International Institute for Applied Systems Analysis

The Potential Role of Citizen Science for Addressing Global Challenges and Achieving the UN Sustainable Development Goals

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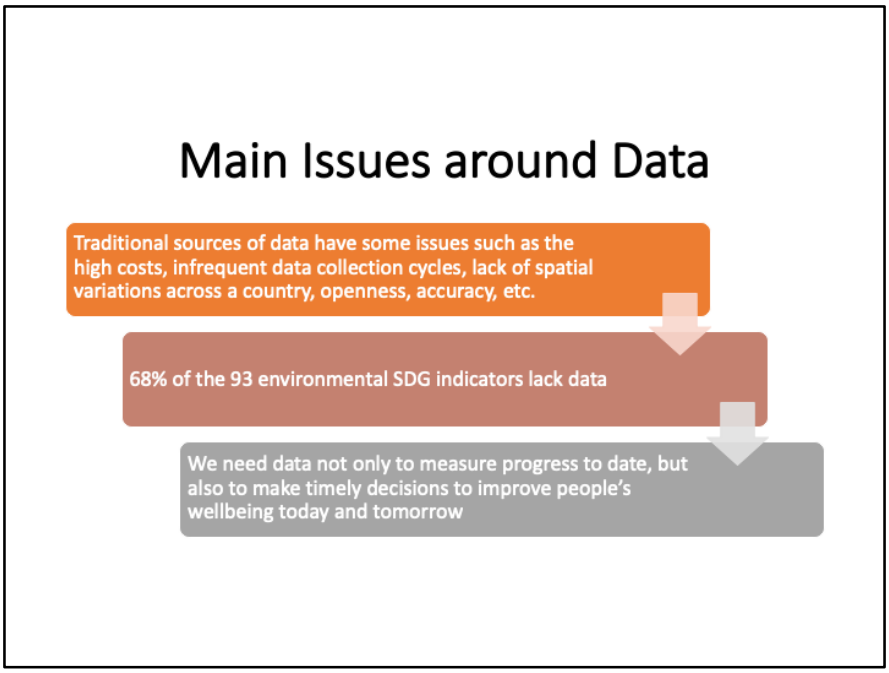
https://www.geo-wiki.org/

- SDGs are a roadmap to achieve a healthy, prosperous and fair future for all. They were adopted by the United Nations Member States in 2015 as a universal call to address the global challenges we're facing today from poverty to climate change. SDGs include a framework of 17 goals, 169 targets and 244 indicators.
- The question is how do we know if we are on track for reaching these targets and indicators? Where do we need policy changes and improvements?



- Traditional sources of data that are currently being used for SDG monitoring have a lot of issues (see above).
- As a result, for instance, 68 of the environmental SDG indicators lack data according to the UN Environment (https://wedocs.unep.org/bitstream/handle/20.500.11822/27627/MeaProg2019.pdf?sequence=1&isAllowed=y).
- Achieving the SDGs requires informed decisions that are based on accurate, timely and comprehensive data. Even though data availability has improved over the last decade, there are still major gaps in information and knowledge for guiding policy formulation and implementation. New innovative approaches to data collection, such as citizen science, which is very broadly defined as public participation in scientific research, can contribute to SDG monitoring. In addition, citizen science could also help mobilize citizen action and promote behavioural change that has a tremendous value in achieving the transformation needed to build the "future we want".

