

## **Tales of Tiger Beetles and Other Citizen Sciences**

**Akiko Busch, *The Incidental Steward: Reflections on Citizen Science***

New Haven, CT: Yale University Press, 2013. 256 pp. \$40.00 hardcover, \$16.00 paperback.

**Caren Cooper, *Citizen Science: How Ordinary People Are Changing the Face of Discovery***

New York: The Overlook Press, 2016. 305 pp. \$28.95 hardcover.

**Mary Ellen Hannibal, *Citizen Scientist: Searching for Heroes and Hope in an Age of Extinction***

New York: The Experiment, 2016. 432 pp. \$29.95 hardcover, \$17.95 paperback.

**Sharman Apt Russell, *Diary of a Citizen Scientist: Chasing Tiger Beetles and Other New Ways of Engaging the World***

Corvallis: Oregon State University Press, 2014. 224 pp. \$18.95 paperback.

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For a practice that has been around in some form for over a century, citizen science has a seeming newness those familiar with its history might not expect. Speculation on why citizen science has gained significant traction in the last few decades—even gaining its familiar banner of “citizen science”—often points to the emergence of online tools for data collection and sharing, and there are websites such as SciStarter that work to coordinate projects and volunteers, and scientists are increasingly turning to the practice insofar as numerous conferences dedicated to citizen science have been held. Despite the threads that lead back a century, the situations to which citizen science projects and citizen scientists respond have notably distinct characteristics from their antecedent forms, and so the current swell of interest in the enterprise is not all together unexpected. Indeed, there is much to explore in how citizen science projects emerge, how they are developed, how they are conducted, and the influence or impacts they may have. Wide ranges of disciplines around the world have engaged in forms of citizen science and this multiplicity poses further challenges for understanding the character of citizen science.

In recent years, several popular nonfiction books, including *The Incidental Steward*, *Citizen Science*, *Citizen Scientist*, and *Diary of a Citizen Scientist*, have added to a growing body of literature that explores citizen science and citizen scientists.<sup>1</sup> Each of these books in particular offer insights into just what is meant by citizen science and attendant conversations to this enterprise’s development. Autobiographical accounts and internalist histories comprise many of these cases, and in each case the nature of citizen science as a meaning-making enterprise as well as a social arrangement is explored to reveal different attributes of this evolving research practice. In this review essay, we offer an overview of these four books as a sample of a growing area of scientific knowledge making, and we identify some key themes that may be of interest to those working in science studies.

The pillar of citizen science is the participation of citizens in the sciences—*citizen* understood in terms of their engagement with the public sphere rather than affiliation with a particular state entity. Mary Ellen Hannibal, author of *Citizen Scientist: Searching for Heroes and Hope in an Age of Extinction*, summarizes the origins of the participatory nature of citizen science in her prologue, writing, “Some people like to call citizen science ‘participatory research.’ This comes out of a decades-long unfolding of thought in the humanities in which researchers began to grapple with the very unpleasant insight that . . . it is impossible to take a ‘me expert, you study subject’ view that is not condescending, incomplete, and more or less self-serving” (9).

Indeed, the sciences too have been grappling with these concerns, as conferences dedicated to citizen science and public participation in scientific research illustrate. The antidote to a simplistic expert-public divide is provided by citizen science, where one

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<sup>1</sup> Our research team has partnered with SciStarter to publish a series of book reviews dedicated to citizen science and has previously reviewed *The Incidental Steward*, *Citizen Science*, *Citizen Scientist*, and *Diary of a Citizen Scientist*. Our reviews appear on the Public Library of Science *Citizen Sci* blog, *Discover Magazine*’s “Citizen Science Salon,” and *SciStarter*. More information can be found at [uwaterloo.ca/scholar/arkelly/research-team](http://uwaterloo.ca/scholar/arkelly/research-team). The Ontario Ministry of Research, Innovation, and Science’s Early Research Award program, and also the Social Science and Humanities Research Council of Canada Insight Grant program have supported this work; views in this review represent those of the researchers, not the supporting organizations.

implicates “the word *I* into the narrative” (10). As Hannibal writes, “If the researcher is also a subject, and if the subject is also a driver of the research project, then maybe we can get some equity here, and ‘co-create’ knowledge” (10). In this way, citizen science is collaborative and involves those affected by research programs. That is, there is a dialogue that is occurring between the researcher and the communities invested in the subject or objects of study. However, Hannibal endorses a much wider scope in her philosophy of citizen science. *Citizen Scientist* weaves a sophisticated narrative that asserts a holistic worldview. In this worldview, Hannibal embraces a connectedness where one citizen is capable of engagement with and direction of scientific research. As Hannibal writes, “In my intention to help nature keep on keeping on, I consider myself a co-creator” (37). *Citizen Scientist* proceeds with eleven chapters, each of which meditate on specific citizen scientists, groups, or projects. In the spirit of this interconnectedness, Hannibal interweaves personal narratives, local histories, biographies, and journalism to demonstrate the range of the pursuits that constitute citizen-science efforts.

