

Environmental Citizen Science

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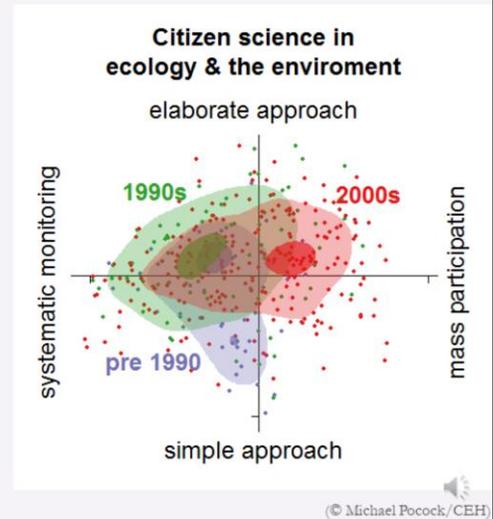
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Mount Rainier National Park
NPS photo by Kevin Bacher

This time, we zoom in on one part of the citizen science landscape – environmental citizen science. In terms of number of projects, longevity, and influence on policy, this is one of the areas where existing experience from this established area can be used to learn many useful lessons for other areas.

Diversity and evolution

- Analysis by Pocock et al. includes different types of projects
- Showing clear trend during different periods – from systematic and elaborate approach to mass participation and simple



A very comprehensive analysis of environmental citizen science was done in 2017 by Michael Pocock and his colleagues at the Biological Records Centre and in the London Natural History Museum.

Pocock 2017: “We found that one of the main differences across citizen science projects was where the projects lay on a spectrum from 'structured monitoring' (repeated visits to specific locations) to 'mass participation' (anyone can take part anywhere). Another important difference was the variation from 'simple' projects (like simply recording a sighting) to 'elaborate' projects (requiring lots of instruction, but resulting in very rich, detailed datasets from each volunteer). Projects can be plotted according to their position on these two axes to show the 'landscape of citizen science' in ecology and the environment.

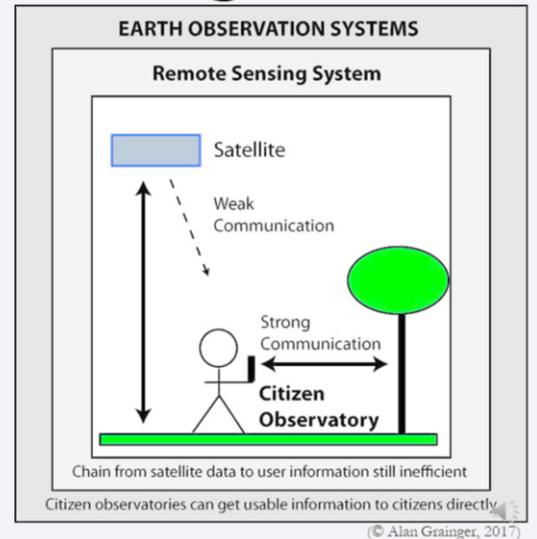
What was really striking was when we looked at projects according to the year in which they started. There were more structured monitoring projects prior to the year 2000, compared to more mass participation projects since the year 2000, and since 2010 the projects had (on average) become simpler.”

<https://www.ceh.ac.uk/news-and-media/blogs/evolving-landscape-citizen-science>

We can see that different types of project are appearing over time, which are influenced by the technologies and the wider societal trends that we've seen before (try to think why we see these specific types?)

