

Lessons from a Transformative Conservation Educator and Building the Future of Conservation Education

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Lessons from a Transformative Conservation Educator and Building the Future of Conservation Education

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INTRODUCTION

Biodiversity conservation, as a discipline and a practice, is undergoing a major transformation, as it faces both intensifying trends and drivers of biodiversity loss (IPBES 2019) and its links to colonization, social injustices, and institutional racism (Tauli-Corpuz 2020; Cronin et al. 2021). Efforts are underway to promote deeper engagement with the full complexity of social-ecological systems by integrating social science (e.g., Bennett et al. 2017) and Indigenous perspectives and values (e.g., Price et al. 2021), among other perspectives and sources of knowledge. How can conservation education keep pace with this transformation? Here, we reflect on what we, as conservation researchers and practitioners, have learned and share our views on directions for the future.

The authors of this editorial all share something in common: we were all deeply influenced by our collaborations with the late Dr. Eleanor J. Sterling (1960–2023), a trail-blazing conservationist and innovative scientist of global influence. Eleanor guided and grew the conservation programs of the American Museum of Natural History's (AMNH) Center for Biodiversity and Conservation (CBC) for more than 20 years (Betley et al. 2023a; Blair et al. 2023) and multiple other higher education institutions, including Columbia University, the University of Hawai'i, Bard College, and Princeton University. Our collaborations with Eleanor were wide-ranging and included research on participatory and biocultural approaches to conservation (for example, see Sterling et al. 2017a, Sterling et al. 2017b), equitable and sustainable food systems education (Sterling et al. 2021), wildlife use (Rivera et al. 2021), ecology and conservation of sea turtles (Sterling et al. 2013), remote sensing and conservation (Horning et al. 2010), primate taxonomy, behavior, and conservation (Blair et al. 2023b), diversity and inclusion in conservation (Foster et al. 2014; Maas et al. 2020), student learning (Bravo et al. 2016a; Sterling et al. 2016; Porzecanski et al. 2021), and capacity development (Bravo et al. 2016b; Sterling et al. 2022; Porzecanski et al. 2022).

In particular, Eleanor's practice in conservation education profoundly shaped our views and approaches. Through multiple projects and activities, she articulated, implemented, and galvanized pathways for responsive, place- and needs-based conservation education and capacity building across scales from individuals to collectives. We see this editorial as a way to honor Eleanor and her work in education, reflect on its impact, and, as we look ahead, share our views on how the needs of conservation education are evolving.

RESPONSIVE CONSERVATION EDUCATION

How can education, in its diversity of approaches and levels, be responsive to the complex context in which it operates? How can conservation education respond to the multiple dimensions of the learners we engage with, who bring diverse personal histories, perspectives, passions, and values

to the learning experience? We discuss a few examples below to illustrate how Eleanor's approach worked in practice and distill the lessons we draw from them.

Strengthening curricula and teaching practice

Through many engagements around the world with conservation projects and educators in the 1980s and 1990s, Eleanor observed a startling lack of access to teaching materials and teaching know-how, particularly in the Global South. In a pre-digital world, both cost and logistical hurdles made accessing training materials very difficult. Once, in a Malagasy forest, Eleanor observed a teacher incorrectly telling her students that the boa they were observing was a mammal because it gave birth to live offspring rather than laying eggs. She later uncovered that the only preparation materials the teacher had access to were handwritten notes of university lectures handed down across generations of students. Many of these notes were sparse and focused on European biodiversity rather than Malagasy ecosystems or species. Informed by experiences like these, Eleanor joined forces with several colleagues to launch NCEP, the Network of Conservation Educators and Practitioners. For almost 25 years, NCEP has been a creative, responsive, needs-based model for co-creating open conservation education curricular materials that are relevant and designed to fit the context where they will be used (for an overview published in this journal, see Landrigan 2019).

With support from the National Science Foundation and the MacArthur Foundation, this work grew and ultimately broadened relevant content (what is being taught), promoted effective pedagogy and learning (how it is being taught and learned), and inclusive learning spaces (who is learning). More recently, this work has come to encompass efforts to develop students' capacities in systems thinking¹ and engage communities of educators in teaching innovations, as described below.