Caren Cooper’s *Citizen Science* offers an introduction to the historic and ongoing citizen-science projects across disciplines and around the world. The stance she takes toward the material is inquisitive and objective, presenting a set of example projects while setting out both their successes and faults. *Citizen Science* is structured into discipline-focused chapters—frequently with several instances of relevant projects—allowing Cooper to introduce how citizen science is represented and performed across the disciplines. Though she does not offer a direct description of how she sees citizen science, she states that “we’ve used the term citizen science to describe various ways lay people collect or analyze data to advance research,” also extending the term to be “used more broadly to describe ways that lay people participate in and influence the practice of science,” associating it with Alan Irwin’s original definition from 1995 (235). The key takeaway from Cooper’s discourse around citizen science is the relationship between experience and expertise with respect to ability and time. In the example of birdwatchers recording observations, Cooper makes evident that “if all citizen science required a high level of expertise . . . then the skew in participation would be even greater. But much of citizen science simply requires time” (49). This key distinction between expertise and time that Cooper is making suggests that much of the work in citizen-science projects can be mastered without significant training; however, as we will explore later in this review, this distinction might also mark a key move from novice to amateur expert, perhaps even to expert, as one engages in a given research effort and masters both the applied as well as theoretical material necessary to conduct said research.

Akiko Busch’s *The Incidental Steward* also moves the reader through a collection of stories, but in this volume, these stories detail the author’s experience with volunteering for ecological research projects. The writing is comprised in part of anecdotes, introspection, and biology. One of the book’s chief achievements is its ability to frame the author’s experiences as meditations on larger philosophical questions, such as the role of certainty and the origins of xenophobia. Meanwhile, the idea of citizen science is described and sometimes explained explicitly. Busch presents the concept of citizen science through both its utility to multiple stakeholders and its capacity as a vehicle for personal development. According to the author, public participation in research is a benefit to the goals of scientists, the health of the environment, and society in general,

while also providing the individual an exercise to gain a sense of belonging with the world around them. It is also credited for driving relationships between individuals from diverse backgrounds as they share an interest in contributing to ecological preservation.

In a similar personal account, Sharman Apt Russell's *Diary of a Citizen Scientist* offers a tale of a working citizen-scientist as she researches the tiger beetle in its natural habitat and in captivity. Her narratives are assembled from a kind of field note or diary of her research efforts and broader thinking on issues of citizen science. What is especially compelling in her work is the way in which the challenges of citizen science—of scientific research—are charted, leading readers to consider the ways in which one's research develops over a period of reflexive engagements with methods, materials, and, in this case, the mighty tiger beetle itself.

In various ways, all these authors consider the social and political implications of citizen science. *The Incidental Steward* characterizes citizen science as an activity that has the potential to shape the human experience. Busch routinely describes its motivations and outcomes in terms of "engagement" between people and the environment, finding value in connections between the natural world and those who volunteer in research projects. Fulfillment from forming this connection is concurrently bolstered by a sense of purpose from doing good, where spending time outdoors begets feelings of "restoration," which "[become] much larger if the result has some societal value" (25). Here, Busch presents citizen science as an impetus for the development of a person's holistic perspective, especially toward one that claims agency over the condition of their natural surroundings, hence the book title's reference to stewardship.

Busch also asserts the importance of citizen science as a resource for academic science. The author cites the affordances of "scale" and "geographical reach" when the public is recruited in data collection, furthering the objectives of researchers, particularly those "whose funding sources are ever more strained" (25). Moreover, Busch asserts that involvement of individuals who do not have an extensive background in a research area has the benefit of preventing confirmation bias, because such members of a project would be "more open to the serendipitous find" (126). When mobilized, nonexpert volunteers situated in a large range of regions are supported, which enables the expansion of a researcher's scope and better the quality of their evidence at low expense. She also considers the ways that citizen science is valued as an available supplement to students' education of biological concepts, understanding of conservation issues, and learning of life skills with teachers deliberately seeking projects appropriate for their class. At the same time, participation in citizen science is proposed as an effective response after acknowledgement of the serious harm perpetrated by people on the planet. According to Busch, it is an opportunity for "ordinary people" to act on a moral responsibility, where volunteers can intervene in problems facing their community "that may have public health consequences" or an "impact on education, research, and policy" (25). As such, the "impending sense of crisis" (23) becomes appealingly actionable. Busch recounts the community-building effect of these research projects, as people from diverse demographics interact and unite around a research activity, collecting data in organized groups. In these sections of the book, the variety of motivations from all those involved parallels the aforementioned narratives Busch packages as citizen science. For example, in "Eels in the Stream" scientists seek to delegate labor, students may get involved for the extra credit, or long-time volunteers return

because they view the activity as ritualistic with nostalgic value. The author observes that shared interest in stewardship and “some innate human impulse to be curious” can serve as a basis for “camaraderie” (147–48).

