

**Maximising the benefits
from Citizen Science
for monitoring the environment**

Workshop Report

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UKEOF Secretariat**

**24 January 2018
Austin Court, Birmingham**

1. Introduction

The UK Environmental Observation Framework is a partnership of public sector research and operational organisations working to improve coordination of the observational evidence needed to understand and manage the changing natural environment. See www.ukeof.org.uk.

The UKEOF workshop titled “Maximising the benefits from Citizen Science for monitoring the environment” was held at Austin Court in Birmingham on 24th January 2018. The workshop was attended by 39 representatives of UKEOF partner organisations and research institutes and NGOs from across the UK.

The overall aim of the workshop was to enable practitioners and commissioners of Citizen Science to access practical resources and expertise that shows how well-informed use of Citizen Science can lead to reliable data, support operational actions and inform policy development. The workshop was designed to enable knowledge exchange during the day, as well as producing a set of resources signposted from the UKEOF website.

The agenda for the day and the list of attendees are included in Annex A and B.



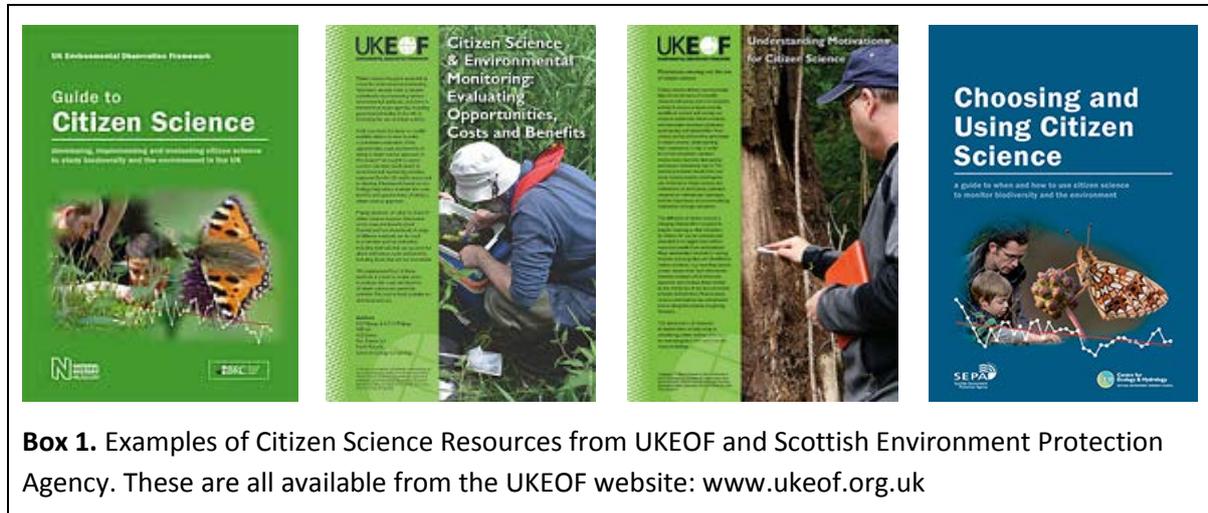
Photo credit: Andy Sier (UKEOF)

2. Setting the Scene

Deborah Procter (JNCC) welcomed the attendees and gave an overview of the workshop. She invited attendees to think about how to maximise the benefits of the use of Citizen Science within public sector organisations, considering (i) what resources we already have that could be shared and (ii) what we would like to have in future.

Deborah introduced the UKEOF partner interest in Citizen Science which encompass both collection of environmental data, and engagement that helps deliver policy objectives. She cited the UKEOF Citizen Science report which asked public bodies to identify opportunities and barriers for the use of citizen science. The main opportunities were engaging with people, providing more / better data, and reduce cost / increased costs effectiveness, while the main barriers were concerns about data

quality, lack of control, and lack of funding. Deborah gave examples of resources available from UKEOF and SEPA (see Box 1): UKEOF reports include a *Guide to Citizen Science*, report on *Citizen Science and Environmental Monitoring: Evaluating Opportunities, Costs and Benefits*, and *Understanding Motivations for Citizen Science*, as well as the SEPA *Choosing and Using Citizen Science* guide.



