen Observatory of Drought project was born in 2020 and it has already produced some results that validate the urgency of its work and it is in line with six of the goals of the Agenda 2030: 6. Clean water and sanitation, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action, 15. Life on land, and 16. Peace, justice and strong institutions.

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Adapting to a changing environment: Inspirations from Eastern Africa

Melvine Otieno

While it is widely known that the African Region is carrying a huge burden of the planetary crisis, solutions and innovation coming from the region are often overlooked or disregarded by the global community. However, while establishing a planetary health community in Eastern Africa as part of the activities of the Planetary Health Eastern Africa Hub, we encountered impressive examples for health adaptation and mitigation in a changing environment. We would like to present the following selection of examples as well as general notions on the capacity for change and innovation among local communities across Eastern Africa. In one case from Zambia, residents of Lusaka Matero compound have exhibited remarkable willingness to adapt to environmentally friendly and healthier sources of energy for cooking and heating. As part of a climate research initiative, communities switched from charcoal as their main source of energy to cooking stoves heated by locally sourced pellets. Contrary to what might be expected, these communities quickly adapted to the initiative and demonstrated an openness for change, showcasing tremendous flexibility. In another example from Kenya, the indigenous communities of Lake Bogoria, one of the Rift Valley Lakes, have shown autonomous adaptive measures to severe flooding resulting from climate change. Their efforts include awareness and educational programs on vector-borne diseases, the initiation of natural mosquito and tsetse fly control mechanisms as well as the protection of endangered medicinal plants. Community members further shifted to increased income diversification and a more resilient food production countering increasing food insecurity. By presenting these examples, we want to provide inspiration to health adaptation and mitigation projects across the globe, explore the openness for change in many communities and eventually, change the prevailing narrative from the African population as a climate victim towards adaptation and mitigation innovators.

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Citizen science as a powerful tool for climate action

***Marjana Brkić, Tanja Adnadjevic, Dobrivoje Eric**

Climate change is a worrisome issue, with manifestations experienced fiercely across the globe. Although effects of climate change are already visible and tangible, the majority of citizens are not yet significantly and adequately involved in climate actions. Citizen science is about participation and inclusion, sharing and motivation. Through the H2020 TeRRIFICA project, we've been combining citizen science with crowdmapping tool for reaching citizens in six pilot regions (Belgrade, Poznan, Paris, Barcelona, Minsk and Vechta), while inviting them at the same time to think about

their surrounding by pinning on the map exact locations hit by climate changes in terms of the effects related to wind, soil, water and air. Participants are also encouraged to propose solutions that could help to better adapt their cities and sites to climate changes. Collected data is further used to create action plans for development of urban areas together with a variety of stakeholders, including scientists, policy makers, local authorities. Moreover, through the "Climate capsule" experimental platform, we're inspiring citizens to immerse into an art-science installation in which they could directly feel and perceive the effects of climate change by 2050. After passing through an uncanny experience, they are invited to share their ideas about future scenarios and possible solutions that will be further used as a feeding ground for the future development of the Climate capsule and related action plans. Citizen science is about learning through engagement, and we believe that through a personal identification with everyday activities, habits and immediate neighbourhoods, and with a possibility to lose all of it as a consequence of climate change, anyone will be eager and well prepared for climate actions.

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Session 20:

Social citizen science and humanities

Session chair: Barbara Kieslinger

How monetary incentives potentially improve the recruitment of participants in citizen science: results from a survey in Germany

***Manh Khoi Ngo, Christian Thiel, Carolin Susann Altmann, Friederike Klan**

The success of citizen science projects often relies on the participation of a large number of participants to collect sufficient amount of data that can be processed later by scientists. While it is known that participation in citizen science is voluntary and typically is based on the participants' intrinsic motivations, other aspects such as obstacles and extrinsic motivations, with monetary incentive as an example, have not been studied adequately yet. Furthermore, it is estimated that only a fraction of the population has actively involved in citizen science. Therefore, based on some initial success stories of deploying monetary incentive in citizen science, we believe that this type of incentive could be used to improve the recruitment of potential participants in citizen science projects and sustain the participation of citizen scientists. In the literature, several incentive algorithms have been proposed to fairly and efficiently distribute a project budget to the participants. However, the real monetary expectation of the general public has not been considered thoroughly in the design and simulation of these algorithms. Consequently, we conduct a survey on the intrinsic motivations and monetary expectations for citizen science among the public in Germany. Through five sample projects that cover various domains of science, 230 adults who mostly have not taken part in citizen science earlier have expressed their intrinsic motivations and desired monetary rewards for their future participation in these projects. On one hand it was found that their future participation is motivated by contribution to science, fun elements of the projects, their personal interests and new knowledge. On the other hand, a majority of the respondents would like to receive a certain amount of rewards. The results of this study can be beneficial to various stakeholders. First, algorithm designers can use the respondents' desired amount of rewards to improve their incentive mechanisms. Second, project organizers can effectively communicate their citizen science projects to the public by stressing the project attributes relevant to the public's motivations. Finally, by combining existing theoretical algorithms and the empirical expectations from the general public, the feasibility of deploying monetary incentive in citizen science can be shown.

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Exploring methodological approaches for citizen science: sharing experiences from a pilot initiative in the social sciences

***Cláudia Carvalho, Rita Campos, Joana Sousa, Denise Esteves, Vasco Martins**

Recent innovative experiences bring us to exploring formats for citizen science research that articulate researchers and different agents from schools, mainly students, teachers, and parent associations in a collaborative effort for participatory research and learning. In this Conference we will explain our methodological experience with a pilot citizen science project that integrated researchers from the Centre for Social Studies (University of Coimbra, Portugal), and students and teachers from a class at the Jaime Cortesão Secondary School (Coimbra, Portugal). The motivation for developing the project resulted from the perception of the low visibility, representativeness and intervention of the Social Sciences, Humanities and the Arts in initiatives that promote scientific culture and communication and, even more clearly so, in citizen science projects. The goal was to promote a critical, inter and transdisciplinary discussion on a social sciences theme from a youth and citizen perspective. From February to May 2022, collaborative research took place in sessions held twice a month and gathered together scientists and citizens, where the latter were active participants in the various stages of the scientific process in the social sciences. The chosen theme was "prejudice in Portuguese society", and participants researched different expressions of it while using different methodological approaches of the social sciences (interviews, inquiries, documental analysis, social network analysis). It was also our intention to promote platforms for dialogue and reflection that involved CES, the school community, (teachers, school technicians, students) and parents or guardians. As a research strategy, allowing teachers and students to lead the research design has potential for successful engagement, learning and research outcomes. However, the (few) examples of embedding citizen science in educational contexts lack a closer collaboration between schools and research centres, or the active voice of youth and teachers in leading the research in the fields of the social sciences and humanities.

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From civil society repair cafes to empowering repair citizen science

***Michael Soegaard Joergensen, Alexander Lindeburg, Christen Monberg, Arlette Bentzen**

Difficult and expensive repair of least electrical and electronic products has led to development of civil society repair activities in terms of local repair cafes and repair events. Volunteers are helping citizens getting "broken" products diagnosed and repaired if possible. The number of repair cafes has grown a lot in recent years. The international network of repair cafes has today more than 1500 members. By prolonging the lifetime of electrical and electronic products, climate impact from resource extraction and processing and product manufacturing is reduced. Also, the consumption of scarce materials is reduced. An international network of repair initiatives, including the international network of repair cafes, have developed the so-called Open Repair Alliance. Participants in the Open Repair Alliance develop data from local civil society repair experiences into what could be called "empowering repair citizen science". The alliance has collected and systematised more than 50,000 local repair experiences. The systematisation focuses on e.g. product type, brand, product age, background for product failure, and whether and how the product could be repaired. The Open Repair Alliance systematises successful and unsuccessful repair experiences for specific product groups, e.g. printers, and organises events where such experiences are turned into demands for design of future products. Such demands have been used in negotiations and lobbying for product specific demands within the EU Eco-design Directive. An important condition for the development of repair citizen science is systematic local registration of experience from the single product repair. Cooperation between Repair Café Denmark and Aalborg University has shown that a barrier for systematic local registration of repair experiences is lack of knowledge among the volunteers in the local repair cafes about the national and international use of the repair experiences. Repair Café Denmark and Aalborg University are cooperating around the development of an environmental calculator, which can show volunteers in local repair cafes the climate benefits of their repair. Furthermore, the network and the university are developing a concept for involving local

volunteers in the national and international learning from repair experiences, which can increase the local data collection and the number of successful repairs.

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Design thinking in citizen science: using methods from participatory design to support citizens in shaping the research agenda

Sander Hermsen

In citizen science projects, participants seldom have the chance to (directly) influence the research questions posed. Fortunately, contemporary discourse in citizen science aims for broader involvement of citizens, offering the opportunity to co-determine research agendas. This is especially important in research involving technology for health, to prevent unwarranted technology push. However, how citizens can take this role remains elusive. Turning everyday health challenges into research questions takes knowledge and skills which most people lack. Methods from participatory design (colloquially known as co-design and often branded as 'design thinking') can play a key role in supporting people in shaping their research questions, making use of designers' experience in mapping user contexts. To help people shape their thoughts and questions towards research that serves their needs and priorities, we propose a three-stage process using methods from participatory design. The first stage uses 'sensitising' methods, e.g. questionnaires, diaries, photography, and other self-registration tools to help people capture what is important. The second stage is called 'provotyping' – combining provocation and prototyping – in which people work with (low-fidelity) prototypes of interventions as a safe, gentle provocation to elicit tacit knowledge such as everyday practices, norms, and taboos. The third stage is 'discussion', in which scientists and citizens explore themes and solution spaces together. We present two case studies in which we applied the three-phase process to collect insights to (further) shape the research agenda of a new institution aimed at technology for personal and planetary health. The first study used a three-day sensitising period and subsequent online discussion meetings to capture insights from low-socio-economic status participants about how technology could help them in healthy nutrition. The second study applied a two-week sensitising and provotyping period to prepare for a group discussion session in a project in which we captured experiences and potential use cases in an augmented health project, i.e. a 'smart' bathroom. The case studies showed that the approach achieved a richness and breadth of scope in the discussion sessions that would have been very hard to achieve otherwise, and led to outcomes that were instantly usable to inform future research.

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Format: A 90-min session with interactive formats moderated by a maximum of three conveners, such as panel discussions, workshops, world café, fishbowl, dialogue sessions, to be described in detail in the abstract. Possibility of participation of 20 participants (subject to hygiene regulations at the time of the call.)

Session 1:

Governance of participation in citizen science for societal transformation

***Maria João Maia , Valeria Arza , Patrick van Zwanenberg**

This interactive session is dedicated to the analysis and discussion of the potentials of citizen science and of citizen engagement in science, technology and innovation (STI) policy, in particular with respect to grand societal challenges. It will entail conceptual reflection of citizen science as a new mainstream practice in technology assessment (TA) research to increase responsiveness in research and innovation, and empirical cases of how citizen science generated knowledge is seeking to reframe and address societal challenges in areas of science, technology and innovation policy covering watershed remediation and agricultural seed innovation in Argentina and diabetes management in German speaking countries. Different perspectives with respect to geographical differences, research or application fields, and the various forms of citizen involvement in science, technology and innovation will be discussed. Questions relevant to this session are: • How can citizen science and engagement contribute to solutions for key societal problems? • What can we learn from specific case studies with respect to the potentials of citizen science and engagement? • What differences and what commonalities between countries, world regions, and research or application fields can be identified in this context? • How can participatory processes and the outputs of such processes be constructively integrated into research and science, technology and innovation policy-making? • How can we measure the impact of participatory activities, at the societal level and with respect to science, technology and innovation policy making? Four pitches (listed below) will be given by four speakers (40 min) as an input for a fishbowl exercise, allowing a highly inclusive engagement of all participants in the discussion (50 min). • "Citizen engagement in science and technology assessment" - Maria Maia, Christopher Coenen, Julia Hahn, Constanze Scherz (all ITAS/KIT) • "Policy making and citizen-generated knowledge to address socio-environmental problems: the case of Argentina"- Valeria Arza (CENIT-UNSAM) • "When citizens assess their own DYS app: what have we learned from TeQfor1 project" - Nora Weinberg (ITAS/KIT) and Monika Pobiruchin (GECKO - Institut für Medizin, Informatik und Ökonomie at Heilbronn University of Applied Sciences) • "Citizen-scientist generated knowledge for open source seed innovation in Argentina" - Patrick van Zwanenberg (CENIT-UNSAM & SPRU)

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Session 2:

Rethinking public services provision: citizen science to support public and environmental health services

***Anna Berti Suman, Nils Heyen, Marisa Ponti, Sven Schade**
Live illustration: Alice Toietta

Current crises are urging institutions to search for help from the organised and unorganised grassroots in fulfilling the task of providing basic services. One can think of the Covid-19 pandemic, disasters induced by extreme weather events and the recent war affecting Ukraine at the borders of the European Union. Crises are understood here as triggering factors of innovation as they 1) destabilise the status quo and 2) augment the demand for public services. In such confronting situations, local people, networks of non-governmental organisations, and associations often mobilise to provide help. They do so by setting up grassroots-driven initiatives and producing (often open access) data that could fall within the category of '*citizen-generated data*' (to be noted that here 'citizen' is understood in a broad sense including, for example, migrants). Such initiatives may be aimed at gathering information on the spread of the virus and analysing it, or collecting geo-located data on settlements affected by a flood event. The data at issue could be considered a basis for *'collective intelligence'* (a term used with reference to the promises of the Internet back in the '90s by Levy), hereinafter CI, i.e., the enhanced capacity created when people work together and join efforts. This knowledge base is of paramount relevance when competent authorities have to intervene on matters they are scarcely prepared for. Indeed, the notion of CI is increasingly spurring the interest of different stakeholders, such as decision-makers at national and sub-national level. These actors are intrigued by the role that CI can play in helping mitigate the said challenges. CI represents not only a strategy to produce information but also a swift approach to work together towards a goal. The said approach could be very valuable to the public sector when in charge of providing relief to the population under stress. By contributing data and time, people demonstrate that a certain 'crisis' matters to them (it can be a systemic crisis of care like what experienced during the pandemic, or an exogenous and sudden shock like an environmental disaster) because it is affecting them directly or it is threatening shared values in which they believe. Institutions in charge of providing services under pressure should look at these enacted practices as possible models of alternative public interventions.
In our session, we will zoom in on public health and environmental health services and we will trigger reactions from the participants positing the following questions. How can decentralised civic data flows help innovate the public sector in particular in relation to public/environmental health services? How can we win over public administrators' resistance to fresh ideas from the public, if they challenge conventional wisdom, as well as their resistance to accept non-official sources? Which methods using civic collective intelligence to engage citizens and the public sector in addressing public/environmental emergencies can we identify? How can citizen science methods and approaches be applied to the field in discussion?

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Session 3:

Challenges, strategies and impacts of doing citizen science with marginalised and indigenous communities: towards a toolkit that can be applied in all contexts

***Dimitris Argyriou, Petra Benyei, Artemis Skarlatidou, Rick Hall, Ida Theilade, Nerea Turreira-Garcia, Danielle F. Latreche, Alexandra Albert, David N. Berger, Mar Cartó-Sabaté, Jessie H. Chang, Rafael M. Chiaravallioti, Arianna Cortesi, Finn Danielsen, Emilie Glazer, Muki Haklay, Emily Jacobi, Asaye Nigussie, Victoria Reyes-García, Eliana Rodrigues, Thamara Sauini, Vyacheslav Shadrin, André L. Siqueria, Mardha Tillah, Nikita Vronski, Timothy C. Woods**

Extending citizen science to maximise its global potential can be a powerful tool to improve local engagement and knowledge in conservation planning, ecological monitoring, environmental sustainability, and in terms

of enriching the indicators of the Sustainable Development Goals (SDGs). However, there are significant barriers to engaging communities and individuals in citizen science projects taking place in non-Western, Educated, Industrialised, Rich, and Democratic ("WEIRD") contexts such as low- and lower-middle-income countries, but also rural and poor settings in high-income countries. This session will attempt to capture barriers and opportunities in conducting citizen science with marginalised and Indigenous communities. Building on the experiences of a consortium of 15 citizen-science projects that was initiated in the online ECSA 2020 conference, this interactive session will seek to uncover learning and reflections from the practical experiences of working with these communities. Up until now, we have found that scientific achievements were not among the most important impacts highlighted since most initiatives working with marginalised and Indigenous communities have a human-rights advocacy approach. Furthermore, looking at the impacts reported by the analysed initiatives, it is possible to conclude that doing citizen science with marginalised and Indigenous communities has a greater impact on participants than on scientists. We will invite participants from similar contexts to discuss their experiences working with marginalised and Indigenous communities. By providing stories from the field in a structured way, this interactive session will aim to directly guide and inform future work in citizen science in such contexts, in the hope that such learnings can inspire other projects and lead to broader participation in citizen science. The session will build upon the submitted and under review paper with the same title in the *Citizen science: theory and practice* journal, and aims to produce a document (working paper or policy brief) of guidelines and recommendations for citizen science with marginalised, indigenous, and underrepresented communities.

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Session 4:

Co-designing solutions for the sustainability and governance of citizen observatories

***Sonia Liñán, Karen Soacha, Alex Amo, Blanca Guasch, Claudia Fabó-Cartas, Àngela Justamente, Sasha Woods, Janice Ansine, Jaume Piera**

Citizen Observatories (COs) have become a hub for managing citizen science knowledge. At various scales -local, regional, global- and in multiple disciplines from environmental monitoring to public health conditions, Citizen Observatories support collecting, storing, opening, and using data and information - and citizen generated data can also contribute to monitor progress towards the SDGs-. As technological platforms, Citizen Observatories face multiple challenges related to the quantity and quality of observations and demands from the user community who expect functional and advanced technological development. Maintaining an active Citizen Observatory based on cutting-edge technologies is difficult and expensive. Although Citizen Observatories are usually intended to run long-term, they often don't continue beyond the lifetime of the project that initially funded the Citizen Observatory, due to the institutions' lack of funding and commitment to maintaining the Citizen Observatory. In this workshop, we invite citizen science practitioners, researchers, developers and the whole community involved in Citizen Observatories to actively participate in the co-design of feasible solutions to overcome those challenges and help ensure the long-term viability of citizen observatories. We will use the co-design methodology developed in the framework of the Cos4Cloud project, as well as some of the technological improvements for Citizen Observatories developed by the project as a starting point for scoping the needs and challenges in terms of sustainability and data governance of Citizen Observatories. Participants will exchange knowledge and lessons learned while co-designing solutions to ensure the long-term sustainability of Citizen Observatories. Additionally, as a result of the event, we will create a public report to be shared with the whole citizen science community. The activity will have facilitators with an extensive experience in collaborative work and co-design using innovative technological platforms.

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Session 5:

Air quality and planetary health

Hester Volten, Wouter Hendricx, Yen-Chia Hsu, Anna Maria Kotrikla, David Riallant, Teije Terhorst, Diana Varaden, Amber Woutersen, Nuria Castell, Kostas Karatzas, Saverio De Vito, Imme Ruarus, Panagiota Syropoulou, Jean-Paul Close

Air quality is the environmental issue with the largest impact on human health. It also has a huge impact on nature and climate. In the ECSA working group on Air Quality, we work together on how to maximize the impact of citizen science in the field of air quality, on society and policy makers. In the Air Quality and Planetary Health session members of the Air Quality working group will pitch their work to inspire a lively panel discussion. The presenters and panel members consist of people with a great diversity concerning their background, reflecting the importance of our shared responsibility as citizens and institutions for our environmental and human health. There will be a 5-minute introduction, followed by 40 minutes of 5-min pitches on a wide range of subjects, such as: 1. citizen participation during a local air quality crisis: citizens monitoring a big fire, 2. data analysis and visualization methods to be used by citizen scientists, 3. educational activities and engaging school students in air pollution measurements with low cost sensors, 5. New mobile technologies for monitoring air quality with sniffer bikes, 6. mitigating air pollution through participation, and efficient policies, 7. indoor and outdoor air pollution combined with outreach and public engagement. The pitches will be followed by 45 min panel discussions moderated by a co-chair of the working group Hester Volten.

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Session 6:

Citizen social science: concepts, practices and experiences from the CoAct project

***Isabelle Bonhoure, Josep Perelló, Franziska Peter, Valeria Arza, Guillermina Actis, Teresa Wintersteller, Veronika Woehrer, Katja Mayer, Stefan Thomas**

Co-designing Citizen Social Science for Collective Action (CoAct) proposes a new understanding of Citizen Social Science (CSS) in topics related to Planetary Health: community mental health care, environmental justice, youth employment, and gender equality. In its more extended form, health is defined as a state of well-being in which an individual realizes his or her own abilities, can cope with the stresses of life, and is able to contribute to his or her community. These topics of the CoAct project indeed consider citizen's health as a fair, equitable, inclusive, and responsive relationship with their close environment. The topics treated in CoAct, in one way or another, are also intrinsically related to issues widely shared on a planetary level. They are faced in a transdisciplinary manner and with a solutions-oriented perspective, just as Planetary Health also envisions.

During almost 3 years, CoAct brought together and further developed methods to give citizen groups an equal 'seat at the table' through active participation in research, from the design to the interpretation of the results and their transformation into concrete actions. This interactive session thus proposes to the participants a 360º vision of the conceptual and practical approaches being put into practice in CoAct.

Different CoAct partners will invite the participants to test, re-use, and critically comment and discuss some of the outputs of the project. The session will consist of short practical activities covering different aspects. It will start with CoAct understanding of the CSS research cycle model, while sharing selected associated open tools. It will present the efforts made to improve the Informed Consent procedure. The concept and tools used to co-evaluate the different Research Actions will be presented as well. This entire set of dynamic activities will be contextualized with the different Research Actions on Community Mental Health Care, Environmental Justice,

Youth Employment and Gender Equality.
Finally, a collective reflection will close the session in relation to challenges faced by CSS. Furthermore, the way to further enlarge and sustain the CSS community while fully embracing the concept of Planetary Health will be discussed.

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Session 7:

A citizen science project which contributes in improving the selective municipal waste collection system

***Diana Reinoso, Josep Perelló, Raúl González, Guifré Ortiz, Albert del Amor, Álex Amo, Tatiana Fernández, Sergio Martínez**

Increasing the percentage of selective waste collection is one key challenge in European countries and it directly relates to planetary health. Moreover, to increase selective waste collection is not only a technical challenge and as neighbours of a particular city we may have a voice and a fundamental role. Citizen science can thus obtain relevant information about citizens' preferences in relation to innovative waste collection systems (smart containers vs. door-to-door system) and open up powerful deliberative spaces to further reflect on waste and on innovative waste collection systems. The project we present has co-created (together with citizens and the city council of Mollet del Vallès, Spain) a digital game with a twofold objective: 1) it increases citizens' knowledge about innovative selective waste collection systems; 2) it collects citizens' preferences regarding environmental, economic and practical aspects of these systems. This information can be used by the city council to better design public policies for the implementation of these systems in the city, anticipating barriers for implementation and designing strategies to better align policies to citizens' needs. The tool has been implemented through a citizen science process, involving high school students in the design of the data collection protocol, the data collection itself, the data interpretation and the writing of a report on recommendations for the City Council. The paper will be presented in the form of an interactive session (workshop) in which participants will be invited to design their implementation plan for innovative waste systems in an imaginary city. Participants will assume a specific role (different profiles of citizens and city council technicians), play the game, visualise data and with the results obtained they will have to decide which plan and which strategies to follow in order to increase the percentage of selective collection in their city. This project is part of the EU Horizon2020 TRANSFORM project (Grant Agreement 872687).

