

## K.C. BUSCH

Assistant Professor  
Department of STEM Education  
College of Education  
Leadership in Public Science Interdisciplinary Cluster  
North Carolina State University

### EDUCATIONAL BACKGROUND

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Ph.D., Science Education, 2016, Stanford University, Stanford, CA  
Dissertation: *The Framing of Climate Change in School Science*  
Advisors: Jonathan Osborne and Nicole Ardoin

M.A., Science Education, 2012, University of Texas at Austin, Austin, TX  
Thesis: *Evaluating Reciprocal Coaching as a Differentiated Professional Development Strategy for Experienced Teachers: The Effect of the GK-12 Program on Teachers*  
Advisor: Leema Berland

B.S., Ecology, 1994, Iowa State University, Ames, IA

### PROFESSIONAL EXPERIENCE

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2017–Present	Assistant Professor, Dept. of STEM Education, College of Education, Faculty in Leadership in Public Science Interdisciplinary Cluster, North Carolina State University
2016–2017	Post-doctoral Scholar, Stanford NGSS Assessment Project, Stanford Center for Assessment, Language & Equity (SCALE)
2012–2015	Graduate Research Assistant, Stanford University
2011–2012	Graduate Research Assistant, University of Texas at Austin
2010–2011	NSF GK-12 Program Coordinator, University of Texas at Austin
1998–2010	Secondary Science Teacher, Austin, Texas [National Board Certified Teacher]
1997	Park Ranger, Great Basin National Park, Nevada
1996	Urban Environmental Community Developer, Peace Corps, Ivory Coast, Africa
1995	Environmental Educator, Keewaydin Environmental Education Center, Vermont

### PUBLICATIONS

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<sup>+</sup> Indicates co-author is current or former student/advisee

<sup>\*</sup> Indicates co-author is former advisor

#### Journal Articles, Peer-reviewed

1. Gibson, L.<sup>+</sup>, **Busch, K.**, Stevenson, K., et al. (Forthcoming). What is community-level environmental literacy and how can we measure it? A report of a convening to conceptualize and operationalize CLEL. *Environmental Education Research*. [2020 Impact factor: 3.512]
2. **Busch, K.**, Kudumu, M.<sup>+</sup>, Park, S. (Forthcoming). Pedagogical content knowledge for informal science educators: Development of the ISE-PCK framework. *Research in Science Education*. [2020 Impact factor: 5.439]
3. **Busch, K.**, Ayala Chávez, R.<sup>+</sup> (2022). Adolescent framings of climate change, psychological distancing & implications for climate change concern and behavior. *Climatic Change*, 171(3), 1-19. [2020 Impact factor: 4.743]

4. Gutierrez, K., Blanchard, M., **Busch, K.** (2022). What effective design strategies do rural, underrepresented students value in STEM clubs while learning about climate change? *Environmental Education Research*. Advance Online Publication. [2020 Impact factor: 3.512; Cited 1 time]
5. **Busch, K.** (2021). Textbooks of doubt, tested: The effect of a denialist framing on adolescents' certainty about climate change. *Environmental Education Research*, 27(11), 1574-1598. [2020 Impact factor: 3.512; Cited 2 times]
6. Hartley, J.<sup>+</sup>, Stevenson, K., Peterson, M., **Busch, K.**, Carrier, S., DeMattia, E., Jambeck, J., Lawson, D., Strnad, R. (2021). Intergenerational learning: A recommendation for engaging youth to address marine debris challenges. *Marine Pollution Bulletin*, 170, 112648. [2020 Impact factor: 5.553; Cited 1 time]
7. Zummo, L., Donovan, B., **Busch, K.** (2021). Complex influences of mechanistic knowledge, worldview, and quantitative reasoning on climate change discourse: Evidence for ideologically motivated reasoning among youth. *Journal of Research in Science Teaching*, 58(1), 95-127. [2020 Impact factor: 4.832; Cited 8 times; Top cited paper in JRST 2020-21]
8. **Busch, K.**, Ardoin, N.<sup>\*</sup>, Gruehn, D., Stevenson, K. (2019). Exploring a theoretical model of climate change action for youth. *International Journal of Science Education*, 41(17), 2389-2409. [2020 Impact factor: 2.241; Cited 25 times; Viewed 1,878 times]
9. Donovan, B., Semmens, R., Keck, P., Brimhall, E., **Busch, K.**, et al. (2019). Towards a more humane genetics education: Learning about the social and quantitative complexities of human genetic variation research could reduce racial bias in adolescent and adult populations. *Science Education*, 103(3), 529-560. [2020 Impact factor: 4.593; Cited 54 times; Altmetric Score: 228]
10. Borko, H., Osborne, J.<sup>\*</sup>, Fishman, E., Zaccarelli, F., Berson, E., **Busch, K.**, Reigh, E., Tseng, A. (2019). Impacts of a practice-based professional development program on elementary teacher facilitation of, and student engagement in, scientific argumentation. *American Educational Research Journal*, 56(4), 1067-1112. [2020 Impact factor: 4.811; Cited 54 times; Viewed 4,371 times]
11. **Busch, K.**, Henderson, J., Stevenson, K. (2019). Broadening epistemologies and methodologies in climate change education research. *Environmental Education Research*, 25(6), 955-971. [2020 Impact factor: 3.512; Cited 58 times; Viewed 2,104 times; Invited author]
12. Román, D., **Busch, K.** (2016). Textbooks of doubt: Using systemic functional analysis to explore the framing of climate change in middle-school science textbooks. *Environmental Education Research*, 22(8), 1158-1180. [2020 Impact factor: 3.512; Cited 46 times; Viewed 2,671 times; Altmetric Score: 169, top 5% of all research outputs scored by Altmetric]
13. **Busch, K.** (2016). Polar bears or people? Exploring ways in which teachers frame climate change in the classroom. *International Journal of Science Education (B)*, 6(2), 137-165. [2020 CiteScore: 3.4; Cited 37 times; Viewed 1,319 times]
14. **Busch, K.**, Osborne, J.<sup>\*</sup> (2013). Can we get “there” from “here”? An argument for improved climate science education through state adoption of the Next Generation Science Standards. *Texas Education Review*, 1(1), 196-208. [Cited 4 times]
15. **Busch, K.** (2013). Appropriate urban teaching philosophies – A book review of “Sketches in Democracy: Notes from an Urban Classroom.” *Democracy & Education*, 21(1), Article 10. [Downloaded 1,223 times]