Connecting teaching, training, and conservation practice

Through innovative partnerships and convenings, Eleanor helped to inspire a revolution in NASA's earth science research and other remote sensing-based research efforts that broadened the use of satellites towards measurements of biodiversity (Turner et al. 2003; Horning et al. 2010). She expertly facilitated a collaboration among staff from the AMNH Library and NASA-trained scientists to apply state-of-the-art Remote Sensing and Geographic Information System (RS/GIS) tools and techniques to training materials, workshops, and effective visual tools that aid in conservation planning and decision-making. In the 2000s, Eleanor led efforts to advance the capacity of biodiversity conservation practitioners, researchers, and professionals in Southeast Asia in these techniques, with a focus on Vietnam and Laos. In addition to increasing access to the data needed by managers, planners, community members, and decision-makers on the ground, her efforts trained a large cohort of skilled and passionate researchers and practitioners in Southeast Asia, forming a vibrant network. This network is active to this day and has led to impactful work, updated conservation management plans and policies, and new collaborations and partnerships in the region related to transboundary conservation (Blair et al. 2022) and wildlife trade management (Blair et al. 2017).

Her work on biodiversity informatics also generated a course, GIS and Remote Sensing for Conservation and Evolutionary Biology, taught at the Richard Gilder Graduate School at AMNH. A favorite among students, the course features a hands-on inquiry-based approach that consistently contributes to students' dissertation chapters and peer-reviewed publications (e.g., Ingala et al. 2019;

¹An introduction to systems thinking and other materials from these courses were published in NCEP's Lessons in Conservation issue on systems thinking; see Betley et al. 2021.

Musher et al. 2020; Provost et al. 2021).

Yet another example of how Eleanor strengthened curricula as well as teaching and learning was through her own teaching practice—primarily at Columbia University’s Department of Ecology, Evolution, and Environmental Biology, where she was Director of Graduate Studies (2002–2012) and an Adjunct Professor (2017–2021). At Columbia, she and Joshua Ginsberg co-taught the two-term core course Conservation Biology for 13 years. With Eleanor always being an agent of change, the course quickly evolved a participatory learning approach that emphasized the role of student-led learning and collaborative work processes. In both terms, groups of four or five students chose a specific geography, and then studied the biodiversity, ecological challenges, social issues, and Indigenous rights, and finally worked to develop a conservation plan for the region. In the early years of the course, some students (and occasionally, faculty) pushed back on the collaborative nature of the experience, asking, “how can individual contributions to a group project be evaluated fairly?” With grace, Eleanor let the students figure out solutions to this challenge, and in the early 2010s, as the approach became more common, the emphasis on student-led learning was amplified by asking individuals and groups to pose questions to be examined in the readings and lead class discussion.

Fostering a holistic lens on conservation learning

Over the course of a decade of co-teaching with Paige West, Sharon Akabas, and Erin Betley, additional courses challenged students to think broadly and deeply, and evolved in how they incorporated systems thinking approaches and collaborative learning techniques. One of the subjects that most fascinated Eleanor was food, both as a bridge between culture and biodiversity, and for its ability to connect people to biodiversity in a very personal way. When Eleanor co-curated an AMNH exhibition on the topic of food, she found a way to feature Jane Austen’s favorite frozen dessert—ice cream—to which she was also devoted. Building on research for that exhibition Eleanor co-developed, with West, two transdisciplinary courses, Food, Ecology and Globalization and Cultural, Biological, and Linguistic Diversity. These graduate-level courses were unique in how they brought together bodies of literature from the social and natural sciences. Undergraduate and graduate students with a range of interests, from ecology to music to law to journalism, found common ground while sampling and discussing the influence of local environment on the finest cheeses from around the world or working together to assess and reflect on what sustainability means in a globalized food system. While rigorous and challenging for the students, PW recalls these as “magically fun to teach” and “deeply transformative” for both her and Eleanor’s approaches to conservation work.

Working with Akabas and Betley, Eleanor redesigned the food course as part of an expanded series of three new undergraduate food systems courses at Columbia University. The courses emphasized the relationship of our food system to our environment and were taken by a wide range of students, many of whom had little or no experience with ecology or environmental biology. Common to all of the courses was a focus on systems thinking, the inequities of access to healthy food, and the value of allowing students to approach “wicked” problems collaboratively.