Box 1. Examples of Citizen Science Resources from UKEOF and Scottish Environment Protection Agency. These are all available from the UKEOF website: www.ukeof.org.uk

She gave examples of current monitoring activities using new technologies and Citizen Science: bat monitoring (www.batsurvey.org) and eDNA detection of Great Crested Newts. The UKEOF catalogue contains over 2000 records of environmental observation activity and has recently been updated to make it easier to find Citizen Science activities. Attendees were invited to see a demonstration of the catalogue over the lunch break.

Deborah gave an overview of the challenges facing public sector bodies who wanted to use citizen science: recognising the range of skills and enthusiasm of the public, finding the right group to work with, being clear of objectives and having realistic expectations, and the need to integrate different types of monitoring activity. She concluded with a reminder of the ambition of the UKEOF Citizen Science Working Group to create a framework to support organisations using Citizen Science for monitoring – this workshop will help scope and contribute to that framework.

Toos Van Noordwijk (Earthwatch) then gave a brief introduction to the OPENER project which has overlaps in interest with the UKEOF objectives. This NERC funded project will scope out a national community of practice on public engagement with environmental research. The vision is for large scale public involvement, and a generation of researchers who know how to use engagement in research, for successful co-production of environmental knowledge and understanding. This initial 1 year project will then be eligible to apply for funding under a £1.3M NERC public engagement programme. Anyone interested in being directly involved should contact the project lead Hilary Geoghegan (University of Reading) h.geoghegan@reading.ac.uk.

3. Barriers to the use of Citizen Science

Jon Parr (MBA) gave a presentation which summarised the homework exercise that attendees had completed before the workshop. Attendees had been asked about the barriers to the use of Citizen Science, what resources might help, and what else might be needed.

Jon had created a word diagram showing the responses to the first question: what are the barriers to the use of Citizen Science for your organisation?



He summarised the responses (in order - highest number of responses first) as follows:

1. Resources (financial, investment in training, for feedback, staffing)
2. Skills (within staff, volunteer coverage by geography and subject of interest)
3. Science (distrust of unqualified people, perception of reputation risk if data collected by unskilled people, lack of understanding by scientists of the potential)
4. Data (lack of confidence in quality, perceived marginal value of CS data vs other priorities)
5. Funding (competing priorities, difficult to get long term funding for CS, seen as low-cost, lack of funds to make links between citizens and scientists to make this work well)
6. IT (limited resource, antiquated, cautious approach to open source solutions)
7. Time (not enough time, particularly to develop engaged communities)

A variety of existing resources were suggested (listed in Annex C) including the European Citizen Science Association 10 principles of Citizen Science (<https://ecsa.citizen-science.net/engage-us/10-principles-citizen-science>), the ENVRIplus Review of Existing Citizen Science Tools (<http://www.envriplus.eu/wp-content/uploads/2015/08/D14.6.pdf>), and the Cornell online Citizen Science toolkit www.birds.cornell.edu/citscitoolkit/toolkit, and SciStarter (<https://scistarter.com/>).

The resource gaps identified were summarised as follows:

- Forum for sharing knowledge
 - Forum for sharing ideas – (could link to BES SIG Citizen Science for ecologically themed CS)
 - Stakeholder/ end-user perspective on appropriate environmental monitoring citizen science
 - Advice/contacts from practitioners
 - Engaging with 'end users' of citizen science
 - UK Citizen science grouping (UKECSA)

- Specific monitoring domains (e.g. for me. Hydrometry)
- Web based sharing of information
 - A UK based web hub for citizen science
 - Case studies, masterclass webinars
 - Effective platforms for sharing experiences
- Addressing data issues
 - Data focused guidance
 - Ensuring 'fit for purpose' data.
- Brokering between organisations and citizen scientists
 - Introduce potential (even unaware) citizen scientists to potential science based organisations or topics that need or would benefit from help from citizens
- The eternal needs - time / money
 - Time and money!
 - Staff time for managing participants; training participants and feeding back to participants on results

4. Case Studies

Rob Grew (Environment Agency and Chair of the UKEOF Citizen Science Working Group)

introduced the speakers for the seven case study presentations. Each of these had been chosen to show the use of Citizen Science in public sector monitoring, and particularly to consider how challenges had been addressed.

