

CONTRIBUTION

A Century of Learning: The Story of ESA's Education Committee, 1918–2025

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Abstract

The Education Committee and its precursors have been highly influential within the Ecological Society of America. Here we document the Education Committee's history, from its origins in reviewing curricular materials through major contributions to ecological literacy, teaching innovation, diversity initiatives, and professional development, and we highlight upcoming challenges. Early activities included preparing periodic education and employment profiles of ecologists, reporting on the status of graduate ecology education, and making recommendations regarding career-ready training for ecologists. In the 1980s, committee duties expanded to creating learning materials for pre-college and undergraduate students, evaluating the portrayal of ecological concepts in existing pedagogic materials, and developing a working definition of ecological literacy. In the 1990s, accomplishments included the production of an ecology lab manual, organizing an education-themed annual meeting, promoting schoolyard ecology for elementary students, and infusing active learning into ecology education. From

1998 to 2021, the Education Committee addressed diversity-related issues as the Education and Human Resources Committee, a title later changed to the Committee for Diversity and Education. Important work included collaboration on the highly influential *Women and Minorities in Ecology I* report that led to the establishment of an Education Office with a Director, supporting ESA's diverse undergraduate mentoring program, and with its chair as Vice President for Education and Human Resources, supporting the combined Office of Education and Diversity Programs. Within the past decade, significant contributions have included developing a curricular framework for ecological literacy and increased emphasis on career-focused professional development. Recent ESA governance changes eliminated the VP position from the ESA Governing Board while enhancing communication within the ESA Council's sections and chapters that promote coordinated addressing of ecology education concerns. Much work remains, but we believe the Committee is positioned to address existing and looming challenges relating to ecology education.

Key words: Committee for Diversity and Education; ecology education; Education and Human Resources Committee; Education Committee; Four Dimensional Ecology Education; Strategies for Ecology Education Development and Sustainability; history; Teaching Issues and Experiments in Ecology.

Introduction

To understand how ecological literacy has developed in the United States, one must look at the educational structures that supported it. One of the most important is the Ecological Society of America's Education Committee. In this brief historical reflection, we illustrate not only how the committee grew and evolved, but also how these reflect our collective understanding about ecology education and its role in our professional society.

During the last five decades, the Ecological Society of America's Education Committee, in a variety of forms, has been a primary driver of education initiatives within ESA. It has served as a crucial think-tank for dozens of initiatives, including those relating to ecology curriculum development; preparation of students for diverse careers in academia, government, and the private sector; and important field experience access initiatives targeting marginalized student groups. The Committee has partnered well with ESA's Office for Education and Diversity Programs (OEDP - which the committee helped to create), the ESA Education Section, and the ESA Public Affairs Office. Led by a series of highly competent, enthusiastic, and visionary Vice Presidents for Education and Human Resources, the Education Committee has become increasingly inclusive, incorporating the views of a diverse array of ecologists. The Committee has served as a great incubator for countless organized oral and poster sessions, symposia, workshops, special sessions, and Water-Cooler Chats during and outside of annual meetings. It spawned numerous education-related published papers, including those associated with the Ecoliteracy and Exploring Ecological Careers series published in *Frontiers in Ecology and the Environment*, as well as those published in the *Teaching Issues and Experiments in Ecology* (TIEE) online journal. Even during challenging times, such as the COVID-19 pandemic of the early 2020s, the Education Committee helped to keep the wheels of ecology education moving. The Ecology Committee's transformation of ESA greatly advanced ecological literacy as a vibrant and growing research field within the larger enterprises of environmental and science education.

The early years (1918–1970s): A scientific society grapples with its role in ecological education

The idea of an official Education Committee within the Ecological Society of America (ESA) can be traced back almost to the origins of ESA itself. As early as 1918, 3 years after the Society's founding, ESA's Committee on Fish and Fisheries formed a subcommittee devoted to educating the public on several aspects of the fishing industry (Pearse 1918). In the 1920s to 1940s, ESA's education efforts mostly involved publishing reviews of textbooks and other books of ecological interest (in *Ecology* until 2019, and in the *Bulletin of the Ecological Society of America* thereafter). During the 1950s, ESA sponsored various education-related initiatives, including a collection of laboratory and field studies for introductory and specialized courses in biology (Hanson 1956) and the development of a report, *Improving College Biology Teaching* (Hanson 1958).

In the 1960s, a decade of societal change, the ESA leadership gave more attention to education. In 1960, the ESA Council (ESA's governing body at that time) sponsored an ad hoc Education Committee chaired by Charles E. Olmsted, a plant ecologist from the University of Chicago, and then Frank Golley at the University of Georgia. Under their leadership, the committee reviewed high school biology manuals published by the Biological Science Curriculum Study (BSCS) program, developed a preliminary brochure, *Careers in Ecology*, directed to high school teachers and students, and reviewed BSCS textbooks and teaching materials (Olmsted 1962, Golley 1963). Interestingly, in his report of the committee's activities, Olmsted (1962) reported that:

...The experiences of the year have convinced the writer that there is a need for an active Committee on Education in the Ecological Society, and he recommends that provision for continuance of such activities be made by the Council.

Unfortunately, that call did not have the desired effect, and that first attempt at an Education Committee disbanded shortly thereafter. In 1967, the ESA made a second attempt at creating a three-member Education Committee, this time chaired by George L. Clarke, a marine biologist and professor at Harvard University. In their annual committee report (Kormondy 1976), the authors bemoaned the Society's relative inactivity regarding education, stating:

...The conclusions reached by our representative included the following: the educational activities of ESA are meager compared with other biological societies and should be expanded in ways suitable for schools and colleges and for the general public; the Society should sponsor institutes, conferences, refresher courses, and public lectures on the modern concepts of ecology; and it should promote the education of the public and of governmental agencies on the application of ecological principles to public affairs.