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Session 8:

Empowerment and innovation through co-creative youth citizen social science - An interactive session organised by the H2020 YouCount project

***Reidun Norvoll, Julie Ridley, Ingar Brattbakk, Egle Butkeviciene, Cathrine Skovbo Winther, Sara Plassnig, Michael Søgaard Jørgensen**

Citizen social science (CSS) can support planetary health and well-being by influencing decision-making and connecting diverse fields and actors in collaborative transdisciplinary research and innovations. The H2020 YouCount project (2021–2023) aims to develop co-creative youth citizen social science (Y-CSS) to increase knowledge of positive drivers to social inclusion and targeted policymaking and innovation. YouCount consists of a multiple case study of ten local projects in nine countries and an evaluation study of the processes and outcomes of Y-CSS. Young citizen social scientists are collaborating with researchers and stakeholders in local living labs. This session will use the world café method to discuss success factors and challenges regarding the use of co-creative Y-CSS. Examples from the YouCount Team's experiences will introduce the discussions. The session will be chaired by Egle Butkeviciene, KTU with world cafés chaired

by the YouCount team and young citizen social scientists. The session will include: 1) Presentation of the YouCount project (5 minutes) by project coordinator Reidun Norvoll, OsloMet. 2) Supporting equal partnership through inclusive methodologies, introduced by Julie Ridley, UCLan. To establish equal co-creative partnerships in citizen science, inclusive spaces need to be integrated into research settings. The co-creation process itself can also increase understanding of social inclusion. Still, creating safe spaces through which everyone can participate can be a challenge. The YouCount Team will share participatory methodologies for engagement, including experiences from the Norwegian case and the SPOTTERON YouCount App Toolkit by Ingar Brattbakk, OsloMet 3) Participants in the world café will be asked to consider these success criteria and challenges before summarising implications for CS.

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Session 9:

The wickedness of citizen science, law and planetary health: grappling with trust, democracy and representation

***Dick Kasperowski, Anna Berti Suman, Niclas Hagen**

The health of our planet is at risk and so are we. This is widely recognized as a highly urgent matter. National and international policy and governance bodies expect that citizen science can help address this urgency, e.g. through large scale environmental observations to monitor the SDGs or creating positive societal effects such as enhancing trust in science. For citizen science to have a significant role in attaining planetary health an important aspect is often forgotten: the roles of citizen science within the legal context. Legal adaptation to the development of manifold citizen science(s) is too slow, hampering the roles of citizen science for planetary health. Individuals and communities now take action towards planetary health on matters such as biodiversity protection and climate change, expressing a discontent with political responses, perceived as lacking responsiveness, unwillingness, or inability to tackle environmental challenges. For such communities, the legal system becomes an alternative route for advancing decisions on environmental concerns. When citizen observations are taken to court this can produce legal but also societal effects as rulings may trigger legal and regulatory interventions. Democratically elected policy-makers may have to 'succumb' to the scrutiny of judges and this has clear implications for democracy and for traditional allocation of institutional powers. We will tackle these and other "wicked" issues in our interactive panel, starting from the following questions: Taking citizens to court might affect citizens' trust in public authorities and politicians. Even official science might not go unscathed. Is this an acceptable route towards societal changes if we wish to achieve a healthier planet? What are the implications for democracy of bringing citizen science in courts? Can we accept this as an 'undemocratic' move yet needed for conserving biodiversity and halting climate change? Citizen science projects display that the majority of participants are highly educated, upper-middle class, middle-aged or older, and white. Gender composition often shows a strong bias of participants identifying as male. What does this imply for using courtrooms in representing larger public interests? Does it risk reinforcing societal polarisation and biases not only in science but also in judicial decisions? What are the implications for democracy and appointed institutions when concerned people turn to producing environmental information themselves 'bypassing' set procedures (of reporting/participating), invoking overarching legal frameworks such as international conventions? Is this a way to improve the system by contesting and opening up institutional informational monopolies?

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Session 10:

Peer-to-peer learning: citizen science and botanical gardens

***Baiba Pruse, Fabio Attorre, Stefano Martellos, Cristina M. Meister, Giulia Mattalia, Dominic Grantley-Smith, Nienke Beets, Costantino Bonomi, Paulina Anastasiu, Anneleen Kool, Michael Kiehn, António Gouveia, Martynas Kazlauskas, Vito Emanuele Cambria, Sofie Meeus, Thereis Choo, Mari Rustan, Suzanne Sharrock**

Through a workshop held during the European Botanic Garden Congress in May 2022, the members of Cost Action 18201 ConservePlants Working group on human dimensions, in cooperation with DiGe project team initiated a discussion on how to fully exploit the potential of botanic gardens for fostering citizen science initiatives. Thus, following the successful contributions, we propose to organise a roundtable discussion as part of ECSA, based on inclusiveness and open dialogue principles, aiming at answering the following questions: - How could an international network enhance the role of botanical gardens in fostering citizen science initiatives? - What would be required to kick-off and sustain such a network? The discussion will focus on how Botanical Gardens could include citizen science in their working agendas, and which are the common requirements for achieving such a goal. A final outcome of the workshop will be the development of a proposal for establishing a working group "Citizen science and botanical gardens" within the European Citizen Science Association. The success of the workshop will be based on the active engagement of the participants, and on their agreement on taking forward the proposal to develop a working group.

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Session 11:

How to measure engagement and behavioural change in a citizen science project?

***Dorottya Varga, Pavel Kogut, Diego Casado Mansilla, Athanasia Orfanou, Núria Castell, Celien Van Gorp, Carolina Doran, Beatriz Ortega**

This application aims at designing a joint workshop whose goal is to explore different ways of measuring stakeholder engagement and behavioural change in citizen science (CS) projects related to Air Quality (AQ). Literature abounds with theoretical guidance on these topics, however is difficult to find recommendations that streamline the specific concept of engagement and behaviour change to then understand how both can be measured Two new EU-funded citizen science related to air quality projects COMPAIR and SOCIO-BEE want to first critically examine available tips and advice with workshop participants, before co-creating a robust evaluation framework with a view to applying it in pilot activities afterwards. As both projects test, refine and exchange their experience on the use of the framework, the accumulated knowledge will become a valuable source of information to new citizen science initiatives looking for validated approaches to evaluating participation outcomes in the context of air quality monitoring. The workshop will be run as a world café, with discussions organised around two main questions. Q1: How to *define* engagement and behavioural change in citizen science projects? In preparation for the workshop, a literature review will be conducted to identify not more than 10 options that participants can rank and discuss. Participants will also be able to propose new definitions not covered by the original list. Q2: How to *measure* engagement and behavioural change in citizen science projects and how air quality mediates this assessment? Here both projects will use a list of their predefined KPIs as a starting point for discussion. The goal is to extend it with new ideas from participants and ultimately understand what makes a successful citizen science project from a participants' perspective, and how best to capture impact on a personal level. The workshop will end with an invitation to take part in the upcoming citizen science campaigns to be organised by project pilots in Athens, Flanders, Plovdiv, Sofia, Berlin, Zaragoza, Anco-

na and Maroussi. All ideas expressed at the workshop will be processed and used to finalise the framework which both COMPAIR and SOCIO-BEE will then apply to measure engagement and behavioural change.

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Session 12:

A hands-on workshop on plant conservation through storytelling and citizen science

***Andrea Isabel Troncoso Quilaqueo, Baiba Pruse, Egle Butkeviciene**

Stories can activate people and invite them to be protagonists of the changes they want. Arguments and facts are often not effective ways to get people to listen and connect. However, we can weave them into stories and make communication more effective. The purpose of this interactive session is to gain knowledge and confidence in storytelling by presenting some cases from the plant conservation realm. The main aim is to raise a discussion on impactful storytelling for endangered (- and soon to become endangered) plants. Participants will learn some cases and that will be a starting point to work on their own stories. The methodology will include: - interaction with participants before the workshop via requesting from them to share stories on plants; - dialogue and discuss together which resonated the most, during the workshop - make a discussion on the reasons for the different ways the stories affected the participants. There will be a "work booklet" for each one, that will facilitate getting the ideas down and from there, move them to action. This session is organised by the Storytelling working ECSA working group, and the COST Action CA18201: An integrated approach to conservation of threatened plants for the 21st Century and DiGe.

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Session 13:

How to plan for impact? Using logic modelling to orient participatory research on planetary health towards societal impact

***Mathieu Mahve-Beydokhti, *Chiara Cardelli**

Impact is a topic which is gaining more and more importance in science and research. Moving away from only generating impact within academia, science also wants to contribute to changes in society. Especially involving citizens in research is a way of bringing scientists and non-scientists together to work collaboratively to create better research and develop new solutions. However, complex and interdependent issues such as those concerning planetary health want to address changes in a wide array of sectors. This begs the question what kind of impact(s) we want to achieve and how we want to get there. How can citizen science help to achieve a greater impact for those issues? What is the interplay between impact on a local and a planetary level? This interactive session will give an introduction into how to use logic modelling to plan for the societal impact of participatory research. Participants will gain a first insight on what it means to develop a theory of change, making the pathways towards the desired impact explicit. A strong emphasis will be put on the role of involving citizens and other relevant stakeholders for impact. By either bringing in their own projects or by working on various example projects which will be provided, participants will work in small groups to develop a first draft for impact pathways using our framework. In the plenum, we will compare the work from the small groups and open up the discussion on the different ways impact can be achieved for planetary health. Participants will not only be introduced to the terminology and thinking related to impact and theory of changes, but they will also gain an understanding on how to orient participatory research projects around societal impact and how citizen involvement plays into this.

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Session 14:

How can we build trust in citizen science data to inform policy decisions and action?

***Dilek Fraisl, Steve McFeely, Omar Seidu, Kwame Fredua, Linda See**

Citizen science data can be a powerful means to inform policies and mobilise action to address the planetary health challenges facing our world. Research on the potential of citizen science data for the monitoring of the UN Sustainable Development Goals (SDGs), a global agenda that guides the world's development efforts by 2030, demonstrates that 33% of the SDG indicators can benefit from citizen science data, and the greatest contribution from citizen science to the SDG framework would be in environmental SDG indicators, 58% of which lack data according to UNEP. However, despite these opportunities offered by citizen science data, its potential is far from being realised. Many initiatives exist, such as applications where participants share observations related to water quality or projects where volunteers help track the spread of COVID-19 or disease transmitting mosquitos, but they rarely feed into official monitoring systems at the local, national, or global levels. This interactive workshop session aims to (i) share successful examples of how citizen science data have informed policies and action in the field of planetary health, (ii) discuss the challenges of building trusted partnerships around citizen science data involving global policy actors, government bodies, citizen science researchers and practitioners, citizen scientists, and other stakeholders, and (iii) provide concrete recommendations on how to overcome these challenges. One example that will be highlighted in the session is from Ghana, which illustrates how existing citizen science data and networks can be leveraged to address the data gap on marine plastics at national level and feed into the global SDG monitoring and reporting processes. Involving UNEP, as custodian for the relevant SDG indicator (14.1.1b), government agencies and citizen science projects operating locally in Ghana and at a global scale, Ghana is now the first country to officially report on SDG indicator 14.1.1b using citizen science data, which will also inform an Integrated Coastal & Marine Management Policy in Ghana. The main outcome of the session will be an increased understanding of the necessary ingredients for building successful citizen science data partnerships that can feed into official monitoring processes to inform policies and invoke action.

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Session 15:

DBU ThinkCamp on public engagement for planetary health

***Kim Grützmacher, Susanne Hecker, Sina Winkel, Lisa Pörtner**

In this ThinkCamp, we invite participants to explore main questions around public engagement and planetary health. Together with invited guests from Berlin society we address the following questions: (i) How can the participation of stakeholders in forms of public engagement support the achievement of the goals towards planetary health in the field of nutrition? (ii) Which issues are suitable for public engagement in the area of planetary health, focus on nutrition? (iii) What framework conditions enable or hinder public engagement for planetary health in the field of nutrition? The results of the ThinkCamp will be brought both to the World Health Summit for further discussion and will deliver valuable insights for the development of guiding principles in public engagement for planetary health. The ThinkCamp is part of a larger feasibility study, funded by the Deutsche Bundesstiftung Umwelt (DBU).

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Poster Session A1

Session chair: Moritz Müller

Implementing inquiry-based learning to the context of citizen science: state-of-art of the possibilities

Joni Lämsä, Suvi Toivonen, Emilia Lampi, Raija Hämäläinen, *Aaron Peltoniemi , *Ohto Sabel

Scientifically reliable ways of thinking improve our capabilities in finding solutions to the planetary challenges we are facing today in social and environment contexts. Education of new thinking skills needs to start early and with a solid theoretical foundation. Combining inquiry-based learning (IBL) and citizen science (CS) projects in school contexts may provide an essential platform for educating future agents for solving complex problems. The framing and investigation of problems are crucial skills that can be taught through IBL. In IBL, learners follow the practices of scientists to solve problems. citizen science projects may provide a meaningful context for IBL in formal education. To facilitate the implementation of IBL in the context of citizen science in formal education, we need a state-of-art view of the citizen science projects that can be used as a context for IBL. We categorise the citizen science projects so that the categorization indicates both the learners' desired input from the perspective of the citizen science project and the IBL activities that learners can conduct to provide the desired input. To establish categorization, we answer the following research question: In what kind of inquiry-based learning activities can learners engage in the existing citizen science projects? We extracted data from SciStarter, one of the largest international citizen science project database and found 220 citizen science projects that can be conducted at school. We found that learners could engage in all the phases of IBL in the existing projects, even though learners could mostly conduct few IBL activities in individual projects. Our categorization may help: 1) initiators of citizen science projects to better consider the possible pedagogical and societal functions of the projects, 2) teachers to choose the suitable citizen science projects for IBL based on appointed learning goals, and 3) researchers to examine systematically the learning effects of IBL in the context of CS.

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Drivers and obstacles regarding public and stakeholders' participation in citizen science

***Aelita Skarzauskiene, Monika Maciuliene, Sabine Wildevuur, Maya Van den Berg, Thomas Bakratsas, Artemis Psaltoglou, Efstratios Styliandis, Konstantinos Karatzas, Alexandros Skondras, Ioannis Tavantzis**

Understanding the diversity and complexity of factors that either enable or hinder the participation of general public and stakeholder groups is of critical importance for any successful citizen science initiative. Since citizen science is de facto based on creating and sustaining a critical mass of participation, in the same way volunteer-based projects does, it is vital to identify what are the conditions that may foster or discourage the level of citizen involvement. The overall complexity of the factors at micro-, meso- and macro-level can either create the necessary conditions to unlock the full participation of public and stakeholder groups in citizen science, or reversely pose barriers and obstacles that hinder participation. To identify the enabling and hindering factors, as well as the personal experiences, perspectives and dispositions, the research project deploys a mixed methodology, entailing an in-depth literature review, a series of semi-structured

interviews with QH stakeholders, and a large-scale survey targeting the citizens and general public from the local ecosystems in four pilot countries: Greece, Lithuania, the Netherlands, and Spain. The research was initiated as part of the implementation of the H2020 project INCENTIVE ("Establishing citizen science Hubs in European Research Performing and Funding Organisations to drive institutional change and ground Responsible Research and Innovation in society"). The results reveal a wide range of findings, both for at the EU (aggregated) level, and for each national setting of pilot (individual level). More importantly, the analysis of the data shows that the four countries differ strongly regarding the current social trends and perceptions vis-à-vis citizen science , as well as the role and limitations of the envisioned citizen science Hubs. In addition, the results show diversification – in some instances quite strong – of perceptions across the QH stakeholder groups. Depending on the country and the pre-existing level of citizen science maturity, the results provide a complicated network of factors that unlock or block participation in citizen science activities. These factors include, to name a few, political maturity, civic engagement, technological infrastructures, economic growth, culture of stakeholder collaboration, psychological stimulus, and surplus of resources.

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State strategy in Spain for strengthening citizen science: the role of universities

Alejandra Calvo-Martínez, Manuel González-Bedia, César López, Victoria Sánchez-García, Francisco Sanz-García, Maite Pelacho, Alicia Moreno, *Fernando Romero

An indicator of the good health of citizen science (CS) in Spain is its high participation and leadership in a broad range of projects funded by the European Commission. At national/local level, the Observatory of citizen science in Spain has identified around 300 citizen science initiatives, involving thousands of people. From an academic perspective, Spain has been in the top-ten of CS-related publications since 2010. In addition, more and more universities are developing citizen science projects. However, the enormous potential of citizen science and its impacts is not yet widely known. The Ministry of Universities in Spain, in addressing the challenges facing the university system, does recognise this potential. This is reflected in the Organic Law on Universities, soon to be approved, in which citizen science is one pillar, together with Open Science, to achieve the necessary openness of the university to the entire society. Despite the challenges, universities continue to be ideal nodes of research and education to establish an integral collaboration with the countless knowledge-generating spaces. For this reason, the Ministry of Universities, in coordination with the Ministry of Science and Innovation (MICINN), the Spanish Foundation for Science and Technology (FECYT), together with the Ibercivis Foundation, have launched a strategy to promote citizen science in, with and from universities. A Summer School will be held in July at the Menéndez Pelayo International University, which will be taught by academic and non-academic citizen science experts at national and international level. Moreover, a new call for grants will be launched for citizen science projects that include the participation of universities, integrating it into the annual call of FECYT and MICINN. The ultimate goal is to create a strategy for promoting citizen science in, with and from universities, in order to achieve the much claimed knowledge democratisation and real connection between universities and their environments.

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Citizen science: linking people and nature

***Aletta Bonn, Rachel Kelly, Rui Ying Rachel Oh, Michael Pocock, Assaf Shwartz, Sven Schade**

We are facing a triple crisis: loss of biodiversity, climate change and rising health issues. To address these three sustainability crises jointly, citizen science may present an intervention tool. Increasingly people are disconnected from direct experiences of nature. This disconnect could weaken people's affinity to nature and their motivation to conserve it, with negative consequences for biodiversity and planetary sustainability. Citizen science could be an intervention tool to reconnect people to nature, by encouraging citizens to

better experience, understand, and protect nature: Here, we outline emerging research on citizen science and nature to determine how citizen science may (or may not) be conducive to these objectives, and develop a conceptual framework of pathways, and identify key directions for developing citizen science programmes that can connect people to nature, foster individual and communal efficacy and empower people to take collective action.

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Biodiversity and peace

***Alfred Nordmann, Sonja Daum**

It is a short path from questions of sustainability to the necessary condition of peacefully cooperative life on earth. As the depletion of species has been labelled „biocide," it is a short path also from the question of cohabitation to peaceful co-existence of human and insect agents acquiring and evolving forms of mutual understanding and mutual benefit. While it is easy to show how war impacts biodiversity, it is equally interesting to see how the aftermath of war creates a niche for the re-assertion of biological life. The hardest task is to show how citizen science and engineering can foster a culture of peaceful cooperation between humans and insects in urban green spaces. The poster seeks to exhibit these three dimensions of biodiversity and peace.

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Public space for biodiversity

***Alfred Nordmann, Sonja Daum**

Questions of sustainable development are social as well as ecological. Questions of planetary health revolve around climate change, biodiversity, and peace. In times of war, not only human life and livelihood is at stake but the very conditions of life also for insects and plants. Efforts to foster and preserve biodiversity are often entangled with social and political struggles - not only when it concerns the rainforest or endangered species. — All of these statements challenge us to think about biodiversity in terms of the moral community of living beings who depend on each other, provide services for each other, who need to work out conflicts of interest among each other. It is here where the proposed presentation seeks to make a contribution: On what basis and with what kind of credibility can we argue for co-dependent living arrangements of humans and animals in an urban environment? In the context of the German FEdA initiative, the BioDivKultur project and IANUS-Peacelab seek to create and sustain a community of citizen scientists, makers and tinkerers, civil society actors who are all concerned with insect life in urban green spaces, seeking to establish these as a public space for thinking about peaceful cooperation within and beyond them. For this we mobilize theoretical approaches from the philosophy of ecology as well as creative strategies for implementing them, if only to stimulate action and thought.

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Empowering people to analyse data through visual programming. Breaking technological barriers with MECODA

***Ana Álvarez Sánchez, Jaume Piera, Karen Soacha, Sonia Liñán**

MECODA (ModulE for Citizen Observatory Data Analysis) is a repository to facilitate the analysis and viewing of all sorts of citizen science data. MECODA is aimed to break the barrier between experienced users or programmers and the general public. It allows users from citizen observatories to make their own exploratory visual data analysis, without the intervention of specialised analysts. It makes it possible for observers to create their own reproducible visual dataflows, share them and reuse them. MECODA is intended mainly for the non-programmer public, and specially for users of citizen observatories, that want to go one step further to get the most of their observations, moving from mere observers to analysts of the extracted data. But MECODA can be used by experienced users and expert analysts as well due to its facility to get access to the data sources that can be processed in any other ways. It is based on Orange Data Mining, a visual programming

toolbox made to simplify analysis and data visualisation. Orange supports the construction of data analysis workflows by assembling components for data preprocessing, visualisation, and modelling. MECODA has developed specific widgets to access data from citizen observatories. At present MECODA allows access to data from Minka, Odour Collect, canAIRio or Ictio, but it can be expanded easily to other observatories and different citizen science data types.

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How can citizen science contribute to climate change education? A citizen science project of species distribution monitoring on rocky shores with elementary students.

***Ana Teresa Neves, Diana Boaventura, Cecília Galvão**

Anthropogenic activities became the major driver of changes and impacts on Earth. For the marine ecosystems, climate change is associated with increasing water temperatures, acidification and deoxygenation, which are related to changes in abundance and shifts in spatial distribution of marine species. Citizen science is an important tool for monitoring biodiversity and to gather data of long time series or large spatial coverage. Therefore, citizen science projects on rocky shores have studied the abundance and spatial distribution of marine species in response to climate change. Citizen science has also been recognized with great potential in the field of science education and can contribute to the development of climate change education in earlier ages. This study aimed to evaluate the impact of the participation of elementary students in a citizen science project on their scientific knowledge, skills, and the importance of their contribution to scientific investigations related to climate change and species distribution monitoring on rocky shores. The participants included students of the 4th grade from 5 classes (n=126), in-service teachers (n=5), marine ecosystems researchers (n=3) and users from iNaturalist platform who validated the observations made by students (n =18). Data were collected through pre- and post-tests applied to students, records inserted in the iNaturalist app, semi-structured interviews with the researchers, and a questionnaire to iNaturalist users. Students registered 271 valid observations at iNaturalist platform, 82.3% of which were correctly identified. Also, 93.1% of the observations had a good quality photo and 59,2% used the scale properly. They were also able to observe 22 different taxa. Patella sp., Actinia sp. and Ulva sp., were the taxa more frequently observed. Students also developed some scientific skills (e.g., critical thinking, observing, interpreting, and communicating) due to their participation. Indeed, according to researchers and iNaturalist users, the data collected by students can be used in scientific investigations, especially for species distribution monitoring, improving the size and quality of citizen science databases. Thus, in a school context, citizen science provides an opportunity to raise awareness, to enable learning and skills development, and it can be a tool for biodiversity research in a climate change scenario.

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SelEe - Researching rare diseases through citizen science

Jörg Scheidt, *Andreas Khouri, *Thomas Zerr, Michaela Neff, Jannik Schaaf, Holger Storf

The SelEe project is one of 15 citizen science projects funded by the German Federal Ministry of Education and Research from 2021 to 2024. The topic of the project is research into rare diseases. A rare disease is a disease in which no more than 5 out of 10000 citizens are affected. It is estimated that there are about 30000 rare diseases, 80% of which are genetic. The goal of the project is to give citizen scientists the opportunity to conduct their own research projects to answer their own research questions. To this end, the team is providing smartphone apps that allow for flexible and generic data collection. A core team of ten citizen scientists, recruited primarily from self-help groups, will conceptualise and design the apps and plan their implementation. Project partners are the Analytical Information Systems Research Group at Hof University of Applied Sciences, the Institute of Medical Informatics at Goethe University Frankfurt, and the Alliance of Chronic Rare Diseases (ACHSE).

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Citizen science solutions kit

***Andres Felipe Dorado, Maria Mondardini**

Citizen participation plays an increasingly relevant role as a source of accurate and unique information in different domains, both in science and society. With the help of gadgets, sensors, and concepts that enhance collaborative participation such as challenges, crowdsourcing events, or hackathons, citizens engage with relevant issues in their environment. All major institutional players in the EU and beyond consider public engagement central to the success of the transformations needed for sustainable development. To promote and support citizen participation, the Citizen Science Center Zurich (the University of Zurich and ETH Zurich), in collaboration with the EU CROWD4SDG project, has built a series of open-source tools that allow easy implementation of digital data-collection and data-analysis projects, providing a platform that encourages citizen participation, contribution and effective collaboration between professional scientists with citizen scientists in the framework of Sustainable Development Goals. The tools include, among others, the Citizen Science Project Builder, to engage people in complex tasks for the analysis of digital data (image analysis, pattern recognition, text transcription, geolocation, etc.) and the CS Logger for contributing digital data in multiple forms (text, images, video, audio, geolocation, etc.) by means of common devices, such as smartphones, tablets, or laptops. In both cases, the project's creation and contributions happen via a web interface, with a simple and intuitive step-by-step process. In this short presentation, we would like to promote and encourage the use of such open tools, especially at the initial level of co-creation conception, and iterative design of new projects looking for an expansive and increasingly wide citizens' participation in academics and scientific matters to achieve objectives in benefit of citizen science progress.

