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Citizen-science programs: Towards transformative biodiversity governance

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ABSTRACT

Biodiversity monitoring is increasingly assessed through citizen-science volunteer programs. Standardized protocols are proposed by scientists to naturalist or non-naturalist volunteers who collect data in a consultative approach. Biodiversity indicators can then be assessed and communicated to inform decision-making at local to international policy levels.

Citizen-science can, however, go beyond such top-down approaches and become more transformative, if citizens were to become involved at different stages of observatory construction. On the condition that ecological scientists adopt a reflexive approach on their values and approaches, citizen-science programs could help to transform science–society–politics relationships. In particular, we consider options to combine consultative and transformative approaches, some of which are already experimented.

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1. Introduction

In environmental sciences, research benefits significantly from the input of citizens, non-specialists, particularly in the collection of data that helps to survey biodiversity in long-term and/or at large spatial scales (Dickinson et al., 2010; Conrad and Hilchey, 2011). For several centuries, the National Museum of Natural History in France has collaborated with citizens to collect biodiversity samples. Such collections were especially important during the 'European Age of Discovery', which

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began in the 15th century, involving for example Alcide d'Orbigny, a French naturalist who made many contributions through his collecting expeditions in South America, ranging from paleontology to anthropology. More recently the museum has constituted data bases on biodiversity, gathering information provided by citizens (see the INPN, '*Inventaire National du Patrimoine Naturel*', www.inpn.mnhn.fr). The citizens involved are most often what we will call for this paper "naturalists", i.e. people able to recognize species, an ability which most often indicates long-time field experience.

Nowadays, so-called citizen science programs relate to a wider audience than just naturalists. One reason for that is related to the larger objectives of these programs, i.e. conducting long-term surveys on all major taxonomic biodiversity groups (see below and Cooper et al., 2007). This larger focus aims to monitor "ordinary" biodiversity, i.e. groups of species that are not yet endangered. In this regard, technology offers interesting new means, from remote sensing which is now able to monitor even individuals (penguins for example) to cell phones (e.g. Turner, 2014), and the role of citizen could be put into question. However, the citizen, naturalists and non-naturalists might still play an important role, not only using these technological devices, but also interpreting and analyzing the information acquired through technology, for example by interpreting aerial photos.

Moreover, beyond collecting and interpreting data, these initiatives can also forge new relationships between volunteers and the natural world and its conservation, and also stimulate social relationships between citizens, scientists and decision-makers to underpin renewal in biodiversity governance. Such renewal could speak to the need to connect a mode of knowledge where science monopolizes 'the truth' and an alternative mode, where the experiential knowledge in the civil society is mobilized. An increasing involvement of stakeholders can lead to participative inquiry, hence to participatory action research (Chevalier and Buckles, 2013; Reason, 1994).

In this paper, we discuss these different social roles of citizen science, depending on the reciprocal relationships between research and civil society, to anticipate new paradigms for collaboration. For this purpose we use a very thorough analysis of Conrad and Hilchey (2011), where the authors distinguished three types of governance for citizen science: Consultative/functional, Collaborative, and Transformative. To clarify our prospective, we will use a simplified version of this typology, keeping two contrasting modes. In the "consultative mode", researchers define scientific questions, and the public contributes by collecting information for this central authority, whereas in the "transformative mode", stakeholders define questions of interest, implement research, and identify researchers and experts where needed.

We base our paper on the experience of the French 'Vigie-Nature' citizen-science initiative, which brings together several programmes (see ***vigienature***.*mnhn.fr)*. Vigie-Nature began 25 years ago, with the STOC (or *'Suivi Temporel des Oiseaux Communs'*, www.vigienature.mnhn.fr/page/oiseaux) programme, a long-term monitoring program of common birds, relying on naturalists. Major scientific papers have been published, based on analyses of the data collected by this programme (for example Julliard et al., 2006; Devictor et al., 2008). On the civil society side, the STOC program has helped to document a major biodiversity indicator, used in public policies (see below). The general objective of Vigie-Nature is to monitor plant and animal communities, in order to document the state of ordinary biodiversity (i.e. species and habitats which are not immediately at risk of extinction, which form the vast majority of individuals and biomass). In these programmes, researchers ask explicit research questions, and build specific standardized protocols to answer them. The first protocols were designed for naturalists with knowledge and experience of some species group (e.g., birds, butterflies). However, new protocols have been progressively developed for a wider audience, with no specific biodiversity knowledge, but who are willing to explore and potentially learn and experience nature through observation and data collection (for example *'Observatoire de la biodiversité des jardins'*, www.vigienature.mnhn.fr/page/biodiversite-des-jardins).

2. Consultative platforms

When observatories are managed by researchers, citizen volunteers collect dedicated information. These involve mainly presence/absence of species, abundance of these species, phenology of plant species… (Table 1). Protocols are defined by the researchers. These observatories have showed their

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