In the 2 years that followed, the Education Committee was expanded to five members, and chaired by Ralph Buchsbaum, an invertebrate ecologist then based at the University of Pittsburgh (Buchsbaum, et al. 1969). After producing a brochure that surveyed careers in ecology, the committee disbanded.

In August 1969, ESA launched its third attempt at an Education Committee, this time authorized as a special committee (Auerbach 1970). The following year, the ESA Council approved \$1,000 to support the development of a Foundation for Education in Ecology, a non-profit corporation

incorporated in October 1970 (Niering 1971a). Those funds were intended to support programs, including “public T.V., interdisciplinary summer fellowships and short courses involving city and state government officials” (Niering 1971b). Despite this, formalized education-related activity appeared to be minimal for the next several years. ESA treasurer reports in 1971–1974 showed a budget line for the Education Committee of \$200 per year. However, in his 1972 report, ESA Treasurer Shelby Gerking commented on the inactivity of that group (Gerking 1973). In fact, during that time period, the Physiological Ecology and Animal Behavior & Sociobiology Sections had their own education committees (Folk 1973, Jessop 1973). Also, in June 1973, the ESA Council voted to “terminate the Foundation for Ecological Education [*sic*]” (McCormick 1973), with no further explanation given.

In 1976, ESA President Frank Golley received approval to constitute a Special Committee on Education (Kormondy 1976) - representing ESA’s fourth attempt at creating such a group. With J. Frank McCormick (a plant ecologist at the University of Tennessee-Knoxville) and Gary Barrett (a landscape ecologist then at Miami University) serving as Committee Chairs, the committee: (1) surveyed degree programs in ecology, specifically focusing on employment needs vs. the supply of students and (2) produced a brochure describing careers in ecology (Kormondy 1977, 1978). By 1979, the committee had completed a survey of graduate students and employment in ecology, mainly in the United States (Risser 1979), published the findings in both *Bioscience* (McCormick and Barrett 1979) and the *ESA Bulletin* (Brown and McCormick 1981), and prepared the first draft of a guide to graduate education in ecology (as reported by Risser 1979).

The pivotal 1980s: Education becomes central to the mission of ESA

The 1980s set the stage for a significant upsurge in interest in ecology education within ESA, and the fourth-generation Education Committee now played a sustaining and central role. The *ESA Bulletin* continued to provide a publishing forum for discussion of the ecology education advice and validation of the emerging ecology subdiscipline. In 1980, the Education Committee was reclassified as a standing, rather than a special, committee, which meant that it could not be dissolved or changed without amending the ESA’s bylaws. The committee chair was elected by the ESA Council, and other members were appointed by the ESA President, with the chair’s approval. The duties of the committee were to: (1) prepare periodic education and employment profiles of ecologists, (2) prepare periodic reports on graduate education in ecology, (3) make recommendations to the Council regarding needs in higher education for training ecologists, and (4) provide reports on educational matters as requested by the Council (Risser 1980). The Education Committee, led by Eldon Franz of Washington State University, monitored the advancements occurring throughout science education during that time, and discussed ways to engage with those advancements, as well as improve the interaction between ecological and environmental education (Franz 1983). Then, under the leadership of Committee Chair Allen Solomon of the Oak Ridge National Laboratory (Fig. 1), the Education Committee focused in part on establishing closer ties with the American Institute of Biological Sciences (AIBS) and enhancing the preparation of graduate students for a marketplace that offers too few career opportunities (Birk et al. 1984). To help achieve the latter goal, the Committee conducted a comprehensive survey of graduate programs across the U.S. (Solomon 1986).

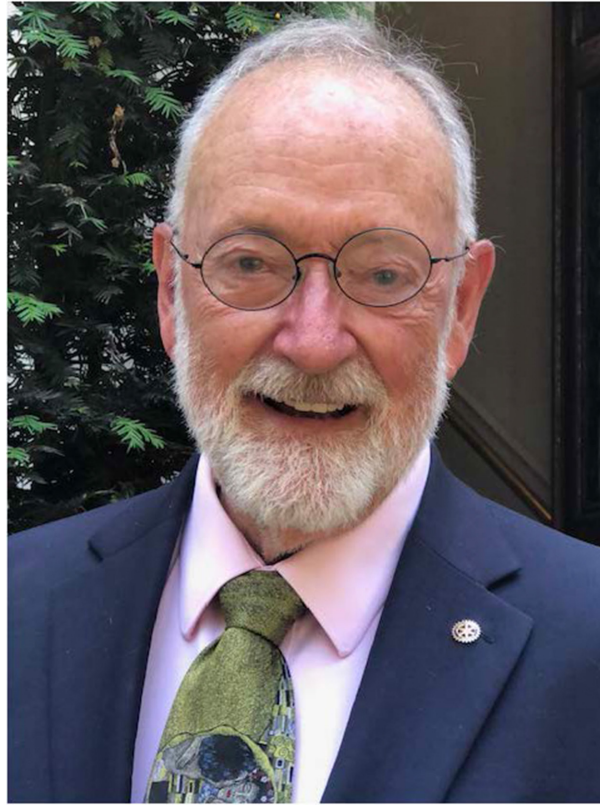


Fig. 1. Allen Solomon. Photo courtesy of Allen Solomon.