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Quality assurance indicators for environmental citizen science

Anett Richter

Indicators are essential for the assessment of the effectiveness and efficiency of e.g. volunteer-based biodiversity monitoring schemes. Here, I present sets of indicators that I developed from findings of a roundtable discussion at the Thünen Conference and evidence from scientific literature that focus on barriers for participation from the volunteers' perspectives. I investigated individual, societal and task-related challenges for volunteers that may hinder them from taking part in citizen science schemes and from achieving project goals. On the basis of formulated actions to overcome these challenges, three sets of indicators are derived, covering the areas of i) capacity building for volunteer-based engagement, (ii) appreciation and valuing of volunteer commitment, and (iii) education and learning in volunteer-based approaches. The poster presents the process of indicator development and the sets of indicators. With the visitors of the poster, I hope to discuss the feasibility of the indicators presented and reflect on the development process and future opportunities for participatory evaluation approaches.

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Evaluation and impact of the transdisciplinary Research Forum Global Health

***Angela Osterheider, Nadin Gaasch, Audrey Podann**

Global challenges become visible at the local level: ensuring urban health with topics such as occupational health, noise and light emissions. These challenges require new ways of communicative collaboration between science and society to co-produce robust solutions together. Within the Research Forum Global Health of the Berlin University Alliance, transdisciplinary networks are being established to jointly develop future topics in the field of urban health, which will then be used both in research and in concrete practical implementation. The goals are to enable transdiscipli-

nary research and to increase the acceptance of the research mode among the participants, to pursue methodological and content-related knowledge interests, and to structurally anchor transdisciplinary processes. But how does this future-oriented project impact the relevant target groups of researchers, non-scientific actors (e. g. organised civil society), and the transdisciplinary community? What specific problems and questions arise in the often time-delayed measurement of impact? On the basis of various qualitative and quantitative indicators the participant experience will be measured and the transformative impact on society and science will be evaluated. In this way, publicly accessible recommendations for the development of the project but also for other transdisciplinary and citizen science projects can be derived and formulated.

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"What happened to the Forest of Giants?" Integrating a citizen science tool in an interdisciplinary environmental education project for monitoring the flora in the suburban forest of Parnitha

***Anna Trigatzi, Maria Daskolia, Matrona Pappa, Maria Pliota, Pierre Bonnet, Sonia Liñán**

The case study reported here was based on the idea of integrating citizen observatories and oral history as educational tools in school environmental education. The educational activities presented were designed within the European project Cos4Cloud, to engage secondary school students with Pl@ntNet and Environmental Oral History methods while visiting the National Park of Mount Parnitha, a protected area at the top of the highest mountain of Attica. 15 years ago (in 2007) a wildfire burned 62% of the core of the National Park. In the educational project designed and implemented, members of the environmental team of a high school located near the mountain spent a weekend in the surrounding forest and conducted an interdisciplinary field study on the effects of this wildfire on the flora of the area. Hiking on the mountain trails, they used the Pl@ntNet app along with a paper observation grid to record the existing flora and they later registered their observations into the Pl@ntNet platform. They also conducted interviews with long-time regular volunteers at the National Park to collect their memories of the flora of Parnitha before and after the fire to the present day. We discuss the additional pedagogical and learning value of this approach and the contribution of citizen science in fostering an interdisciplinary exploration of environmental experience to develop in students (and future citizens) an environmentally responsible stance towards a healthier and more sustainable planet.

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From ecological research to public engagement: the multiple values of citizen science

***Anne Eichenholtzer, Don Driscoll, Rebecca Patrick, Justin Lawson, Shuddha Rafiq**

Habitat destruction and climate change are increasingly pressuring biodiversity and ecosystems in general. To respond effectively, up-to-date knowledge of changes in biodiversity and a solid engagement of society with nature are necessary. Citizen science is one way of contributing to research and ecological knowledge, while engaging society with nature. Our citizen science project has been taking place around Melbourne (Australia) in the past year. The project aims to evaluate a novel and non-invasive monitoring method for ectotherms (with a focus on reptiles and amphibians). Reptiles and amphibians remain difficult to survey and tend to be under-studied in favour of more "charismatic" species. Combining a new video-camera trap and artificial intelligence, this new method is being tested with the help of citizen scientists who are directly contributing to the data collection and analysis. On top of the benefits that citizen science brings to ecological research, our cross-disciplinary study seeks to investigate the potential impacts and co-benefits of participation for the participants themselves. Do they value nature more? Has their well-being been impacted? Has their attitude towards the environment and biodiversity changed? Evaluating participants' outcomes - especially around economics and health - can create new narratives to engage society in conservation

matters; and reach beyond audiences who already have a special interest for biodiversity and nature in general. After the many delays following the Covid disruptions, we are now happy to present the results of the surveys and share the insights.

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OutBe, outdoor sports at the service of marine conservation: case study of an innovative start-up from Italy

***Arianna Liconti, Luca Tixi**

The sea is vast, deep and little known. It covers about 71% of the surface of our planet, is up to 10.9 km deep in some places, yet only less than 10% has been explored. And it is precisely because of its extent and because we know it so little that it is so difficult to protect it. The less we know about marine ecosystems and the physical characteristics that govern them, the less we will be able to protect them and cope with imminent problems including climate change, overfishing and pollution. For this reason, citizen science stands as a cost-effective means of collecting extensive data sets across vast spatio-temporal scales we need for effective marine conservation (Earp and Liconti, 2019). In particular, the water sports community represents a potential fleet of outdoor enthusiasts, ready to be the many eyes and hands scientists need to understand and protect the Ocean. With a little training and the right tools, swimming training, paddling, sailing, or recreational diving can become real scientific sampling and monitoring expeditions. With the aim of connecting those who love and explore the sea every day, with those who study and protect it, OutBe was born. OutBe is an innovative start-up with a social vocation which, starting from the sea, aims to connect outdoor sport communities to marine research projects. Through an online ecosystem and modern communication styles, OutBe is creating a new model of interaction between people and nature where sport is at the service of environmental conservation, and businesses can support and participate in meaningful and fun conservation actions. The proposed model aims to tackle some of the main challenges marine citizen science projects face up to date, including citizen recruitment and retainment, feedback dissemination, funding and data sharing. This presentation will showcast OutBe's case study, gathering the current connections and future potential between outdoor sports and marine citizen science projects, and analysing the proposed start-up model reframing citizen science in modern times of uncertainty, climate change and financial difficulties.

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Citizen science health project and high school students – evaluation on scientific literacy

***Berit Elisabeth Alving, Mette Fentz Haastrup, Connie Svabo, Katrine Berkvist Borch, Maiken Westen Holm Svendsen**

The University Library of Southern Denmark (ULSD) is a partner, in co-creation with the Region of Southern Denmark, five region hospitals and two media houses, in the Citizen science health project "A Healthier Southern Denmark." In parallel a high school panel was established, in collaboration and co-creation with six high schools. The aims were: 1. Engaging high school students to participate and contribute to a citizen science health project. 2. Investigation in empowerment on student's scientific literacy level. Methods The students were presented with designs for user-involved studies and participatory democracy. Documents, videos, and dilemmas on health subjects were on a Libguide,, as part of the curriculum. The students interviewed researchers and produced a conference poster, based on the methods learned. For evaluation, a mixed-methods study was conducted. An online survey on scientific literacy inspired by TOSLS (Test of Scientific Literacy Skills) was developed as a multiple-choice test, in SurveyXact. The aim was to see if there was a significant progression in the high school student's literacy level during the project. The survey was conducted on all the enrolled students. To supplement the quantitative data, observations in the classroom and during events were made. Follow-up interviews (semi-structured questions) were held with a selected number of students, and teachers. Results All results will be available in June 2022. Results from the survey shows that there is a progression in the student's scientific literacy level, and it is significant in seven out of ten of the questions. The average

score for all classes were 5,2/10 in the first survey and 5,8/10 in the second. Questions on source criticism had a higher score, questions with mathematics had a lower score. Observations and answers from the interviews with the students, showed a little progression in Scientific literacy. The students were engaged in the citizen science project. They learned to be more critical towards scientific information and learned how to read and communicate a scientific topic. ULSD sees projects with high school students as a core task, making students more scientific literate and sees a potential for expanding the high school project.

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Citizen science during Covid-19 pandemic to enhance an activating environment in a low-socio-economic status neighbourhood

***Berry van Holland, Nikki Jepkema, Johan de Jong**

One neighbourhood in Groningen, the Netherlands, is a neighbourhood housing about 12,000 citizens with on average a low socio-economic status background, showing a less healthy and active lifestyle. In the past, initiatives have been undertaken to promote active lifestyle by implementing outdoor facilities stimulating physical activity. However, use of facilities was poor due to lack of citizen involvement. The aim of this project was to engage citizens in the overall process of capturing, plan making and prototyping concepts for an exercise-friendly physical and social environment. From January 2020 - June 2022 a Living Lab was run following the "Our Voice" citizen science method. Participatory citizen science was applied in which a community of stakeholders (public and private parties) and citizens was built. The community addressed the problem by creating more insight in promoting/degrading features in the neighbourhood concerning an active lifestyle. Citizens used the Stanford Neighborhood Discovery Tool, which allowed for systematic observations of the physical environment. Additionally, emergent research walks gave extra information on neighbourhood barriers/facilitators next to Discovery Tool data. Collected data allowed citizens to brainstorm on possible solutions in sessions facilitated by the researchers. Solutions were presented to the local government and further developed for implementation and realisation. Use of the Discovery Tool created an overview of the neighbourhood. Based on positive/negative features, new ideas were generated for improving exercise-friendliness. One example was a walking route along art objects in the neighbourhood. Furthermore, a citizens work group was formed which discussed this route, and other ideas and prototypes, with local government. This group was also involved in the realisation of prototypes. Our project resulted in a citizen science approach which can be transferred to other neighbourhoods. Use of the Discovery Tool showed many benefits for neighbourhood plan making. Early and continuous involvement of citizens will lead to more sustainable engagement and is a powerful method to create engagement around societal problems and social innovation in the field of Health Enhancing Physical Activity. Main messages: A transferable method for neighbourhood development based on citizen science was developed. Key features in our method were integration of design thinking, citizen engagement, use of digital tools.

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Corporate volunteer programs and citizen science: promises and Pitfalls

***Bradley Allf, Caren Cooper, Lincoln Larson**

Citizen science is often lauded as a means of "democratising" science and of fostering deeper public engagement in environmental issues. However, the ability of citizen science to achieve these objectives is hampered by the fact that most volunteers enter into projects already highly engaged in environmental topics and/or science. Since 2020, SciStarter.org, an online citizen science database, has organised a program to engage participants in Verizon Inc.'s corporate volunteer program with citizen science. These corporate volunteers participate in projects via an online portal and earn volunteer hours. Since 2020, the Verizon citizen science program has enabled more than 8,000 volunteers to make 157,000 contributions to dozens of citizen science projects focused on the environment, health, and other topics. Survey results indicate that these volunteers come from more diverse racial and ethnic backgrounds, have less science-focused occupations, and are

less well-educated than typical citizen scientists. Additionally, these volunteers have lower levels of pro-environmental attitudes and behaviours than typical citizen scientists. Preliminary results also show that these volunteers feel more engaged with environmental issues after participating in the citizen science program and become more intrinsically motivated to do citizen science. In conclusion, corporate volunteer programs are a promising source of new citizen scientists. According to our case study, these volunteers may come from more diverse backgrounds than typical citizen scientists and have the potential to learn and change from their experiences—particularly in terms of their engagement in environmental issues. We suggest that citizen science practitioners looking to reach new audiences consider non-traditional sources of volunteer energy, such as employees in corporate volunteer programs.

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Citizen science for local government - a guide

Carina Veeckman, *Jef Van Laer

Recent technological and societal advancements are allowing an increasing number of citizens to participate in citizen science. At the same time, government institutions are adopting data-driven decision-making practices, are exploring the potential added value of citizen science data. However, local governments are not always fully acquainted with citizen science methodologies, nor with its potential benefits or pitfalls. They are in need of further support to set-up citizen science initiatives themselves, or to collaborate successfully with citizen-driven projects. In order to address these issues, we have developed a guidebook on citizen science with and for local governments in Flanders (Belgium). This project was tendered by the Flemish Agency for Home Affairs. The poster presents the insights gained from the consultation process with both local governments and citizen science actors, which led to the development of an online guidebook (in Dutch and English) for getting involved with citizen science as a local administration. In June 2022, a year after launching our guide, we plan to organise a survey with local governments in Flanders, polling the uptake of the guide and further needs of local governments regarding citizen science. We hope to be able to share these insights as well on our poster.

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Monitoring water quality with the KduPRO, a Do-It-Yourself modular instrument

***Carlos Rodero Raul Bardaji, Estrella Olmedo, Jaume Piera**

Monitoring water transparency provides an indicator of the environmental status of the water body. One parameter to estimate the water transparency is the light diffuse attenuation coefficient (Kd) (Mobley, 1994). Historically, water transparency has been measured with a simple and inexpensive tool: The Secchi disk, a black and white disk that is lowered from above the water surface and tracked visually until it goes out of sight (Pitarch, 2020). Despite it being a valuable index of visual water clarity, the quality of its measurements is user-dependent, owing to differences between observers (Bruckner, 2018). In addition, ZSD (Secchi disk depth) measured data is discrete in time, and it is dependent on external factors such as water surface conditions and sunlight intensity. For this reason, we need electronic devices to get accurate measures and facilitate monitoring over a long time scale. This need to develop novel approaches for monitoring environmental data is reflected in the recent growing attention toward citizen science (Njue et al., 2019). Citizen science is an expanding practice in which scientists and citizens actively collaborate to produce new knowledge for science and society (Vohland et al., 2021). Nowadays, we can find a wide range of projects to monitor aquatic ecosystems thanks to the progress in marine citizen science, especially enabled and promoted through technological developments (Garcia Soto et al., 2021). Within the framework of the European H2020 MONOCLE project, it is developed the KduPRO, a cost-affordable and DIY (Do-It-Yourself) moored system evolved from the KdUINO (Bardaji et al, 2016). It is based on a modular system of light sensors, independent of each other, measuring the irradiance at different depths. The depth of each module can be modified according to the requirements of the project or the environment, offering the user a custom array of sensors. The Kdu-

PRO measures the light intensity in the red, green, blue and PAR (Photosynthetically Active Radiation) bands at several depths in the water column to estimate Kd. The affordable cost, along with ease of build and use, make this instrument a valuable tool for anyone interested in getting involved in water quality monitoring programs.

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Making citizen science within the Humanities: the Collaborative History Project

***Cecilie Bjerre, Mette Fentz Haastrup, Klaus Petersen**

Background citizen science (CS) in education programs at high schools can potentially engage youth in research with a hands-on, active learning process. Researchers at the University of Southern Denmark (SDU) engage high school students through the citizen science project The Collaborative History Project (CHP). The topic is the so-called family revolution in Denmark from 1960 to 1980s, when Danish families underwent dramatic changes in cultural, economic, and political terms. The CHP combines a research project with an educational program at high schools. A pilot (1) was completed in Autumn 2021 with 14 classes (approx. 350 students) and a new pilot (2) will run from August 2022 with 17 classes (approx. 450 students). This poster focuses on: 1) How to implement citizen science within the humanities? 2) What are the perspectives of engaging high school students in citizen science – from the perspectives of researchers, teachers, and students? Methods A formal learning program was co-created between researchers and teachers with SDU Library as third-party mediator. It included a flexible lesson plan and learning materials on the historical topic and practising the methodological skills of conducting life-story interviews. As part of the education program the students interviewed informants, tagged, and uploaded the interviews to an open digital archive. Afterwards the students analysed the materials and shared their findings at a poster session at SDU, where the best posters were awarded. Teachers and students evaluated the program. Results and perspectives The pilot demonstrated the potential for activating and engaging students in an academic topic, improving their scientific literacy, and collecting valuable qualitative data. The life-story interviews will give new insights into an often-overlooked perspective; the lived experiences of 'ordinary' people. We have developed a new generic citizen science model, the CHP, within the humanities that can be adapted to a wide range of historical topics applying an oral history approach.

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Oceanographic citizen sciences, new opportunities to study oceanographic environment at large scale.

Cédric Courson

The ocean is a major contributor to climate change and, with the influence of ocean currents, is the main thermal regulator of the planet. It also hosts one of the largest terrestrial ecosystems and is responsible for most of the oxygen we breathe. Understanding and preserving the Ocean, and in particular understanding its dynamics, its marine currents and its evolution, is therefore fundamental to our environmental and climatic future. However, the Ocean is still a poorly known territory, difficult to access and where man does not live permanently. The scientific community lacks the data and the means to acquire it to assess changes in the Ocean and its influence on the climate and terrestrial ecosystems. In this context, where data collection is time consuming and spatialization of data is difficult, the use of citizen science is a logical evolution for faster and larger scale environmental science. The coastal community is the largest in the world, with 60% of the population living in coastal areas. Among recreational boaters, 14,000 sailboats per year are permanently on the high seas, while professional offshore oceanographic vessels number around a hundred worldwide. Sailing yachts are therefore a real opportunity to conduct oceanographic research on a larger scale. In addition, the Fablab networks (citizen laboratories) offer so many spaces for innovation and citizen creation to create the tools necessary for scientific data collection. Here we explore new opportunities for large-scale oceanographic science through citizen engagement in participatory marine science programmes. We will present SensOcean (Citizen

Oceanography) and LittObs (Citizen Coastal Observatories Network). Participatory marine science programmes in which citizens (whether on land or at sea) are involved at all scales, from protocol design to data analysis.

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Together for clean air

***Celien Van Gorp, Inge Smets**

How to set-up a scientifically sound measurement campaign? Over the past decade the awareness of the link between air quality (AQ) and several health issues increased enormously. As a result, more and more people became interested in knowing the air quality in their neighbourhood. This increased demand for hyperlocal air quality measurements stimulating the emergence of numerous citizen science initiatives. Though this dense network of local data can be a valuable addition to the reference measurements required by the air quality Directive, there are some pitfalls to bear in mind. The "Together for Clean Air Project (ZULU)" therefore built a website " Together for Clean Air" with. On this website citizens and local authorities can find information about: performing their own measurements, information about the pollutants that citizens and local authorities can measure, with extra attention to the measurement set-up, the logbook for collecting meta-data and guidelines for analysing their data. The VAQUUMs test protocols are also included on the website (citizen science principle 6) Data portal: data from citizen measurements (PM) and reference stations of VMM can be found here (citizen science principle 7) - Inspiration (citizen science principle 5 & 8): o Measures you can take to ensure a better air quality o Inspirational examples to encourage others to take action o Ongoing projects, indicating whether or not citizens can participate in the project This website wants to meet the needs of citizens and local authorities, through : - Being a living website, that will be further updated when there are new insights: - Have a translation function, that gives a rough translation of the website in e.g. English, Spanish. - A collaboration with the RIVM (National Institute for Public Health and Environment of the Netherlands), so that the website crosses borders and we can learn from each other - Give not only information about how to measure air quality but also how you can improve air quality.
Links: Together for Clean air project: https://www.projectzuiverelucht.eu/ Together for Clean air: https://samenvoorzuiverelucht.eu/ VAQUUMS test protocols: https://vaquums.eu/sensor-db/tests/protocols

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Citizen science in the classroom - A guide for citizen science practitioners for developing projects for primary and secondary education

Philippe Bastiaenssens, Jelle Boeve-De Pauw, Mart Doms, *Charlotte Hens, Filip Mennes, Jef Van Laer

Contemporary research more often and more frequently involves citizens to scale up the data collection of their research and to promote recognition among the population. In this participation in citizen science projects, schools see an opportunity to work on research competences with their students. These research competences are part of the 21st century skills and are embedded in the obligatory competences to be learned in Flemish primary and secondary education. Ideally, students learn these research competences in the context of authentic scientific research. This is not an easy task for teachers. In that way, citizen science in schools has a lot of potential and can be an added value for all parties, the scientists initiating the project, the teachers and the students. Not only do schools provide citizen science projects with a reliable audience of young citizen scientists. Educational professionals also appreciate citizen science in the classroom for its motivational and educational effects on the students. To unlock this potential we are developing a guide for bringing citizen science to the classroom. The guide is aimed primarily at citizen science practitioners, explaining the context in the primary and secondary school systems in Flanders. The guide offers tips on how to engage school staff and students with citizen science. It focuses on engaging students, teachers and scientists in a win-win situation for both students, teachers and citizen science practitioners, in which knowledge and impact creation as well as educational gains are achieved. This guide is currently in development and we aim to launch it in November 2022.

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Meteorological measurements with the low budget platform MESSI

***Christopher Böttcher, Jonas Lehmke, Vincent Sobottke, Henning Rust**

The autonomous measurement platform MESSI was developed for meteorological measurements based on the microcontroller SAM L21. The autonomous power supply was made possible by a strict energy-efficient design that uses only a mini PV module on the base board to charge a LIFEPO4 cell. Variable sensors can be used, which are placed onself-developed expansion boards. For 2 citizen science projects the MESSI was equipped with the following sensors: Double temperature measurement with PT1000 resistance thermometers (inside and outside the screen), air pressure with BMP388, humidity with SHT31 or HDC2080 and illuminance with SI1151 or SI1145. Data communication is done in an energy-saving way via LoRaWAN (SX1261) and the TTNv3. Measurement data is compressed to enable high temporal measurement intervals (up to10 s) and still comply with the fair-use-policy on 868 Mhz. In addition, data is stored in a flash memory on the device as backup as there is no confirmation of receipt via LoRaWAN. The USB-C interface can be used to recharge the battery, update the firmware and read data from the flash memory. Time synchronisation is realised via LoRa and a GPS module, which also determines the position of the measuring device. The Messi boards are covered with protective paint and are directly glued into the fins of a 3D-printed Stevenson screen. There is no active ventilation. After decoding, the measurement data is stored into a relational database and made available to the user via a python based web-application (https://messi.met.fu-berlin.de/). The progressive web-app can be used by the citizens on any device with a browser and allows near real-time visualisation of instantaneous measurements and time series plots for different time periods. The instantaneous atmospheric information for the participants supports weather literacy. With machine learning, we estimate a hypothetical temperature as it would have been measured from a professional device at this location using the two-point temperature measurements (inside and outside the screen) together with the illuminance information.

Democratising research through the lenses of citizen science

***Christothea Herodotou, Ian Kenny, Eileen Scanlon**

The involvement of people in research varies. Two decades ago we observed a shift from using terms such as “subjects” to “participants” and aspired to actively engage people in research by allowing them to define what research should be done and how. Under the banner of citizen science , we have seen various ways volunteers take part in scientific research; from collecting data or crowdsourcing to processing or analysing data to support activities led by scientists. Recently, using concepts such as ‘community citizen inquiry’ and ‘extreme citizen science’, we observe a growing interest in bringing together communities to identify and examine personally relevant topics and devise solutions that best match their needs. In this study, we aimed to capture and detail what engaging participants with research looks like across researchers at a higher education institution. In particular, we collected the views of 14 self-selected researchers about their research practices and experiences with volunteers, how they would like their research practices to evolve or change in the future and what systematic support they would need to achieve that, embodied in the notion of a ‘Centre for Democratising Research’. The 14 researchers had considerable experiences of engaging participants with research in the fields of wellbeing, education, maths, engineering, technology, business and law, and psychology. Interview data were thematically analysed. The following themes emerged: current practices in research with volunteers, perceived benefits for volunteers, challenges to conducting research with volunteers, function and challenges of a centre for democratising research. Overall, participants acknowledged the significance of engaging volunteers in more meaningful and inclusive ways in research as this is likely to result in greater immediate and long term benefits for them. Yet, they noted several challenges to achieving that such as time availability, identification of diverse participants, volunteers’ skills and power imbalances. These findings will be discussed in the talk with the aim to identify ways we can make our research activities more democratic.

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Poster Session A2

Session chair: Moritz Müller

Is there a future for our Lockdown Webinar Series on education & learning in citizen science?