Case Study 1: Cobweb – Colin Chapman (Welsh Government)

Colin Chapman noted that data issues were a major barrier to organisations use of Citizen Science, particularly in terms of quality, credibility and risk. He shares his experience of the COBWEB EU project which developed a suite of tools to collect, manage and publish high quality environmental data. The project finished in 2016, all the material is published on the project website <https://cobwebproject.eu/>. The project considered how to make Citizen Science data more palatable as a source of evidence for decision making including using it for statutory monitoring. It included a range of case studies with volunteer groups co-designing projects e.g. Japanese Knotweed Surveys in Snowdonia National Park, using Citizen Science to validate Earth Observation data. Findings were used to produce an EU policy brief. The lessons were in terms of making data easy to integrate by using data standards and a clear and robust protocol with good support materials and teaching. Metadata needs to be meaningful and findings must be published openly, to get the most power from the data collected. To close, Colin shared his thoughts on addressing the perceived limitations of Citizen Science: it can fill evidence gaps where it links to the interests and motivations of the volunteers, it is important to work with volunteers, not to see them as free labour, and recognise that data is an asset, it is important to invest in it.

Case Study 2: WOW - Jake Brown (Met Office)

Jake introduced the Met Office Weather Observations Website (<http://wow.metoffice.gov.uk/>) which has recorded over 1 billion observations since 2011. It provides the Met Office with information on actual weather impacts and people also send photos, which means the Met Office can issue targeted warnings. It is an effective use of crowdsourcing of weather observations from members of the public that complements the Met Office's formal Surface Observation Network. This is an example of a Citizen Science initiative that has become embedded within the working of an organisation. The data collected is used outside the Met Office, by academic researchers. WOW partnerships are now established in Australia, New Zealand, the Netherlands, Belgium and Ireland. The realisation of new technological concepts such as the Internet of Things has opened up future possibilities – one current area of interest is capturing temperature and pressure readings from cars, this could be done every minute. The potential is huge, but so are the challenges!

Case Study 3: Capturing our Coast – Jane Delaney (Newcastle University)

The Capturing our Coast (CoCoast) project is a partnership involving non-professional scientists in systematic collection / analysis / interpretation of scientific data, and testing of natural phenomena. It focusses on Marine Citizen Science which is often less accessible to people and is less developed than terrestrial Citizen Science. It has selected clearly defined tractable tasks, ensured data is relevant (to policy, conservation management and science) and has developed as partnership into a national network for Marine Citizen Science. 3000 people have been trained. Study topics include shifting ranges of species and marine invaders. The new CoastXplore App is in development with Marine Management Organisation, Natural England, Cefas, Natural Resources Wales and others.

Jane shared three key learning points from the project. 1. What will your data achieve? Ensure you and your volunteers are clear on this, manage expectations. 2. Is your data robust? Ensure the task is tractable for volunteers, trial it and iron out ambiguities in language, provide adequate training. 3. What do the volunteers get out of it? Be prepared to modify the task if it isn't appealing / engaging.

Case Study 4: BGS Digital Geology Map – Patrick Bell (British Geological Survey)

The British Geological Survey (BGS) was founded in 1835 and provides objective and authoritative geoscientific data to government, industry, academic and the public. Current issues include carbon capture and storage, shale gas, ocean drilling, flood analysis and pollution. The data generated by survey still underpins a lot of BGS activity, but now it has become more hi-tech e.g. using rugged tablet PC with integrated BGS units. BGS involvement with Citizen Science has been mostly through apps such as iGeology, mySoil and myVolcano. The mySoil app enables users to visualise and explore soil maps of Great Britain and Europe, and for Citizen Scientists to submit basic soil measurements and images which BGS uses to validate data. This app has been very successful in generating interest and has been widely recommended in the mainstream media, but has not delivered science or informatics impact. Next, BGS will move into crowdsourced data with the iGeology app which will enable 300,000 users to contribute to improving the geology map by submitting geological points of interest, rock outcrops visible at the surface and provide feedback on maps or descriptions. Much of BGS borehole data now comes from volunteers. There are great opportunities in Citizen Science for

public engagement, community development and to improve data products, but concerns remain about issues such as IPR, quality control, health and safety, managing personal data and how to credit contributions.