The Education Committee's mandate expanded in the late 1980s, thanks in part to outgoing ESA President Paul Risser's influential clarion call for the ESA to address the need to increase ecological literacy in his outgoing presidential address (Risser 1986).

...Thus the challenges for ecological literacy are quite clear. The public is not attuned to scientific issues in general, and perhaps particularly not to ecological issues. There are declining numbers of students, and the quality of students in ecology is unknown but probably not increasing dramatically. At the same time, ecological issues in this country are intensifying, and many overwhelmingly important ecological problems are now correctly recognized as global in nature. Under these circumstances, it is not responsible for this Society to conduct business as usual. It is foolish and short-sighted to continue the same patterns of activity and outlook just because it feels comfortable and looks right. My thesis tonight is that we must direct our efforts toward increasing ecological literacy, particularly in the public and at the undergraduate level. (Risser 1986)

In the months following Risser's address, ESA President Margaret Davis requested that the Committee examine the potential role of ESA in undergraduate education in ecology. After some discussion, the Committee concluded that:

The present ecological ignorance among public school teachers, politicians, and voting citizens requires ecological education of today's undergraduate biology majors who will become the next generation of teachers dealing with ecology in the public schools. (Solomon 1987)

To address that issue, the committee recommended that the following initial corrective actions, should be taken: (1) develop curricula and learning materials for undergraduate biology majors, elementary and secondary students, and even groups like Girl Scouts, 4-H, and conservation organizations, (2) evaluate and certify textbooks and other educational materials to ensure the soundness of the ecological concepts covered, and (3) develop a sound working definition of ecological literacy. The committee recommended that the latter would be accomplished by a series of workshops, sponsored by ESA and funded by outside agencies and relevant businesses, to reach the requisite consensus (Solomon 1987).

In the late 1980s, the Education Committee supported two important initiatives regarding ecology education. First, committee members supported efforts to develop an ESA Education Section (Klemow 1987), which, following its establishment, collaborated closely with the Education Committee for decades to come. Second, the committee helped to launch the Ad Hoc Committee on Ecological Education of Young Children. Chaired by Peter Feinsinger (University of Florida), the Ad Hoc Committee defined ways for ecologists to provide input into local ecological curricula for precollege students, especially those in elementary grades (Feinsinger 1988). Partnering with Karen Hollweg of the North American Association for Environmental Education (NAAEE), Feinsinger subsequently developed the Schoolyard Ecology for Elementary School Teachers (SYEFEST) project. That program, funded by the National Science Foundation and the Environmental Protection Agency, addressed the question: “What kinds of experiences, resources and support do teachers need in order to teach ecology (1) outdoors and (2) using student-centered, inquiry-based methods?” (see Cary Institute (2025) for more information).

The 1990s: A time of growth

The early 1990s were a dynamic time for ESA, with the newly established Public Affairs Office producing a comprehensive report profiling ESA ecologists (Lawrence et al. 1993a, b). The survey data described in detail the demographics and environmental career pathways representation of society members and indicated the great importance of undergraduate and K-12 ecology experiences as the motivations for pursuing careers in ecology. These efforts to understand the factors that helped recruit and retain ESA members in ecology careers led to the convening of a Women and Minorities in Ecology (WAMIE) task force, chaired by Barbara Bentley (Bentley et al. 1993). Several members of the Education Committee participated in developing and disseminating the highly influential ecology education and human resources strategic plan in the 1993 WAMIE I report (Bentley et al. 1993).

Moreover, during the early 1990s, the Education Committee produced a laboratory manual to teach ecology that was geared toward students in upper elementary grades through introductory college courses (Beiswenger et al. 1992). The Committee also helped to organize symposia and other events for the 1991 annual meeting that had “education” as its theme (Beiswenger et al. 1991, 1992). In 1993, the Education Committee underwent a substantial change in membership, and Alan Berkowitz, a plant ecologist and Head of Education at the Cary Institute of Ecosystem Studies (Fig. 2) assumed the role of Chair (Berkowitz 1993). The committee provided valuable input into education-related initiatives undertaken by the American Association for the Advancement of Science, the National Research Council, and the National Science Teachers Association with the goals of: (I) promoting the teaching of ecology through frequent, repeated, hands-on inquiry experiences with organisms as they interact with their environment

in the out-of-doors, (2) assuring that the ecological content reflects current knowledge, and (3) infusing innovative pedagogy into the teaching of ecology (Berkowitz 1994).

In 1995, ESA underwent a change in governance structure to facilitate financial stability and meet membership needs. That change led to the development of an overseeing ESA Governing Board, which included three Vice-Presidents, representing Finance, Science, and Education and Human Resources. The first VP of Education and Human Resources, Alan Berkowitz, was elected for his first of two three-year terms in 1995 (Huntly 1996). His advocacy for addressing ecological literacy and diversity concerns of the ESA membership promoted increased activity by the Education Committee and by ESA Education members. The VPEHR was *ex officio* Chair of the Education and derivative committees (C. Brewer, pers. comm.).

By the mid-1990s, the Education Committee expanded its efforts to include pre-college ecology education and national science education reform (helping to inform education standards for secondary-level students), improving undergraduate teaching (by surveying undergraduate program offerings in ecology), supporting the development of an Office for Education and Diversity Programs within ESA, and confronting a value system that under-recognized ecologists' work in education as opposed to research (Berkowitz 1995). Other initiatives included the development of a position statement arguing for a strong role for ecology in the undergraduate curriculum; identifying key concepts, theories, and skills in ecology; building collaborations with more than a dozen other organizations; and developing the first stage of a field ecology education enhancement project called



Fig. 2. Alan Berkowitz. Photo courtesy of Alan Berkowitz.