***Claire Ramjan, Julia Lorke**

During the 2020/2021 lockdowns, members of the ECSA Working Group for Learning and Education in citizen science launched a series of research-focused webinars. These sessions involved speakers from across Europe and the US speaking on a range of topics including studies on learning online, conservation and biodiversity citizen science, and the role of identity in citizen science. The sessions involved a presentation component and an open discussion. The presentations were recorded and can be accessed through the ECSA Youtube channel, the discussions were captured and presented as blog posts on the ECSA website including links to the speakers and their work. You can find a link to an example webinar here, and a blog post here. The webinar series brought together citizen science researchers and practitioners at a time when in-person meetings were not possible. The resultant network offers an opportunity to engage with the learning and education community within citizen science and this proposed poster presentation looks to consider how to take this forward. Our poster showcases highlights from the webinar series, drawing attention to the key discussion points that were explored. Yet we acknowledge that with many countries ending pandemic rules, the community's needs and preferences may have changed. Therefore, we would also like to use the poster and the poster presentation as an opportunity to listen to the community and explore whether and how to take the series forward in the future. To document conversations and thoughts from the attendees, we dedicate space on the poster for them to contribute ideas for topics and speakers as well as communication and dissemination formats for upcoming events.

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School-based citizen science experiences within an eco-citizenship capabilities framework

Claire Ramjan

The culmination of a PhD research project, this presentation will describe the experience of school pupils engaged in three different environmental citizen science projects. The projects related to biodiversity, climate change, and soil science topics and engaged pupils in broadly contributory citizen science experiences involving outdoor fieldwork and data collection. Participant observations during the fieldwork days, and survey and focus group interviews a short time afterwards were used to analyse the pupil experiences using a Situational Analysis (Clarke et al, 2018) approach. While recognising the contested nature of the term, environmental or ecological citizenship relates to the actions that individuals and communities are able to undertake in support of pro-environmental beliefs (for example, Hadjichambis et al, 2020; Dobson, 2007, 2010; Stern, 2000; Dimick, 2015). This research identifies the ways in which environmental citizen science projects are able to support the development of these pro-environmental capabilities when they are experienced through the non-voluntary setting of formal schooling. The pupils (n = 74) involved were aged between 12 and 18 years old and engaged in studying either geography or science at formal curricular levels in Scotland/England. Reflecting on Nussbaum's (2011) suggestion that eighth of her ten central capabilities is to be able to "live with concern for and in relation to animals, plants and the world of nature". The pupils involved were asked if and in what ways the citizen science experience had changed the way that they feel about plants, animals and the natural world, in a written survey response. Analysing the responses to this question alongside the fieldnotes drawn from the participant observations of the fieldwork days and focus group discussions has allowed me to identify ways in which the citizen science experiences of the pupils have been able to support the development of eco-citizenship capabilities. This presentation will outline the findings of the research and identify the opportunities and challenges faced by implementing citizen science experiences within the formal education arena. Recommendations for future practice will be presented to promo-

te discussion on how to effectively integrate citizen science into formal education curricula.

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Data crowdsourcing innovations for planetary health: developing a measurement framework in Kenya

***Claudia Robbiati, Hinjal Bhatia, Winnie Chelagat, Martha Gutterridge, Lilian Koskey, Goeffrey Mwai, Iregi Mwenja, Aloyce Odhiambo, Emma Ogden, Laura Peters, Chloe Wood, Des Tan, Geordan Shannon**

Communities in low-resource settings are the most impacted by challenges related to planetary health, like climate instability. These impacts are usually not monitored by routine indicators and local knowledge is overlooked. Without available information and without including community perspectives, decision-makers lack the knowledge and the evidence they need to make decisions or to measure impact of interventions. As a result, communities are disempowered and left out of the process to sustain planetary health priorities. Participatory data innovations are needed to empower communities and decision makers and improve understanding of planetary health challenges in ways that align with local perspectives and priorities. STEMA is a not-for-profit organisation working to innovate citizen science approaches, to allow communities in low-resource settings to crowdsource information about planetary health issues, through pairing participatory community research approaches with advanced tools like computer vision and GIS. These approaches are developed upon a planetary health measurement that is developed and tailored to communities' concepts of positive health. To this end, STEMA is performing a multi-site, mixed methods research study in Kenya to develop a locally tailored measurement framework for planetary health data and to translate it into a toolkit/platform based on crowdsourcing alternative citizen science datasets (i.e. qualitative data, photographs, maps). The study employs largely qualitative and participative methods across three stages. Stage 1 focuses on conceptualising what communities consider to be positive health and the local resources available to pursue local health agendas. Stage 2 focuses on understanding how these concepts could be measured using innovative methods and data sources. Stage 3 focuses on collaboratively designing the toolkit/platform. Preliminary research findings from stage 1 identified the building blocks of community-led planetary health, and highlighted that positive community health is closely linked with planetary health concepts and available natural resources (eg. water, local crops, land). Findings also indicated that one of the greatest challenges to positive health was climate instability, associated with droughts, floods and natural resource degradation. These preliminary results show how crucial it is to enable communities to crowdsource information about planetary health challenges, in order to characterise and prioritise them for action.

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Mapping citizen science in Portugal: contributions to planetary health issues

Katarzyna Pydzińska Azevedo, Ana dos Santos Carvalho, Alexandra Lopes, *Cristina Luís, Elizabete Marchante, Inês Navalhas, Isabel Pessôa-Lopes

Similarly to other countries, citizen science (CS) in Portugal is not a new practice and it has been steadily increasing over the last decade. Previous efforts have led to the characterisation and mapping of several citizen science projects, however, a systematic inventory of public participation in scientific research has never been conducted at national level. Several efforts were also recently made to establish the 'Rede Portuguesa de Ciência Cidadã' (Portuguese citizen science Network - CC.pt), a network aiming to interconnect citizen science players across the country, raise public awareness about citizen science and showcase projects/findings to all interested parties and stakeholders. One of the currently active working groups in CC.pt is dedicated to mapping existing citizen science projects in Portugal. It is widely recognised that understanding and acting upon planetary health challenges requires massive collaboration across scientific domains and (inter)national boundaries, whilst also involving society as a whole. citizen science initiatives may indeed play an important role to help addressing and resolving planetary health issues, therefore it is crucial to have a good

and updated knowledge of ongoing initiatives – reason why the Portuguese citizen science Network has run a survey to collect information to help identifying and locate this type of initiatives nationwide. The responses received are being analysed and cross-checked with information obtained in other listings. The final analysis is expected to provide valuable insights on different aspects such as: which scientific areas/topics are more often represented, which projects are maintained over time, how many people are involved on a regular basis, what kind of communication is used to give feedback to participants and what kind of techniques and technologies are being used. The geographical representation of those projects will also be evaluated, as well as which type of institutions host and/or promote them. Regarding planetary health issues, the mapping will also highlight which of those identified citizen science initiatives address them specifically - for instance, projects dealing with ocean pollution, changes in biodiversity, invasive species, etc. This analysis shall therefore contribute towards a broader overview of the scope and the role of citizen science in Portugal as a response to global challenges.

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Evaluation of citizen-scientist data quality on *Schistosoma* snail hosts in Lake Albert region, Uganda

***Noelia Valderrama Bhraunxs, Julius Tumusiime, Daisy Namirembe, Grace Kagoro-Rugunda, Casim Umba Tolo, Christian Albrecht, Ronald Twongyirwe, Anton Van Rompaey, Tine Huyse, Liesbet Jacobs**

90% living in Sub-Saharan Africa. Lack of experts presents a major challenge to implement the WHO's recommendation of snail control to supplement other measures like drug treatment in the roadmap for the disease elimination. The ATRAP project adopts a citizen science approach to alleviate this problem by involving citizens in snail monitoring. A network of 24 citizen scientists (CS) have collected snail data at 73 water contact sites around Lake Albert in Uganda, on a weekly basis for 20 months. We aim to assess the quality of this data by comparing it to the data collected by an expert malacologist that visited the same sites on a monthly basis. The binary agreement in presence/absence of *Biomphalaria* spp snails for the paired data reports (907 points) between the expert and citizen science is 76%, with 15.7% false negatives. A generalised binomial logistic mixed-effects regression showed that agreement increased when snail abundance increased ($p < 0.01$) and site type was a significant predictor of disagreement ($p < 0.01$). The citizen science and expert data showed similar trends in snail population changes in time, depicting seasonal changes, although the expert consistently recorded higher abundances than the CS. Finally, the top 10 list of putative transmission sites of both the citizen science and the expert overlapped for 84.1%. The pros and cons of involving citizens in mapping putative schistosomiasis transmission sites will be discussed.

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How a national citizen science platform can contribute to planetary health: the case of Österreich forscht

***Daniel Dörler, Florian Heigl**

In the *São Paulo Declaration for Planetary Health* many different stakeholders are addressed to show how they can contribute to planetary health in their respective area of activity. Although citizen science platforms and/or networks are not addressed specifically, they can be an important intermediary between different stakeholders and therefore can significantly contribute to the promotion of planetary health. In the proposed poster we present how this can be done via an online citizen science platform using the example of the Austrian citizen science platform Österreich forscht (www.citizen-science.at). Österreich forscht currently displays 60 citizen science projects from all over Austria, with a large majority in ecology (roughly 45%). All the projects together reach more than 175.000 citizen scientists. The platform encourages networking and trans- and interdisciplinary collaboration through dedicated events, such as the annual Austrian citizen science Conference or the biannual platform meeting. Several collaborations between projects could be initiated over the last years that promote planetary health in Austria (e.g. collaboration between four projects coming

from four different institutions detected a correlation between phenological events and amphibian spring migration, facilitating the timely setup of amphibian conservation measures). Furthermore, Österreich forscht also encourages and enables direct exchange between citizens and researchers through its blog, where people can publish blog posts on a wide variety of topics and can discuss via the comments. So-called "teams" focus on specific aspects of citizen science (e.g. team "UN Sustainable Development Goals"). Österreich forscht also promotes open science and supports projects in implementation of open science aspects. Open data is a default for all projects that want to be listed on Österreich forscht, and there are two working groups dealing with open science (WG Open Biodiversity Databases and WG Open Science Tools). Citizen science training and university courses (both on a regular and on a single event basis) enables e.g. students, researchers or teachers to use citizen science for their inquiries on a national and international level. These are just some examples how a citizen science platform can promote planetary health aspects in both research and practice.

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Open Urban Climate Observatory Berlin for environmental research and adaptation

***Daniela Schoster, Marco Otto, Martin Göber, Henning Rust**

Considering the fast urban growth and the rapid increase of the city population, urban areas are constantly changing. Additionally, the spatial heterogeneity of Berlin leads to a pronounced spatial variability of meteorological variables that is impossible to capture with the existing network of urban measuring stations. Therefore, the Open Urban Climate Observatory Berlin aims to establish an open meteorological measurement network by involving the urban society, e.g. allotment gardeners, who maintain the measuring devices especially developed for this purpose. With this extension of the classical measurement network and a recently installed high-resolution precipitation radar for Berlin, a new data basis becomes available to answer relevant questions for the urban community. The OpenUCO project includes two aspects with different degrees of citizen participation: First, we aim to benefit from the high number of additional precipitation measurements provided by the participants to improve the calibration of the new radar (low degree of participation). Second, in collaboration with the citizens, research questions will be developed and addressed and the potential of possible applications will be explored during workshops (high degree of participation). In this process, citizens will be supported by scientific staff from the TU and FU Berlin with technology and knowledge about the urban climate. Ideally, the results will serve as a basis for the development of applications, one example being a digital watering assistant that provides watering recommendations optimised for plant growth and resource utilisation based on local measurements and appropriately processed precipitation forecasts. We will report on the current status of the project and hope to be able to present some preliminary results of the measurement campaign.

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Creating a marine biodiversity citizen science strategy 2023-2028

Dave Wall

Marine Biodiversity citizen science is increasingly recognised at national, EU and international level as a valuable contributor of robust data to support marine policy reporting requirements, develop marine environmental policy, and engage citizens in ocean literacy and marine policy. Significant gaps in our knowledge of marine biodiversity have highlighted an urgent need to integrate Marine Biodiversity citizen science into marine conservation, monitoring, and reporting. In 2022 the National Biodiversity Data Centre set out to create a Marine Biodiversity citizen science Strategy 2023 – 2028 which sets out a pathway for the Data Centre to engage and support the Irish public, NGOs, state agencies and departments, and academia in conducting Marine Biodiversity citizen science . The strategy aims to address data gaps; integrate marine biodiversity citizen science into policy; coordinate initiatives with key state agencies; build the Explore Your Shore! programme as a national platform for marine biodiversity citizen scien-

ce; and encourage a culture of Open Access in marine biodiversity data. The Data Centre has engaged in consultation on the draft strategy with key partners and stakeholders involved in Marine Biodiversity conservation, research and policy and the strategy will be a 'live' document to allow for response to changing landscapes in Marine Biodiversity citizen science in Ireland, the EU, and internationally.

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Integrating citizen science in schools through treasure hunt

***David Kocman, Johanna Robinson, Rok Novak**

In this contribution, we report the concept and lessons learned involving pupils in research activities based on citizen science principles, as organised over the years at a primary school in Ljubljana, Slovenia, within various EU projects dealing with environment and health. The overall aim was to introduce the profession of researcher, and approaches and concepts of citizen science to schoolchildren. Central activities were organised in the form of a treasure hunt game, in order to trigger children's curiosity and active involvement, and which was carried out in a local forest near the school. To this end, several locations where pupils had to navigate to and look for hidden questions on various topics of urban stressors were marked on a treasure hunt map. The five general topics selected and adapted to the school curriculum included the following: (1) use of a map for orientation, (2) the role of green spaces, (3) ecosystem services of the forest, (4) waste recycling, and (5) environmental pollution with the focus on air quality and noise. At each of the preselected locations, a discussion on a particular topic followed on the basis of questions prepared in advance. Among others, pupils were introduced to tools and approaches for monitoring the state of the environment. For this purpose, with the help of low-cost sensors and an application on a smartphone, they measured and recorded data on air quality and noise levels. At the end of the treasure hunt, a discussion followed on the collected results. The pupils, guided by the researcher, tried to find explanations for the observed differences among different locations of the two measured parameters. Participatory evaluation and impact assessment of the concept was two-fold. The pupils were administered pre-and post-questionnaires in which we checked their perception and knowledge gained. A focus group discussion with teachers involved in the design and execution of the event was also organised. Overall, the concept was well received amongst the pupils and teachers. Integration of citizen science principles to school curriculum positively influenced the pupil's perception and knowledge of discussed topics in environmental sciences.

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The Citizen Science Global Partnership

***Maria Rosa Mondardini, Dilek Fraisl, Libby Hepburn, Martin Brocklehurst, Ted R. Smith, Mendel Wong**

The Citizen Science Global Partnership is a network-of-networks that seeks to promote and advance citizen science for a sustainable world. It brings together existing networks of citizen science researchers and practitioners with actors representing policy, business, and community-based perspectives. The partnership is currently being incorporated as a formal entity. What does CSGP entail for local and global practitioners? Is it too late (or too soon) to engage? Can your institution join? This poster session presents a short compendium of the current understanding of the "who, why and how" and provides an opportunity for the community to interact with some of the drivers of the initiative and to engage in a more personal and tailored Q&A.

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Step Change, fostering alignment with local contexts for planetary health

Elena Buzan

Wildlife conservation, non-alcoholic fatty liver disease, energy communities, infectious disease outbreak preparedness, and off-grid renewable energy in rural Uganda. These are the main topics tackled by the project

Step Change, funded under programme H2020 and implementing 5 citizen science Initiatives (CSIs) in Europe and Africa. The project, launched in March 2021, draws on the expertise of 11 partners from 7 European countries and Uganda, and its aim is increasing the mutual responsiveness of science and society while boosting the capacity of scientific investigation over phenomena that cannot be completely seized within conventional disciplinary boundaries. Our poster provides an overview of the CSIs and explains how a citizen science approach to green energy, health and environment, could be beneficial when it comes to planetary health. In fact, our CSIs are being implemented in synergy with local stakeholders, and with a precise approach seeking alignment of research with the specificities of local contexts. Our aim is not only to demonstrate the added value of citizen science practices to support evidence-based policymaking, but also to raise awareness on the importance of topics such as biodiversity, energy sharing mechanisms, or renewable energy in agricultural production as a means to promote environmental sustainability. Within this context, the presentation will both deep dive into the specific features of the CSIs and present the main goals of the project. Last but not least, we will provide a snapshot of the citizen science navigator which will be designed within the framework of our project to support the spread of citizen science, and we will also mention the multifaceted methodology that we are making use of. To maximise its impact, in fact, Step Change is not only fostering alignment with local contexts, but also nurturing mutual learning, encouraging self-reflection, and performing participatory evaluation exercises. More specifically, during our presentation we would like to engage in the conversation with citizen science practitioners, to exchange views, create synergies and explore possible avenues for collaboration.

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Institutional changes supporting citizen science in research performing organisations

***Eugenia Vilarchao, Ildiko Ipolyi**

Citizen science is experiencing an increasing number of projects, initiatives and actors with a wide range of new models and outcomes. Funding bodies have also been encouraging the development of a multitude of guidelines, indicators and quality criteria. While this increase clearly indicates the appreciation of including citizens in R&I (responsibility of science to society) as well as the societal desire to participate more actively in knowledge production, knowledge assessment and decision-making, the majority of Research Performing Organisations (RPOs) (e.g. universities, institutes of technology, research institutions, and similar organisations) in Europe still does not support the official implementation of citizen science by fostering institutional transformations, based on a combination of social (more bottom-up) and organisational (more top-down) changes. TIME4CS (Supporting Sustainable Institutional Changes to promote Citizen Science in Science and Technology) is a H2020 project that aims at exploring institutional changes that are needed to systemically embed citizen science in RPOs, building on the concept of personalised institutional roadmaps to promote sustainable institutional changes. TIME4CS identified 4 Intervention Areas (IAs) that, alone or combined, can stimulate the institutional changes necessary to promote CS: Research; Education & Awareness; Support resources & Infrastructure, and Policy & Assessment. For each IA, specific Grounding Actions (GAs) were defined for the RPOs to implement, with the aim of paving the way to the more complex institutional changes. In Time4CS, 4 RPOs ('Implementers') are currently facing the challenge of introducing citizen science in their structures. In order to support this process, 3 more experienced organisations within the consortium, ('Front-Runners') assist and mentor the Implementers to follow their personalised institutional roadmap and implement the set of tailored GAs. This poster provides an extensive overview of how the concept of institutional roadmap and GA can be applied to stimulate the adoption of citizen science as research methodology in RPOs. It will be supported with concrete examples and recommendations

together with the most common expected challenges and suggestions on how to overcome them.

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Landscape study on funding schemes for Social Sciences and the Humanities' Citizen Science activities and Funding Advocacy Plan

Maite Pelacho, Francisco Sanz-García, *Alicia Moreno, Daniel Lisbona, Elisabeth Ernst, Claire Murray, Léa Morabito, Alessia Smaniotto, Kelly Achenbach

We propose a poster, outlining the results of research conducted as part of the H2020 COESO project ("Landscape study on funding schemes for Social Sciences and the Humanities' citizen science activities"), which investigated the available funding schemes in Europe for social sciences and the humanities' citizen science activities. Information on the accessibility and diversity of the current funding schemes will be presented and good practices, gaps and shortcomings will be highlighted, from the perspective of both funding and funded entities. The poster will also present feature suggested advocacy actions, originally laid out in COESO's "Funding Advocacy Action Plan," for funders and funded entities. Additionally, some recommendations for a successful citizen science funding policy will also be also provided The methodology for elaborating the landscape is based on: Desk research on funding stakeholders Desk research on common methods and good practices, as well as gaps and shortcomings of existing funding schemes Two online surveys targeting researchers and socio-economic actors and funding entities The main results presented are: The need for funding options for small scale and local projects. The role of third sector organisations in citizen science methodologies. The relevance of "impact indicators" as criteria for granting funding. COESO's preliminary (and ongoing) work in funding advocacy will inform the development of a virtual platform where SSH citizen science project members can find each other, collaborate, and find funding for projects that, among other topics, will address issues that contribute to increasing planetary health.

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The dynamics of citizen science for health: findings of an international survey

***Gaston Remmers, Bastian Greshake Tzovaras, Alexandra Albert, Jef van Laer, Mic Starbuck, Sabine Wildevuur, Martijn De Groot, Lea Den Broeder**

Even though citizen and patient engagement in health research has a long tradition, citizen science is a relatively underdeveloped branch in the health domain. Traditionally, patients are often included in health research programming. However, their involvement is much less developed in domains like decision-making on specific research questions, in methodology development, data collection, analysis and the development of conclusions and recommendations, or in new role definitions. Yet, in recent years, a new generation of citizen and patient involvement in health research is growing. Sometimes their involvement is an implicit part of established programmes. At the same time a substantial amount of citizen engagement with health research occurs off the beaten institutional track. To explore the diversity of citizen science for Health projects and to identify the differences between these and citizen science projects to other domains, a workshop was hosted on the topic at the 2020 Trieste ECSA conference. This workshop lead to the establishment in December 2020 of the international Working Group on citizen science for Health, under the umbrella of ECSA. As one of its key-activities, the Group has developed an international survey to further document the diversity, key differentiating characteristics and the opportunities and barriers of citizen science for Health. The survey was available in 6 languages and was disseminated in Europe and beyond. The survey covered 4 sections: a) characteristics of stakeholders in citizen science for health; b) characteristics of citizen science projects in health; c) opportunities and barriers ; d) citizen science and COVID. Data collection took place between December 2021 and June 2022. This paper presents the findings of the survey. Among the features that differentiate citizen science in the health domain from citizen science in other domains, these stand out: a) citizens-as-researchers can be research subjects too; b) ethical requirements and consent mechanisms are different and more complex; c) data quality is under more scrutiny. These lead, among others, to methodological and institutional hurdles and oppor-

tunities that are specific for the health domain. The paper will elaborate the aforementioned issues.

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Beyond the definition: an ethical framework for citizen science to unlock investigative capacities for planetary health

***Gaston Remmers, Julia Hermann, Egbert Siebrand, Catherina van Leersum**

Safeguarding human health in the Anthropocene demands addressing imagination, knowledge, and governance failures (Whitmore et al, 2015). Citizen science, understood as a humanising endeavour unlocking the investigative capacities of humans, has potential to help address these failures. The point at stake, however, is not what type or hence definition of citizen science is most suited for this purpose (c.f. Heigl et al. 2019; e.g. Auerbach et al. 2020), but to acknowledge the ethical boundaries (Eitzel et al 2017), that support addressing the aforementioned failures. In this paper, we reflect on the ethical boundaries of research projects initiated by citizens or involving citizens as active researchers. We focus on citizen science in the context of health but believe that most of our points are valid for other contexts as well. Based on our practical experiences with citizen science initiatives, both in the Dutch Twente region and (inter)nationally, and the concerns voiced by citizen scientists, we suggest an ethical framework composed of six desiderata: (1) recognition of each other's capacities and knowledge; (2) relationship between equals; (3) reciprocity; (4) capacity for agency; (5) goal orientation; (6) openness for different methods. We argue that these desiderata should respond to two fundamental qualities: that of symmetry (the employment of the ethical desideratum should be neutral to either researcher or citizen) and that of transparency (as a conditio sine qua non for all the desiderata). These desiderata reflect ethically problematic practices, such as the use of citizens by academic scientists as mere sensors, and biases in the existing literature on citizen science, such as the presentation of projects that are initiated and led by citizens as "extreme". The main aim of the ethical framework is to stimulate and facilitate reflection among researchers, citizens, and other practitioners alike, upon what needs to be considered when co-creating or evaluating a citizen science initiative. We envisage that a purposeful deliberation on these desiderate enhances the empathy and conceptual clarity needed to acknowledge the potential contribution of all stakeholders to support planetary health.