Ecological monitoring

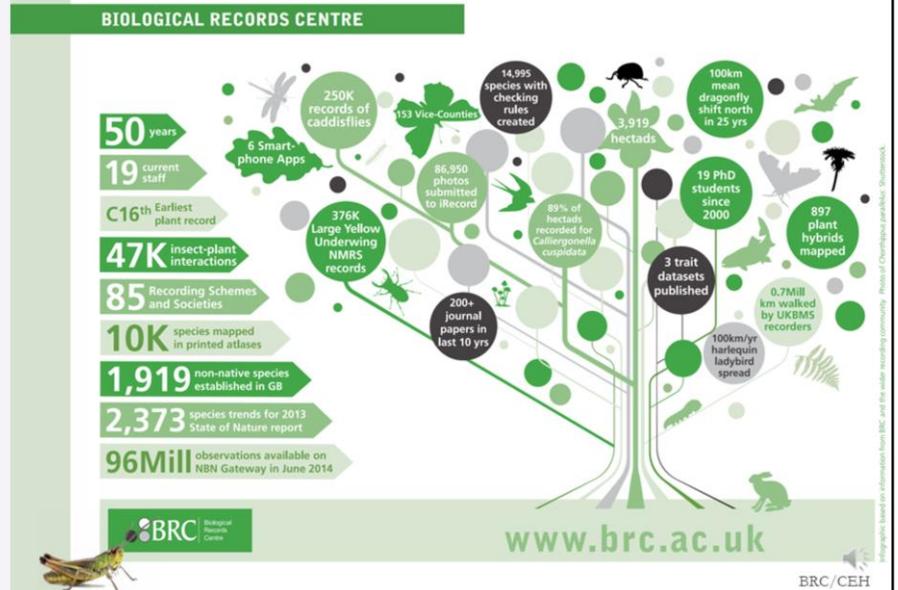
- **Terminology:** Amateur naturalist, Birding, Birdwatching, Butterfly collectors...
- **In the literature:** Biological recording, biodiversity monitoring, Ecological observation, Citizen observatory...



Because of the history of this area, which goes back very far, there are lots of terms. From terminology that is about a specific participant role (amateur naturalist), or in a specific field (birding...). The literature is also confusing (and in previous lectures you might have noticed that I'm mixing the terms liberally). In the UK, because of historical links to the term, going back to the 17th century, Biological Recording is used. Other cases, ecological observations or monitoring, or biodiversity monitoring is common. Fairly recently, in the past 10 years and because of links to practices in remote sensing and Earth Observation field (so Big Science), citizen observatory is also being used to describe the activity. COBWEB, which we covered in Week 5, was a citizen observatory. We can start dissecting the meaning of each one, but instead, and for the next 5 minutes, let's stick with Biological Recording