Strategies for Ecology Education, Development and Sustainability (SEEDS) to increase participation of under-represented groups in ecology by providing access to field experiences (Berkowitz 1997, 1998, Huntly 1997).

In 1998, the Education Committee merged with the recently renamed Gender and Minorities Affairs Committee to become the Education and Human Resources Committee (EHRC) (Berkowitz 1999) with expansion to include human diversity, equity, and inclusion, in addition to education. EHRC's objectives in the late 1990s included: continuing efforts to improve undergraduate ecology education through workshops, webpages, and review of undergraduate curricula; transferring ecological understanding (knowledge, information, skills) to the general public through various outreach approaches; supporting, recognizing, and rewarding ecologists' work in education-related efforts, including an ESA award in education that would result in the creation of the Odum Award - thanks to the efforts of Eugene Odum and ESA President Diana Wall (Graumlich 2001); supporting efforts to improve the training that K-12 teachers receive in ecology; defining and promoting scholarship in ecology education; and establishing an ESA office and staff focused on education and diversity issues (Berkowitz 2000).

A new millennium: Expanding to online teaching and learning

By 2000, several EHRC members, inspired by discussions and initiatives within the committee, began to work independently to enhance undergraduate ecology education. Through those efforts, they continued to expand ESA's education initiatives. Bruce Grant, (a herpetologist at Widener University) and Charlene D'Avanzo (an estuarine ecologist at Hampshire College) received funding from the National Science Foundation to develop a web-based, peer-reviewed, interactive resource to support undergraduate teaching, a resource that would come to be known as *Teaching Issues and Experiments in Ecology* (TIEE) (Berkowitz 2001). At the turn of the millennium, other EHRC-inspired education initiatives included active learning, innovative teaching, and alternative assessment in science courses by Diane Ebert-May (Michigan State University), Carol Brewer (University of Montana), and Charlene D'Avanzo; *Environmental Inquiry: Learning Science as Science is Practiced* by Michael J. Mappin (University of Calgary) and Marianne Krasny (Cornell University); *Encouraging Student Biological Research* by Michael J. Mappin; and *Faculty Institutes for Reforming Science Teaching Through Field Stations* (FIRST) by Diane Ebert-May and Jan Hodder (University of Oregon). Members of EHRC also explored the status of ecology in the undergraduate curriculum, environmental justice and education, public perceptions of ecology, publishing in ecology education, support for the creation of a Student Section within ESA, and enhanced professional development for ESA members (Berkowitz 2001). EHRC provided input for the ESA's contribution to the development of the American Association for the Advancement of Science's (AAAS) BioScience Education Network (BEN). That project was funded by NSF to create a digital library for undergraduate educators in the Biological Sciences. ESA's role in the BEN project was led by Jason Taylor, Director of Education at ESA.

The establishment of an ESA office and staff focused on education and diversity issues proved to be pivotal to the success of education-related initiatives within the Ecological Society of America. The individuals that led the education office have been an incredible asset to ecology education and to the broader fields of discipline-based education that they've collaborated with (including



Fig. 3. Carol Brewer. Photo courtesy of Carol Brewer.

the Botanical Society, American Association for the Advancement of Science, National Earth Observatory Network, and many others). (A. Berkowitz, personal reflection)

In 2000, Carol Brewer, a plant ecologist and biology educator at the University of Montana (Fig. 3), became Vice President for Education and Human Resources and Chair of EHRC, succeeding Alan Berkowitz's leadership of the group. During her tenure, the committee continued to support the efforts of SEEDS, TIEE, and FIRST, as well as a plan to develop leaders in ecological education within the membership of the ESA. In particular, SEEDS transitioned from the Cary Institute of Ecosystem Studies (under Alan Berkowitz's direction) to the ESA, enabling the evolution of the program that exists today (Brewer 2003).

Education-related activity at the ESA annual meetings increased dramatically during the early 2000s, shifting from hosting a few education sessions to having nearly two full days of pre-meeting workshops and events, along with a wide array of sessions during the week of the meeting itself. Also during the 2000–2002 period, EHRC began engaging graduate students and post docs, not only in pedagogy, but also in learning new tools for their research— a trend that continues today (Brewer 2002, 2003; personal communication).

In 2002, EHRC spearheaded a popular initiative called *Profiles of Ecologists* that featured posters of about 25–35 ecologists per year and provided biographical stories about their careers in ecology (Brewer 2003, 2004, 2005, 2006). In 2004, EHRC launched a survey to evaluate the status of ecology in

the undergraduate curriculum, an effort led by Saran Twombly and completed by the end of the following year (Brewer 2004, 2005). In March 2006, EHRC members visited congressional representatives and learned more about the Congressional Fellows program, as well as congressional staff viewpoints on how ESA can better communicate ecological science to Congress (Brewer 2006).

Throughout Carol Brewer's terms as EHRC Chair, the committee worked diligently to diversify ESA along many dimensions, including bringing more women into leadership roles and working to ensure more women were nominated and recognized for their scholarship, leadership, and service to the field of ecology and the ESA. The committee also restarted the WAMIE surveys and endeavored to have them occur at regular intervals so ESA could monitor progress and successes. In 2005, the WAMIE II Committee was formed, and the WAMIE II report was developed to assess the implementation of WAMIE I report recommendations, giving further strategic planning direction to EHRC (Ortega et al. 2006). Under Brewer's leadership, EHRC ensured that ecological education was one of the pillars of national programs, including NEON and Vision and Change, both in the planning and implementation.