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Tiny Forests: supporting urban nature through communication, coordination and education with multiple stakeholders

***Georgina Sturgeon, Macarena Cardenas, Claire Narraway, Daniel Hayhow, May Chemais**

High quality greenspace is vital to a healthy urban environment, providing benefits including mitigating the effects of climate change and providing health benefits for urban residents. Tiny Forest is an intervention that creates small pockets of woodland (usually 200m2), in urban areas, where space is often limited for high quality greenspace developments. The forests mimic semi-natural woodlands within the area. Tiny Forest combines Miyawaki's specialised afforestation method, with an integrated multiple stakeholder engagement, education and citizen science programme, to raise awareness of urban environmental issues whilst providing a tangible way to become part of the solution. Citizen science is used as a powerful engagement tool and to monitor the environmental benefits of the forests. The approach brings together diverse stakeholders including: educators and pupils, corporate employees, local communities, and councils. Tiny Forest provides a variety of opportunities for involvement which span different levels of engagement, facilitating stakeholder participation in taking positive action towards the environment and ownership of their local greenspaces. Corporations engage through integrating their employees in citizen science monitoring activities. School pupils are engaged through organised science days, supported by scientists and education specialists. We also host educator training sessions. Community and council coordination results in well informed project management, using local expertise to select site locations. Community members can become a 'Tree Keeper' for their local forest - a

leadership role encompassing Tiny Forest maintenance and facilitation of citizen science and engagement events; which allows us to carry out this national project. The first UK Tiny Forest was planted in March 2020 and there are now 149 Tiny Forests across the UK. Initial results suggest that whilst small, Tiny Forests could have a large impact; with over 774 citizens trained, 1,442 environmental surveys submitted and 290kg of carbon stored in the first 17 monitored sites. The outcomes so far have been positive, 92.8% of participants have reported their experience as 'fantastic' or 'really good'. This poster highlights the benefits and challenges of a complex yet rich programme employing citizen science as a core tool for engaging, and increasing environmental awareness and stewardship of multiple stakeholders.

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Citizen science and farmer-led innovation at the frontiers of farming and biodiversity

***Gerid Hager, Gitte Kragh, Michael K. Poulsen, Finn Danielsen, Graham Begg**

Agriculture is a key frontier for ensuring planetary health and conserving and promoting biodiversity. One way to strengthen biodiversity and sustainability in the countryside is through 'top-down' implementation of, for example, land reforms or increased research on green conversion. Another way is by 'bottom-up' promotion of farmer-led innovation and community engagement. The EU project "FRAMEwork", led by The James Hutton Institute in Scotland, is helping farmer groups, so-called 'farmer clusters', with a shared interest in monitoring biodiversity on their farms in partnership with researchers and local communities as well as implementing more biodiversity-friendly farming at a landscape scale. In eleven active farmer clusters from Spain to Estonia, the project is combining two concepts, stemming from different practice domains: Farmer Clusters and Citizen Observatories. A farmer cluster, a popular concept first started by the Game & Wildlife Conservation Trust in the UK, is a community of farmers, located in the same region, who work together to share knowledge and support and motivate one another to conserve and enhance the biodiversity and ecological health of their farming landscapes. Citizen Observatories, on the other hand, are considered as a particular form of citizen science and collective action with the aim of collecting evidence, creating knowledge, and applying the evidence and knowledge for advocacy and place-based decision-making to reach environmental and societal impact. The combination of the two concepts aims to maximise the strengths of both and create a strong, evidence-based, locally embedded community approach to biodiversity protection and enhancement by enabling the integration of structured monitoring with adaptive land management practices. In this poster, we will present a summary of the approach including different pathways to link farmer-led innovation via farmer clusters at a landscape scale with the Citizen Observatory concept as well as some intermediary results of the project ("Farmer Clusters for Realising Agrobiodiversity Management across Ecosystems"; €8M; 2020-2025; link: https://cordis.europa.eu/project/id/862731).

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ARSTEAMapp

Hatice KIRMACI

ARSTEAMapp(Erasmus+KA220SCH) addresses the challenges of improving the teaching of STEAM disciplines in the 12-16 age group, designing an innovative way to establish connections between these disciplines in a meaningful and viable way with the educational context. The development of an augmented reality (AR) educational app (hereafter AR-STEAMapp) that can be used to explicitly reflect on the connections between STEAM disciplines through the analysis of relevant European cultural heritage (i.e. sculpture and buildings). As an example of the app, students would scan the façade of a Cathedral using tablets or smartphones; next, through a virtual tour, students will learn aspects related to science (type of rock used), technology (tools used for its construction), engineering (successes and failures in its design), mathematics (structure) and art (historical context in which the cathedral is designed and built; social and cultural importance of the cathedral), while making explicit connections between the STEAM disciplines content. Therefore, this project aims to develop a pedagogical framework to guide secondary school teachers' enactment of the STEAM approach through an AR educational

app and a comprehensive guideline. We will imply AR in various educational themes like cultural heritage , environmental regulation , education, physics, chemistry, etc. The first environmental law of the Ottoman Empire was enacted in the early 1500s during the reign of Sultan Beyazid II. The "Environmental Cleansing Ban", prepared by Suleiman the Magnificent in 1539, about the cleanliness of Edirne's neighbourhoods, streets and bazaars, has been accepted as the world's first most perfect environmental regulation. In this conference, I will connect AR to cultural heritage and environmental regulation. In the poster presentation, I will share the first environmental law (prepared by Suleiman the Magnificent) on Augmented Reality (AR) technology.

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Participation motivations and platform governance in citizen science platforms

***Hazal Baytok, Müge Özman, Nicolas Jullien**

In this paper we aim at understanding the relationship between the participation motivations and the platform governance in citizen science platforms. Previously motivations for participation are studied (Curtis, 2018; Nov et al., 2011; Raddick et al., 2013; Wright et al., 2015), and the change of motivations throughout the journey in the platform is found (Crowston & Fagnot, 2008; Curtis, 2018; Jackson et al., 2015). We contribute to this line of studies by investigating the motivations for participation, the role of motivations in platform governance, and the impact of platform governance on motivations to participate. We use the Multi Sided Platforms (MSPs) approach to understand the relationship between the motivations and the governance mechanisms. MSPs are platforms that have 2 or more sides, the interactions of different sides create externalities, and an intermediary coordinates these interactions (Evans, 2003). We use Self-Determination Theory (SDT) and Theory of Planned Behavior (TPB) to propose a feedback loop between the motivations of participants and the platform's governance mechanisms. SDT is a theory of motivation (Deci & Ryan, 2015) and TPB is a theory aiming to explain human behaviour (Ajzen, 1991). We do so by examining 3 citizen science platforms, 2 from Turkey (eKuşbank or eBird Turkey and Trakuş), and 1 from France (Faune-France). 26 in-depth interviews were conducted with the participants of these platforms. We found that there is a duality that should be considered regarding the motivations: a) motivation towards the object of knowledge, that is the motivation for the engagement in the activity that gives rise to knowledge, and b) motivation for sharing the knowledge. We argue that the platform makes value deals with each "side" or "role", and it addresses the motivations of each role with these value deals. We further argue that some negative externalities decrease motivations to participate, and the platform addresses these externalities as well. We also found that motivations about the object of knowledge may negatively affect motivations for sharing. We concluded that the motivations for participation and non-participation are key for the platform in making value deals and addressing negative externalities, which in turn increase participation.

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Incorporating place-based community and citizen science into primary schools at scale: studying how children develop knowledge, identity, and agency with science in California forests

***Heidi Ballard, Erin Bird, Amanda Lindell, Sol Henson, Annika Alexander-Ozinskas, Evan Portier**

As hundreds of community and citizen science (CCS) projects around the world have begun to engage schools in studying environmental threats and impacts on planetary health, it raises the question of how best to incorporate authentic, community-relevant scientific research into the fabric of formal school systems at large scales. Can impactful science learning be achieved, while also contributing to local environmental problem-solving? The "Our Forests" project examines the mountains of Northern California, USA, which have experienced an unprecedented increase in catastrophic wildfires in recent years due to historical fire suppression policies and effects of climate change. Jointly led by university education researchers and a community-based watershed organisation, we partner with a county-wide school system which includes over 25 schools. Our program model partners 3rd through 5th grade (8-10 years old) students, their teachers, local forest scien-

tists and land managers. Together we developed forest ecology protocols for students to monitor and assess sites near their school for variables such as forest density, recruitment of pines and oaks, fuel load, and biodiversity. We investigated this year-long program to examine how participation impacted students' environmental science agency (ESA): 1) environmental science content knowledge, skills, and norms of science, 2) identity with that science, and 3) agency to use their scientific work to make and/or envision change in their lives, communities and environment. We report here on findings from student pre-post surveys, interviews, and ethnographic observations of 10 case study classes with over 50 focal students who participated in the year-long program. We found that involving students in the entire "data life cycle" (Developing testable questions, collecting, evaluating and documenting data, making meaning of data, sharing data online and with community partners, and developing new questions), enabled students to take ownership of their scientific work throughout the data life cycle. We also found that facilitating students in sharing their findings directly with local forest managers allowed children to not only grapple with the trauma of wildfire and see the benefits of fire, but also to see themselves in science and identify as part of their local forest scientist community.

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Forum Deutsche Sprache (German Language Forum)

Henning Lobin , Christine Möhrs , *Elena Schoppa-Briele

The IDS is the leading scientific institution for documenting and researching the German language in its contemporary usage and in its recent history. It is funded by the German Federal Government and all 16 German states. For years, citizens have been involved in the IDS's research processes, e.g. in the construction of language corpora and in surveys on language attitudes. With the Forum Deutsche Sprache (FDS), the IDS is currently developing a unique place of contemporary science communication, where questions about language will be systematically developed, investigated and negotiated together with citizens: in exhibitions, in events and through diverse opportunities for citizen science participation. The Klaus Tschira Foundation will donate a representative building, which is being built in an inner-city location in Mannheim, to the IDS. Since visitors will bring the exhibition and research object themselves, they will directly influence the orientation and design of the new institution's offerings. The participation of visitors via their own language is a main concern (e.g., via dialect recordings, anonymised chats, personal attitudes to linguistic phenomena). Within the permanent exhibition, too, there will be the opportunity to voluntarily donate one's own language and thus spontaneously participate in the research of everyday language and at the same time learn about one's own language behaviour. In scientifically supported communication and survey areas, people interested in language have the chance to actively participate in research processes as citizen scientists. In this way, completely new formats of mutual knowledge transfer are created in an equal dialogue between science and society. Collaboration with schools and day-care centres will play a particular role and will manifest itself in a specially designed adventuresome area where language can be experienced by the youngest without literacy. The accompanying educational programme will also be offered in the permanent and special exhibitions, at survey stations and in workshop rooms. Decentralised formats on site at schools as well as participation opportunities in virtual space (e.g. via apps) are an equally crucial part of the concept. In our contribution, we would like to present the project and especially highlight the participatory approaches planned in the FDS. (www.forumdeutschesprache.de)

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Showcasing the Cos4Cloud Toolbox and Evidence Hub

***Janice Ansine, Rachel Redford**

Cos4Cloud (https://www.cos4cloud-eosc.eu/) is a European project focused on boosting citizen science technologies by providing user-centred services for citizen observatories. This project includes the development of the Cos4Cloud Toolbox and Evidence Hub, an online repository of training materials, education and capacity building resources; user guidelines and handbooks as well as the sharing of best practice and case studies all supporting citizen science observatories. This market stand will showcase the Cos4Cloud Toolbox and

Evidence Hub, part of the work led by The Open University (OU), and will demonstrate a range of resources available, while highlighting and gathering input on future developments . The Open University is a leader in distance learning and using innovative educational technology and applies this to citizen science. the Cos4Cloud Toolbox and Evidence Hub is being created using Open University's free open educational resources collaborative platform OpenLearn Create (https://www.open.edu/openlearncreate/) featuring key areas such as training materials for COs4Cloud services and resources supporting the integration of citizen observatories within educational settings.

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Towards the Integration of interdisciplinary citizen science communities

***Joan Maso, Andreas Matheus, Kaori Otsu**

Even though most of the citizen science data is openly accessible, it is split across very many different portals. Typically, each portal operates different APIs for fetching the data programmatically, and the data returned is structured differently. This makes Re-use of the data a real challenge, in particular when it comes to knowledge building about planetary health where merging data from different portals is required. In Cos4Cloud we have explored two different approaches, one coming from the Biodiversity domain (Darwin Core) and another from the Internet of Things (Sensor Things). We applied both approaches to existing Biodiversity and Environmental research citizen observatories. Our work focuses on an extension to the existing Open Geospatial Consortium (OGC) standard SensorThings API – called STAplus – aiming to reinforce the FAIR's aspects of Interoperability and Reusability. To add the necessary element for considering the citizens and their recognition we propose a generic data model as an extension to the OGC Sensor Things standard that supports the following business logic: Ownership, Licensing, Data Grouping and semantic enrichment via Relations. Because our extended data model is backwards compatible to the existing OGC SensorThings API v1.1, it can be applied to already existing deployments and thereby offering a wide potential uptake. The approach was validated with Cos4Cloud implementations using use cases such as camera traps, Natusfera and Pl@ntNet data. We are contributing an interoperable data model and powerful API to better support integration of interdisciplinary citizen science communities to better meet the objectives of planetary health research. (This work has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 863463.)

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EU Step Change - Citizen science tenant electricity

Johannes Baumann

Step Change is an EU cooperation project of universities and NGOs in the field of environment, health and energy and actively involves citizens into research. The specific project of WECF consists of research about the potential and barriers of tenant electricity as an important instrument of the energy transition. Additionally, the project examines which potential citizen science offers for a broader distribution of the tenant electricity model in Germany. Background: PV systems on single-family homes are widespread in Germany. However, the potential for photovoltaic on multi-family-buildings remains largely untapped, even though these make up 53% of the German housing stock. Although the tenant electricity law was introduced in 2017 to release this potential, tenant electricity has only rarely been implemented so far. Overall, the advantages of tenant electricity are the use of energy from local and renewable sources, savings in electricity costs and positive effects on energy consumption behaviour. What do we want to achieve? Citizens are actively involved in research on tenant electricity, as "prosumers" are important players in the energy transition. Their interests and application-related knowledge about local energy production and consumption is used and further developed together with scientists, experts and local energy companies. This innovative research approach involves new findings regarding the barriers and drivers of the tenant electricity model and the potential for a decentralised energy transition with the participation of citizens. How is it implemented? Citizen scientists have the opportunity to actively participate in the planning and design of the research. Meetings/workshops over a period of one year enable an exchange with citizen scientists, experts and researchers.

Furthermore, data on habits and energy consumption are collected with a questionnaire. This data will be collected with previously installed smart metres and visualisation software. At the end of the project, the results are evaluated and recommendations for society, politics and research are drawn up.

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Facing the information challenge of planetary health to boost citizen participation in science-related activities

***Juan Romero-Luis, Alejandro Carbonell-Alcocer, Manuel Gertrudix, María del Carmen Gertrudis Casado, Alberto Sánchez-Acedo**

The involvement of policymakers, scientists, public institutions, and companies is crucial to boosting the transition from a linear to a circular economy. In addition, the participation of citizens is of equal importance to moving forward to a more sustainable future. Therefore, promoting activities and communication campaigns to engage citizens in science-related activities is essential. Under the H2020 CS Track project (grant agreement No 872522), and the BIOTRES-CM project (funded by the Community of Madrid, Spain, and the European Regional Development Fund, S2018/EMT-4344) a piece of research is being carried out to find out what the key aspects that make awareness campaigns successful are, based on declarations made by scientists and experts in the creation of awareness communication strategies. This work-in-progress research contributes to facing the information planetary health challenge and aims to formulate recommendations that help improve communication actions to engage citizens, especially in the school environment. It affords preliminary results that suggest the need to address communication actions by means of a 360º communication strategy that integrally considers the customer journey. Experts also identify different essential agents for communication and determine that private entities are the most powerful agents for bringing about a change in habits due to their large investment in advertising, their scope, and their communicative freedom to reach their target public. However, these actions must be aligned with the coordinated efforts of public institutions, whose isolated actions are ineffective. Thus, a joint effort should be made among all agents, especially between public and private entities, to promote CSR (corporate social responsibility) actions in order to achieve the greatest impact and conversion, measured in terms of participation and change of habits towards a circular economy model.

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Inclusive and diverse: new methodology needed?

***Julia Brüggemann, Heike Köckler, Christian Walter-Klose**

People with disabilities were isolated for a long time. Their engagement in political and social processes did not take place in many areas around planetary health and urban planning. Nowadays, vulnerable groups are being more and more included in urban planning processes. However, the group of "people with cognitive disabilities or with learning difficulties" is still underrepresented in these processes. There is still a long way to go. With our project, we engage in developing participatory methods in the field of urban planning. Using participatory research, methods and formats are developed and tested together with people with cognitive disabilities living in social institutions. The goal is to draft a recommendation on participation methods for inclusive digital collaborative healthy urban planning. The practice can in turn vary these according to need and initial situation. Together with people with cognitive disabilities, we ask ourselves questions from the field of urban health: How do you perceive your environment? Where are there spaces that make you feel comfortable? Which areas do you feel less comfortable in? What ideas and suggestions for improvement are expressed? These questions are used to practically test and improve various methods. Digital application methods, such as the PhotoVoice method using the KobotoolBox or the creation of an open source mapping software are in the focus of the project. This should make a sustainable contribution. The project is designed circular. Processes of development, testing, implementation, reflection and adaptation phases will alternate. Inclusive feedback rounds with stakeholders are part of the process so that a maximum of feasible participatory stages can be reached within the project duration. This also means that new research questions and ideas for new projects are formulated together with the key stakeholders. Following on from this, we ask

ourselves the questions: How can transdisciplinary projects be coordinated? Is there an accurate and purposeful way to communicate with people with cognitive disabilities on an equal footing? Which way shall we communicate? What forms of communication are most appropriate? The presentation will address particular methods and their methodological potentials and challenges. Subsequently, the perspectives will be presented for discussion.

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Taking citizen science to the streets! How effective is a citizen science contest in mobilising civil society's engagement to address local issues on planetary health?

***Julia Lorenz, Gesine Heinrich, Florence Mühlenbein, Linn Jördens, Wiebke Brink, Silke Voigt-Heucke**

Promoting citizen science as an approach to answering local research questions is the overarching aim of the municipal contest, "Take it to the streets! Citizen science in your city" ("Auf die Plätze! Citizen Science in deiner Stadt"). A total of six concepts that will realise citizen science activities in public spaces and implement structural measures for the long-term anchoring of citizen science within their communities will receive funding. The contest envisages joint projects by actors from science, administration, business, and civil society organisations. In designing the contest, special emphasis was given to reaching diverse networks of actors new to citizen science, in particular civil society organisations. Their project ideas for mobilising citizens' knowledge to sustainably transform local environments and thus planetary health are at the core of the contest. The contest is designed to be low-threshold to take into account potentially limited resources of local stakeholders. The contest is researched in parallel to understand and improve the impact of network communication, the communication strategy, and the impact of the chosen competitive format. In our presentation, we aim to provide first insights into the research question of how effectively the format unlocks the potential of citizens to contribute to transdisciplinary research and influence local policy in the area of sustainable development.

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Poster Session B1

Session chair: Moritz Müller

The contribution of citizen science projects to biodiversity and conservation frameworks using the example of Berlin

***Julia Rostin, Silke Voigt-Heucke**

Policy frameworks such as the Sustainable Development Goals (SDGs) or the Convention on Biological Diversity (CBD), for example, are means to help protect healthy ecosystems. To do so, conservation programs and actions need solid data sets to monitor and report on trends. The aim of our research was to identify and classify the contribution of citizen science projects to biodiversity and conservation framework. To obtain an overview of the citizen science landscape, we first evaluated existing project platforms on participatory conservation projects in Germany and were able to identify a geographic focus in Berlin. We then focused on the contribution of citizen science projects towards policy frameworks in Berlin. To classify and characterise the contribution, we created an online interview questionnaire and conducted interviews with 22 citizen science project leaders, using Berlin as an example. Specifically, the questionnaire focused on the following questions: What kind of citizen science projects on biodiversity exist in Berlin, and how are they structured? What is the output of the citizen science projects, and which data are shared with which authorities and frameworks? The results of the questionnaire showed that citizen science projects in Berlin make a valuable contribution to the research and conservation of biodiversity, but to date, only 50% of the projects share their data with authorities or official databases. This direct contribution could (and should) be increased by creating appropriate interfaces that support and facilitate data sharing.

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Does participating in citizen science affect children's nature relatedness and interest in science?

***Julie Koch Sheard, Aletta Bonn**

We depend on nature, yet we are becoming increasingly separated from nature. Many children do not spend time in nature and do not like interacting with nature. For example, some show a dislike for getting their hands dirty and a fear of insects. The main place many people now interact with nature is in cities. In gardens. In May 2022, 15 schools and over 400 students from grade 3-7 in Berlin, Leipzig and Halle participated in MikroSafari, a citizen science project to understand how climate change and urbanisation is affecting soil invertebrate communities. In school and at home, they conducted baiting and pitfall trap experiments to inventory the diversity of soil organisms in their gardens. At the same time, the students were given a survey before, immediately after and six weeks after participating to assess the short- and long-term impact of the project on their interest in, and knowledge of nature, science and specific invertebrates. We here present our findings from these surveys. Specifically, we look at whether participating in citizen science increased children's 1) awareness of animals around them and how their actions affect nature, 2) their confidence that they can do research and their interest in science, 3) their attitude towards different groups of invertebrates and 4) their specific knowledge based on 8 pop quiz questions.

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Knowing by owning - How Web3 infrastructures support citizen science through NFTs and SBT

***Kai-Ti Wu, Sania Pastor García**

"CitizenSci" is an award-winning project from NFTBerlin 2022 Hackathon. Citizen science has a long history of civilians contributing data and knowledge to support their respective nations' scientific and policy advancements. However, the relationship is often one-sided as the results of research rarely provide follow-up opportunities for civilians. The motivation of participating in citizen science has often been categorised as "volunteer work", "feel-good activities" and "want to support science", which are very valid motives, but the current practice in citizen science projects still lacks consistency in reward mechanism, contribution recognition, as well as follow up communication in terms of research results. Our solutions, in addition to traditional monetary incentives, are intended to recognize the citizens' efforts with the registration of ownership and reputation on the permaweb (a non-corruptible, decentralised form of data storage), as well as rewarding them for their efforts with mintable Non-Fungible Tokens (NFT) and Soulbound Tokens (SBT) when the data is accepted as valuable for scientific research. With such a culture, the citizens' efforts will be recognizable, connected with scientific published results, and can also easily contribute to related scientists' future work. We will demonstrate in our poster the concept of how a platform facilitated on Web3 and incentivised with NFTs and SBT can work better than traditional Web2 interfaces. An online prototype will also be made available via QR code for participants to have a taste of how NFT-incentivised citizen science solutions will work. We hereby also welcome scientists and citizen science practitioners to get in touch with our team and collaborate on a pilot project.

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Citizen observatories: don't define me, just use me

***Karen Soacha, Jaume Piera**

Citizen observatories (COs) and citizen science platforms (CSPs) have recently been positioned as a hub for the practice of citizen science, particularly in the biodiversity and environmental monitoring field. There is a growing interest from multiple fields of knowledge about how these platforms are defined and how they operate. Multiple definitions have been developed according to the area of knowledge or field that adopted the Citizen observatories. Although, there is no consensus on the definition, operational models and characteristics of Citizen observatories and citizen science platforms. To contribute to addressing this issue, research was carried out to compile the existing knowledge about Citizen observatories-citizen science platforms, using peer-reviewed publications as well as grey litera-

ture, accessible through mainstreaming databases and open repositories. The existing Citizen observatories-citizen science platforms research was analysed using a bibliometric analysis and a content analysis. As a result, it was developed a conceptual model and a set of main characteristics of the Citizen observatories. The conceptual model proposes looking at Citizen observatories as a multifaceted concept that is evolving, which is based on a set of main characteristics linked to a set of political and social drivers. These characteristics are separate from and independent of the purpose for which the Citizen observatories is used. In addition to the main characteristics, Citizen observatories can adopt 'purpose-specific characteristics' depending on the topical area that they cover. This talk will combine the results of the systematic literature review and the conceptual proposals with the experience in Citizen observatories, their development and operation, that the speakers have as part of the European funded projects such as Cos4Cloud, MINKE and their work in the research group of Environmental and sustainability participatory information systems (EMBIMOS). It is expected to offer participants in the talk a glimpse into the evolution of the concept and role of Citizen observatories in the context of citizen science. Share data on who, where, when and what research is being produced around COs. To conclude with a reflection on the challenges faced by Citizen observatories and the possible paths to explore in order to continue consolidating them as essential infrastructure for citizen science.