Case Study 5: Flooding management - Kate Pearson (Environment Agency)

Kate described the Environment Agency's work on Community-Led Flood Warnings in Devon and Cornwall. She reminded the audience of the severe flooding in Boscastle in 2004 – this flash flood came with no warning. The steep valley sides and short watercourse meant the river levels rose quickly after sustained intense rainfall. These events present a severe danger to life. The Agency has identified communities at high risk of flash flooding, some of these are not served by traditional flood warning service. The aim was to explore direct warning methods for these locations.

The Agency has worked with communities to install their own rain or river level alerting systems, piloted in 14 communities in Devon. This works through Detection, Dissemination and Action. Detection – the community considers the pros and cons and decides whether they want a river level gauge or rainfall intensity alarm – the former is slower but greater certainty. Dissemination – share the message with people at risk, through a direct alert or via volunteers making phone calls / door knocking. Action – individuals know what to do to protect themselves e.g. move items upstairs or ensure they are in a safe place. This pilot has shown the challenges that need to be overcome. One issue is motivation – helping people understand that we can't eliminate flooding, but that we can reduce the impact through a community response. An investment of time is needed to establish a flood interest group, and for regular meetings with community representatives. The main barrier was the maintenance cost of the gauge - £200-£700 per year. This can be reduced if the community takes on some of the maintenance.

Case Study 6: FreshWater Watch – Toos van Noordwijk (Earthwatch)

Earthwatch's FreshWater Watch project has been used with over 9000 Citizen Scientists over the past six years. It provides community groups with a tool for monitoring water quality (including nitrogen, phosphorous, turbidity), and to submit their records through an app and web platform. The data collected has contributed to over 20 scientific publications, and 95% of participants reporting changing their own environmental impact. Toos shared two main areas of learning from Earthwatch's experience in science and engagement. First, ensuring data quality – make sampling "fool proof", provide training and build quality checks into sampling and analysis protocols. Second, for recruiting participants – make the activity easy, provide feedback, collaborate with community groups, ensure local relevance and have a clear pathway to impact. One major challenge has been the acceptance of Citizen Science data by statutory agencies. This has increased due to peer reviewed publications, local case studies and testimonials from agency staff. Toos cited a publication comparing Citizen Science and Agency data suggesting that FreshWater Watch could provide data types that would otherwise be under recorded¹. She closed by suggesting that sharing expertise, ideas and platforms is key to unlocking the huge potential of Citizen Science.

¹ Hadj-Hammou J, Loiseau S, Ophof D, Thornhill I (2017) Getting the full picture: Assessing the complementarity of citizen science and agency monitoring data. PLoS ONE 12(12): e0188507. <https://doi.org/10.1371/journal.pone.0188507>

5. Lunchtime activities

Over lunch, participants had the chance to network, to see demonstrations of the UKEOF Catalogue, the Cost-Benefit Analysis tool, to watch an animation of the evaluating a citizen science project from the UKEOF Motivations Report and to see posters that participants had brought along.

6. Carousel exercise

After lunch, **Anita Weatherby (UKEOF Programme Manager)** introduced the participants to the afternoon's carousel exercise, What do we need for us to maximise the benefits of using Citizen Science within public sector organisations? This activity saw the participants divide into four groups and move to one of four tables, with the following headings:

Table 1: Designing monitoring strategies

Table 2: Accessing Citizen Science expertise

Table 3: Working with volunteers

Table 4: The future of Citizen Science.

After 15 minutes at each table, groups were asked to move round, so that each group spent time at each table. Participants were asked to consider "what do we already have that could be included in a set of resources?" and "what would we like to have in future?" Answers were captured on flipcharts and during the afternoon tea break, participants were asked to vote on priorities.