Biological Records Centre

- Established 1964
- Symbiosis of science body with volunteering societies

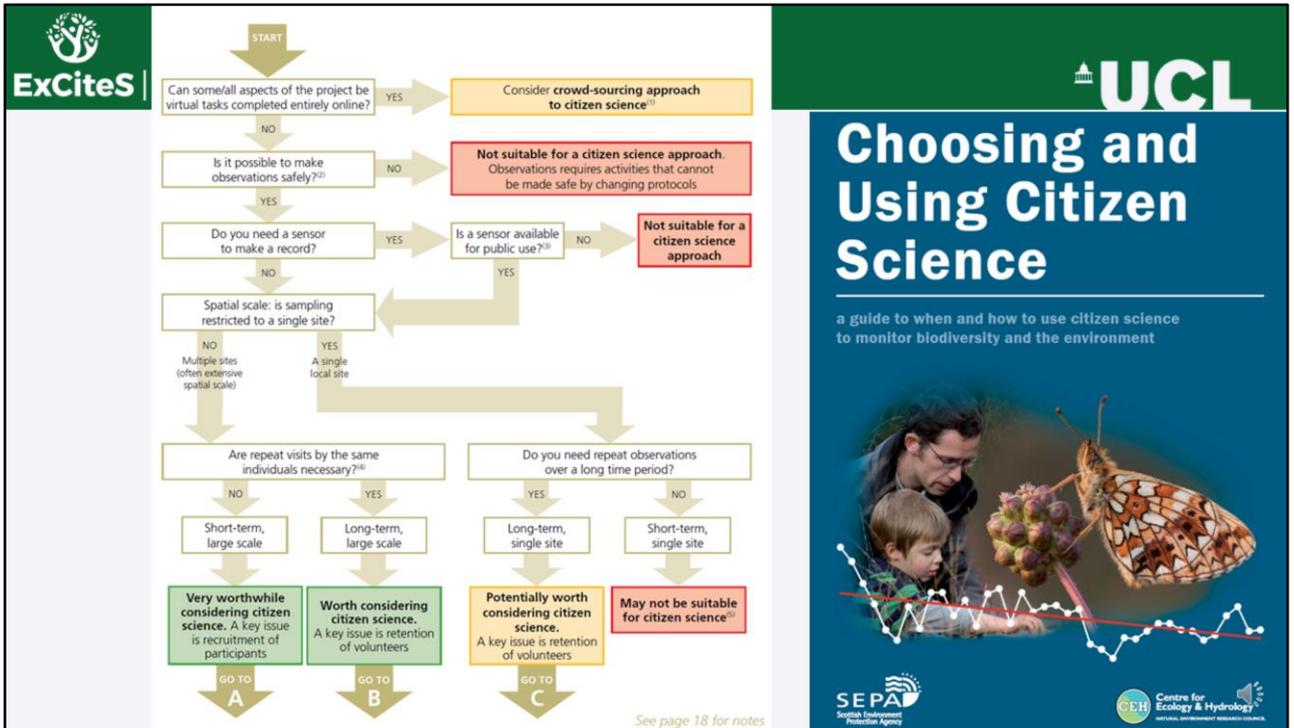


“The historical legacy of biological recording in the United Kingdom is unique and inspiring, resulting in vast sets of species observations (biological records) built up through the expertise of committed volunteers. But there is a need for a focused approach to the collation, management, dissemination and interpretation of these datasets.

The Biological Records Centre (BRC), established in 1964, provides a national focus in the UK for terrestrial and freshwater species recording. BRC works closely with the voluntary recording community, principally through support of national recording schemes and societies. Its scientific research role is central to much of UK conservation practice.”

(edited from <https://www.ceh.ac.uk/our-science/projects/biological-records-centre>)

The fundamental symbiosis of the BRC is “we give services to support biological observation society (creating atlases, newsletters, managing data) and in return scientists get access to the data”. They work with different size groups of 80 recording schemes, and with local records centres. Focusing on the terrestrial environment - plants and animal groups. It continue to provide access to technology for different projects – we’ve seen Indicia and iRecords last week, which are examples for the technologies that BRC develops. They are government funded, but a relatively small team in comparison to the amount of data that they generate together with the volunteering organisations.



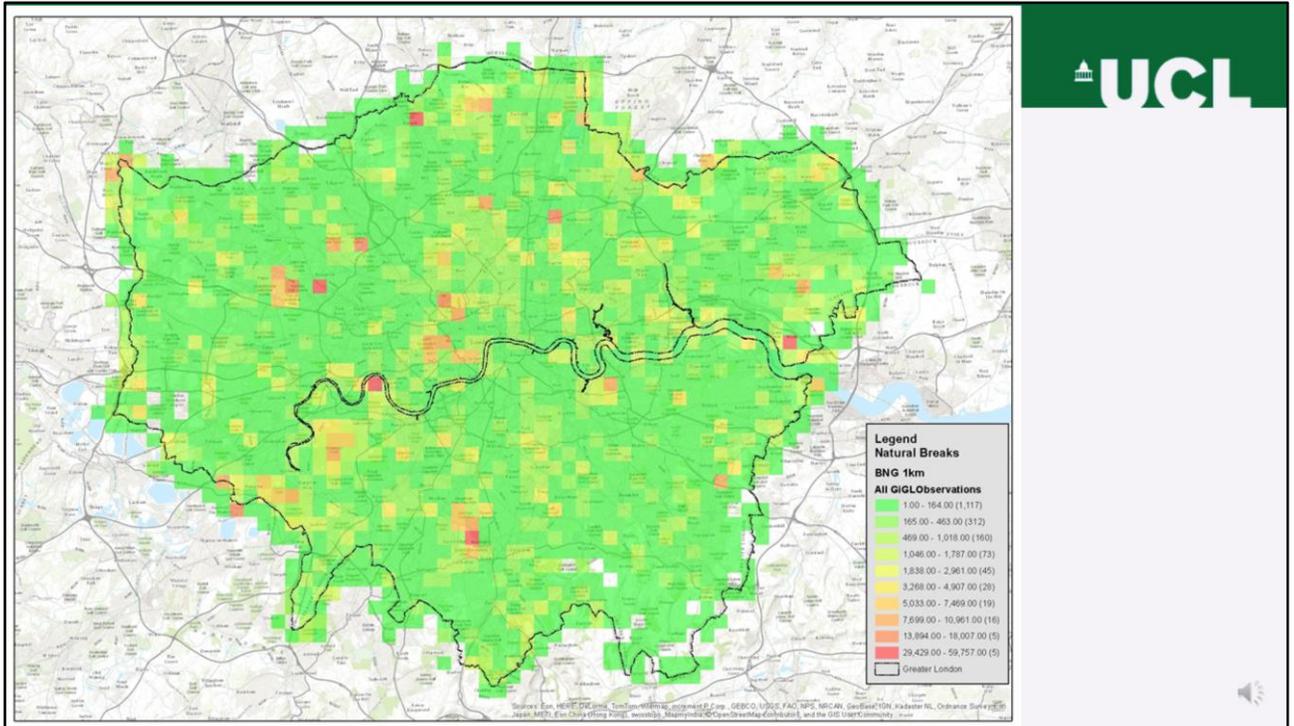
Nowadays, the BRC contribute to national strategies and practice in the area of citizen science. For example, this is a report that was developed with support from the Scottish Environment Protection Agency, which was designed to help making the decision when and how to use citizen science for environmental management. The report is design to help those who are working in environmental management bodies to understand its potential – so for example, notice how the study of a specific site over short time, or the need to use very specific sensors might mean that citizen science is not the right method. The BRC is a centre of experience in managing and using environmental citizen science, with a very comprehensive expertise on the topic (including the analysis that we’ve seen earlier)