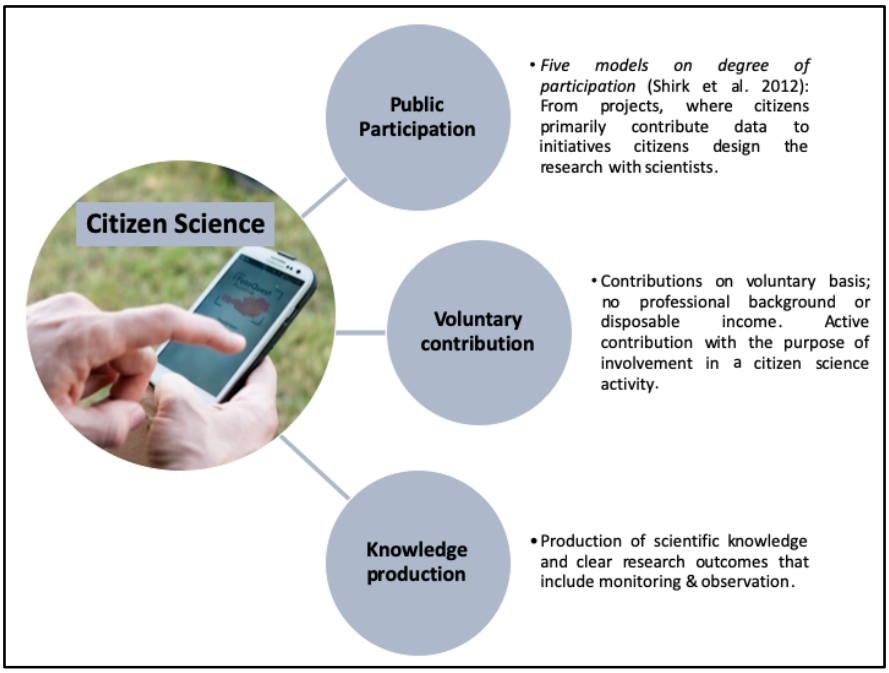
- As mentioned, citizen science has a role to play to address some of these challenges. Therefore, we launched the SDGs CoP (https://www.weobserve.eu/weobserve-cop4-sdgs/), as part of the EC funded WeObserve (https://www.weobserve.eu/) project.
- The WeObserve SDGs and Citizen Science Community of Practice (SDGs CoP) is an open platform for citizen science/citizen observatories and the SDGs.
- Our aim is to connect citizen science practitioners and researchers; National Statistics Offices (NSOs) and government officials; UN and other international agency representatives; and the broader data and stats communities to share and exchange knowledge, ideas and resources on how to demonstrate the value of citizen science data and impact for SDG achievement.

SDGs CoP Objectives

- Understand the opportunities and challenges for the use of data from citizen science/citizen observatories for SDG monitoring; and
- Advance our knowledge of how citizen science and citizen observatories can help behaviour change towards achieving the SDGs.

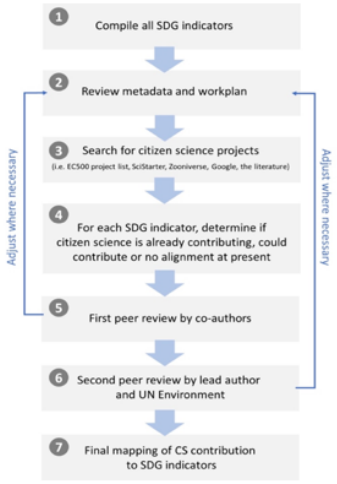
- We launched the SDGs CoP at the "Citizen Observatories for Natural Hazards and Water Management (COWM) Conference on 29 November 2018. During a 3-hour launch session at the event, we co-created the objectives and tasks of the SDGs CoP together with the participants. In this slide, you see the agreed objectives of the SDGs CoP.
- We already have achieved all the tasks of the objective 1 above, which translated into two papers (one published in Nature Sustainability and the other is currently under review in journal Sustainability Science). For the rest of this presentation, we will talk about the results if one of these two papers.

- The main goal of this research is to present an overview on where exactly citizen science is already contributing and could contribute data to the SDG indicator framework and provide recommendations for how to bring citizen science data into SDG monitoring.

