

Citizen Science in Scotland

Introduction

This briefing paper provides an overview of the value of Citizen Science, including information on Citizen Science activity, key organisations, links with policy, significant outputs and the potential to deliver positive outcomes for Scotland's environment and people.

The paper was written by representatives of SEPA, Scottish Natural Heritage, Forestry Commission Scotland, Scottish Government and The Conservation Volunteers.

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Citizen Science and its role

The term 'Citizen Science' describes the involvement of volunteers, including the public and communities, in scientific research. Citizen Science is a relatively new term, but amateurs have been participating in, and contributing to, scientific research for years. As early as the 17th century, amateur natural historians were developing sophisticated collaborations through natural history societies in order to obtain large amounts of data and information about far-flung locations that they could never visit themselves.

In the context of the environment, Citizen Science can be defined as the 'volunteer collection of biodiversity and environmental information which contributes to expanding our knowledge of the natural environment, including biological monitoring and the collection or interpretation of environmental observations' (UK Environmental Observation Framework 2011). The UK-EOF proposes that Citizen Science is 'an indispensable means of combining environmental research with environmental education and wildlife recording' and it provides evidence that, across the UK, volunteer observers for biodiversity surveillance are estimated to contribute time in-kind worth more than £20 million per annum.

The EU Biodiversity Plan 'Our life insurance, our natural capital: an EU biodiversity strategy to 2020' states that 'the active involvement of civil society needs to be encouraged at all levels' and suggests that 'Citizen Science initiatives are a valuable means of gathering high-quality data while mobilising citizens to get involved in biodiversity conservation activities'.



The term Citizen Science covers a range of activities. These include:

- *Surveillance & monitoring*: gathering records to inform distribution atlases and change-monitoring programmes
- *Informing action*: for example on floods, pollution or invasive non-native species
- *Engaging and promoting learning*: including 'Bioblitzes' and many environmental engagement and learning programmes
- *Promoting environmental stewardship and building community capacity*: by supporting people to value and develop local environmental assets
- *Testing hypotheses*: activity which answers a specific question
- *Crowd sourcing*: web-based engagement of many people in a large scale data analysis project, for example in the interrogation of photographs and video, most famously used in astronomy

Citizen Science helps deliver results for a wide range of policy areas. A number of recent policy documents and initiatives recognise the importance of engaging volunteers in environmental monitoring including the Scottish Climate Change Adaptation Programme, Scottish Government's '2020 Challenge: A Strategy for the conservation and enhancement of biodiversity in Scotland' and the Strategic Plan for Biodiversity 2011-2020 (Convention on Biological Diversity). Of particular note is the potential for Citizen Science activity to make a significant contribution to monitoring environmental pressures, as reported on in the Strategic Framework to Support the Implementation of Citizen Science for Environmental Monitoring (Pocock et al 2014).

Citizen Science has been promoted by Education Scotland because it provides substantial opportunities for learning and skills development at all ages, achieving outcomes across Curriculum for Excellence; delivering the Outdoor Learning Strategy and responding to the STEM agenda¹. Citizen Science also provides opportunities for community education and lifelong learning and is relevant in the context of a number of other Scottish Government policies and processes focussing on health, education and community.

At a community level Citizen Science has been shown as an agent for increasing capacity and resilience: building community skills and confidence, contributing to increased health and wellbeing, and developing local citizenship and empowering communities to act as environmental stewards in protecting and improving their local and global environment.

Citizen Science is recognised as a valuable tool for connecting people with nature, increasing understanding of our natural heritage, and building confidence in being outdoors. We know that connectedness to nature is a factor influencing the adoption of sustainable lifestyles too, so recording the local environment can effect individual and social change. Research carried out in 2014 (SEWeb, TCV) shows that there is a meaningful link between Citizen Science participation and increased environmental knowledge, attitudes and behaviour.