Local Records Centre – GiGL

- Greenspace information for Greater London CIC - a Local Records Centre
- Set in May 1996 London Wildlife Trust and operating to serve different volunteering and professional surveys



Local records centres are working at the level of a county, operate as the a custodian of ecological and geological data for the county, and work with the local recording community – the people and organisations who are interested in carrying out biological recording activities. As an example of a local records centre, we can look at the organisation Greenspace information for Grater London (GiGL). It started in 1996, by the London Wildlife Trust as as Biological Recording Project – the first step towards a biodiversity records centre for London which then emerged into GiGL. Today they are hosting millions of records going back to 1975 and serving as part of the environmental information bodies in London. It is operating also as a consultancy body to help in environmental planning and other activities that require environmental information, training, and visualisation of data.

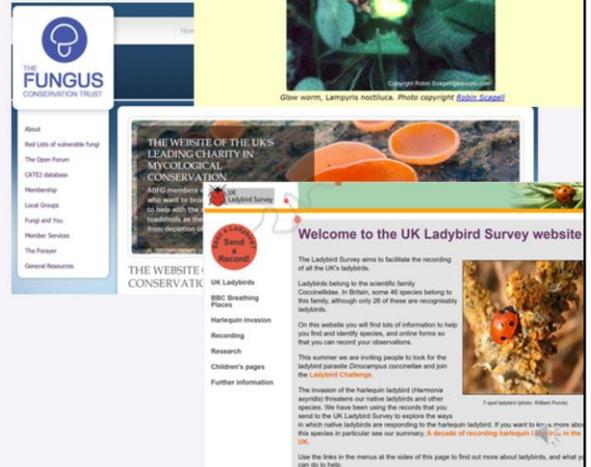


This analysis, which was carried out by Gianfranco Gliozzo and is part of the discussion in the paper by Boakes et al. 2016, showing the distribution of observations that are coming from citizen science recording across London. We can see that recording is covering the whole area, but there are hotspots – places with higher concentration of observations, some of them because specific individuals who submit many records live nearby, other because of the location is linked with nature or there are many visitors to an area (e.g. nature reserve). The valuable thing to notice here is that a local record centre is now accumulating a lot of digital information – in this case going back to 1975. However, the information is kept in multiple formats – sometimes spreadsheets and other forms and that requires special effort to organise and use it. Notice that this image does not differentiate the type of observation.

Boakes, E.H., Gliozzo, G.A., Seymour, V.S., Harvey, M.H., Smith, C.S., Roy, D.B.R., Haklay, M.H. (2016). Patterns of contribution to citizen science biodiversity projects increase understanding of volunteers' recording behaviour. *Scientific Reports*, (6), doi:10.1038/srep33051)

Survey programmes

- There are hundreds of local and national programmes – some of them are part of organisations (e.g. a charity), other are operated by few committed volunteers



The National Biodiversity Network lists over 200 recording schemes and surveys. The biological recording involves many volunteers in many different organisational structures – some of them are organised as charities, while others are run by interested individuals who are dedicating their time to a specific topic – e.g. few committed individuals who are running the Glow worm survey, or the scientists behind the UK Ladybird Survey.