Photo credit: Andy Sier (UKEOF)

The full responses to the questions are included in Annex D, and the answers which received the most votes are listed below, grouped into topics.

1. Deliver through the suite of resources being developed
 - Online library of resources and links
 - One-stop shop on a website listing useful resources (national and international)
2. Scope future needs and opportunities for CS
 - Horizon Scanning

- UK/EU list of “challenges” that citizen science could present solutions for (statutory)
3. Further engagement of decision makers within UKEOF partner organisations
 - Greater understanding of costs/benefits of incorporating citizen science into monitoring strategies. Pathways for engagement.
 4. Formalise CS roles within monitoring organisations
 - “Champions”, “Broker”, “Support” – educational within an organisation to guide individual workers to address. The US have a requirement to have this designated person who is “au fait” with CS in statutory agency
 5. Connect monitoring agencies and CS groups
 - A framework to best integrate agency programmes (data and methods) and citizen science projects (data and method scarce)
 - More engagement with communities of interest – science educator practices
 - How do we make it easy to participate? Special interests / niche e.g. climbers
 6. Future vision (beyond a set of resources)
 - Durable & sustained funding – needs to be mainstream
 - Concept of citizenship – citizen science should be a part of it (community organisations in the US)
 - Build groups for specific tasks e.g. hackathons; Tackle a single problem in a one off hit; Creates new engagement
 - Responsibility to ensure legacy of the social capital that is built- pathway to progress/sustain network – highlighting there is a future. More than just feedback

7. Close of the workshop

Deborah Procter then summed up the day, recapped the top scoring suggestions. She explained that the existing resources identified will now be developed into a signposted set of resources for the UKEOF website. The other ideas generated during the day will be discussed by the UKEOF Citizen Science Working Group as potential activities for their future workplan, to see if any activities can be taken forward by others in the community (e.g. through OPENER).

Helen Roy closed the day and thanked all participants for their engagement and attendance.

8. Evaluation

Participants were asked to fill in a feedback form for the day. The event was very well received, with the case studies being foremost in the appreciation of the day. The discussion time was thought to be very useful. The carousel exercise was very well received, but some participants felt that this activity might have benefited from a longer time slot. In terms of next steps, there was interest in a clear set of actions, next steps and who might take these forward; more interaction with statutory agencies management teams to help those pioneering Citizen Science approaches and ideas to generate wider buy-in from their own organisations and increased signposting resources.

9. Acknowledgements

The UKEOF Secretariat would like to thank members of the UKEOF Citizen Science Working Group, particularly Deborah Procter, Colin Chapman, Kieran Hyder and Jon Parr for their excellent work in convening this workshop, Jane Delaney and Helen Roy for facilitating, all the presenters and all the participants for such engaging and enthusiastic discussions.

Annex A – Workshop Agenda

UKEOF Workshop: Maximising the benefits from Citizen Science for monitoring the environment

24 January 2018 - Austin Court, 80 Cambridge Street, Birmingham, B12NP

Aim: to enable practitioners and commissioners of Citizen Science to access practical resources and expertise, including case studies demonstrating how well-informed use of Citizen Science can lead to reliable data, support operational actions and inform policy development