Cooper similarly maintains a highly optimistic view of citizen science; in one of her cases, she examines the extension of civic tech communities to citizen science. This is most evident in her “Biochemistry” chapter where she begins by discussing the @home networks involved with passive contribution to citizen science. Cooper shows that it is “thanks to volunteers who link their personal computers to the network” that researchers across disciplines and projects “are able to crunch otherwise uncrunchable numbers” (110). In the same chapter, Cooper describes the gamification of citizen-science projects and their ultimate goals. With a particular focus on the protein folding game FoldIt, she quotes David Baker saying that “the user community wants to play God” (Baker qtd. at 125). The key vision here is not that citizen scientists have a need for control, but that they want to lead the charge on new discoveries. The theme of citizen science as discovery is common throughout the book, however with the era of big data upon us, the opportunity for online gamification opens the door for another theme: competitive comradery. In FoldIt, the citizen participants in these tech communities are engaged and driven by a particular motivator—the glory of points and leaderboards.

As Cooper lists and identifies citizen-science projects, she identifies several issues with individual projects, occasionally expanding them to citizen science more broadly. The most striking example is in regard to citizen science around health research, where she states that, “when citizen scientists allow themselves to be the subject of the research, they let their bodies supply the data” (242). This is a telling narrative of what Cooper is trying to illustrate for the reader. Not only do people want to find answers, cures, and proactive measures, but they also are willing to put their lives on the line to do it. The key takeaway here being that without the support of researchers and support teams, these citizen scientists are limited in what they are able to produce. While the principle of nonexpert participation seems clear, Cooper as well as Hannibal and Apt Sharman recognize that there are ongoing negotiations of expertise when delegating workloads in the process of knowledge production through citizen science.

Beyond the social, there are several examples posed by Cooper in which there is an intersection with political forces. Considering the importance of climate change in today’s social and political sphere, it is not surprising that citizen-science communities have arisen to support and lead research around climate change. However, due to certain circumstances—economic, among others—governmental organizations such as the Environmental Protection Agency in the United States have been unable to determine and catch companies in the act of contributing, grossly, to climate change. The best example of this from *Citizen Science* is the air pollution of Tonawanda Coke in which they were seen “to be in compliance with emission standards during every inspection they *scheduled*” (207; emphasis in original). Citizen-scientists were ultimately the ones who determined what was occurring and brought it to governmental attention. In this example—and others—Cooper demonstrates not only that interactions between citizen scientists and governmental authorities occur but also that they can lead to tangible results.

In Apt Russell’s *Diary of a Citizen Scientist*, we find the common topoi of science. Discovery drives citizen science, as Apt Russell evidences, writing, “Spoonful after

spoonful, the dirt from my terrarium spills onto the newspapers laid on the table. I'm looking for a glimmer of movement, something very small and pale, with the same general features shared by all tiger beetle larvae," which, importantly, "no human being in the universe has ever seen (or at least documented)" (66). Indeed the topoi of discovery has driven scientific narratives for centuries, and is a rhetorically rich site for exploration itself as we examine the limits of discovery narratives set against the rhetorical conception of invention in discourse and argument, and citizen science challenges those in science studies to renew their interest in such distinctions as the professional spheres of discourse, the history of professional science, and socio-cognitive apprenticeship models of scientists are reconfigured in citizen science. At the nexus of these issues is a question of expertise and the democratization of science, and Apt Russell's unfolding narrative of novice becoming amateur becoming professional amateur becoming citizen scientist again renews lines of inquiry as scientific research is reconfigured.

Throughout her book, Apt Russell engages with on-the-ground research as well as research literature and correspondences with other researchers. In this way, her book details important characteristics and practices of citizen science—or, at least, of one citizen scientist—that provides some access to the way science is conducted. It is important to science studies to attend to these internalist accounts as they provide another way into a community of researchers conducting science. How citizen science might reconfigure professional scientific research promises to reveal much about how citizen science changes scientific research and policy making as well as providing insight into how science understands itself as currently configured.

In attending to Hannibal's internalist account, citizen science is extended beyond science as practice to also consider science as philosophy. For Hannibal, citizen science emerges from the philosophical trajectories shared by Joseph Campbell, John Steinbeck, Ed Ricketts, and others, where knowledge from nature, art, and spirituality combine to inform the human experience. Even though it can feel as though the actions of one person are not enough to make a difference, Hannibal's citizen science emphasizes connectedness in the world and encourages hope in this connectedness. The individual can do their part by contributing to larger efforts in the community, which contribute to larger patterns in nature, which in turn affect the individual. In the ninth chapter, Hannibal writes extensively of Campbell, Steinbeck, and Ricketts's entanglements and the scientific pursuits that resulted from their relationship. The chapter demonstrates how deeply communal and investigative citizen science is. In between recounting the fascinating relationships producing intellectual exchange, Hannibal emphasizes, "Ricketts' worldview is also key to Steinbeck's ecological vision. Both Ricketts and Steinbeck sought a holistic comprehension of the natural world. Humans take a place in this integrated world but do not dominate or determine it" (304).