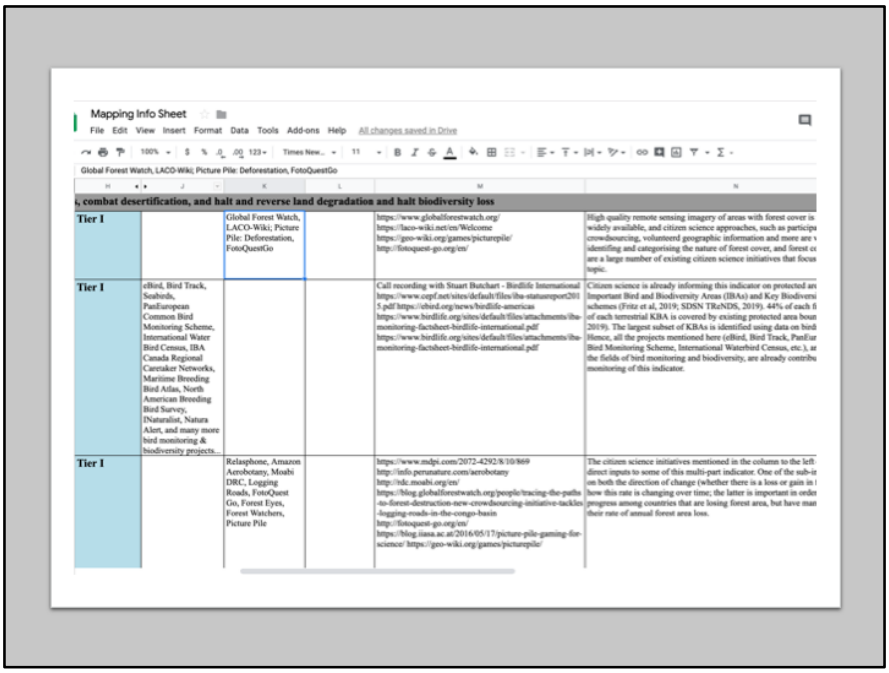


- First of all, what is citizen science (https://ecsa.citizen-science.net/sites/default/files/ecsa_ten_principles_of_citizen_science.pdf) exactly and how we defined it as part of our research. Citizen science (https://ecsa.citizen-science.net/sites/default/files/ecsa_characteristics_of_citizen_science_-_v1_final.pdf), as a concept, has diverse definitions, terms, and interpretations. No single term or definition is suitable for all contexts. We take an all-encompassing approach and define citizen science using three main characteristics: *"public participation"*, "*voluntary contributions*", and "*knowledge production"*.
- Our approach most closely matches the definition of Shirk and colleagues definition of *"Public Participation in Scientific Research (PPSR)*", which is: intentional collaborations in which members of the public engage in the process of research to generate new science-based knowledge.
- We included any initiative that produces scientific knowledge through the participation of volunteers, such as community-based monitoring, participatory action research, citizen-generated data, crowdsourcing, participatory mapping and more.

Methodology (in review)



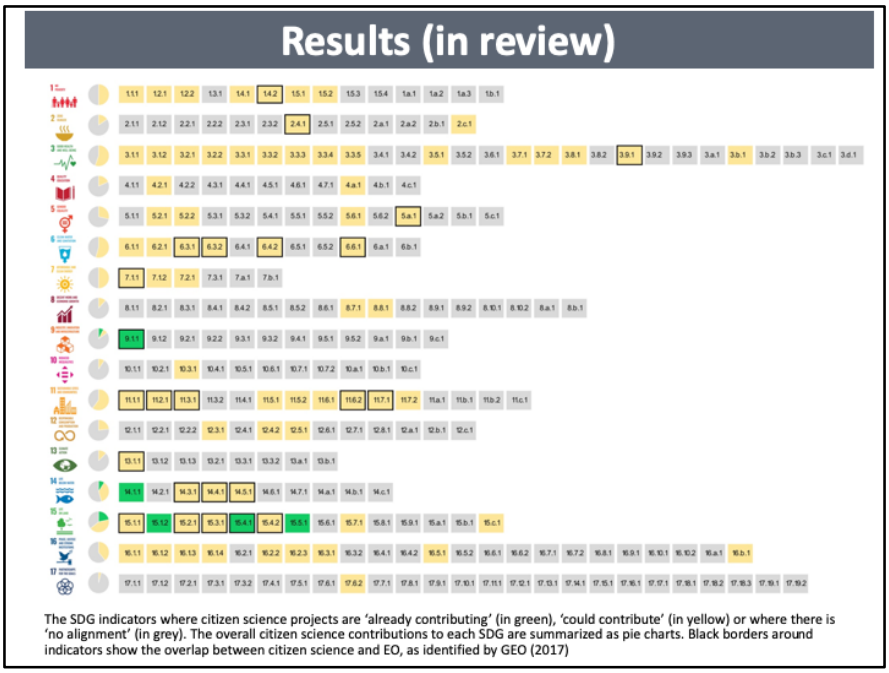
- This slide shows the methodology we adopted.