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Amai! Co-creating AI-based solutions for societal challenges

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The project "amai!" ("Oh my" in Flemish) implements citizen science methods in order to more effectively develop AI-based solutions for societal challenges. The project focuses on four key domains (mobility, climate, health, and work) and a fifth overarching theme (digital inclusion). It encompasses four phases. First, together with all stakeholders, key societal issues were identified, and it was determined whether AI can be part of a solution. During this phase, we collected 352 ideas from citizens on our online platform. Secondly, we gathered citizens and experts to co-define the scope of these issues, as well as the requirements of a possible AI-solution. In the third phase, a number of projects were co-selected for an open call and in the fourth phase, four consortia were selected to co-create an AI-system as a solution to the societal issue at hand. These four AI-systems are currently in development by the consortia, also including citizen science methods. Throughout the project it is crucial that citizens, domain organisations and other stakeholders are maximally involved, e.g. by defining relevant issues for AI, co-defining the problem spaces, having a say in which issues and consortia will be selected, and being involved in the training of the AI-systems. Attention is paid to digital inclusion and to ethical challenges of AI. Next to the co-creation of AI-solutions, we organised activities for sensibilisation on AI to the general public and created an accessible card game. The primary stakeholders are "societal implementers": people who are not primarily interested in AI, but who are deeply concerned with current societal challenges. Introducing them to information and experts on AI, they can uncover the value of AI to their own professional and personal contexts. Conversely, AI experts can apply new AI systems on societal issues that rank high on the agenda of citizens and domain organisations.

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A participatory research action group: GARP for ecological transition in gardens

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GARP ('groupe d'action de recherche participative') is a participatory research action group created in 2019 as a space for gardeners and researchers to meet and develop ideas for projects in gardens. The group members co-create all stages of a research project from the process of formulating the scientific objectives to the implementation of the project with the assistance of CELL asbl - the transition hub of Luxembourg for facilitation, administration, finance and logistics. Projects so far have investigated the

suitability of OYA systems to save water and time and simplify water management for gardeners as well as the effect of the density of cultures on production in a small space. Results showed that the OYA system had equal productivity and consumed less water and time when rainfall was scarce, however there was no benefit during seasons with sufficient rainfall. Density improved the production of some cultures but not of others. Valuable outcomes other than scientific results are the exchange of theoretical and practical skills and knowledge between gardeners. Furthermore gardeners acquire scientific literacy and autonomy with each project.

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Setting the scene for co-creating citizen science hubs

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A citizen science hub may act as an essential constituent in an ecosystem of citizen science centred activities, where Research Funding and Performing Organisations (RFPOs) are involved in Responsible Research and Innovation (RRI) projects. These hubs require careful consideration of the existing landscape and good practices surrounding citizen science initiatives before they are founded. A methodological guide and toolbox can support their establishment and also offer benefits for their operation and sustainability. During the implementation phase of an EU-funded H2020 project, namely INCENTIVE, the research teams that are involved in the project address the hubs' challenges in four different RPFOs located in four EU countries, with every one of them reflecting a different approach and level of engagement in citizen science activities. Therefore, the current state of citizen science units is analysed, including hubs, centres, initiatives, networks, and projects not only in Europe but also across the world. We examined aspects regarding their presence (virtual or/ and physical), diffusion over the different continents, and similarities in their structures, needs, and challenges. To complete the analysis, several metrics are provided, based on the Sustainable Development Goals (SDGs) regarding the level of participation, funding sources, and prevalent research fields, to address the characteristics of the different citizen science hubs we have pinpointed. An initial approach to answer some substantial questions when setting up and operating a citizen science hub is also attempted, like how to engage stakeholders and citizens, maximise their participation and support their needs and uniqueness. Finally, the present study concludes with the different views and expectations that have emerged so far in the research group. These views derived from workshops organised to map, on the one hand, the different expectations of the involved RPFOs and, on the other hand, the complementarity of the approaches followed by each RPFO towards the adoption of citizen science as an additional institutional and functional characteristic.

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Science communication for policy makers to increase citizen science projects' engagement facing 21st century challenges

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NEWSERA is a project funded by the European Commission that analyses the complex and multidirectional science communication strategies by addressing the quadruple helix stakeholders in citizen science projects as the new paradigm for science communication. The aim of NEWSERA is to show the virtues of citizen science as an inclusive, broad and powerful science communication mechanism that can increase trust in science communication while opening up science and innovation to society, raising awareness and reducing the chances of incurring in fake news by means of promoting critical thinking. For this purpose, NEWSERA set up a series of workshops on communication for citizen science projects, the #CitSciComm Labs, that involve representatives from citizen science projects, science communicators, science and data journalists, quadruple helix stakeholders (citizens, academia scientists, policy makers, industries and SMEs): together they collaborate on new and improved strategies of communication to help citizen science projects reach different stakeholders and face new challenges, within the evolving relationship between science and society. Each Lab consists of a series of co-creation workshops

that are being organised in Spain, Portugal and Italy, allowing for participation and mutual learning. Building trust among citizens and institutions is still a great challenge. In modern democracies, public institutions need to be close to citizens, to increase their legitimacy, accountability and good governance.In addition, there are many citizens who would like to be actively involved in the policymaking process. Increasingly, policy makers are turning towards citizen science as a way to engage with their citizens and gather evidence for science-informed policies, in order to face the 21 century challenges, including planetary health. In this poster, we will present the Policy Brief that has been developed after the second round of #CitSciComm Labs, addressing the challenges that citizen science initiatives may face when reaching out to Policy-Makers, as well as pinpointing innovative ideas to overcome difficulties and adapt to a changing science communication environment. Acknowledgments: This project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement n. 873125.

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SDU Moves: take our own medicine

***Linnea Marie Sjöberg, Jens Troelsen, Anne Kathrine Overgaard**

Our body is predisposed for physical activity and not to sit still for a prolonged period. The project 'SDU Moves' is investigating cultural change through citizen science -methods. We aim to create sustainable change and empower employees to make healthier choices in their work life and advocate the UN SDGs. University of Southern Denmark has adopted the UN Sustainable Development Goals as an official strategy. SDG3 with focus on health and well-being is prioritised and initiated with the project 'SDU Moves'. The employees at the university are engaged in a co-creation process on how to become more active during their workday. Based on a collaborative investigation through workshops, survey data and the empowerment and education of 150 volunteer ambassadors as well as building on research from the Department of Sport Science and Clinical Biomechanics, one activity was particularly desired during working hours: Walking. Therefore, the concept of walking meetings was investigated as a meeting format in line with traditional meeting formats. Data from the pilot showed walking meetings were not as simple to implement as a meeting format as first predicted. Walking meetings were new to the employees and thorough introductions were needed together with a clear permission from the management. On the other hand, almost 90% of the participants in the pilot was positive toward walking meetings and wanted to continue using this meeting format as a supplement to traditional meetings. Data also showed that barriers existed, most pre-dominantly with regards to workplace rules, regulations, and policies. Based on the data 'SDU Moves' launched a co-created campaign on walking meetings with employees in the spring 2022. In connection, the format of walking meetings was on behalf of the ambassadors proposed to university management and acknowledged as a key activity in over to reach SDG3. Thus, the university is taking its own medicine. 'SDU Moves' will continue the dialogue and co-creation process with the employees as 'citizens' in the CS-project to investigate and develop new methods and tools for a more active workplace. It will be a matter of cultural change and deliver with co-created approaches to overcoming barriers.

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Empowerment through local news in plain language

***Lisa Birnbaum, Anne Hümmer**

More than 700 million adults world-wide – and about 20 million German adults – cannot adequately understand texts. However, if texts are written in plain language, 95% of adults in Germany can be reached with it. Thus, the goal of the citizen science project "Einfach informiert" (plainly informed) is to inform people in plain language about what is happening in their region. This enables people to participate more in society and in everyday life. Together with citizen scientists, not only is a local newspaper developed and published in plain language. Rather, the citizen scientists are also involved in the design of a questionnaire in plain language in a co-creation workshop. Around 20 people are currently involved as citizen scientists, who either already have experience in the editorial field or work with people from the

target group. The questionnaire is addressed to the readership of the newspaper in plain language. The questionnaire data will be used to examine the relations between self-perceived reading competence, the comprehensibility of the newspaper, and being informed about and connected to the region. The questionnaire will be distributed together with the first and fourth issues of the monthly local newspaper „Einfach informiert" (1st issue: June 2022, circulation: 30,000). In addition, interviews will be conducted with the citizen scientists to understand what motivated them to participate in the project and what they learned through their participation. At our talk, we present our citizen science project including the results of the questionnaire data from both measurement dates. It is assumed that also persons with a low reading self-concept and independent from sociodemographic variables understand the newspaper in plain language well. Regarding the citizen scientists, we discuss to what extent their previous experiences with the target group or in writing favours their motivation to participate in the project and how they experience empowerment in the project in the sense of how they can contribute their own competencies and acquire new competencies and experiences. Implications for further citizen science projects in the field of literacy and non-formal learning are discussed.

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Tackling plastic pollution through citizen science: longitudinal changes in motivation, knowledge and attitudes of volunteers

***Liselotte Rambonnet, Anne Land-Zandstra**

Citizen science is increasingly being used to monitor and tackle plastic pollution. In the Dutch project Clean Rivers volunteers collect and study litter on river banks since 2017. In such a long running project it is important to understand why volunteers want to be involved and what keeps them motivated. Where most citizen science projects study motivation only once, in this project we examined the motivation, attitudes, and learning of Clean Rivers volunteers using one pre and three post-surveys between 2017 and 2021. This gives us the opportunity to shed light on how motivation, learning, and attitude may change over time. Our results show that the most important reasons for volunteers to participate in the project were because they are disturbed by the litter because they want to tackle the plastic soup and contribute to a better environment. Their main motivation changed during their participation, it shifted slightly, from tackling the plastic soup to being disturbed by the litter. Reasons for participating as citizen scientists specifically, thus collecting data in addition to cleaning up, are mainly because of activistic motivations like tackling the source of plastic pollution and contributing to new measures by the government or companies. While tackling the source was still the most important motivation, and although this first increased, it decreased in 2021. Their motivation of contributing to new measures by the government or companies became more popular in 2020 and 2021. Participants' attitude towards natural sciences and nature were already quite high from the beginning and did not change significantly. This could be expected because most of the volunteers were highly educated. But, their feeling of connectedness to all life on this planet did increase after participation. Regarding the impact of participation on citizen scientists' knowledge, especially after the first year, the self-reported knowledge of the volunteers on topics related to plastic pollution and the scientific method increased. Our results help to understand how motivations of citizen scientists can change over time and what impact participation can have on their personal life. This knowledge can help project leaders and policymakers when they collaborate with the public.

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Citizen science in soil research – the "Expedition Erdreich"

***Luise Ohmann, Susanne Döhler, Susann Heinrich**

Soil is omnipresent and at the same time hidden. This valuable resource, with a great variety of functions for humans and the environment, is facing increasing challenges. The world's population is growing steadily and needs to be fed. At the same time, the cultivation of plant-based raw materials for industry and energy production on fields is increasing. Already, about a quarter of all agriculturally usable soils are degraded worldwide and can no longer adequately fulfil their functions. Protecting soils as a key element in maintaining an intact ecological balance is a joint task that cannot succeed

without the participation of the general public. Citizen science is gaining importance in Environmental Science. The collection of large data sets by non-professionals can be combined with knowledge transfer, science communication and environmental education. Therefore, this method not only generates data, it is also a powerful tool to increase environmental awareness in the general public. Still, citizen science approaches are rarely used in soil research in Germany. "Expedition Erdreich" is a citizen science project, in which citizens across Germany analysed soil properties at approximately 1,400 locations. As the first nationwide citizen science project in soil research, it offers the opportunity to test and critically examine the method on a national scale. In addition to collecting data on site-specific soil properties, the project aims to evaluate the usability of citizen science and its possibilities and limits in soil research. The collected datasets include coordinates, current land use, pH value, and decomposition rates according to the Tea Bag Index. In addition to the data, the evaluation also includes our experiences from the implementation of this project as well as feedback from the participants. It is shown that citizen science is basically applicable in soil research and that this method is suitable for the collection of large data sets. In particular, individual soil parameters, such as the pH value, can easily be surveyed. However, the successful collection of several soil properties for a more complex characterisation of sites depends strongly on a specific research question and the precise definition of the targeted participants.

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Identidades comunes (common identities): a common space for planetary health from citizen science in social sciences and humanities

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Identidades comunes (Common identities), the first national meeting of citizen science (CS), social sciences and humanities (SSH), took place in Ethiopia, Art and Technology Centre, Zaragoza (Spain), on 23 September 2021. The meeting was co-organised by Ibercivis Foundation, the Zaragoza City Council and the University of Zaragoza, with the support of the Spanish Foundation for Science and Technology-Ministry of Science and Innovation and the Spain-USA Council Foundation. A second edition will be held on 20 September 2022. Identidades Comunes consisted of a knowledge exchange meeting between citizen science project managers, citizen and academic researchers, together with the citizenry at large, as well as a common space to discuss the present and future of citizen science in social sciences and humanities. Participants shared experiences and knowledge through presentations, round tables and workshops. The citizen science initiatives presented were developed in transdisciplinary fields around social sciences and humanities themes and/or methodologies, showing the relevance of social sciences and humanities research for planetary health: social perception of nursing; implications and forms of drought management; mental health; risk of social exclusion; social and citizen innovation; climate change; visibility of migration, and many others. In addition, workshops were held to learn more about some of these projects. Institutional support for Identidades Comunes was manifested in the participation of representatives from Government and Academia: the Regional Minister of Science, University and Knowledge Society of the Government of Aragon, the Regional Minister of Economy, Innovation and Employment of the City Council of Zaragoza and the Vice-Rector of Planning, Sustainability and Infrastructures of the University of Zaragoza. The main conclusions were as follows. From citizen laboratories and activism: affected communities will always be a key to citizen science; something that was considered revolutionary is now endorsed by European policies. a. From the governmental sphere: citizen science, still unknown to a large part of society, must be integrated into everyday life, and the value of research using citizen science methodologies must be recognised. From the academic community: certain research could not be developed without citizen science; universities must open up much more to society as a whole, highlighting the role of citizen science and SSH for the co-creation of open, democratic and innovative knowledge.

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The ethical-political principle of "the common": citizen science as a commons for better research governance

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Knowledge is often managed in unsustainable ways and is not accessible to all individuals and social groups. Examples include: (1) The interests of certain communities affected by environmental, health, etc. issues are not a priority for those deciding what should be researched. As an emblematic example, in the field of rare diseases, a part of society is excluded from the research benefits. (2) Publishers subject research centres to a multiplication of payments to access the knowledge they themselves have generated. (3) The open science model faces the dilemma of whether or not to protect the rights of researchers and institutions. If the potential research benefits should also revert to those who generate them and if, simultaneously, the research results should be widely disseminated, knowledge cannot be managed identically to business/industrial models. Solutions to these conflicts seek to curb the privatisation of science claiming for "public science". However, in the last decades a whole line of research and activism is developing to recover the "commons" concept, distinguished from "public goods", with relevant consequences for the sustainability and accessibility of knowledge. We propose citizen science as a powerful practice for constituting "the common", in a double sense: the research itself is configured as a "commons" while, by "acting in common", more co-responsible and inclusive communities are created. The epistemic, social, ethico-political and cultural elements associated with these practices are co-constituted, resulting in a co-responsible citizenship of a more open, sustainable and accessible research. Citizen science represents a fundamental element - although also depending on the motivations of the protagonists - for the governance of research systems, with the consequent reduction of the ethical-political, epistemic, social and economic conflicts characterising our societies. Motivations based on cooperation generate networks of reciprocity, deliberation and common action, mutual recognition, creating co-responsible and committed communities. Under this ethical-political principle, citizen science can truly constitute "the common".

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The long journey of the Citizen Science Global Partnership

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The idea for establishing a Citizen Science Global Partnership (CSGP) originated in 2017 at the UN Science-Policy-Business Forum on the Environment. At the event, attended by international citizen science practitioners from all the established citizen science Associations, representatives of the UN and other international organisations, the UN suggested that a formal, global, and unique entry point was required to enable the international citizen science community to fully engage in the global sustainability effort (well encompassed by the UN SDGs). Since then, a small motivated group of volunteers, including representatives of different citizen science networks and other stakeholders, has been putting in long hours to make this vision a reality, with the ambition of bringing together citizen science researchers and practitioners with actors representing policy, business, and community-based perspectives. Via community consultations and internal discussions, trying to balance ambitions and constraints, enduring successes as well as drawbacks, the original idea of a "network-of-networks has evolved and matured. Now that a major milestone is just around the corner, the interim management of the CSGP would like to take advantage of the first post Covid in-person gathering of the community to share an update on this instructive and passionate journey, including key learnings from the past and promises for a bright and impactful future (more info on how to get involved at the poster session).

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Making the case for open citizen science tools

Maria Rosa (Rosy) Mondardini

Thanks to the successful activities of local, national and international citizen science networks and their effective communication and outreach, an increasing number of practitioners is approaching citizen science, including academic scientists, activists, community organisers, and more. Alas,

some of them will soon encounter what can be a major obstacle to their new endeavour: the lack of (financial) resources to develop the appropriate interfaces and tools that will allow citizens' participation. In most cases, this would be a web interface for data analysis, or a smartphone app for data collection, or a low-cost DIY kit for sampling. The implementation of citizen science projects is often hindered by the cost of technical solutions. What new practitioners may not know, is that there are several existing solutions out there that are free, open, and available for anybody to use. Developed by EU projects, academic institutions, or international organisations, existing citizen science solutions are powerful and versatile, easy to use, and support most of the functionalities commonly needed in citizen science projects. By providing a quick overview of some of the existing tools, this short presentation aims at spreading this good news, and stimulating the citizen science community to try what is available out there before investing time and resources in new solutions.

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Misinformation handling for citizen-centered policy making

***Maria Tsourma, Foteini Dervisi, Anastasis Drosou**

The spread of misinformation is a phenomenon that is becoming increasingly prevalent in modern societies, leading to negative implications by preventing people from making well-informed decisions, threatening social cohesion, and decreasing the confidence levels between citizens, the public administration, and policy-makers. Public administrations and policymakers use information daily for policy and decision-making. It is therefore imperative for them to be able to detect misinformation, filter the data before decision-making, and take action on time, to mitigate its spread and the consequences it entails, while being correct-informed before decision-making. In an attempt to facilitate misinformation handling, we introduce a multi-factor misinformation handling platform for public organisations. The main objective of the proposed platform is the identification of the topics raised within a community, the detection of misinformation using knowledge graph-based approaches, recognition of any threats by identifying topics related with criminality and violence, and extraction of valuable information regarding arising social issues (i.e., immigration), as well as resilience-related events (i.e., environmental disasters, road traffic accidents). The proposed platform collects and processes data referring to the municipality from social media posts, online news articles, and the citizens themselves, enhancing thus inclusive policy-making and increasing transparency. Citizens will be able to access the platform, view any previous topics identified and view any misinformation dispersed per topic. The collected information is processed to extract issues referring to the municipality using Natural Language Processing and AI methods such as topic modelling and text classification algorithms, in order to collect information per topic and detect misinformation. The extracted topics are further prioritised automatically through the corresponding methods and by taking into considerations multiple factors that the municipalities currently use for this process, allowing the municipality to respond to all topics in a timely manner and perform the corresponding counteractions based on the severity of each topic. The use of this platform in municipalities and in public administrations in general aims to facilitate the early identification of topics or threats occurring within a municipality, initially, and allow the municipality to take the corresponding counter-actions earlier aiming to minimise the time of response and perform resource allocation wiser.

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Using collaborative knowledge to address greywater reuse at a Chilean school

***Mariela Yevenes, Ana Araneda, Alan Kolok**

Schools provide water to students and teachers with basic services including drinking water and sanitation. Chile has been facing a mega-drought for the past 13 years which is becoming a significant threat to the basic needs that students and teachers rely upon. Clearly, meeting sustainable development goals regarding clean water and sanitation (ODS 6) is going to be a challenge in future years, and it will be necessary to create awareness in schools and their communities. This article addresses nature-based

techniques and initiatives that have been implemented to reuse water sustainably in a school in the Nonguen valley, (36o50 29.332 S, 73o0 30.225 W) Biobío region, Chile. The study was co-created with the school Community between 2019 and 2021 and was carried out through participatory activities between the school community and scientists. In this investigation, the objective was to build a biofilter system to recover the greywater (dishwater and handwash water) generated in the school. In general, the reuse of greywater requires a minimal quantity of water, which was available at the school. The biofilter consisted of a circular area that was constructed by the school community and that was connected to the school. The biofilter was composed of several materials, with each material making up a single level of the biofilter. Layers include rocks, sand, topsoil, as well as earthworms and wetland plants which were collected by the community. Chemical analysis was conducted to evaluate the physiochemical parameters of the water quality after it had run through the biofilter. The recycled water was used according to the needs of the school, mainly for irrigation of ornamental and recreational spaces. This project supports the contention that recycled water can be used in small scale situations to help Chile address its burgeoning water supply issues.

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Citizen science for water quality monitoring: a case study of lake sevan

Marine Voskanyan

While the international community has increasingly put forward citizen science to address the lack of water quality data, there is still no successful implementation of citizen science projects for water quality monitoring in Armenia. Starting from 2017, several attempts to citizen science projects have been done, mainly related to the collection of data about the environment: water quality, water quantity, bird watching, waste management, forestry management, inspection. Unfortunately because of the improper design, many of them did not succeed. In the last four years, the data show that there is a lack of water quality data to understand the source of the blooming pollution of Lake Sevan, the largest lake in Armenia, which is also one of the largest high lakes in the world. Since 2018, the normal amount of water quality parameters of the lake has been changing over time. This problem is exacerbated due to the lack of the human and financial resources. Moreover, it is difficult to implement water quality monitoring all over the lake if relying on governmental initiatives. This paper describes a water quality measurement of Lake Sevan. It discusses the citizens' and related institution involvement to understand their interconnectedness of the case of the Lake Sevan. The research questions are: which parameters of the water quality have been changing during the blooming years and which appropriate citizen science design should be implemented. The review of water quality data from accessible governmental and scientific resources in the last 4 years and a literature review of international best practices' projections for this case study are used as the method in the study. The result shows that the particular water parameters (phosphorus, dissolved oxygen, biological oxygen demand, and temperature) have been changing over time, and that the government should take actions for the healthy environment with the continuous support of the trained citizens. Keyword: Lake Sevan, citizen, citizen science, climate change, institution, water quality.

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Governance in citizen science networks: a comparative review from the perspective of sustainability in the Global South

***Mariana Varese, Karen Soacha, Jaume Piera, Sonia Liñán**

In the last decade, the Ibero-American Network of Participatory Science (RICAP), the Citizen Science for the Amazon Network, and the Women's Network for Conservation in Latin America and the Caribbean emerged and began their own consolidation processes. After several years of implementation, which included the challenging context of COVID-19, it is time to assess their experience to celebrate achievements, draw lessons, and identify best practices. We will reflect on the challenges and opportunities of sustaining networks and consolidating connections and collaborative workspaces involving citizen scientists, accredited scientists, practitioners,

and other civil society actors. The analysis will focus on the Global South given the greater challenges faced in this hemisphere to secure funding and long term support for citizen science, and, more broadly, scientific research. In addition to the three networks listed above, the recently created Citizen Science Associations of Asia and Africa will also be included. The presentation will thus share the results of a comparative, qualitative, analysis of said networks, including a first proposal of indicators to assess consolidation and impact of citizen science networks in the global South. The Governance Roadmap will be used to structure network assessments (Soacha et. al., 2020, DOI: 10.5281/ZENODO.3996491). Through seven key areas of governance (purpose, organisational approach, operational structure, participation model, decision making model, communication flows, and financial sustainability), this roadmap provides guidance for citizen science networks to make structured decisions and reach governance agreements that increase the likelihood of their sustainability. Ideally, this presentation and ensuing discussion will be connected to an open space at ECSA 2022 for collective reflection of citizen science networks from the global North and South.