Across the scientific community, there is widespread recognition that Citizen Science "offers a means of

¹ The need to develop a highly-skilled workforce that is aligned to the future needs of the science-base and an awareness amongst young people of increasing opportunities to pursue careers in science, engineering and technology.

doing substantial, thoughtful public outreach and of tackling otherwise intractable, laborious or costly research problems” (Gura 2013). Data quality is ensured through the incorporation of robust data validation and verification steps into Citizen Science projects.

Current Citizen Science activity in Scotland

The current Citizen Science landscape in Scotland includes a wide range of organisations fulfilling different roles:

Delivery bodies: there are over 100 NGOs and recording schemes and societies that organise, manage, facilitate and support the submission of environmental records in Scotland, including charities such as RSPB, Plantlife and Butterfly Conservation, as well as local and regional recording groups.

Enabling bodies: these organisations, partnerships, projects and initiatives support and enable citizen science at national, regional and local levels. These include SNH, SEPA and other bodies supporting NGOs to deliver Citizen Science projects, the Scotland Counts project which aims to increase participation in Citizen Science across Scotland, environmental volunteering and education organisations such as The Conservation Volunteers and Field Studies Council as well as countryside rangers and outdoor education workers from a wide range of organisations. Bodies facilitating data collection, improving coordination, providing access to data, and promoting Citizen Science more widely include the National Biodiversity Network (NBN), Scotland’s Environment Web and the online application iRecord.

Participating bodies: these groups and organisations increasingly use Citizen Science activities to achieve their core purposes. Schools participate in Citizen Science to achieve learning outcomes, and community groups participate to increase knowledge and outdoor activity. Awards bodies (e.g. the John Muir and Duke of Edinburgh Awards schemes) promote Citizen Science participation within their activities.

Coordinating bodies: a number of bodies coordinate Citizen Science activity including Local Records Centres, Biological Recording in Scotland (BRISC) and the Scottish Biodiversity Information Forum (SBIF). SNH and SEPA also play a role here, supporting other parties and coordinating activities in their own right.

Data use bodies: SNH, SEPA, FCS, academic and research institutions, NGOs and local government make substantial use of data collected by volunteers.

The contribution of Citizen Science

Across the UK over 1 million biological records are submitted to the NBN Gateway each year by volunteer recorders. This substantial contribution is facilitated through the work of a wide range of delivery, enabling and coordinating bodies and includes projects such as:

- *Birdtrack:* a partnership project that provides an online recording and data management facility to capture information about migration movements and distributions of birds throughout Britain and Ireland
- *Botanical Society of Britain & Ireland:* a network of county recorders and county groups, which record the flora of each county
- *Scottish Raptor Monitoring Scheme:* gathers data to provide information on Scottish raptor populations to determine trends in numbers, range, survival and productivity and to understand the causes of population change
- *Dumfries & Galloway Environmental Records Centre, North East Scotland Biological Records Centre, The*

Wildlife Information Centre: Local Records Centres established to bring together local information on wildlife and the environment

- *Seasearch:* volunteer sports divers map out the seabed and record species in the near-shore zone around Britain and Ireland
- *OPAL Tree Health Survey:* enables members of the public to examine the trees in their local area and to keep a special eye out for pests and diseases, particularly those affecting Oak, Ash and Horse Chestnut

Over 1,000 volunteer meteorological stations submit records to the Met Office every day across the UK. In Scotland, 28% of SEPA rainfall recording sites are operated by volunteer observers.