Output: a suite of Citizen Science resources signposted from the UKEOF website

- 09:30 **Registration**
- 10:00 **Welcome – Chairs Deborah Procter and Rob Grew**
- Introduction – Deborah Procter**
- Interests of UKEOF partners, Benefits of & barriers to the use of Citizen Science
 - Towards a set of UKEOF signposted resources
 - Introduction to NERC OPENER project – Toos van Noordwijk
- 10:30 **Review Homework Exercise – Jon Parr**
- Overview of responses: What are the barriers? What resources exist?
 - Discussions: How to address the barriers? What are the gaps in resources?
- 11:00 **Tea & coffee**
- 11:30 **Case studies – Rob Grew**
- The use of Citizen Science in public sector monitoring: how have challenges been addressed, what resources are available?
1. Cobweb – Colin Chapman (Welsh Government)
 2. WOW - Jake Brown (Met Office)
 3. Capturing our Coast – Jane Delaney (Newcastle University)
 4. BGS Digital Geology Map – Patrick Bell (British Geological Survey)
 5. *Observatree – Jake Morris (Defra / Natural England) (unable to attend)*
 6. Flooding management - Kate Pearson (Environment Agency)
 7. FreshWater Watch – Toos van Noordwijk (Earthwatch)
- 12:40 **Discussion: Making the case for Citizen Science – Deborah Procter**
- 13:00 **Lunch** - Demonstrations, posters, UKEOF catalogue
- 14:00 **Carousel exercise – Anita Weatherby**
- What do we need for us to maximise the benefits of using Citizen Science within public sector organisations? (i) What do we already have that could be included in a set of resources? (ii) What would we like to have in future?
- **Table 1: Designing monitoring strategies** (Colin Chapman)
 - **Table 2: Accessing Citizen Science expertise** (Jane Delaney)
 - **Table 3: Working with volunteers** (Helen Roy)
 - **Table 4: The future of Citizen Science** (Kieran Hyder)
- 15:00 **Tea & coffee. Sticker voting for priorities – Anita Weatherby**
- 15:30 **Review voting, discussion, next steps – Deborah Procter**
- 16:00 **Close & thanks – Helen Roy**

Annex B – Workshop Attendees

Name		Organisation
David	Allen	Natural Resources Wales
Patrick	Bell	British Geological Survey
Linda	Birkin	British Ecological Society
Sylvia	Blake	Defra
Katrin	Bohn	Natural England
Jon	Brock	Environment Agency
Jake	Brown	Met Office
Ross	Bullimore	Cefas
Colin	Chapman	Welsh Government
Wim	Clymans	Earthwatch Institute (Europe)
Jane	Delany	Newcastle University
Brian	Eardley	Scottish Natural Heritage
Leasa	Fielding	Welsh Government
Poppy	Fraser-Lakeman	Imperial College London
Rob	Grew	Environment Agency
Kieran	Hyder	Cefas
Hannah	King	Natural Environment Research Council
Andy	Nisbet	Natural England
David	Noble	British Trust for Ornithology (BTO)
Gareth	Old	UKEOF
Jon	Parr	Marine Biological Association
Mark	Parry	National Marine Aquarium
Kate	Pearson	Environment Agency
Jodey	Peyton	UKEOF
Deborah	Procter	Joint Nature Conservation Committee
Cindy	Regalado	University College London
Helen	Roy	CEH
Paul	Sadler	Environment Agency
Joanna	Savage	UKEOF
Aleks	Schmidt-Hansen	Scottish Environment Protection Agency
Jack	Sewell	The Marine Biological Association
Andrew	Sier	UKEOF
David	Slawson	Imperial College London
Claire	Spooner	Economic & Social Research Council
Deborah	Steele	Defra
Helen	Townsend	Forestry Commission England
Toos	van Noordwijk	Earthwatch Institute
Anita	Weatherby	UKEOF
Cheryl	Willis	Natural England

Annex C – Homework Exercise

Suggestions of Citizen Science resources from homework exercise

- The ScienceWise programme that looked at the National Ecosystem Services Assessment
- National Marine Aquarium meeting on citizen science – outcomes?
- European Citizen Science Association (ESCA) – app development discussion; 10 principles of Citizen Science
- Newsletters and links via groups such as UKEOF and ECSA
- Macroinvertebrate monitoring in rivers www.riverflies.org/rp-riverfly-monitoring-initiative
- SciStarter
- Citizen-Science for Coastal and Marine Conservation/Cigliano-Ballard
- Envriplus tools listed www.envriplus.eu/wp-content/uploads/2015/08/D14.6.pdf
- www.birds.cornell.edu/citscitoolkit/toolkit Online toolkit
- <https://www.routledge.com/Citizen-Science-for-Coastal-and-Marine-Conservation/Cigliano-Ballard/p/book/9781138193222>
- UCL have just set up an online MOOC/in-person hybrid course on an intro to citizen science;
- At least 4 new 'popular science' books on citizen science
- Discussion brief by West & Pateman on how CS can address the SDGs
- For CS related to bird monitoring, recent best practice guides such as Vorisek et al. 2008 cover all aspects
- One well-established text is Dickinson et al. 2012 Citizen Science: Public Perception in Environmental Research.

