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Leveraging the power of place in citizen science for effective conservation decision making

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ABSTRACT

Many citizen science projects are place-based - built on in-person participation and motivated by local conservation. When done thoughtfully, this approach to citizen science can transform humans and their environment. Despite such possibilities, many projects struggle to meet decision-maker needs, generate useful data to inform decisions, and improve social-ecological resilience. Here, we define leveraging the 'power of place' in citizen science, and posit that doing this improves conservation decision making, increases participation, and improves community resilience. First, we explore 'place' and identify five place dimensions: social-ecological, narrative and name-based, knowledge-based, emotional and affective, and performative. We then thematically analyze 134 case studies drawn from CitSci.org ($n = 39$), The Stewardship Network New England (TSN-NE; $n = 39$), and Earthwatch ($n = 56$) regarding: (1) use of place dimensions in materials (as one indication of leveraging the power of place), (2) intent for use of data in decision-making, and (3) evidence of such use. We find that 89% of projects intend for data to be used, 46% demonstrate no evidence of use, and 54% provide some evidence of use. Moreover, projects used in decision making leverage more ($t = -4.8$, $df = 117$; $p < 0.001$) place dimensions ($\bar{x} = 3.0$; $s = 1.4$) than those not used in decision making ($\bar{x} = 1.8$; $s = 1.2$). Further, a Principal Components Analysis identifies three related components (aesthetic, narrative and name-based, and social-ecological). Given these findings, we present a framework for leveraging place in citizen science projects and platforms, and recommend approaches to better impart intended outcomes. We discuss place in citizen science related to relevance, participation, resilience, and scalability and conclude that effective decision making as a means towards more resilient and sustainable communities can be strengthened by leveraging the power of place in citizen science.

1. Introduction

Citizen science is a phenomenon born out of a long history of public participation in scientific research (Miller-Rushing et al., 2012) enacted through many approaches (e.g. contributory, collaborative, and co-created) that can involve crowdsourcing, community-based monitoring, and participatory action research (Bonney et al., 2009; Danielsen et al., 2009; Ballard and Belsky, 2010; Shirk et al., 2012). Some projects extend the spatial and temporal scale of data available for scientific investigations (Loss et al., 2015; Theobald et al., 2015) while others improve the coupling of natural and human systems data collection (Crain et al., 2014). Regardless of approach or goal, citizen science projects often focus on a particular topic of interest to the scientific community such as bird diversity, precipitation, phenology, astronomy, or public health; not necessarily on multi-faceted conservation decisions, issues, or actions relevant to specific place(s). Moreover, empirical reviews of citizen science reveal that its contribution to decision making and, ultimately, social-ecological resilience, can often be relatively trivial (Conrad and Hilchey, 2011; see also Gray et al. this issue). There is a need to understand the barriers to use of citizen science data in decision

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making and examine factors and circumstances influencing success (Conrad and Hilchey, 2011). We do not fully understand how knowledge gained from citizen science translates into conservation decision making processes - processes often requiring integrated knowledge across many topics related to particular places.

Indeed, little is known about the possibility and implications of leveraging aspects of 'place' in citizen science to impart applied solutions through informed conservation decision making (Haywood, 2014). The stewardship of any particular place ideally relies on scientifically informed decision making rooted in place in conjunction with continuous monitoring, evaluation, reflection, and management by diverse stakeholders (McGinnis, 2016). Stakeholders influencing decisions include governmental agencies, non-profit organizations, private landowners, county planning offices, collaborative conservation initiatives, concerned citizens, and similar actors. For those becoming involved in citizen science, recent technological advances can streamlined traditionally time consuming tasks such as data entry and volunteer coordination. For example, support platforms such as ebird, iNaturalist, CitSci.org, and SciStarter are empowering more people to create (and connect with) place-based efforts. Here, we hypothesize that projects leveraging the power of place strengthen their influence on conservation decision making. In this paper, we define these terms, identify and test one indication of leveraging the 'power of place,' and recommend ways citizen science practitioners (both project and platform designers) can better leverage place to make their efforts more likely to inform conservation decision making.