One important aspect of my time as VPEHR involved working with Jason Taylor, the Director of ESA's new Education and Diversity Programs Office. He grew the education profile within the ESA and ensured that office would have stability and impact. Jason was fantastic in this role and played a major part in formalizing the portfolio for the office in its early years. My efforts would have been much diminished without his dedication and hard work. (C. Brewer, personal reflection)

Margaret D. Lowman, a tree canopy ecologist at New College (Fig. 4) became the new Vice President for Education and Human Resources and EHRC Chair in 2006. One of her first actions was to implement annual committee retreats in the fall of each year. The first retreat was held at the U.S. Fish and Wildlife Conservation Center in Shepherdstown, WV, while subsequent retreats under Lowman's tenure were at the Burgundy Center in Capon Bridge, WV. During Lowman's first retreat in 2006, inspired by fall foliage and the surrounding rustic forest setting, EHRC created ESA's first-ever strategic plan for education



Fig. 4. Margaret D. Lowman. Photo courtesy of Margaret D. Lowman.

(Lowman 2007). That plan had three objectives: (1) ensure the supply of new ecologists with continued career sessions at the Annual Meeting and other activities, (2) adopt the theme of No Child Left Inside, by challenging all ESA members to engage in some type of community outreach for ecology education, and (3) fund and execute a national Education Summit, to prioritize bringing together diverse stakeholders to achieve goals for sustainability through environmental education (Lowman 2007). Subsequent retreats examined progress toward the items in the strategic plan and discussed other important initiatives under the purview of the committee (Lowman 2008).

In 2007–2008, ESA's SEEDS program twice received national recognition:

In November 2007, ESA received the 2006 Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM) at the White House. The award, the highest of its kind in the United States, is supported and administered by the National Science Foundation (NSF) and includes a \$10,000 grant for continued mentoring work. SEEDS was also recognized by the American Institute of Biological Sciences (AIBS) with its Diversity Leadership Award in May 2008. (Mourad 2008)

Beginning in 2007, Teresa Mourad, the newly hired ESA Director of Education and Diversity Programs, worked with VP Lowman to expand the diversity representation of the EHRC to include representatives of K-12 education, graduate students, people involved in environmental justice, and Hispanic, Native American, and African-American ecologists. Early in 2008, VP Lowman advocated for ESA to take over the publication of TIEE because of NSF support ending in November of that year. To that end, she proffered a resolution to the ESA Governing Board that the Publication Committee form a subcommittee that included educational expertise to conduct a feasibility study (Inouye 2008). EHRC also recommended that ESA archive data such as the results of surveys conducted by ESA committees, e.g., the WAMIE reports (Inouye 2009), and supported the organization of the 2008 annual meeting in Milwaukee around the theme of *Enhancing Ecological Thought by Linking Research and Education*. That meeting featured 64 posters, 13 workshops, 44 talks in 6 Organized Oral Sessions, 54 talks in 7 symposia, and 10 special sessions – far more than any other ESA conference up to that point (Lowman 2008). Still, the ESA Governing Board did not establish a separate journal for ecology education, and this continued to be an issue to advocate for in the development focus of future ESA journals.

The 2010s: Increasing equity and inclusivity

The 2010s proved to be particularly active for EHRC. Accomplishments included: organizing a first-ever annual meeting workshop representing a local partnership with K-12 teachers mentored by ESA members who conducted hands-on ecology education activities; drafting a SEEDS fund-raising plan; developing a process to engage all ESA members in some type of community outreach for ecology education. In addition, EHRC carried out key objectives outlined in its strategic plan of 2006, including: hosting career-related sessions at the annual meeting to ensure the supply of new ecologists; adopting the theme of No Child Left Inside; supporting EcoEd DL - the ESA's digital library for undergraduate education resources; and planning, fund-raising, and executing an Ecology Education Summit in fall 2010. EHRC's ultimate stated goal was to raise ecological literacy both regionally (with every ESA member working locally) as well as nationally (Lowman 2009, 2010, Inouye 2010).

The Summit, *Environmental Literacy for a Sustainable World*, which was held in Washington DC in October 2010, deserves a bit of additional elaboration. Thanks to the combined efforts of EHRC and ESA's Office of Education and Diversity Programs, led by Teresa Mourad, the ESA hosted the Summit in conjunction with partner National Education Association and more than twenty national organizations, including the AAAS, NSF, American Institute of Biological Sciences (AIBS), and the North American Association for Environmental Education (NAAEE). Over 200 people attended. The Summit helped to disseminate best practices, reduce duplication of efforts, and coordinate strategies to build capacity and pathways of support for next-generation green careers. The Summit resulted in a Decadal Plan of activities prioritized by attendees (Lowman 2011).

ESA was a pioneer in creating a Summit that was inclusive of many different scientific organizations, with a priority for inclusivity at all levels -- staff, scientists, students, and actions. As a result of our Summit, we not only re-organized ESA for its commitment to diversity but we also shared best practices for diversity with a multitude of organizations. These were seminal years that gave a first-ever spotlight to the importance of having diversity at the leadership table for conservation decision-making. (M. Lowman, personal reflection)

In November 2011, EHRC's name was changed to the Committee for Diversity and Education (CDE) (Canham 2012, Lowman 2012).