Additional comments added during the meeting to posters summarising feedback

- 1. What are the barriers to the use of citizen science for your organisation?**
 - In general researchers in universities have not practiced community engagement themselves- there is a lack of humility to what local groups bring or are already doing. We need to step into their world and meet them where they are at- not where we want them to be.
- 2. What resources might help an organisation considering using citizen science?**
 - Grassroots organising community for environmental monitoring: Public Laboratory for Open Technology and Science. Publiclab.org
 - Also partner with local organisations and social enterprises who are tackling similar or additional issues: they complement us
- 3. What other resources might help i.e. what gaps are there in the resources?**
 - Official funders/commissioners: if useful to you, how can citizen science be “mainstreamed” into official monitoring? Many projects are time-limited and networks, resources, volunteers etc may be lost when the current funding ends.

Annex D – Full responses to Carousel Exercise

Introduction

Attendees took part in a carousel exercise on the question “What do we need for us to maximise the benefits of using Citizen Science within public sector organisations?”. This activity saw the participants divide into four groups and move to one of four tables, with the following headings:

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After 15 minutes at each table, groups were asked to move round, so that each group spent time at each table. Participants were asked to consider “what do we already have that could be included in a set of resources?” and “what would we like to have in future?” Answers were captured on flipcharts and during the afternoon tea break, participants were asked to vote on priorities.

The full responses to the questions are included below, showing the number of votes for each answer. Answers with the most votes are shown in bold

Table 1 - Designing Monitoring Strategies

Responses: Existing Resources	Votes
Resources: Lots of volunteers (e.g. Botanists)	
E.g. National Plant Monitoring Scheme – an existing methodology	
Access to partnerships	
Strategic monitoring reviews (details the need)	
UKEOF catalogue	
Tree Health Fellowship – Systematic review of how citizen science can contribute	
Choosing and using citizen science	
Existing strategy. Agency specific monitoring plan.	
A citizen science data standard	1
Responses: Future Resources	
Comprehensive overview of platforms; <ul style="list-style-type: none"> • Are projects open/live • Open to collaboration/expansion/sustainability maybe 	4
Greater understanding of costs/benefits of incorporating citizen science into monitoring strategies. Pathways for engagement.	7
Hub of expertise to field questions	3
Accessible citizen science data repository understandable to “non-specialists”	2
Curated library of best practice	
UK/EU list of “challenges” that citizen science could present solutions for (statutory)	9
A framework to best integrate agency programmes (data and methods) and citizen science projects (data and method scarce)	12
Means to address a need in collaboration with citizen science projects (an early dialogue)	2

Table 2 - Accessing Citizen Science Expertise

Responses: Existing Resources	Votes
MOOC	
UKEOF citizen science working group	
ECSA	
CSA	
ACSA	
Citizen science conference as resource → outputs	
BES special interest group (citizen science)	
Public Lab	
NERC research centres	
Natural History Museum – ECSite	
Global Community Monitor	
Citizen science specific NGOs such as Earthwatch and Wildlife Trusts	
Platforms, e.g. COBWEB	
Huge citizen science literature – specific	
Gathering an Open Source Hardware (OSH)	
Parish community groups - gateway	
Local councils	
NCCPE: National Co-ordinating Centre (PENG)	
Hubs: Brokerage Directory, SciStarter (U.S.)	
#citizenscience, #citsci	
Facebook for specific taxonomic groups	
Case studies: existing and past projects	1
Data Interoperability	
Lay expertise and local community groups	
Responses: Future Resources	
Simplified signposting	4
Clear contact starting point for new comers	3
“Champions”, “Broker”, “Support” – educational within an organisation to guide individual workers to address. The US have a requirement to have this designated person who is “au fait” with CS in statutory agency	6
Data need – who to talk to vs meeting	
Engagement drive – who to talk to	
Education/ Training/ Awareness raising	1
Speaking out an non-CS events/newsletter	1
Brokerage: better co-ordination of “offer” and opportunities to undertake	1
Linkedin Community to offer expertise – connecting existing profiles	2
Centralised database	
Process to “convert” (?)/ engage CS cynics	
Online library of resources and links	8
Engagement with groups and data sets that are as yet unaware of the value of this e.g. umbrella organisations, e.g. LA partnership	
UK version/branch of ECSA	3