- In this slide, you see our mapping. We took the "Inter-Agency Expert Group on SDG Indicators" framework (https://unstats.un.org/sdgs/files/Tier%20Classification%20of%20SDG%20Indicators_17%20April%202020_web.pdf) and added our mapping categories to it, which are:
    - Already contributing: Data from at least one citizen science project is already used for reporting on a specific SDG indicator at the national or global level;
    - Could contribute: Data from at least one citizen science project could be used for a specific SDG indicator, but it is not used so far and the project and/or data requirements might need modification/adaptation before the resulting data can be used (provided this modification is feasible);
    - No alignment at present: We couldn't identify any alignment between any existing or past citizen science initiative and that particular indicator.

- Then we added the identified citizen science initiatives to the relevant column (already contributing or could contribute).

- In the next columns, we provided justification to our mapping and relevant links that would prove our point.



The SDG indicators where citizen science projects are 'already contributing' (in green), 'could contribute' (in yellow) or where there is 'no alignment' (in grey). The overall citizen science contributions to each SDG are summarized as pie charts. Black borders around indicators show the overlap between citizen science and EO, as identified by GEO (2017)

- This figure shows the results of our analysis. Yellow boxes show the indicators that could benefit from citizen science data. Green boxes show the indicators that citizen science data is already contributing to and grey means we couldn't identify any alignment with any past or ongoing citizen science initiative.

- Our results show that citizen science is "already contributing" to the monitoring of 5 SDG indicators, and "could contribute" to 76 indicators, which, together, equates to around 33% of the whole SDG indicators. Our assessment highlights that the greatest contribution of citizen science to the SDG framework would be in SDG 15 Life on Land (64%); SDG 11 Sustainable Cities and Communities (60%), SDG 3 Good Health and Wellbeing (56%); and SDG 6 Clean Water and Sanitation (55%). This also demonstrates that citizen science data have the greatest potential for input to the environmental SDG indicators. Of the 93 environmental indicators in the SDG framework, citizen science could provide inputs to 37 of them or around 40%.

- Our results indicate that citizen science could help to monitor 30% of Tier I; 41% of Tier II and 20% of Tier III indicators based on the Tier Classification for SDG Indicators (https://unstats.un.org/sdgs/files/Tier%20Classification%20of%20SDG%20Indicators_13%20February%202019_web.pdf) as of 13 April 2019, when the data were downloaded).

- Methodologies for how to collect data already exist for Tier II indicators. However, countries do not produce the data regularly due to poor statistical capacity, lack of resources or other factors. Citizen science could inform such indicators to fill the identified data gaps. As for the Tier I indicators, even though agreed methods exist and the data are widely available, not all countries are at the same level in the production of data needed to track their progress. In other words, there are opportunities to use citizen science for improving the temporal frequency and spatial resolution of Tier I and II indicators which could complement the national reporting. Finally, citizen science data have the potential to contribute to Tier III indicators, as they have no established methodology and standards to support them. Citizen science could be introduced as part of the methodology development process for relevant Tier III indicators by the responsible custodian agencies, as implemented for indicator 14.1.1 on marine plastics by the UN Environment.