Recognizing a pedagogical gap in support for sustainable food systems educators, Eleanor and collaborators group launched a Community of Practice of 26 colleges and universities across the U.S. and Canada centered around turning thought into action, particularly with regard to racial equity and food justice (Valley et al. 2020; Sterling et al. 2021). The Community of Practice has brought educators and students together to explore how food builds and sustains both human connections and connections with the natural world. This initiative illustrates Eleanor’s intangible quality of being the center of gravity that held together and inspired growth in disparate groups of people.

Mentoring

Among her many accomplishments, perhaps Eleanor's most significant contribution was her devoted mentorship of others. Eleanor directly mentored some 80 students, including 37 Ph.D. and 22 Masters candidates. She also supported the careers of many other students and early-career professionals at AMNH through the CBC and the Richard Gilder Graduate School and at Columbia. Many students sought out her guidance because they were doing "radical" work, which was either interdisciplinary or weaving together knowledge systems, and they required mentorship that was not available in their programs. The lives of dozens of conservationists from around the world—from Brooklyn to Bolivia to Solomon Islands to Uruguay—have been profoundly changed by Eleanor. The best way to understand the impact of this mentoring is through the words of her past mentees who are co-authors of this editorial.

Christian Rivera recalls the robust and vibrant education and mentoring network he became part of once he met Eleanor. "I found myself an active part of it in unprecedented ways. I was a freshman when Eleanor gave me an opportunity to enroll in the Con Bio upper-level course she taught as a visiting professor at Princeton University in Spring 2011, and the exposure to biocultural diversity and conservation in the course changed my career trajectory. During my undergraduate studies, I did not have much opportunity to explore the linkages between biological and cultural diversity and often struggled when having to choose natural science courses over social science ones. Fast forward five years later to 2016, and I was now a master's student at Columbia, co-advised and mentored by Eleanor, Mary Blair (who was herself a former student of Eleanor's), and Suzanne Macey. Eleanor gave me the space and encouragement to engage in interdisciplinary conservation projects that allowed me to bridge together my passions. Her transformative applications of systems thinking and biocultural approaches to conservation were a common thread among our discussions and interactions in and outside of the classroom, and those conversations continue now in my day-to-day life. I am proud and privileged to now have returned to Princeton and help build on Eleanor's legacy of teaching and mentoring undergraduate students in interdisciplinary and systems approaches to conservation."

Alex Moore recalls how four months into their position as a postdoctoral fellow in the CBC, Eleanor extended an unexpected invitation to join her for a New York Philharmonic Orchestra concert. "I remember hesitating initially, still unsure of my place at the Museum and even more unsure of what boundaries I should establish between myself and my colleagues/supervisors. But I love the orchestra, and so I said yes. Even now, several years later, that night stands out as a core memory and an undeniable highlight, not just because of the beautiful performance but also because that night Eleanor showed me what good mentorship actually looks like: seeing me as a full person (not simply a mentee or employee) and finding ways to enrich my life. This was a pattern she continued to exhibit throughout our working relationship, providing opportunities for me to develop critical skills while also caring for my needs, modeling mentorship in a way that I had never experienced before and haven't experienced since. Now, as a new faculty member, I am driven to connect with my students and mentees beyond their academic interests because I understand firsthand how transformative it is to be seen. While I may never be able to replicate for others all of the ways that Eleanor enriched my life, every effort I make—asking my students about their weekends, checking in about challenging family matters—adds to the foundation of care and support that she built for me."

Paige West recalls how often, over the course of the twenty years that they were colleagues at Columbia University, Eleanor picked up students who had been treated poorly by other faculty and enveloped them with her support and love. "Eleanor collected mentee-orphans: people who could no longer bear the inattention or the abuse or the inability of a person in power to see them. Often, I

knew the person who had previously advised them, so there was no need to speak about the faculty member, but never, not once in all those years, did she center the failed mentor in our conversations; it was always about the student and their potential. This practice of taking on students who needed help and who needed kind mentorship, even when their interests are wildly different from my own, is something that Eleanor taught me, and I suspect many others.”

Finally, Eleanor’s leadership of the Society for Conservation Biology Education committee led her to champion the creation of the Diversity, Equity, and Inclusion Committee to address the ways in which conservation itself was failing to embrace and support the full membership of the Society. In all these endeavors, Eleanor was always at the forefront, leading necessary change in conservation education and practice.