Biological recording – main points

- Wide diversity of organisations, some with long organisational and practice history
- Complex web of support and coordination
- Emerging data infrastructure
- Increasing recognition, but resource allocation challenges

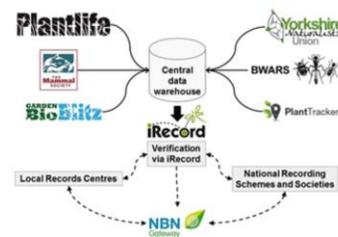


Figure 3. Schematic representation of data flow using the indicia toolkit. Data from many sources feed into the same data warehouse making verification and data sharing more straightforward. Solid arrows show data capture processes whereas dashed arrows show the flow of data post-collection.

August et al. 2015

While the UK have especially long history of biological recording and the management and sharing of information that emerge from these programmes, it's not unique, A similar situation of mixed organisations, thematic focus, and interaction between scientists, amateur naturalists, and government bodies is similar to many other countries, which make this area of environmental citizen science a bit complex. There are multiple organisations and networks (e.g. an association of local records centre, a national biodiversity network for information sharing, the BRC relationships with local records centres). Especially over the past two decades, we see an emergence of data infrastructures, but because the organisational structure of these activities, there is a need for sensitivity on data ownership, sharing and use. While they increasingly being recognised by official bodies and policy makers, there are challenges in terms of the resources that needed for the different scheme and for whom.

Monitoring resources

- Required for many aspects of human activity (e.g. weather) and in understanding the state of the physical environment (e.g. water)
- As with biodiversity observations – long term history of data collection and organisations
- More direct link to national governmental bodies



The other large and active part of environmental citizen science is the area of resource monitoring – water, weather, soil etc. The information is used within the DPSIR structure especially in assessing the pressures (e.g. pollution events) and the state and conditions of different part of the environment. As with biodiversity observation, there is a very long history of data collection and organisation of information, and as a result, multiple ways of organising and sharing data. However, in this area we can see a more direct link to national governmental bodies that are responsible to managing the environment. We actually seen many of these programmes

Monitoring resources

ABOUT PROGRAMS JOBS RESEARCH GUIDE FOR GROWING PROGRAMS RESOURCES CONTACTS

USA VOLUNTEER WATER MONITORING NETWORK



Another example for resource monitoring is in the US, with a long established activity of volunteer monitoring of water quality – According to <http://volunteermonitoring.org/> “trained volunteers are monitoring the condition of their local streams, lakes, estuaries, wetlands, and groundwater resources. This action called "volunteer monitoring" is encouraged by the US Environmental Protection Agency (USEPA). ...Volunteer water monitors build community awareness of pollution problems, help identify and restore problem sites, become advocates for their watersheds, and increase the availability and amount of needed water-quality information”. There are over 1700 groups and programmes across the US. They are using different methods, some of them are fairly sophisticated and require special handling. This is a case of identifying pressures (pollution events) but also collate data about state of the environment. The local interest and ability to access the water which volunteers have is a major advantage in this case. As Kris Stepenuck pointed in a very recent article, the data is used for management, but problems of perceptions of data quality set a barrier to use it for policy

(Stepenuck, K.F. and Genskow, K.D., 2018. Characterizing the Breadth and Depth of Volunteer Water Monitoring Programs in the United States. *Environmental management*, 61(1), pp.46-57.

Summary

- Environmental Citizen Science is a well established, and extensive area of citizen science.
- It has developed over the years, adopting new technologies and modes of engagement
- It is also an area of important challenges: from training participants in identifying species to ensuring that devices in participatory sensing produce meaningful data



We have seen today environmental citizen science is an important subset of the field. From weather observations, biological recording and water monitoring, we learn that it holds a long history and practices which make a complex web of organisations, data sharing and practices in how to run activities. We also seen that it evolved over the year, with new types of activities while old ones continue to be active. We also seen that there are challenges in it – from ensuring correct identification of species to ensuring the sensors and devices are recording the right thing.