Examples of Citizen Science Projects that are ”already contributing” to SDG Monitoring (in review)

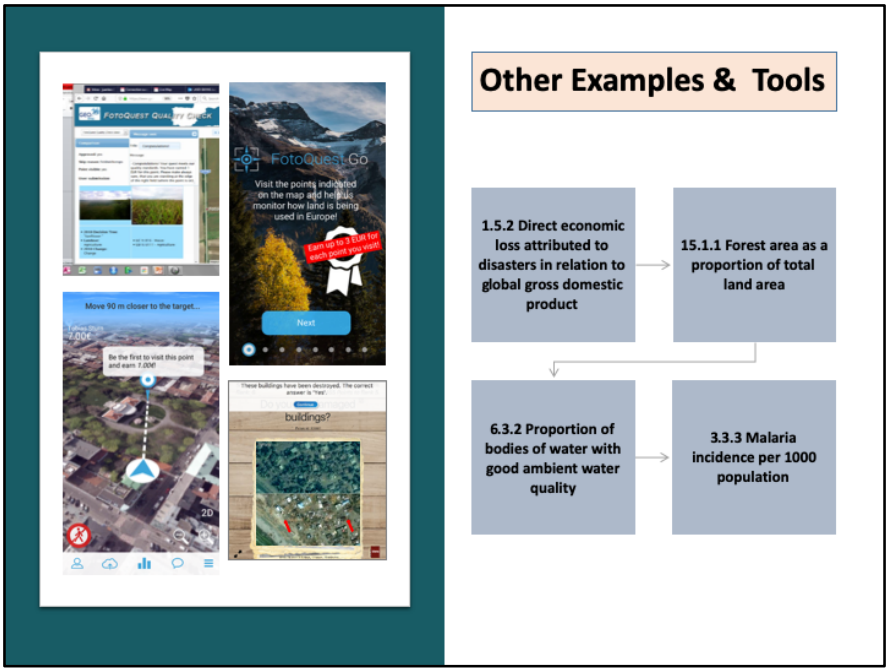
14.1.1 Index of coastal eutrophication and floating plastic debris density

- UN Environment, the custodian agency for this indicator, has recently developed a methodology that uses citizen science data as a primary source of information for measuring marine plastics on beaches and shorelines:
- https://unstats.un.org/sdgs/metadata/files/Metadata-14-01-01.pdf

- Litter Intelligence is a large-scale citizen science program led by Sustainable Coastlines. The initiative collaborating with the Ministry for the Environment, Stats New Zealand and the Department of Conservation since the design phase of the program in 2016. The results are included in the official environmental report 'Marine 2019' produced by the Ministry for the Environment and Stats New Zealand (Counting on the World to Act, SDSN TReNDS).

9.1.1 Proportion of the rural population who live within 2 km of an all-season road

- This indicator is about the Rural Access Index (RAI) and it measures the share of a country's rural population that lives within 2 km of an all-season road (defined as a road that is motorable in all weather conditions).
- OpenStreetMap is an online crowdsourced community-driven project to create an open, editable, and free map of the world.
- Metadata for indicator 9.1.1 refers to OpenStreetMap as an alternative source of data for countries that do not have sufficient road location information available or it is completely missing.
- In addition, measuring the RAI using OpenStreetMap in 120+ countries is a work in progress at the World Bank. Hence, citizen science is already contributing to this indicator.



- SDG indicator 1.5.2 is about quantifying direct economic losses that result from a disaster. The metadata for this indicator defines the *direct economic loss* as the "monetary value of total or partial destruction of physical assets existing in the affected area". So it's about physical damage. There are a number of different citizen science initiatives that could help in quantifying damage. For example, Picture Pile (https://geo-wiki.org/games/picturepile/) for post disaster damage assessment is a project where volunteers classify satellite images to identify damaged buildings after a disaster (https://www.isprs-ann-photogramm-remote-sens-spatial-inf-sci.net/IV-4/27/2018/). In Humanitarian OpenStreetMap (https://www.openstreetmap.org/about), participants digitize the areas affected by disasters, which includes identifying damaged roads for disaster responders to reach those in need.