EVOLVING CHALLENGES IN CONSERVATION EDUCATION

Eleanor’s responsiveness, reciprocity, innovation, and horizon scanning continue to inspire us. As we look ahead, here are some of the areas and issues that, in our view, will—or should—become central concerns of conservation education.

The (still very real) challenges of integrating across natural and social sciences

In recent years, multiple frameworks have been proposed to guide the development of interdisciplinary conservation research (e.g., Pooley et al. 2014; Bennett et al. 2017). Significant challenges persist, however, in not only building interdisciplinary capacity for integrative approaches to conservation (e.g., Blair et al. 2017; Sterling et al. 2017b) but also in accessing and designing interdisciplinary courses. In the same way that setting up multi- and interdisciplinary research projects requires thoughtful planning and reflection, from recruitment of team members to developing a shared language (Pooley et al. 2014), so too must course development in conservation. Existing interdisciplinary frameworks can be used to guide syllabus development; this was recently done, for example, by building on the social-ecological systems framework of Blair et al. (2017) to analyze wildlife trade issues and develop a course that emphasizes the development of skills in systems thinking and synthesizing across natural and social sciences in the context of the wildlife trade (CJR, Princeton University, Fall 2023). Challenges associated with proposing such courses will vary across institutions and departments and may include 1) a perceived lack of disciplinary focus, 2) challenges to the “technical” and scientific credibility of the course given its equal emphasis on the social sciences, and 3) disparities in personal, departmental, and institutional interpretations of the goals of conservation science and related pedagogical approaches (e.g., the role of human cultural diversity in definitions of “biodiversity”). Perhaps we may begin to overcome the aforementioned challenges by emphasizing and advocating for the importance of developing skills in (social-ecological) systems thinking (Gray et al. 2019) and the implications for transformative innovation in the environmental and conservation arenas in the academy and beyond.

Embracing the “decolonial turn”—and putting it into practice

Contemporary conservation is in the midst of what we might call a “decolonial turn”: a moment during which the field is looking back at its history and practices, and thinking about its role in dispossessions of many kinds. This effort should be celebrated. However, some of this disciplinary moment of transformation looks and feels like performance and not transformation because it is about discourse and optics, instead of practice, so examples of how to put this into practice as part of our scholarship and education are especially valuable.

Eleanor served as an early decolonial voice in conservation practice and education. PW believes that this stance went back to her time in Madagascar with the United States Peace Corps in the mid-1990s. She recalls: “Over the years, as we taught together and read conservation histories and critiques, an approach we came to think of as ‘radical listening’ came about. We noticed how rare it was for outsiders to really hear what people living with biodiversity were expressing in terms of their deep knowledge of socio-ecological assemblages and their careful attention to biocultural changes.” By teaching these practices to her students, and to the scholars and practitioners reading her work (e.g., Pretty et al. 2009; Sterling et al. 2020; Sterling et al. 2022), her work was transformative in how it forced conservation to attend to Indigenous approaches to ecological futures. This attention to what Indigenous community members and community members living in richly biodiverse areas know, see, and feel can serve as the basis for learning how to work with communities and the conservation of their social-ecological places.

For many conservation researchers and practitioners, a way to put this into practice has been through a shift toward biocultural conservation, which acknowledges the reciprocal relationships among human and ecological communities, and emphasizes the myriad positive roles human cultures have played in supporting and managing biodiversity (e.g., Sterling et al. 2017b; Díaz et al. 2019). By adopting a biocultural lens to conservation, we are able to center the social-ecological contexts of species and ecosystem management explicitly and to attune our attention to local needs and values, in addition to their wider connections (Pretty et al. 2009).

Additionally, conservationists have begun to more fully recognize that the same systems that have led to the degradation and loss of biodiversity have been responsible for widespread marginalization, oppression, and loss of cultural diversity. When these connections are recognized, it becomes clear that conservation education must acknowledge and address the ways social justice issues are entwined with conservation ones (Cronin et al. 2021; Schell et al. 2020), and include environmental justice as a goal. This has been the focus of several professional development programs from high school through early career stages. For example, the Doris Duke Conservation Scholars Programs have supported undergraduates holding a wide range of identities across the USA in exploring the intersections of conservation and environmental justice. DDCSP students learn to analyze the historical and present-day cultural contexts of conservation practice and envision changes that better connect across communities to forward more effective conservation projects.