Table 3 - Working with Volunteers

Responses: Existing Resources	Votes
Guidance/Code of conduct on working with volunteers – National Trust have excellent provision for volunteers. Other volunteer groups, e.g. scouts, school governors – how willing will they be to share?	1
Royal Society (and other) film on unconscious bias	
European project on defining citizen scientists - definitions around types of people. Paper Eitzel <i>et.al.</i> 2017	
Lots of information across NGOs – but distributed	
Earthwatch Waterblitz – excellent interface for upload of information	
Science education practices (small NGOs develop education and confidence to engage) – formal and informal	
BNHC Bioblitz database of volunteers	
Training course for community leaders (through OPAL)	
On-line CS module (UCL)	
SciStarter	
Responses: Future Resources	
One-stop shop on a website listing useful resources (national and international)	12
Sharing ideas on appropriate feedback; <ul style="list-style-type: none"> • Template • Guidance 	2
Compilation of case studies and good practice	
Evaluation methods – sharing ideas	
More online training modules	1
Capture information from NGOs on experiences of motivating volunteers etc	
Simple field on data capture from volunteers to add feedback. Exists but make more widely used	
More engagement with communities of interest – science educator practices	5
Social media: excellent for feedback – good practice guide	2
Ethics: good practice	
A tool to help scientists etc improve understanding of social aspects and how to apply this	5
Document/evaluate networks of volunteers across projects (memberships). Represent current missed opportunities. Look at overlap/crossover	
Data protection guidance – what is required to meet obligations	1
Synergies between/among projects – using catalogue dynamically	3
Understanding what “typology of volunteers” means in terms of participation – how to work with them? How to appeal to the right people?	
Understanding risks of engaging with citizens i.e. they want different action to that of the agency.	
Recruitment of volunteers where they don’t already exist	
Responsibility to ensure legacy of the social capital that is built- pathway to progress/sustain network – highlighting there is a future. More than just feedback	5
Lots of focus on expert-led CS but how can you most effectively co-create or/and get involved with the community-initiated or led initiative	3

Table 4 - The Future of Citizen Science

Responses: Future Resources	
Durable and sustained funding;	5
• Needs to be mainstream	5
• Learn from other sectors	1
Public-private partnerships for CS to bridge funding gaps	1
Concept of citizenship – citizen science should be a part of it (community organisations in the US)	7
Break barriers between professional and CS – all science (cf music – don't get citizen musicians)	1
Horizon scanning – futures exercise. Need to include bigger picture to support future CS	9
Disconnection with the environment	
Open source and open data resource available to all	
Challenges around data protection – resources to deal with this	
Capacity to support local community based projects. Sharing information. Partnerships, catchments, gate keepers and citizens UK.	3
Use of new media to contact new people and interest	2
Dealing with the “threat” of CS – breaking barriers	2
Benefits – can you make money from the products and use to support CS	2
Internet of things and new sensors – calibration and ground truth	
How do we design projects to develop capacity? Durable; NGO; COMMS (+ working with)	1
Crowd-funding and crowd source opportunities. Invest money will increase engagement and participation	
Public engagement groups within universities to share information	
Build groups for specific tasks e.g. hackathons;	5
• Tackle a single problem in a one off hit	
• Creates new engagement	
Internet based CS	3
• Opportunity to go beyond monitoring	
• Tie with machine learning	
How do we make it easy to participate? Special interests/niche e.g. climbers	7
Open Society – people from start. Everyone is a scientist, not just those in white coats. Inclusive.	1
Web scraping of information	1
• Validation	2
Ways of finding out opportunities to engage with CS	