1.1. Citizen science

Citizen science is a process where citizens become involved in science (Kruger and Shannon, 2000) or, more generally, public participation in scientific research (Bonney et al., 2009; Shirk et al., 2012). A growing number of projects are motivated by local conservation issues. These projects are considered community-based monitoring and represent "…a process where concerned citizens, government agencies, industry, academia, community groups, and local institutions collaborate to monitor, track and respond to issues of common community concern" (Whitelaw et al., 2003, p. 410). Some projects might even be construed as community-based management, where citizens and stakeholders are included in management of (and hence decision-making regarding) natural resources (Keough and Blahna, 2005; Conrad and Hilchey, 2011). When done thoughtfully, these projects can transform the relationship between humans and their environment and have been implicated in increasing community social-ecological resilience through improved conservation decision making (Shirk et al., 2012).

1.2. Conservation decision making

Conservation decision making is a difficult process to define. For this paper, we focus on a few core components: decisions about land-use and/or natural resource management made either by institutions or by individual private landowners regarding the stewardship of property. These decisions can be about policy changes or about how to work and act within existing policy, and can be made at any scale from local to global. Decisions beyond those of the individual landowner involve some degree of political interaction. Public participation in decision making is seen as critical to sustainable development (WCED, 1987; Kates et al., 2001), is integrated in the Rio declaration of 1992 (UNEP, 1992) and is now considered an important pillar of environmental democracy (Mauerhofer, 2016). It is therefore assumed to be normatively good (Haklay, 2003, Miller, 2013), but some maintain that this is true only when managed fairly and effectively (Reed, 2008). In practice, effective participation in decision making involves establishing rules in advance; creating a culture of empowerment, equity, trust, transparency, and learning; continual (and early on) opportunities; institutionalization; inclusion of local and scientific knowledge(s); presence of experienced moderators; integration of stakeholders; and organizational cultures that foster continual goal negotiation and outcomes assessment (Reed, 2008; Luyet et al., 2012). Involving participants in participatory modelling has also been shown to improve participation experiences and group decision making (Gray et al., this issue).

1.3. Leveraging the power of place

Although most field-based citizen science occurs at, and is grounded in, specific places, little research has extensively explored the affective interactions and relationships among volunteer participants and the places in which they participate in citizen science (Haywood, 2014). The place literature historically emphasizes the "lived experiences" of humans within specific social-ecological contexts (Allen, 2004; Casey, 1993; Hubbard et al., 2002). For example, the phenomenological geographers Relph, (1976) and Tuan (1975, 1977) claim that the concept of place is much more particular and nuanced; it is linked to life histories, social processes, and individual experiences (e.g., race, age, gender, sexuality, and spiritual orientation) that, in turn, influence our understanding of place (Haywood, 2014).

We define the 'power of place' by combining material and symbolic perspectives which together create the capacity for citizen science to foster sustainable place-making. Our concept of place draws on interdisciplinary approaches developed over the last several decades in place studies (see Lewicka, 2011; Manzo and Devine-Wright, 2013 for comprehensive reviews of place studies), environmental communication (Cantrill and Oravec, 1996; Spurlock, 2009; Druschke, 2013), and human geography (Massey, 2005). An early definition of place defined it as a type of affective relationship or attachment that connects people to specific physical locales (Irwin Altman and Low, 1992; Lewicka, 2014). Much like the discussions that have occurred within citizen science, studies of place have explored this concept through quantitative and qualitative approaches that use a variety of methods. Although the 'sense of place' concept has been used to explore how citizen science participants make connections between embodied experiences, thoughts, ideas, interactions, and behaviors (Haywood et al., 2016), there is a clear need to build upon conceptualizations of 'place' and explore how use of place concepts may affect the decision making outcomes of citizen science (Haywood, 2014).

For us, the phrase 'power of place' embodies actions motivated by the emotional, cultural and material connection that many people have for the place in which they live, sometimes expressed as 'love' or 'attachment to place'. It also includes actions guided by the interconnected understandings which can come with this intimate connection (McGinnis, 2016). Hence, citizen science projects and platforms that 'leverage the power of place' are those that connect with these motivations and understandings. There are many means towards this end. Here, we explore one in detail - specifically use of place dimensions in project materials as an indicator of leveraging the power of place - and test it against our hypothesis that doing this improves a project's influence in conservation decision making.

2. Methods

Our goal is to explore the connections between citizen science, conservation decision making, and how projects that leverage the power of place influence data use in decision making. We focus our analysis on projects, but return to the scope of platforms in our recommendations, discussion, and conclusion. We first identify and describe five dimensions of place as one indication of leveraging the power of place and then use qualitative, quantitative, and statistical techniques (mixed methods) to explore this potential relationship.

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