In 2012, Julie Reynolds, a Duke University biology professor who focuses on disciplinary-based education research (Fig. 5), was elected as Vice President for Education and Human Resources and EHRC Chair (Canham 2013). Among the many achievements of her leadership, three particularly significant contributions stand out.

The first was an initiative to increase member donor support for SEEDS and included both quantitative and qualitative assessments of SEEDS. VP Reynolds' advocacy for SEEDS financial



Fig. 5. Julie Reynolds. Photo courtesy of Julie Reynolds.

support to come from the ESA membership created a space for such appeals to continue at various ESA annual meeting events, especially at the ESA Diversity Luncheon. The quantitative assessment provided evidence that SEEDS increases persistence in science, and its report advocated for the role of professional scientific societies in broadening participation in science (Mourad et al. 2018). The qualitative assessment (Ahern-Dodson et al. 2020) explained how SEEDS had been so successful in influencing participants' decisions to study science and pursue science careers, and their resulting integration into ESA.

The second major accomplishment was an effort to identify fundamental concepts in undergraduate ecology education. That effort involved empanelling a task force of CDE members and other ecology education leaders to develop an inventory of concepts that would be endorsed by ESA (Cid et al. 2015). This task force eventually evolved into the 4DEE Subcommittee of the CDE, and subsequently into the Education Committee, as detailed below.

The third major accomplishment was the development of an official diversity statement for ESA, drafted by the committee while gathered around a picnic table during their annual fall retreat adjacent to the Potomac River:

The Ecological Society of America is dedicated to the science and study of ecology. The society welcomes and encourages participation by all individuals regardless of age, culture, ethnicity, gender identity or expression, national origin, physical or mental difference, politics, race, religion, sex, sexual orientation, socio-economic status, or subculture. We strive to cultivate a society built on mentorship, encouragement, tolerance and mutual respect, thereby engendering a welcoming environment for all. Ecologists believe in the need for interdisciplinary study, both in terms of disciplines and participants. We believe in biodiversity both in terms of ecosystems and membership. We will vigorously and proactively reject prejudice and stereotyping wherever it is encountered in our profession. ESA further promotes diversity in all areas of activity, including fostering diversity in membership, leadership, committees, staff, outreach, public engagement, recruitment, and all other areas of societal activity. adopted by ESA Governing Board in November 2014 (Reynolds 2015)

Additional noteworthy initiatives and accomplishments between 2012 and 2015 included: cultivating a diverse committee membership including representatives from the Environmental Justice, Student, and Traditional Ecological Knowledge Sections, as well as leaders in the area of ecology education (Reynolds 2013); preparing a report addressing the support that ESA could provide to “contingent faculty”; advocating for a *Commitment to Human Diversity in Ecology* award; having an Education representative on the Publications Committee; and developing a new *Careers in Ecology* initiative that focused on those seeking careers outside academia. The committee advocated that all ecologists engage in outreach to foster environmental literacy for diverse stakeholders; leverage social media and other emerging communications to better prepare the next generation of ecologists with relevant skill sets; and identify effective strategies to equip ecologists to advance sustainability and effective conservation of resources. The committee discussed the potential for ESA certification, including a teaching certificate for graduate students and a Certified Ecology Educator program for informal science educators, and it reviewed the ESA's Professional Certification program. Thanks to an ESA Long-Term Planning Grant, the CDE supported CDE members Carmen Cid and Ken Klemow in

developing an historical timeline of education and diversity-related milestones in ESA's history in preparation for the Centennial meeting in 2015 (Reynolds 2013, 2015). The ideas fostered by this Education Committee promoted ESA discussion of what was needed to improve ecology education, but several of these ideas did not develop into full ESA education initiatives until later, or else remained unfulfilled. In 2014, members of the CDE analyzed the degree to which women and underrepresented minorities made up the society membership, its leadership, and award recipients (Beck et al. 2014).

Nalini Nadkarni, a tree canopy ecologist at the University of Utah (Fig. 6), became Vice President for Education and Human Resources and CDE Chair in 2015 (Canham 2016). She brought to the position a strong perspective in public outreach and education. Early in her tenure as Chair, she worked with the members of the CDE to develop a Strategic Plan for the Committee. Goals of that plan included: enhancing public awareness of and engagement with ecology; disseminating best practices in ecology to attract a continuing supply of new ecologists; diversifying ESA membership, the population of ecologists, and the range of publics whom we reach; shaping the CDE as a hub to coordinate and amplify impacts of events and initiatives; and measuring and understanding the efficacy and extent of the impacts of CDE activities to create improved programs and best use resources into the future (Nadkarni 2016).

The CDE accomplished much under Nadkarni's leadership, including the development and implementation of activities to better prepare K-12 instructors to teach ecology; the transformation of the inventory of ecological concepts for undergraduates into a Four-Dimensional Ecology Education (4DEE) framework; hosting faculty development workshops and support for other ESA Education and Diversity office initiatives, such as the Life Discovery – Doing Science Biology Education conference (LDC); undertaking steps to enhance career development for students and early career ecologists; and working with ESA sections and chapters to reach diverse populations (Nadkarni 2016, 2017, Gurevitch 2017). During the late 2010s, the CDE was especially active in supporting sessions at the annual meeting that addressed education and diversity issues. In 2017, the CDE discussed the need for an update on the status of women and minorities in ecology (WAMIE), 10 years after WAMIE II, and to include LGBTQ and people with disabilities in a future study (Nadkarni 2018). Unfortunately, while much of this planned



Fig. 6. Nalini Nadkarni. Photo courtesy of Nalini Nadkarni.



