

## Chapter 48

# Citizen Science and Its Role in Sustainable Development: Status, Trends, Issues, and Opportunities

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### ABSTRACT

*The chapter aims to analyse the role of citizen science in sustainable development, including case studies implementation, with specific focus on its suitability of citizen science in environmental sustainability. The authors structured this chapter in five sections: Background; Main focus; Solutions and recommendations for designing and executing citizen science initiatives; Future research directions with thoughts on the future role of citizen science; and Conclusion. In section of main focus, first, the authors reviewed the state of citizen science in sustainable development and explored the potential of citizen science for environmental research and governance. Second, authors identified and elaborated the core components that support the role of citizen science and demonstrated the practical approach to realize its objective. Third, using several citizens' observatories studies from various regions in Europe and within diverse environmental fields, authors highlighted the lessons learned, and reflected on major outcomes, challenges and opportunities.*

### INTRODUCTION

Participation of the public in scientific and action research, independently or in cooperation with scientists, is often referred to as 'citizen science' (Hand, 2010). Additional terms, such as 'crowd science', 'crowd-sourced science', 'civic science', or 'networked science' may be viewed as synonyms (Hand, 2010). Citizen science itself can be said to have existed since the very start of scientific practice, where it has developed in many different guises. As the internet continues to proliferate in the world, new tools like social media, mobile devices and mobile sensors are becoming the norm (Lanfranchi, Wrigley, Ire-

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son, Ciravegna, & Wehn de Montalvo, 2013)). Lately, it has been witnessed a global increase of citizen science projects and citizens engaging in projects as amateur researchers, as sensors, as advocates and even watchdogs (Haklay, 2015). Further, crowdsourcing methods, data processing and visualization technologies are developing rapidly, leading to a wide range of new opportunities for public participation in a compelling range of topics (Buytaert et al., 2014). As an example, it can be seen that a tremendous increase of environmental observation activities in this area, i.e., various citizens' observatories that encompass different models of citizen science and span a diverse range of subjects (e.g., biodiversity, water, air, climate change, agriculture, disaster, etc.), empowering average people to monitor their environment, collectively generate scientific data and support environmental risk response (Liu, Kobernus, Broday, & Bartonova, 2014).

The objective of this chapter is to analyze the role of citizen science in sustainable development, including case studies in citizen science implementation, with specific focus on the suitability of citizen science in environmental sustainability. It comprises the following five sections: Background; Main focus of the chapter; Solutions and recommendations for designing and executing citizen science initiatives that help inform and create environmental action, based on evidence, sound science and citizens' needs; Future research directions with thoughts on the future role of citizen science; and The Conclusion. In the section, 'Main Focus', the authors have divided it into the following substructure:

1. First, the authors reviewed the state of citizen science in sustainable development and explored the potential of citizen science to complement more traditional ways of scientific data collection and knowledge generation for environmental research and governance;
2. Second, the authors identified and elaborated the core components that support the role of citizen science and demonstrated a practical approach to realize its objective of environmental sustainability;
3. Third, using several citizens' observatories case studies from various regions in Europe and within diverse environmental fields, the authors highlighted the lessons learned, and reflected on major outcomes, challenges and opportunities in the integration of environmental-oriented citizen science within environmental management, the role of scientific knowledge in the decision-making process, and the potential contestation to established community institutions posed by the co-generation of knowledge.

## **BACKGROUND**

Citizen participation with environmental science has a long history, before it was termed 'citizen science' (Roy, 2012). In fact, until the late 19th century, there were no professional scientists as it is well known them today (Kight, 2012; Miller-Rushing, Primack, & Bonney, 2012). Research was typically undertaken by amateurs, often Gentlemen of Leisure or men of the cloth (Miller-Rushing et al., 2012). Charles Darwin, for example, was not a trained scientist (Kight, 2012; Dillon, 2014). Likewise, the Swedish botanist and physicist, Linnaeus, was not only a Lutheran minister for a period, but worked with a wide network of citizen volunteers who sent samples to him, a not uncommon practice (Scyphers et al., 2015). One could argue that he exemplifies the very nature of citizen science. However, these men were at the pinnacle of the scientific community, so it might be somewhat disingenuous to claim they were amateurs. Nonetheless, citizen science was an activity that many average citizens engaged in at

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