Within this holistic vision, citizen science helps us not only to reframe our idea of an individual as part of a community but also forces us to reframe our idea of history. Hannibal describes citizen science as a field that brings local histories to the forefront. We reframe local histories since we recognize that interwoven local histories make up the larger changes in our planet. Despite the rush of modernity and globalization, local histories and personal narratives are more important than ever in this account. Hannibal makes it clear that "expeditions of the past hold keys to understanding our current

terrain” (8) as she describes various citizen science contributions made up by log books, personal journals, local records, and other observational work. While reframing history, citizen science maintains a collective approach that must consider how smaller, local narratives are woven together in a “double narrative” (30) of now and the future. This is evident in Hannibal’s coverage of the collaboration at the Quiroste Valley Cultural Preserve and her description of “extreme citizen science,” in which local communities are consulted as partners in research (111–13). The benefits of this work are evidenced in the exchange of knowledge, which allows experts to contribute their research to local communities and for local communities to contribute their histories and traditions to the experts. The paradigm shift in science begotten from citizen participation is evident in Hannibal’s discussion with some specialists. Hannibal quotes Melissa Miner, a University of California, Santa Cruz, research specialist in discussion of the Pacific Rocky Intertidal Monitoring Program and comments on the difficulty in straddling the expertise barrier: ““We wanted to add some aspect of citizen science to what we do, because there’s huge interest in it. Some of our funders have been calling for it for a long time. But a lot of what we do requires expertise.’ It’s hard to tell one species of sea anemone from another and forget it when it comes to sea worms” (22). As previously mentioned, this contention of expertise in the practice of science has been increasingly important to consider, and these internalist narratives of citizen science can inform us as to how scientific inquiry is being negotiated.

All four of these books demonstrate that citizen science remains a broad concept describing a variety of ways in which research is executed and conceived throughout affected and interested communities, while exploring the societal, cultural, and political effects and challenges that lay ahead for citizen scientists. Each book takes on something of an advocacy position for citizen science, extolling the virtues of such efforts, and indeed they are commendable efforts. What would be especially interesting to delve further into, however, would be some of the more significant challenges that citizen-science projects might address or, indeed, might even illustrate. It is not difficult to see that many citizen-science projects may emerge in conditions where state entities or bureaucracies have inappropriate responses to crisis. In Cooper’s book, she discusses early research interventions in addressing the HIV/AIDs crisis, and since then numerous grassroots citizen-science efforts have addressed environmental crises and ongoing pollution, and the aftermaths of techoscientific disaster. While citizen science offers hope, indeed, the broader trends to which these grassroots efforts respond underscore something more worrying. In current configurations of technoscientific rationality, politically charged environmental policies, and reconfigurations of the public sphere, citizen science’s popularity may in part be a response to large systemic failures. Although citizen science offers a way to meet these failures in an effort to redress their particular problems, perhaps a more critical view would ask how citizen science might be configured to encourage broader changes in a more offensive rather than defensive approach.

One way we might understand the potential of citizen science is in its reconfiguration of expertise. Distributing and assessing expertise for the execution of efficient research, and the distribution and delegation of tasks for maximal outputs, is certainly one framework for approaching this question, and those working in citizen science have begun to explore these questions. But perhaps of more promise is how the emergence of citizen science may challenge simplistic divisions of experts and

nonexperts. Certainly third-wave science studies have some insights into the complicated nature of expertise, and certainly those insights can help us understand how citizen science may or may not serve important roles in reconfiguring domains of expertise. It is clear, however, by some of the projects described that the question of expertise is rich in citizen science.

The integration of technological advances and big data approaches to citizen science are also growing areas of interest in citizen science that promise new discussions in our pursuits of knowledge in communities. Indeed, reconfiguring expertise to allow citizen scientists to more fully participate in research is perhaps among the most promising and hopeful visions for citizen science. Communities might ask questions—questions asked in a way that address their concerns—build in local knowledges, and allow for more integrated research models. However, there are also numerous challenges for data and data approaches in citizen science, including requiring human and material resources to conduct studies, management and sustainable data practices, and of course data security, particularly where sensitive data might be concerned, as well as legal issues concerning what kind of data might be collected even on public land and how collections of human and animal data are to be managed.

With all of these questions left largely unanswered, there is certainly a need for the growing literature committed to citizen science.

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