Fig. 7. Pam Templer. Photo courtesy of Pam Templer.

work did not occur, other undergraduate education initiatives did continue to expand. CDE members also supported the creation of a series of articles *Exploring Ecological Careers* published in *Frontiers in Ecology and the Environment*, that examined career paths beyond higher education.

As an ecologist who sees deep value in public engagement of ecology both for ecologists and the public groups we engage, it was encouraging to see the growing interest, and even more, the actions that ESA members were taking during my tenure as VP for Education – and beyond. Public engagement training workshops at our annual meetings, organized oral sessions and symposia about ecology outreach, and articles in Frontiers in Ecology and the Environment grew sharply. All of those have contributed to the flourishing of public engagement about ecological topics and approaches in academic and community venues. (N. Nadkarni, personal reflection)

Pamela Templer, a forest ecologist and biogeochemist at Boston University (Fig. 7), succeeded Nalini Nadkari as Vice President for Education and Human Resources and Chair of CDE in 2018. Under her leadership, the committee continued to include diverse ESA member representatives of ESA's Inclusive Ecology, Communications, and Black Ecologists sections. The committee created an Annual Meeting Diversity and Inclusion Scholarship to support speakers new to ESA who bring diverse perspectives to the ESA annual meeting (Templer 2019). In fall 2018, the CDE approved the 4DEE Framework, which was subsequently endorsed by the ESA's Governing Board (Gurevitch 2019). Shortly thereafter, the 4DEE subcommittee supported the preparation and publication of 4DEE-related articles in *Frontiers* and the *Bulletin of the Ecological Society of America*. Much of the CDE's activities through the end of the decade were focused on supporting education and diversity-awareness activities at the annual meeting (Templer 2019, 2021).

Working with Teresa Mourad, ESA Director of Education and Diversity Programs, was one of the great highlights of my time in this role. Her knowledge of the long history of the CDE provided

the context needed for our work to be effective. Her dedication to all ESA members, staff, and leadership has always had a profoundly positive impact on the society. (P. Templer, personal reflection)

The 2020s: The modern era of ESA's Education Committee

The activities of the CDE continued during the restrictions imposed by the COVID-19 pandemic in 2020 and 2021 – they just went virtual. During that time period, the CDE supported numerous oral sessions and workshops addressing education at the virtual annual meetings held in those years (Templer 2021, 2022), as well as *Water Cooler Chats*, informal virtual web events that were held throughout the year (Templer 2022). Concurrently, the ESA's leadership initiated steps to change the governance structure of ESA, resulting in the ESA Governing Board eliminating two VP positions: Education & Human Resources and Science. The governance changes were approved in August 2021. Along with modifications of governance, the 2020 ESA's Diversity, Equity, Inclusion, and Justice (DEIJ) Task Force recommendations to elevate the human dimension in ecology throughout all ESA functions and programming also led to a change in the committee structure associated with education and diversity initiatives. In 2021, the CDE split into two committees: one focused on education and a second addressing diversity issues (Gurevitch 2021a, b). The 2020 ESA DEIJ task force, charged with examining the issue, recommended that CDE indeed should be split, once again forming an Education Committee, functioning as a program committee, and another, separate committee addressing diversity, equity, inclusion, and justice issues that was elevated to a board committee (Gurevitch 2021c). In these designations, a Governing Board member has a seat on the Education Committee and chairs the Diversity Committee. The rationale for the change was that the issues addressed by the ESA Diversity Committee articulated with all aspects of ESA structure and functions and thus required a Board Committee reporting directly to the ESA Executive Committee.

Under that framework, the 4DEE committee continued to be designated as a subcommittee of the Education Committee (Gurevitch 2021d, Templer 2022). The split of CDE was carried out in September 2021; Carmen R. Cid, a plant ecologist and Dean of Arts & Sciences at Eastern Connecticut State University (Fig. 8), who had just been elected as ESA VP of Education and Human Resources, was named as the Education Committee Chair, and as chair of the new ESA Diversity Committee (Cid 2023a, b). The oversight of SEEDS remained entirely within the ESA Office of Diversity and Education Programs, as it had been since 2002, under the direction of first Jason Taylor and then Teresa Mourad.

The new Education Committee took on several key functions. The first was to provide advice on ESA's strategic education and workforce development priorities and their related budget needs. The second involved engaging the ESA membership and the wider community in the development and implementation of ecology education, including the Four-Dimensional Ecology Education (4DEE) framework. The third emphasized encouraging collaborations across ESA sections, chapters, and committees to elevate the visibility and use of ESA's education initiatives and resources (Cid 2023a, b).

Much of the work of the Education Committee in 2021 focused on the career development of students and ESA members in ecology careers outside higher education. The committee identified key priorities to increase visibility of careers in applied ecology and to develop clear environmental career tracks



Fig. 8. Carmen Cid. Photo courtesy of Carmen Cid.

in both two-year and four-year institutions. The Education Committee sponsored a large number of sessions and workshops at both the 2021 (still virtual) and 2022 (in person) annual meetings devoted to those priorities. Several members of the 4DEE Subcommittee also were part of the Steering Committee for the newly NSF-funded project: Transforming Ecology Education Research Coordination Network, focused on creating faculty mentoring networks to help implement 4DEE curricular changes (TEE RCN) (Cid 2023a).