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Learning in citizen science. Comparing the project coordinators' perspective to participants' experiences

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Over the past few years, educational effects of participation, such as the development of scientific skills or increased awareness about biodiversity and conservation, have become one of the most widely discussed aspects of citizen science . As such, they are also the focus of one research line within CS Track (https://cstrack.eu), a Horizon 2020 project whose objective is to broaden our knowledge of citizen science by exploring its formats, demographics, impact and potential. The importance of learning in the context of citizen science is evident both by the numerous academic papers written on the subject and by the fact that citizen scientists' learning outcomes play a central role in many citizen science evaluation frameworks. Moreover, the majority of citizen science projects offer some form of instruction or training. However, for this training to be effective, it needs to correspond with the participants' needs, interests and expectations. In order to assess to what extent this is actually the case, this study provides a comparison of learning opportunities as envisioned by project coordinators and as experienced by citizen scientists. Educational effects envisioned by project coordinators were examined through content analysis of project descriptions (N=94) stored in the CS Track database, while learning experiences of citizen scientists were studied using both Twitter data and an online survey (N=610) the CS Track consortium conducted in 2021. This approach enabled us to identify overlaps, similarities and discrepancies between the project initiators or coordinators' perspective on educational aspects of their projects and the way citizen scientists perceived learning in those same projects. At the ECSA conference we would like to demonstrate our strategy for analysing and triangulating three different datasets (project descriptions, tweets, and survey responses) using a combination of qualitative and quantitative, manual and automated methods. We will furthermore present some initial findings and suggest ways in which the project coordinators' and citizen scientists' perspectives on learning in citizen science projects can be brought into closer alignment.

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Citizen science project descriptions: what do they really tell us about citizen science projects?

***Yaela Golumbic, *_Marius Oesterheld_**

Project descriptions are the gateway for citizen scientists to engage with new projects and thus play a key role in recruiting volunteers. As such, they need to be carefully crafted and explain convincingly how prospective citizen scientists will benefit from joining the project. One of the main reasons for and benefits of participating in citizen science , discussed broadly in the literature, is the opportunity to acquire new skills and knowledge. In 2018, Tina Phillips and colleagues developed a model of individual learning outcomes intended to cover the entire range of educational effects potentially associated with participation in citizen science. During the interve-

ning four years, this categorization of educational outcomes has been cited more than one hundred times and used as a framework for evaluating the success and impact of citizen science projects. But is the broad range of learning dimensions offered in Phillips et al.'s model also reflected in the way projects are presented and communicated? To answer this question, we have conducted a qualitative content analysis of a random sample of 94 project descriptions. The results show that some learning dimensions feature very prominently in the project descriptions we studied (such as data collection or using technology), while others are clearly underrepresented (e.g. experimenting, study design, community action). In other words, these project descriptions do not fully reflect the educational potential of participation in citizen science suggested by Phillips et al. At the ECSA conference we will present the results of our qualitative content analysis, discuss potential reasons for the uneven representation of learning dimensions in the project descriptions we examined, and suggest ways in which this issue could be addressed by project initiators and coordinators. Our study contributes to both the theory and practice of citizen science and is intended to provide tangible tools for the design and communication of projects.

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UndercoverEisAgenten - The Arctic permafrost citizen science project

***Marlin Markus Mueller, Christian Thiel, Friederike Klan, Josefine Lenz, Soraya Kaiser, Moritz Langer, Hugues Lantuit, Sabrina Marx, Oliver Fritz, Alexander Zipf**

People in the Arctic have been experiencing severe changes to their environments for several decades. In particular the thawing of permafrost affects the livelihoods of indigenous people and has far-reaching ecological impacts including the additional release of greenhouse gases. By fusing local knowledge on landscape changes in Northwest Canada and remote sensing, we seek to better understand and monitor land surface changes attributable to permafrost thaw. The goal is to investigate permafrost thaw impacts through the acquisition and analysis of imagery from Unmanned Aerial Vehicles (UAVs) and satellites together with young Citizen Scientists from schools in Northwest Canada and Germany. For this, we utilise DJI Mini 2 drones in combination with the "Litchi for DJI" mobile application as the controller software. This combination allows for the easy creation of flight missions with standardised parameters to enable reproducible results. Permafrost landscapes often feature striking polygonal surface structures which change dynamically when thawing processes are in progress. The polygonal landscape structures extend over different spatial scales and can be used to determine the severity of permafrost thaw. While very high-resolution UAV imagery provides detailed insights into the small-scale thermo-hydrological and geomorphological processes, local knowledge and experience is required to identify relevant sites and to set the environmental changes into temporal, cultural, societal, and economic context. These data and background information are urgently needed to improve our prediction on the impacts of permafrost thaw. To this end, school classes in Germany and the Canadian Arctic will collaborate on the analysis of high-resolution remote sensing data. The students will use a mobile application to map striking structures and changes in the land surface on satellites and UAV images. Utilising feedback from co-creative workshops with German teachers, concepts are being developed to introduce the different topics of this project into school curricula of German high schools. This project will enable the development of better climate adaptation planning tools for local communities and engage Canadian and German students and citizen scientists in Arctic climate research. The project "UndercoverEisAgenten", funded by the Federal Ministry of Education and Research in Germany, was initiated in summer 2021.

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Empowering zero-emission citizens – Horizon 2020 project AURORA

Martin Brocklehurst

This application is for a poster session to support the short presentation on the project that is a separate submission. This poster session presents a short outline of the project's overall approach and will illustrate work underway at 5 pilot sites in Portugal, Spain, Slovenia, Denmark and the United Kingdom. It will provide an opportunity for the citizen science community

to interact and understand how they can track, learn from and replicate the AURORA project, which is being designed and developed using Open Science principles so that anyone can replicate our success world wide.

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Ecosystem services of urban soils in the context of a citizen science project

***Martin Hamer, Isabelle Hirsch**

Neither the diverse functions and ecosystem services of soils nor the current trend towards degradation of global soils are known to a satisfactory extent. Especially in urban regions, there is an increasing alienation from the ecosystems surrounding us. Despite the comparatively small share of urban soils in terms of area (approx. 10 % of the total area in Germany), their importance for the well-being of people living in cities is increasing. In particular, the functions of climate and water regulation will be of increasing importance for growing cities in the future under the influence of rising temperatures. In addition, the habitat function for plants and animals (biodiversity and recreational value) as well as food production (e.g. urban gardening trend) are important components of urban development for many people. Against this background, an active involvement of the above-mentioned target group in soil science issues appears to be very promising for knowledge transfer and dialogue processes with society. In addition to the aspect of knowledge transfer and (soil) awareness raising, citizen science projects also open up the possibility of data collection on areas that can only be carried out with great effort using conventional survey methods. Within the framework of a project funded by the federal government and the state of North Rhine-Westphalia, various possibilities are offered for the active involvement of citizens in soil science issues and data collection. Soil data have been collected at the regional level through the joint analysis of soil samples in practical workshops, through analyses and experiments that participants can carry out on site (at the university or in their own garden), and through the possibility of sending in soil samples for analysis. The resulting findings are processed and communicated in a target-group-specific manner and thus make a significant contribution to communicating soil protection-relevant content. Concrete recommendations for action, e.g. for garden owners and public green space offices, are intended to contribute to the protection of soil functions at regional level. This paper shows the potentials of involving citizens in research processes for a higher social acceptance, anchoring and implementation of developed solutions for soil protection.

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Learning together: growing a planetary health education community in Eastern Africa

***Melvine Otieno, Given Moonga**

Planetary health as a holistic perspective on human health and its interconnectedness with nature calls for interdisciplinary and transregional teaching and research around the globe. While the concept becomes increasingly popular in the Global North, it is still largely missing in the Sub-Saharan African curricula. Educational institutions play a vital role in shaping our and the world's future and are thus essential in creating change within society. The Planetary Health Eastern Africa Hub, initiated by the Planetary Health Alliance and only founded in 2019, aims at raising awareness for planetary health across the region. It is fostering an education community involving regional lecturers, researchers and students from different disciplines including medicine, public health and environmental science. The goal is to create and establish planetary health courses that are based on globally shared values and principles, but reflect local needs, expertise, and teaching conditions. By bringing together researchers, lecturers and interested students, the Hub offers the opportunity to mutually explore how planetary health connects to the ongoing efforts on creating healthy environments in Eastern Africa and to inspire conversations around the health of our planet. Here, we want to highlight challenges, opportunities and successes of planetary health education over the past two years in the Eastern African Region. By sharing the growth that is happening within and beyond our network, we hope to inspire others and exchange ideas for improving planetary health education initiatives for transformative action.

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Poster Session B2

Session chair: Moritz Müller

Bürger schaffen Wissen - The German citizen science Platform

***Fabienne Wehrle, *Moritz Müller, Wiebke Brink**

Since 2014, the platform "Bürger schaffen Wissen" has actively moderated the rise of the German citizen science community by giving it a voice and a stage. This makes "Bürger schaffen Wissen" one of only four national citizen science platforms in Europe! Since its launch, many projects that contribute to the goals of planetary health have registered on the platform. Therefore, we want to make use of the 2022 ECSA conference to present our platform, the projects on it and our understanding of citizen science at a poster booth to discuss the synergies between citizen science and planetary health. Besides the classically strongly represented projects in the field of nature and biodiversity monitoring, it is recently especially the growing number of citizen science projects in the field of "everyday research" that we associate with the target horizon of planetary Health. Overall, we find that the objective of citizen science as a whole is consistent with the planetary health agenda. As "Bürger schaffen Wissen" considers itself a mediator between science, society and policy, our core objective is to increase the visibility and reputation of citizen science in order to promote civic engagement in the eye of the upcoming socio-environmental challenges that planetary health addresses. Our goal is to establish citizen science as a recognized method that can lead to the improvement of our living environment. As we want to focus more strongly on this development in the context of our project support, we are looking forward to engaging in a dialogue about possible strategies at ECSA.

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Transdisciplinary research on global health: spotlights on activities of the Berlin University Alliance

***Nadin Gaasch , Angela Osterheider, Audrey Podann**

In our short presentation we introduce our conceptual approach and first insights of how to address the lack of transdisciplinary research and funding within the health community outlined by the organisers of this year`s ESCA conference. The Berlin University Alliance (BUA) pursues the goal of jointly turning Berlin into an integrated research environment addressing particularly global grand challenges. One of its two Grand Challenge Initiatives is on global health. Another goal of the BUA is to foster the multidirectional knowledge exchange between science and society. The BUA-project Research Forums (Objective 2) combines the content-related demands of global health with conceptual and methodological approaches of transdisciplinary research. We expect the interplay of excellent research and intensive exchange with society in transdisciplinary settings to provide new impulses for a) robust solutions for global health issues and b) greater acceptance of transdisciplinary research in the network and beyond. We seek to meet our goals in two ways. First, to promote the funding of transdisciplinary research projects, we have launched a call for exploration projects (jointly with BUA-Objective 1) in which transdisciplinary research approaches were a prerequisite for being successfully reviewed. Therefore, we have set up a review process that took equal account of both content and method. The transdisciplinary projects will start this year and we will closely accompany them to follow up on two questions: 1) What are the added values of such a transdisciplinary research approach on global health and 2) What are the structural obstacles in transdisciplinary research within the BUA? Secondly, in May 2022 we started with an almost one-year series of thematic workshops on urban health bringing together representatives from society and science to create a space for multidirectional exchange of knowledge on urban health in Berlin. This science-led process pursues the question: Which topics in urban health can be dealt with particularly well in Berlin due to their scientific, societal, cultural, political and economic relevance? In the medium term, transdisciplinary partnerships are

to be created that work on these topics–and thus promote the idea of a Berlin integrated research environment.

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Help us in opening the mystery box of marine and riverine citizen science in Europe

***Nancy Fockedey, Bart De Smet, Annelies Tavernier, Jan Seys**

Considering the vastness and the importance of the ocean, coastlines, estuaries and rivers for ocean and human health – and by extension planetary health – the contribution of citizen scientists is essential for the purpose of science, policy and public awareness. Within citizen science, the public can be engaged in different levels of participation, ranging from crowdsourcing and participatory science, to distributed intelligence and extreme citizen science (Hacklay, 2013). Today, there is no comprehensive overview available of marine and riverine citizen science projects in Europe (Garcia-Soto et al., 2021), except for the North Sea area (van Hee et al., 2020). Setting up this inventory for all European seas and river basins, and performing an in-depth analysis on the current state, tools and impact of these citizen science projects is highly recommended. The analysis can detect specific knowledge and technological gaps, improve the exchange of good practices, and act as a basis for the set-up of recommendations on specific strategies, platforms, technological tools, etc. The Horizon Europe project Prep4Blue aims to generate such a comprehensive inventory and analysis. However, the majority of marine and riverine citizen science projects – and by extension other types of public engagement projects –are often country and language specific. The regional scale and the foreign language hamper the collection of project information and the completion of the planned inventory. With this presentation we would like to call the participants of this conference to share marine and river-related projects with us. We are interested in the full spectrum of citizen science initiatives: from biological observations on species and biodiversity, over human and environmental health and pollution, to non-biological sciences (geology, history, coastal engineering, technology etc.). Join us at our booth and inform us about the citizen science initiatives in your country or region!

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Expectations and reality: characteristics of the research collaboration between citizen science volunteers and scientists in the german project "tracing the garden dormouse"

Nicola Moczek

The garden dormouse (*Eliomys quercinus*) is a small, nocturnal rodent species that hibernates. In the last 30 years, the species' population has declined dramatically. As Germany covers more than 10 % of the species' range, the country carries a high degree of responsibility for its future conservation. One of the challenges in exploring and conserving small mammals is locating them in their habitats. In the project lasting a total of six years, the distribution of the species in Germany and possible causes of decline was researched with the help of many citizen science volunteers. For the formative evaluation of the impact on the participants, online studies were conducted at the beginning (2019) and at the end of the research phase (2022). The presentation highlights various aspects and perspectives that may play a role in the collaboration between institutionally employed researchers (N > 25) and citizen science volunteers (N > 450). In particular, the expectations and reality of the active participation of citizen science volunteers, the quantity and quality of data, the assessment of mutual dependencies, the approach to scientific work as well as aspects of project organisation will be addressed.

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How can Bioblitzes contribute to analyse biodiversity trends?

***Patrícia Tiago, Cristina Luís, Inês Rosário**

Biodiversity is threatened by the effects of human activities such as climate change, habitat loss and the introduction of alien species, and it is essential to assess its trends to guarantee the sustainability of food webs and human survival, which depends on safeguarding the balance between multiple ecosystems. The growing concern about the emergence of zoonoses that reflect the unruly way in which humanity has been relating to nature, shows how crucial it is, even for public health reasons, to increase knowledge of the state and threats to biodiversity. While there are observations for climate collected daily and globally, for biodiversity there is no global observation system, so we have no regular and timely information on its change. Establishing biodiversity monitoring programs faces challenges such as cost, human resources training and political instability. One way to increase the collection of biodiversity data is through public participation by implementing citizen science programs. Among the wide range of citizen science tools, BioBlitz events are being adopted as an effective methodology for conducting a rapid and assisted assessment of biodiversity, thus contributing to the evidence base for managing and preserving biodiversity and ecosystem services. In Portugal, as in other countries, many of these events are being organised in urban areas, which have great potential for public participation and to increase knowledge of urban biodiversity and ecology. With this presentation we intend to analyse the different typologies of BioBlitzes, the various entities that promote them and the different objectives set. We also intend to discuss the potential of these activities in all domains: from science dissemination to conservation measures. Understanding how these activities can help assess biodiversity trends, support environmental management policies and encourage people to connect with biodiversity is essential to give relevance to BioBlitzes in the context of biodiversity conservation.

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How does a Citizen Science App work? The essential basic knowledge about the technical infrastructure when utilising digital Apps in Citizen Science

Philipp Hummer

We all use digital Apps all the time, each day, every hour, every minute of our life. But when asking the question "How does the technology behind an App work?" many do not know in detail.
In this poster, Philipp Hummer from SPOTTERON Citizen Science (www.spotteron.net) answers this question with an overview of the processes of an example App on the platform. The technology behind a modern Citizen Science or Public Engagement App involves a complex ICT infrastructure to ensure performance, safe data transfers, and user privacy. Various services and software packages handle different tasks and data processing, enabling the public to contribute observations via mobile devices and be part of a Citizen Science App community. We follow the path of a user's submission in a Citizen Science App from the photograph and data inputs to processing, storage, and data administration by a project's team. Integrated community features and communication tools complete the process of forming a living environment for buzzing communities and social interaction on the digital technology infrastructure.
We all use user-driven Apps every day on our smartphones. Getting an insight into the involved processes behind it will support our better understanding of essential aspects of digital tools and Citizen Science Apps and the underlying technologies in practice.

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Creating communities – How projects facilitate digital social interaction and communication in citizen science apps on the SPOTTERON platform

Philpp Hummer

Citizen science has strong roots in community engagement. With the ongoing rise of smartphones, connected devices, and internet technologies, unique opportunities to include and immerse the public in science

projects and citizen action have emerged. On the SPOTTERON app platform, created by Citizen Scientists for citizen science, we strive to help make citizen science a part of our daily lives for impact and change.
With the constant design and development of new integrated tools in direct collaboration with the project scientists and teams, modern functionalities like @user mentions, push notifications, or community networks encourage persistent user activity and allow citizens to work together for sounder data quality, direct learning possibilities, and to create a welcoming user experience from the start – all in a privacy-safe and digital-ethical environment. The power of creating interactive communities in citizen science is directly utilised in the Apps of all projects on SPOTTERON across Europe and beyond for university research, NGO engagement, and our participation in Horizon 2020 projects.
The poster introduces the core concepts of the platform. It presents how these communication-enabling possibilities, developed over the last six years together with citizen science stakeholders, are interchained and how they enrich participation in citizen science apps. A visual user journey highlights how citizen science projects put such digital communities to use in their Apps and how in-App communication leads to ongoing contributions, storytelling, motivation, user inclusion, and sustainable project growth. To tap into the practice of running interactive citizen science projects, we reference various partners' examples of citizen science apps in different scientific fields, from biodiversity monitoring over geo-research to interactive social science.
For the market stand, we bring a range of devices from phones to tablets to touchscreens for hands-on testing of live citizen science applications and to experience the power of integrating digital social functionalities with their possibilities for better user engagement and science communication. Also, the market stand offers device charging for everyone with many adapters available, which has been a frequently used asset in past conferences.

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CrowdBots: integrating imperfect machine learning models into citizen science

Pietro Michelucci

Hybrid collective intelligence may serve as an effective progression in the evolution of crowd-powered systems such as citizen science projects, which rely on human cognition. Supervised machine learning has been treated as a panacea for automated image classification under the assumption that prediction performance depends primarily on the quality and volume of the training corpus, which is often obtained through crowdsourcing. We have observed that this assumption may fall short when accurate classification depends upon contextual knowledge that is not encoded in the pixels or on the inference needed to apply that knowledge. 37,000 volunteers on our "Stall Catchers" citizen science platform have contributed over 12 million classification labels for a biomedical research application. Bespoke "wisdom of the crowd" methods, which effectively create ensemble models out of humans, combined multiple individual labels for the same input to produce 1.5 million research grade labels. These gold standard data were used by over 900 participants in a machine learning competition to train 55 unique models exhibiting a range of performance characteristics. Though none of these models exhibits classification performance sufficient to replace Stall Catchers, the sensitivity and bias distributions of these models are remarkably similar to those of human volunteers, suggesting the models' suitability for crowd-based participation. We endowed the top three models with sufficient agency to participate as humans do on our citizen science platform and discovered that our wisdom of the crowd algorithm was effective in extracting research grade classifications from hybrid cohorts. These results suggest that human/AI ensembles may give purpose to imperfect machine learning models as an intermediate practicable step toward fully automated solutions.

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Investigating the potential of citizen science to respond to emerging health challenges – The case of COVID-19

***Reuma De-Groot, Yaela Golumbic, Anne Turbe**

The COVID-19 pandemic has challenged scientists, researchers, and industries to rapidly divert their research to better understand the COVID-19 virus spread, biology, health implications in addition to identifying medical solutions and cures. One of the avenues utilised for this cause was citizen science. We investigated the power of citizen science to respond to the emerging COVID-19 pandemic, under the ongoing EU project CS Track. 25 citizen science projects conducting research related to COVID-19 were identified (within the CS Track database and beyond) and analysed using a two-phase research approach. First, website content analysis was conducted to understand and characterise citizen science projects that endeavoured to respond to the pandemic, in terms of their geographical distribution, aims, design and citizen engagement. Followed by detailed case studies of seven citizen science initiatives which provided in-depth understanding of projects' development and projects' experiences in diverting their research to COVID-19 context. Content analysis of projects' websites revealed projects focused on three main domains, namely tracking the spread of the pandemic in the population, investigating the influence of COVID-19 on people's wellbeing, and investigating the COVID-19 virus biology. Citizen scientists' tasks centred around responding to an online survey, self-tracking data from a wearable device and distributed computing. Overall projects were widely accessible, targeting a broad audience, and requiring no special skills. Most projects required at least a moderate degree of effort from participants, asking a few types of questions, and many required frequent contributions at regular intervals. The case studies revealed the importance of early preparedness to respond to new challenges, building on existing experience, collaborations and modular software infrastructure. Important features highlighted by projects included regular and honest feedback securing the trust and engagement of the participants, and thinking big, open and collaboratively when designing a project. These findings have important implications for the design and management of citizen science projects, planning for a sustainable future and promoting planetary health in times of harmony and in times of crisis.

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Student well-being through student science

Rhoda Schuling

In recent years, students have become part of a larger trend that shows well-being related illnesses, such as depressive disorder, burnout and obesity are strongly on the rise throughout the world. In the Netherlands, national surveys show that students increasingly suffer from these conditions. The percentage of students that meets national guidelines for exercise dwindles every year. The Hanze University of Groningen aims to tackle this concern within its own context through citizen science ; i.e. to come to innovative solutions through co-creation with students that lead to reductions in student ill-being. Two auxiliary aims are 1) to improve the University's general infrastructure / research capacity for citizen science (including the monitoring and evaluation of impact), and 2) to fortify an extended ecosystem of local businesses working in the field of vitality and active lifestyle, as well as local municipalities concerned with youth health and wellbeing. In our experiment, students will be involved in all stages: starting with the crowdsourcing of the exact urgencies within this topic, to identifying student ambassadors / working groups, and piloting various angles for innovation together. These student scientists ideally come from all departments of the University; in addition we aim to recruit students from specific departments to bring in relevant expertise (e.g. Health Sciences, Applied Psychology, ICT, Communication and Sports Sciences). These disciplines will be amplified with input from local businesses and municipalities. Hanze researchers will primarily function as initiators and facilitators, with the addition of translating impact and output through the relevant scientific canals. Though we try to adhere to all ECSA citizen science principles, especially principles 3, 4, 6 and 9 apply for this project. We expect increasing resilience and well-being in our future workforce through an approach that enhances democratic science and end-user agency, will contribute to planetary heal-

th. Presentation Come October 2022, we will be able to present an overview of lessons learned and milestones achieved from the early stages, i.e. the crowdsourcing, identifying and working with student ambassadors, and building the ecosystem. We will also be able to outline next steps.

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FAIR data and citizen science for health: how open should we be while sharing data?

***Ria Wolkorte, Lieke Heesink, Michelle M.A. Kip**

Openness and transparency with regard to data are cornerstones of citizen science. One of the 10 principles of citizen science according to ECSA is 'Citizen science project data and meta-data are made publicly available and where possible, results are published in an open access format'. Making data publicly available can be achieved by placing them in a repository. Repositories facilitate the reuse of data for other research, and allows reproducing and confirming the findings of the original study. To accommodate this, repositories offer different levels of openness ranging from completely open, to placing data under embargo with access only upon reasonable request, to only publishing the metadata and never sharing the actual data. In the domain of health and wellbeing the principles of openness and transparency sometimes collide with the principles of privacy. These issues particularly occur where it concerns qualitative data, as anonymization can be more difficult to achieve. For these situations, the balance between openness and privacy should be considered on a project-by-project basis. Within the Citizenlab project at the University of Twente we conducted a citizen science project in cooperation with people with rheumatoid arthritis. The project entailed interviews, surveys with open- and closed ended questions, focus groups, and the longitudinal collection of data on a digital platform. The collected data concerned among others personal and health-related data and is a mix of quantitative and qualitative data. To inform the data management strategy of our project, it was important to understand the views of different stakeholders with regard to the use of repositories to share the data collected during this project. We therefore held a focus group discussion with co-researchers, and another multidisciplinary focus group discussion including not only co-researchers but also ethicists, data stewards and citizen science researchers. In these focus groups we discussed motivations and prerequisites for sharing data. We further asked 10 people with arthritis about their preferred level of openness when sharing their data. Based on the outcomes, we are working on a preliminary data management guide for citizen science for health and to extend the findings in future research.