These approaches demand not only greater attention to Indigenous and local management approaches as part of curricular design (e.g., Kainer et al. 2019), but also to the capacities of academics and local actors to embrace multiple worldviews, and co-design and co-produce conservation research and actions, especially with communities most intimately related to their local biodiversity to maintain and enhance the resilience of their homelands and waters (e.g., Aini et al. 2023). A recent review of biocultural efforts in higher education (Saavedra 2023) has illuminated the need for closer ties between academic and Indigenous knowledge holders, with implications for curricula, faculty, and students, and the role that academia can play in linking traditional and local knowledge to policy and governance.

Making space for the affective domain

Engaging with the content from our discipline is as much an emotional experience as an intellectual one. For many learners, this is causing feelings of anxiety and grief, across generations and particularly in youth. The challenges and value of engaging the affective or emotional aspects of learning have been actively discussed in other fields, such as queer and feminist studies (e.g.,

Fawaz 2016). In conservation and environmental science, there is a growing awareness that we have emphasized the cognitive and behavioral domains of learning and neglected the affective domain.

Traditional taxonomies of learning (e.g., Bloom 1956) have guided our teaching and the levels of learning we target, from the ability to know and apply to the ability to analyze, synthesize, and evaluate. These taxonomies are being extended beyond their original emphasis and scope, in ways that could foster the kind of reflexivity, humility, intercultural literacy, and stamina needed to engage with wicked problems, and decolonizing and biocultural approaches. For example, Bloom's taxonomy has been extended to encompass "create" (Anderson and Krathwohl 2001). And Fink's Taxonomy of Significant Learning (Fink 2013) considers six dimensions of learning that combine to produce significant learning, including the more familiar dimensions of foundational knowledge, application, and integration, but now also including learning how to learn, learning about oneself and others, and developing new feelings and values ("caring").

Shifting our learning objectives to encompass, and center, the affective dimensions of conservation learning and practice will be important to build and maintain psychological resilience and develop agency in the face of climate change and biodiversity loss. The implications for conservation classrooms could be profound. Eleanor and collaborators demonstrated such transformations in the case of food systems education (Sterling et al. 2021). As scholarship and guidance for conservation educators begin to emerge (e.g., Atkinson and Ray 2021), it feels critical to create the spaces to explore and revise our curricula, syllabi, and teaching approaches, skills, and decisions and priorities accordingly. Communities of practice and interdisciplinary collaborative teaching, especially with experts in psychology and education seem promising avenues to explore.

Measuring what matters

Conservation is striving to become more rigorous, evidence-based, and evidence-informed, through more robust monitoring, evaluation, and learning (e.g., Baylis et al. 2016; Knight et al. 2019). Eleanor modeled a fierce commitment to the idea that "not everything important is measurable, and not everything measurable is important" (quote by Elliot Eisner). At the same time, recognizing that what is measured is what gets attention, her research pursued and illuminated new ways to measure what was previously considered unmeasurable—from students' systems thinking (Gray et al. 2019) to cultural ecosystem services (Sterling et al. 2017b; 2022).

This focus on efficacy has also taken place in education, and especially STEM education, as we aim to shift to evidence-based pedagogy and bring about diverse and significant learning outcomes (Freeman et al. 2014). Eleanor's co-instructors recall her attention to developing metrics and including evaluation, reflection, and improvement into every course. This commitment was manifest in her teaching in many ways, from rubrics that in lieu of grades assessed students from a scale of emerging to developing to mastering; to the use of peer review of both individual and group work; to student journals that elicited students' reflections on what and how learning occurred and how newly acquired knowledge or learning altered existing knowledge. Conservation education should embrace the power that is generated by a co-developed learning and assessment agenda; one that is co-developed and co-owned by teachers and learners. This has the potential to not only foster learning that flows both ways, but also to model the kind of co-production we aim to center in conservation practice.

CONCLUSION

Conservation education has evolved and must continue to evolve. Those of us who learned from Eleanor Sterling have been fortunate to see a truly interdisciplinary mind at work, asking exciting

new questions. We have seen what it looks like when one strives to see beyond the horizon, to face upcoming challenges and opportunities of all kinds, for research, for partnerships, for teaching and learning. We have a model for what it looks like to do leading work and lead the field forward. We hope this editorial provides inspiration for others to do so as well, as we question, diversify, and broaden conservation thinking, learning, and practice.

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