The newly formed, separate Education Committee in 2021 brought together many new people to train faculty on 4DEE methods for integrating human-environment interactions, hands-on learning, and multidimensional thinking in teaching ecology to majors and non-majors. This was remarkable, given that ESA was only holding virtual meetings due to the COVID-19 pandemic. More importantly, the 4DEE subcommittee recruited more ESA educators to establish working groups on innovative use of media in undergraduate ecology education, assessment of 4DEE learning goals, non-majors ecology education and developing a comprehensive 4DEE report, while helping launch the first ESA undergraduate education faculty mentoring network program. (C.R. Cid personal reflection)

Tom Langen, a conservation ecologist at Clarkson University (Fig. 9), became the Chair of the Education Committee in August 2022. The committee was composed of eight members, including a representative of the very active 4DEE Subcommittee, an ESA Board member, and representatives of a variety of stakeholders, including a student, faculty members from higher educational institutions with different missions and student compositions, an educator working at an NGO, and a private-sector ecologist. The EC met monthly and coordinated activities with Teresa Mourad, Director of Education and Diversity Programs for ESA, who continues to serve as the primary ESA support staff, along with other Education and Diversity Programs staff. One goal of the group involved identifying ecological knowledge and skills that are essential to be job-ready, especially those that are frequently missing in traditional curricula. In that context, the Committee set out to identify sources of online coursework and



Fig. 9. Tom Langen. Photo courtesy of Tom Langen.

certifications that may make ecologists more competitive for public and private sector ecology-related jobs, including those transitioning to ecological careers from other backgrounds (Langen [2024](#), [2025](#)).

ESA conference special sessions and Water Coolers organized by the EC members generated lively discussions that continued long after the activities ended about teaching ecology at different types of institutions. These discussions revealed that many instructors at four-year and community colleges are disciplinarily isolated at their institutions and seek the dialogue among the community of ecological educators that ESA meeting special sessions, water coolers, and other activities provide. The EC also identified through these activities the need to help graduate advisors be better mentors on how to prepare ecology degree-holders for careers beyond research-intensive universities to other types of higher education institutions, and for careers in the private or public sectors. Graduate students and postdocs were vociferous about the need for better information on different career paths and how to prepare for them.

At the monthly EC meetings, we occasionally drift off-topic into fascinating discussions about how the institutions at which we teach or practice ecology, the courses we teach, and the students and other people to whom we teach or do outreach are so different from what we expected at the start of our careers. A recurring theme has been 'how do we prepare students

and ourselves with the skills and knowledge we all need to adapt and respond to everything that is happening?’. However, we also share anecdotes about funny and fun experiences with our students and others in the field – the same kinds of anecdotes as have probably been shared since the start of ESA - and how the one thing that is unchanged is people still are excited and motivated to experience and learn about nature and the science of ecology. (T. Langen, personal reflection)

Conclusions and future directions

Since the 1960s, the ESA’s Education Committee, under various names, has responded to expressed needs for improvements in how we address ecology education from K-12 to graduate levels and beyond to the general public. The Committee’s education initiative priorities have focused on K-12 teacher training, recruitment and retention of diverse ecologists at the undergraduate and graduate levels, and developing a curricular framework that promotes understanding of human-environment interactions and applied ecology careers. Education Committee members have been highly involved in the ESA’s most influential education-related society-wide strategic planning for WAMIE I (Bentley et al. 1993), WAMIE II (Ortega et al. 2006), and 4DEE Task Forces (Klemow et al. 2019), acting on information gathered from ESA member surveys and forums for prioritizing ecology education change. Over time, the education initiative’s emphasis has gone from graduate to K-12 to undergraduate/graduate educational enhancement. The ESA membership surveys in 1992 and 2005, which propelled the WAMIE I and II Task Force reports, have led to a deeper understanding of ESA members’ education and diversity priorities. We need to continue that type of comprehensive membership surveying to lead ESA’s strategic planning to address current and future societal needs for ecology education, whether general public engagement, K-12, or college-level students.

The story of the ESA’s Education Committee continues, and new issues related to its mission continue to arise. What’s in the future for the EC? That should be a lively discussion involving current and future members of the EC, the EC Board, and the ESA membership. We, the authors of this historical review, have some thoughts. Ecology educators face many challenges, including ongoing pressure to reduce the teaching of ecology in favor of other biological subdisciplines such as molecular biology; uncertain prospects for ecologists aspiring to careers in the higher education sector; and changing needs in ecological education to prepare students for ecological careers outside academia. There is a continuing struggle to foster an ecological field that is attractive, welcoming, inclusive, and supportive to all. Ecology education must adapt to and address the growth of big data and the rapid emergence of disruptive new technologies like artificial intelligence. Ecology education needs to innovate to inform and motivate people to address critical environmental issues, including climate change, environmental justice, environmental degradation, species habitat loss, biodiversity loss, conservation and restoration of forests, and the need to secure sustainable resources to support a growing human population that now exceeds 8 billion. Perhaps the most pernicious issue in ecology education is that many in the United States fail to appreciate our ecological heritage and display an antipathy for environmental conservation, ecology, and science in general, dismissing ecology as ‘woke’ (Cifrino 2025). Inspiring effective ecological education practices that engage all students, as well as helping an adult population think through important societal challenges that have an ecological dimension, is vitally important to our shared future. The ESA’s Education Committee must continue to play a central role in creating an ecologically literate society.

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Author contributions

KMK originated this article and served as the lead author. All co-authors contributed substantially to idea development and authoring sections of this article.

Conflict of interest statement

The authors declare no conflicts of interest.

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