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Towards a framework for the monitoring and evaluation of citizen science for health projects

***Ria Wolkorte, Sabine Wildevuur**

Evaluation is an important aspect of scientific projects. It supports reflection on the process and helps to formulate improvements for future projects. Evaluation also aids in reporting the outcomes and impact of a project. Structured evaluation of a project is essential to create an accurate overview of both the process and outcomes. If the project has a longitudinal set-up, monitoring is an important aspect as well as it supports expectation management and can help to redirect projects where necessary. A framework can be used as a tool to support monitoring and evaluation of projects. Several frameworks have been created for citizen science projects. One such framework is the 'evaluation of citizen science framework'. This framework incorporates the evaluation of both the process and the outcomes and impact, and distinguishes between the areas of science, participants, and socio-ecology and economy. An upcoming domain in citizen science is health. Projects in the domain of health can be distinct from projects in other domains, especially with regards to: • Ethics • Data privacy • Transdisciplinary cooperation • Personal and societal health outcomes • Education (of participants, researchers, professionals, and students) • Reciprocity. Therefore, health-related citizen science projects require a domain-specific evaluation framework. However, it is not necessary to create such a framework from scratch as frameworks for other domains, such as the 'evaluation of citizen science framework' may inform the creation of a framework for the eva-

luation of health-related citizen science projects. We are cooperating with the original authors of the framework to adapt it for use in monitoring and evaluating citizen science projects for health and wellbeing. This includes expert elicitation to identify factors in citizen science for health projects that need different and/or additional attention during monitoring and evaluation, and creating a general framework and practical tool.

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Experiences from a citizen science project engaging children and young people in lake ecology through spare time activities

***Sara Egemose, Christina Greve, Anna Okholm, Annika Melgaard, Gitte Kragh, Kristian Hvidtfelt Nielsen, Thomas Kaarsted**

All children and young people should have the possibility to experience the joy of learning about nature and planetary health. Only through learning will we also understand, love, and protect something (Diom, 1968), in this case our freshwater environments. In the citizen science project 'Lakes in Spare Time', the participating children and young people learn about freshwater quality and biodiversity through participatory science in and around Danish lakes and ponds, of which there are approximately 200,000. Through the various project activities, the participants contribute to freshwater research by collecting data while they gain knowledge and awareness of environmental challenges in relation to lakes and ponds. All project activities are happening in collaboration with nature schools, libraries, societies engaging children and young people, families, volunteers, and researchers. There are four main activities; Find a lake, Book a lake communicator, Lake suitcases and Lake camps. All in informal arenas and centred about experiments, activities, and equipment in relation to lake ecology, but in different timespan. Project goals, in addition to the learning goal, include gaining new and improved knowledge about water quality and biodiversity, as well as making data gained available online by the participants or us, depending on the activity, so it can be viewed and used by all interested parties, including the public. Our presentation will focus on the experiences gained from engaging children and young people in a citizen science project in their spare time in an informal learning environment. We will share our thoughts and considerations as well as our experiences in relation to engagement and commitment of young participants, collaboration across disciplines, data collection, quality of data and knowledge dissemination.

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YouCount: engaging youth as citizen social scientists in co-creating sustainable futures – A Scandinavian approach for a healthy planet

Cathrine Marie Skovbo Winther; *Sara Noémie Plassnig

All over the world, youth are facing the risk of social exclusion by not getting a job, dropping out from education or being deprived of a meaningful participation in local activities (OsloMet, 2021). YouCount is an EU-funded project engaging youth (13-30 years) as citizen social scientists and experts in investigating their local community to develop new knowledge and innovations on social inclusion and Citizen Social Science. Through a multiple case study approach across nine countries in Europe, local youth at risk of social exclusion are recruited to be a part of the scientific processes. By doing so, YouCount aims to empower youth to become active citizens and increase their social participation, feeling of belonging and engagement in policy-making – factors that we believe will contribute to the well-being of YouCount youth, their peers and communities.

Three of the YouCount cases are located in the Scandinavian countries Denmark, Norway, and Sweden. Each of the three cases have recruited 10-17 young co-researchers and established a close collaboration with local stakeholders to create and maintain interest and sustainability.

The poster will present the experiences and initial results from the Scandinavian partners in YouCount, the different approaches and creative methods and how they have fostered engagement and empowerment. It will compare different outcomes and summarise how the three cases have worked together with youth as co-researchers, the impact so far and what we can learn from each other's work. The challenges and possibilities of collaborating with educational, entrepreneurial, and political partners will be visualised. We want to inspire a discussion on the importance of engaging

youth in matters of sustainability and showcase examples how this can be done such as through the Living Lab concept. The youth are the future and our planet depends on their well-being and actions. A more youth-friendly space is needed for a true co-creation, enabling young people to participate and act in their communities.

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How to engage young people in mental health research?

***Signe Herbers Poulsen, Nina Maindal, Gitte Kragh, Kristian Oddershede, Mathias Sejerkilde, Stine Breiner Pedersen, Manziha Haghju, Emma Sinclair, Anne Harrits, Ulrik Bak Kirk, Jacob Sherson, Carsten Lyng Obel**

Mental health and planetary health have been shown to be interwoven and we are only just starting to understand this relationship. Climate change and the effects thereof, of which it has been suggested that the COVID-19 pandemic is one, have adverse effects on people's mental health. Protecting and improving the mental health and well-being of young people is an important task for present and future societies, both in general and in particular when crises, such as the COVID-19 pandemic, strike. During the COVID-19 pandemic lockdowns, young people's mental health was especially challenged by restrictions compared to other age groups. However, young people are rarely involved in research on identifying solutions and coping strategies dealing with their mental health challenges. This poster presents our experiences with co-creation with young people about their mental health challenges and coping strategies during the lockdowns. We involved young people (n=150) aged 17-22 in three workshops in Denmark to collect personal reflections, co-analyse the material, and then co-create coping strategies and communication materials to help other young people cope with the situation. The participants were current or former students from The Academy of Talented Youth, an extracurricular activity for high school students. Mixed methods were used including written reflections, questionnaire, interviews, Miro-board and observation notes. Participants reported that the engagement provided them with the opportunity to reflect on their own life, share experiences, and be inspired by their peers. Additionally, they experienced feelings of being heard and felt they could contribute with a unique perspective by, for, and on youth. Furthermore, we engaged in a closer collaboration with five young people as co-researchers in planning and execution of the co-creation workshop, data collection, analysis, and communication, creating a safe space for the workshop participants to share their mental health challenges. The activities also resulted in outputs for the research project, including insight into young people's challenges during the pandemic, co-creation of coping strategies, and input to communication products. Our study indicated several benefits as well as challenges from engaging young people in science communication and co-creation, though we believe the benefits far outweigh the challenges.

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Influencing how students feel, think and act towards the planet with school-based citizen science

***Smriti Safaya, Lynda Dunlop, Sarah West**

My mixed-methods research findings add to nascent conversations about the impact of citizen science on how youth feel, think and act towards the natural environment. In contrast to current discourse based on experiences mainly from Europe and North America, my study took place in Hong Kong. This investigation sought to understand changes that occur in youth values, attitudes, knowledge and behaviours after a citizen science experience, and the influence of situational and environmental behavioural psychology factors that affect self-reported pro-environmental behaviour. I carried out my study with 8 local and international secondary schools in Hong Kong, which led to 187 paired student surveys, field observations and interviews with 46 students, 18 teachers and 4 citizen science organisers. All project topics were environmental, with most schools investigating urban or coastal biodiversity using a contributory citizen science approach with 'iNaturalist'. Two schools investigated biodiversity and/or marine pollution using a co-created citizen science approach, one enlisting the help of an environmental NGO and the other an environmental startup company. This entire study is a valuable addition to the field as it compares the experien-

ces of a range of students (aged 12-19) attending schools with different curricula (local and international) and participating in citizen science projects of varying types and durations (one-time versus regularly over a few months). I share results about changes in environmental values, self-efficacy, knowledge and self-reported behaviour after citizen science experiences, including through the lenses of school type, citizen science project type, school level and gender. Pre and post-survey changes (measured by related samples Wilcoxon signed rank tests) reveal statistically significant increase in knowledge and self-reported pro-environmental behaviours attributed to citizen science experiences. Multiple linear regression of the variables leading to behaviour suggest personal experiences in nature, social influence of others, one's own preservation values and pro-environmental behaviour within one's household have significant influence on self-reported behaviour. Insights from interviews raise sometimes divergent student, teacher and citizen science organiser perspectives about school-based citizen science, environmental education and activism. Lastly, I provide practical implications for educators and citizen science organisers to enhance citizen science experiences for students to inspire planetary stewardship.

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OpenGeoResearch – A citizen science platform to collect geospatial research questions for planetary health

***Stefan Herlé, Thomas Lemmerz, Alexandra Weber, Larissa Böhrkircher, Gunnar Ketzler**

Research questions regarding the relationship between mankind and the planet inhabit a spatial dimension. Thus, the three global challenges of planetary health often manifest in local characteristics, which are multi-variant and region-specific. To tackle the challenges of research and information about planetary health on a regional level, citizen science may help collect questions, find answers, and disseminate knowledge. The platform OpenGeoResearch provides the possibility of information and knowledge exchange between researchers and interested citizens. In the project, citizens become human sensors, which share research data in the form of geospatial research questions or specific local knowledge. This citizen science approach might help generate new regional research topics, gather answers and data, as well as gain and disseminate regional knowledge. Citizens encounter various questions during, e.g., hikes, walks, or everyday life: Are rainbows predictable? Why can we find Saharan dust in Central Europe? OpenGeoResearch offers a smartphone application that can be used to collect and report geospatial research questions instantly. These can be annotated with descriptions, user-defined tags, photos, and the location to provide background information and a spatial context. The platform collects and visualises the regional questions on a map in a browser-based application. Here users, such as experts, scientists, or citizens, may explore the posed questions with all their information, provide answers or discuss questions using comments. Hereby, the project addresses all kinds of geospatial research questions. A growing team of experts from the geosciences such as geology, geography, climatology, and urban planning tries to give insights into possible answers. However, the community may also answer questions or provide additional local knowledge. OpenGeoResearch follows the ECSA principles of citizen science. It aims at the participation of citizens to find new research fields, but also to give feedback and subsequently to involve citizens in conducting research projects. Moreover, the project offers a platform to pass on information gained from past research projects to the public. Since the platform uses open standards, the collected questions are publicly and interoperable accessible. The project is part of Germany's "Wissenschaftsjahr 2022 - Nachgefragt!".

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Deconstructing citizen science – A framework on communication and interaction using the concept of roles

***Susanne Hecker, Monika Taddicken**

Citizen science opens the scientific knowledge production process to societal actors from different fields and areas of expertise. In this novel collaboration process, scientists and citizens alike face the challenge of new tasks and functions, eventually resulting in changing roles within the scientific

endeavour. Creating mutual understanding is key to achieve project results and eventually success. But how can we provide a structured way to capture communication and interaction in and about CS? Role theory provides a way of conceptualising the roles that people take in communication and interaction. We use role theory to create a framework that identifies scientists' and citizens' tasks in citizen science projects, main aims of communication, spaces they interact in, and their roles — thus providing a structured way to capture communication and interaction in and about citizen science for further scientific reflection and practical application (Hecker & Taddicken 2022). We invite the audience to critically evaluate our theoretical approach and develop ideas on how to apply the framework.

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JOS – A pilot project for transformative citizen science in gardens

***Tania Walisch, Marie Gérard, Stephanie Klaedtke, Markus Molz, David Porco, Pierre Stassard, Karine Paris**

In 2017, the Transition TOWN movement (CELL asbl) together with the natural history museum of Luxembourg launched a participatory research project JOS 'Les Jardins fOnt Science' in collaboration with researchers from different disciplines. At the launch of the project, a forum with community gardeners generated ideas which were grouped under 'One Health' domains: biodiversity and ecological pest management; cultivating whilst preserving and improving the soil and saving water; soil pollutants; the interactions of humans with nature in gardens: climate change, animal and human cohabitation, wellbeing in nature; relation between soil quality, human health and the quality of food; community building. An iterative process of participatory elaboration and selection of research questions involving forums and workshops with gardeners and discussions between researchers led to the following research questions: 1) What is the relationship that gardeners have with nature, food production and pleasure in their gardens? This was the subject of an exploratory sociological study. 2) How could gardeners evaluate the gustatory quality of their crops? For this study 7 varieties of beans were grown in one of the sites and their gustative quality was evaluated by voluntary gardeners. 3) Gardeners intervene in their crops through practices such as mulching or weeding, thus modifying the properties of the soil and the environment in which the plants grow. What is the effect of these interventions on crop yield, worm communities in the soil and aboveground in biodiversity? For this part scientists developed a protocol for an experiment on a bean culture with several types of mulch treatments. Gardeners set up the experiment in their gardens, made species observations using the iNaturalist smartphone app, evaluated earthworm functional categories and measured bean yield. They transmitted their data for processing and analysis by the scientists. During the project, scientists gave trainings on biodiversity and earthworm ecology. The results of each part were presented at the yearly gardeners forum and made available online (eisegaart.lu). Finally, JOS gave rise to a participatory research group of gardeners and scientists called GARP 'Groupe d'action de recherche participative' which has, since then conducted several autonomous research projects on garden related themes.

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How to manage organic waste as a common good, develop digital commons tools and propel local food systems

Thales de Freitas Santos Cunha, Helen de Freitas Santos, *Gabriel de Freitas Santos Sabio

A cosmo-local citizen social science project to apply in the city of Araçatuba, São Paulo, Brazil, our field research findings regarding Barcelona's circular economy financed projects, digital commons tools and commoning practices. In May 2020, in Brazil, we started proving different methods that accelerate the transformation of organic waste into compost. Since then we proactively collected over 2T of organic waste from 4 restaurants in our neighbourhood and transformed it into compost using a do it yourself composting bin. In October 2020, we started to openly share compost through an autonomous shelf within the neighbourhood as an alternative against the devastation of social relations aggravated by the pandemics. So far,

we have distributed more than 1T of fresh compost and by doing so, we started commoning in a minimally viable manner. On top of that, everyday we openly inform through an offline scoreboard how many kilograms of compost were distributed and how many bags reused during the previous month's distribution. With a broad interest in the digital transformation process, we have been carefully attentive to the debates around the still existing digital gaps and their impacts in human rights, inclusiveness and political systems. Since the beginning we've been working in a Living Lab environment and as an output, since July 2021, this same group has been developing a cloud-based software module of waste management which we hope to reinforce social & environmental transparency towards municipal accountability.

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luftdaten.at – A citizen science project on air pollution measurement

***Thomas Ogrisegg, Silvio Heinze**

luftdaten.at is a citizen science project that is part of the global sensor. community framework. Based on simple and cheap microcomputers and air pollution sensors we developed a tiny measuring station that can be plugged on the outside of windows or walls and allows to measure the air pollution (PM10, PM2.5) in the immediate environment. The station can be built even by inexperienced citizens within minutes. The data collected by the stations is then sent to a server which allows individuals to view and download it in an open data format for further analysis. We want to inform about our latest developments that will include the measurement of PM1.0, baseline measurements of NOx and VOCs, a new way to make assembling the measuring stations even easier and a new portable measuring device which has great educational value as it allows to walk through the city and see differences of air pollution in different places in real time.

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Endometriosis and citizen health science: a new future for responsible research and innovation priority setting?

***Ulrik Bak Kirk*, Maria Kathryn Tomlinson, Bruno Sales da Silva, Melike Sales da Silva, *Liv Juul Nielsen, Peter Lübben, Tong Zhu, Nora Salas Seoane, Diana Reinoso**

Endometriosis, defined by the presence of endometrial-like tissue outside the uterus, is a chronic and incurable condition associated with debilitating pain and subfertility that affects approximately 190 million assigned females at birth. Despite an estimated prevalence that mirrors that of diabetes, Crohn's disease, and rheumatoid arthritis, the full socioeconomic impact of endometriosis remains underestimated, mainly because endometriosis research globally is considerably underfunded. This FEMaLe project (H2020 ID: 101017562) poster will present the collaborative work with the Endometriosis Priority Setting Partnership (EPSP) and discuss whether a citizen health science approach could guide future activities for responsible endometriosis research and innovation priority setting. EPSP was formed with the objective of identifying the key questions about endometriosis that were most important to both patients with endometriosis and healthcare practitioners involved in their care. Using methods established by the James Lind Alliance, a shortlist of priorities for research in the UK and Ireland was agreed by patients with endometriosis and healthcare practitioners. In an online survey, 4767 research questions were submitted by 1225 respondents from the UK and Ireland, and a further 111 research questions were identified from literature searches. 72 research questions were listed in a second survey allowing participants to vote. 1418 participants from the UK and Ireland voted. From the 30 research questions that received the most votes, ten research priorities were agreed during a workshop that involved 26 participants and was held in London. We will discuss how a citizen health science framework could benefit EPSP and its future priority setting activities. In addition, we will reflect how inclusiveness and empowerment of patients and the public can be ensured in priority setting, and how the involvement of non-research stakeholders in responsible endometriosis research and innovation, e.g. a citizen health science approach, can have sustainable impact for research but also for society at large.

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Volunteer observational skills: a cross-project analysis

***Veronica Del Bianco, Cathlyn Davis, Rachel Becker-Klein, Tina Phillips, Andrea Grover**

Citizen science volunteers contribute scientific observations that are critical for research supporting the well-being of all life on Earth. However, cross-project studies using shared assessment tools are needed to understand if volunteers have the necessary proficiency to produce high-quality observation data and any associated challenges.
Funded by the US National Science Foundation, we examined volunteer proficiency of two components of scientific observation— "record standard observations" (describing phenomenon using standard units that can be duplicated by all observers) and "notice relevant features" (characteristics necessary to identify a species). We worked with 10 CS project leaders to develop shared embedded assessments of two components of scientific observation that could be used by multiple projects. Seven of these leaders administer at least one with their volunteers (between July 2019 and October 2020). From data of five projects, 72.26% of volunteer responses accurately recorded standard observations. Volunteer observations of animals (M=0.76, SD=.43) were more likely to be accurate than their observations of plants (M=.66, SD=0.47), t(396) =2.07,p<.05. 80.61% of volunteers among three projects accurately identified species. 65.07% of volunteers could notice at least one feature that is considered relevant to identifying the organism. Volunteers that could notice at least one relevant feature of an organism were more likely to accurately identify the species (M=0.97, SD=0.17) than those that could not (M=.59, SD=0.49), $t(291)=9.24, p<.05$. Veteran volunteers were more likely to accurately identify an organism to the species level (87.36%) than new volunteers (70.83%), and $t(292)=3.57$, p<.05, respectively. Our study adds further evidence to the credibility of volunteer-collected data, while demonstrating the value of cross-project analyses using a shared assessment tool. Results highlight the benefit of breaking broad skills into components for assessment and to inform training of volunteers, ensure high quality scientific data, and determine if learning outcomes have been achieved.

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Citizen science data to measure human use of green areas and forests in european cities

***Vito Emanuele Cambria, Thomas Campagnaro, Giovanni Trentanovi, Riccardo Testolin, Fabio Attorre, Tommaso Sitzia**

Detecting and quantifying the use of green spaces and forests is paramount for sustainable urban planning. The increasing availability of large databases from existing citizen science tools can contribute to developing novel approaches to investigate urban green infrastructure. Using the iNaturalist database – a citizen science initiative on collecting the occurrences of plant and animal species worldwide – we estimated the intentional use of these urban spaces by people for their value and to understand the main drivers. We retrieved the total number of observations obtained across 672 European cities and focused on reporting from mapped green areas and forests. We used two separate multivariate explanatory models to investigate which factors explained variations in the number of observations for green areas and forests. We found a relatively heterogeneous use of these two types of urban green spaces. Gross domestic product (GDP) was important in explaining the number of visits. Availability and accessibility also had positive relationships with green areas and forests in cities, respectively. This study paves the way for better integration of citizen science data in assessing cultural landscape services provided by urban green infrastructure and, therefore, supporting the evaluation of spatial planning policies for the sustainable development of urban areas.

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BioMARathon: the marine bioblitz

***Xavier Salvador, Ana Álvarez, Karen Soacha, Sonia Liñan, Carlos Rodero, Jaume Piera**

Citizen science is a tool that will contribute, increasingly, to improve the knowledge of the natural environment and face the Sustainable Development Goals with the involvement of the citizens, acquiring new information

and data that will be used in scientific studies or in governance (Soacha et al, 2022). In these terms, it is important to energise activities that allow the citizens in scientific projects and be part of the entire decision-making process, with data endorsed by the academy. In other areas, the use of citizen science has relevant results, for example in terms of floods (Ferri et al, 2019; Lanfranchi et al, 2014), monitoring of odours (https://odourobservatory.org/; Bax et al, 2020) or for example, in terms of biodiversity, the study of the bird communities (Tulloch, 2013). But, in terms of marine environment, they are few in proportion to the knowledge contributions of citizen science in this area. In the EMBIMOS groups aims to create tools that permit the citizen contribute with the science in all entire decision-making process, and in this case we created the initiative BioMARathon (BioMARatón in Spanish and BioMARató in Catalan), a marine Bioblitz (citizen census of biodiversity in a concrete dates and locations) to acquire the maximum number of marine species in the Catalan coast. The project was developed in the framework of COS4CLOUD project. To improve the engagement of the activity, we use the Quintuple helix model of innovation (Liñan et al, submitted) that includes the participation of enabled entities to energise the citizens and the involvement of local administrations to recognize the work and results of the initiative. We want to expose the highlight of the project with a poster that shows the excellent work of the citizens in this bioblitz, with more of 1060 taxas censored, 117 participants and more of 10000 observations of biodiversity in this first attempt that will repeat this 2022. All the data are disponible in Natusfera: https://natusfera.gbif.es/projects/biomarato-2021-catalunya

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Pollinator Pathmaker – A multifaceted approach on connecting art, environmental science, technology and citizen science for pollinating insects in urban contexts

***Yori Schultka, Sylvia Hinz, Frederic Griesbaum, Louisa Ramke**

Pollinator Pathmaker aims to promote integrated public participation and knowledge transfer through planting a living artwork created by the artist Alexandra Daisy Ginsberg. Using a specially developed algorithm tool, a garden will be planned and planted in Berlin for the increasingly vanishing pollinating insects in an urban context. In cooperation with Light Art Space (LAS), we aim to establish and evaluate sustainable future-centric gardens for Berlin with pollinator-friendly adaptation. At the same time we, as the Museum für Naturkunde Berlin, develop a multi-dimensional education program which covers different subjects like insects in urban environments, wild bee conservation and sustainable gardening. Furthermore a school program, including classes, workshops and citizen science data collection will be conducted in the following months. The aim is not only to engage young children to participate in scientific work, but especially to raise awareness of the overarching issue of insect extinction.

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Expanding the learning potential of a citizen observatory – Young students as contributors, players and designers of a digital game in a school environmental education project

***Zacharenia Daskalaki, Maria Daskolia, Maria Tzinieri, Chronis Kynigos, Pierre Bonnet, Ángela Justamante Rodríguez, Karen Soacha**

This study focuses on the ways in which the use of a set of digital tools, such as a citizen observatory app, digital images taken and digital games designed, played and challenged, can be used in combination as teaching and learning tools in school environmental education to enhance students' environmental awareness and learning and engage them in transforming their school environments. In the case study reported here, 5th and 6th graders of a Greek urban primary school were introduced to the use of Pl@ntnet to observe and record the plants of their local area. Based on the information collected, a digital game entitled "Plant your own garden" was developed by the teacher using ChoiCo (Choices with Consequences), an open source web-based programming software for educational digital game design, and was given to the students to play. As a follow-up, the same digital game was passed to a different class of students in another Greek primary

school and the students were invited to think about how they could change and improve it by suggesting modifications and designing their own digital games. The process of conceiving and implementing this educational research project is outlined, highlighting how a citizen observatory can provide more and diverse learning opportunities besides contributing to citizen science.

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Museum für Naturkunde Berlin

European Citizen Science Association

Berlin, 20 September 2022

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