- Another powerful example is on water quality which is the indicator 6.3.2 (https://unstats.un.org/sdgs/metadata/files/Metadata-06-03-02.pdf). This indicator aims to measure the proportion of water bodies in a country with good water quality. Although an established methodology exists for 6.3.2, the data are not regularly produced (Tier II) as substantial investments in financial and human resources are required for organizing routine data collection activities at high spatial and temporal resolutions. Accordingly, many of the least developed countries do not collect data on water quality or they have very limited monitoring programs available. Citizen science initiatives such as FreshWaterWatch could provide meaningful contributions to the monitoring of this indicator. FreshWaterWatch (https://freshwaterwatch.thewaterhub.org/) has a global water quality database based on the contributions made by 8,000+ citizen scientists for more than 2,500 water bodies. This is a field where citizen science is already quite present.

- Indicator 3.3.3 (https://unstats.un.org/sdgs/metadata/files/Metadata-03-03-03.pdf) is another example. For example, MAHEFA (MA-lagasy HE-althy FA-milies) was a community-based health project run by USAID and the Madagascan Ministry of Public Health from 2011 to 2016. As part of the program, thousands of community health volunteers were chosen by their own communities to be trained in providing basic health care services and identifying serious cases. In Analalava, community health volunteers provided a wide range of services including promoting good health practices and hygiene, offering family planning services, diagnosing and treating simple cases of malaria, diarrhea and pneumonia for children under age 5, and raising childhood immunization (USAID 2015). MAHEFA Miaraka is the continuation of the MAHEFA program, running between 2017 and 2021 (USAID 2017). Although primarily designed for action rather than monitoring purposes, initiatives such as MAHEFA could inform this indicator. In addition, some citizen science projects are aimed at measuring mosquito populations at the national and global levels through different types of activities and data collection protocols. These include Mosquito Alert (Palmer et al. 2018), a project that monitors adult species presence, and the GLOBE Mosquito Habitat Mapper, which monitors breeding grounds (https://www.globe.gov/web/globe-mosquito-project). The Global Mosquito Alert Consortium (Tyson et al. 2018) is a consortium of citizen science mosquito monitoring projects that collaborate on protocols and data sharing. Global Mosquito Alert could also support this indicator by providing

supplementary information on mosquito populations and their possible breeding sites, in a coordinated way, that allows for local differences in monitoring methodologies (such as focusing on adults or breeding grounds) but also supports coordination and data sharing.

Some indicators could be more amenable to citizen science than others. This include:

- Environmental SDG indicators (https://wedocs.unep.org/bitstream/handle/20.500.11822/27627/MeaProg2019.pdf?sequence=1&isAllowed=y);
- Indicators that could benefit from observations such as bird and biodiversity monitoring (15.1.2, 15.4.1) or monitoring of land use and land cover changes (15.1.1, 15.2.1);
- Indicators that could be supported by spatial data, e.g., monitoring of water quality (6.3.2) or air quality (3.9.1), disease threats (3.3.3), post disaster damage assessment (1.5.2) or open spaces in cities (11.7.1);
- Indicators that could be supplemented through self-reporting such as sexual violence (16.1.3) or perception of safety (16.1.4);
- More generically, indicators measuring issues that raise a concern among citizens and communities are more amenable to citizen science. The reason for this may be these issues affect or could affect their health, environment and quality of life.

Way Forward

- Building awareness and sharing experiences on the use of citizen science for the SDGs;
- Developing case studies or success stories where citizen science data have been used in innovative ways by NSOs;
- Identifying criteria for ensuring data quality or data quality assurance procedures;
- Integrating citizen science into the methodologies of SDG indicators;
- Promoting consistent data collection across citizen science initiatives through aligning definitions with global definitions; and
- Supporting open citizen science data that are formatted using standards.

https://www.**nature**.com/articles/s41893-019-0390-3

Thank you!

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