Investment in Citizen Science in Scotland over the last three years by Scottish Government, SEPA, SNH, the Heritage Lottery Fund and the Big Lottery Fund has enabled a wide range of activities and outcomes to be achieved. As a result of The Conservation Volunteers' 'Scotland Counts' and 'Our Green Places' programmes:

- 180 teachers in 10 local authorities have attended CPD training linking Citizen Science to achieving experiences and outcomes for Curriculum for Excellence
- 80 school pilot projects have been supported
- 26 community groups are more confident to carry out Citizen Science in their own communities as a result of attending 'Citizen Science in your Community' training
- 80 rangers & outdoor education workers are more confident to engage volunteers in Citizen Science through attending 'Involving Volunteers in Citizen Science' workshops
- 12 'hard to reach' communities and groups have participated in Citizen Science, with 3 new co-production Citizen Science projects initiated in 2014
- **Since 2012, over 25,000 people across Scotland have been engaged with Citizen Science activities for the first time and helped to understand its relevance in their local communities**

Other initiatives include establishment of the Scottish Biodiversity Information Forum by BRISC in partnership with SNH and the launch in 2014 of OPAL Scotland, delivered by The Conservation Volunteers, Field Studies Council, Glasgow City of Science and Aberdeen University, which will engage 35,000 disadvantaged people to understand their local green places.

Future Opportunities

A range of opportunities exist for increasing Citizen Science activity and its contribution to achieving outcomes for a Greener, Smarter, Healthier and Safer & Stronger Scotland. In particular in delivering directly on 3 National Outcomes:

1. *We value and enjoy our built and natural environment and protect it and enhance it for future generations.*
2. *We have strong, resilient and supportive communities where people take responsibility for their own actions and how they affect others.*
3. *Our young people are successful learners, confident individuals, effective contributors and responsible citizens.*

In future, Citizen Science has the potential to play a substantial role in the following areas of need and opportunity:

Scottish Environmental Monitoring Strategy: Citizen Science projects can contribute new and more plentiful data on invasive non-native species, air, soil and water quality, flooding, pollution incidents, barriers to fish migration and impoundments, and the environmental impacts of recreation, agriculture, forestry and development.

Under-recorded species: new, targeted Citizen Science projects could effectively increase records for under-recorded species, such as lower plants and invertebrates.

Education and skills: more support for schools to participate in Citizen Science will improve science literacy among learners by providing local 'hands-on' science opportunities. Developing opportunities for Citizen Science activity to be incorporated into awards and accreditation will result in recognition and development of the skills required to monitor the environment.

Citizen Stewardship: continued broad engagement of the public with Citizen Science will increase understanding of the environment and motivation to take action to protect it.

Community Empowerment: developing confidence to participate in Citizen Science at a community level will enable communities to identify, protect, improve and take ownership of their environmental assets; such as watercourses and woodlands. Communities (and individuals) will not just participate in Citizen Science projects as organised by professionals, but will be increasingly empowered to collaborate in the development of projects that best suit their own needs.

Increasing capacity: building a vibrant movement of engaged Citizen Scientists facilitated through the online platform Scotland's Environment Web will lead to more robust and plentiful data and increase use of this digital resource

Health & Wellbeing: developing new Citizen Science projects that focus specifically on achieving outcomes for health and wellbeing through including a focus on older people, young adults, mental health and wellbeing, outdoor activity and local air quality.

Achieving the potential

Taking forward these opportunities will require a coordinated approach to developing and investing in Citizen Science in Scotland. Continued support and development of established and successful schemes is vital. Recent and ongoing developments in online Citizen Science platforms including SEWeb and iRecord will continue to provide new opportunities for data collection, coordination and dissemination.

New projects continue to emerge, many based around digital media and the use of smartphone apps; it is therefore essential for the community of Citizen Science stakeholders to effectively prioritise and coordinate and align data needs and project development. Modern technology enables the generation of vast amounts of data, but resources are required to effectively verify, store, visualise and use these data. The recruitment of new Citizen Scientists will continue to be a focus. The Conservation Volunteers have taken a lead in increasing participation in Citizen Science, integrating it into their work with people to improve health, prospects and outdoor places for the long-term. With a wide range of programmes working with thousands of volunteers across Scotland, TCV are well-placed to continue to research, develop, trial and promote Citizen Science in order to:

- *Increase public knowledge of Citizen Science and confidence to participate*
- *Facilitate community participation in Citizen Science*
- *Support Learning through Citizen Science*
- *Engage new audiences with Citizen Science*