### Encyclopedia Entry, Peer-reviewed

1. **Busch, K.** (2017). Framing of climate change in U.S. science education. In M. Nisbet (Ed.), *The Oxford Research Encyclopedia of Climate Change Science*. Oxford University Press. [Cited 3 times; Invited Author]

### Conference Proceedings, Peer-reviewed

1. Berland, L. \*, **Busch, K.** (2012). Negotiating STEM epistemic commitments for engineering design challenges. *American Society for Engineering Education (ASEE)*. Available at: <http://www.asee.org/public/conferences/8/papers/3906/view>. [Cited 14 times]

### Practitioner Articles

1. **Busch, K.**, Osborne, J.\* (2022). Effective strategies for talking about climate change in the classroom. *Association for Science Education (ASE) International Journal*, 14, 15-24. [Selected by editor to be republished from *School Science Review*, 2014]
2. **Busch, K.**, Osborne, J.\* (2014). Effective strategies for talking about climate change in the classroom. *School Science Review*, 96(354), 25–32. [Cited 12 times]

### Book Chapters

1. **Busch, K.**, Román, D. (2017). Fundamental climate literacy & the promise of the NGSS. In D. Shepardson, A. Roychoudhury, and A. Hirsch (Eds.), *Teaching and Learning about Climate Change: A Framework for Educators*. Routledge Press. [Cited 13 times]
2. **Busch, K.** (2016). Speaking of climate change: Comparing science and social discourses. In E. Fretz (Ed.), *Climate Change across the Curriculum*. Lexington Books. [Cited 6 times]

### Articles in Revision and Review

1. None currently in Review

### Manuscripts in Preparation

1. **Busch, K.**, Chesnut, L.<sup>+</sup>, Stevenson, K. (In preparation). Seeing social learning: Visualizing communities of practice using social network analysis.
2. **Busch, K.**, Chesnut, L.<sup>+</sup>, Stevenson, K., Larson, L., Yelton, C., Stover, D., Black-Maier, A., Peterman, K. (In preparation). Building capacity for collective evaluation for informal science education centers: A tested model for a collaborative approach.
3. **Busch, K.**, Rajwade, A.<sup>+</sup> (In preparation). Community level science literacy: A literature review and Delphi study to conceptualize and operationalize CLSL.
4. Hartley, J.<sup>+</sup>, Stevenson, K., Peterson, M., **Busch, K.**, Carrier, S. (In preparation). Let's talk about it: Family discussions promote pro-environmental behaviors in children on the topic of marine debris.
5. Rajwade, A.<sup>+</sup>, Hartley, J.<sup>+</sup>, Stevenson, K., **Busch, K.** (In preparation). Teachers' perceptions of best curricular practices to support youth leadership for community marine debris solutions.

### Other Publications

1. **Busch, K.** (2022). *A "whole" climate change education is needed*. National Center for Science Education. <https://ncse.org/whole-climate-change-education-needed> [Invited contribution]
2. NCSU Coastal Resilience and Sustainability Leadership Group. (2020). *Coastal resilience and sustainability initiative white paper*. [White paper]. [Contributor]
3. **Busch, K.** (2020). *Book Review: Communicating climate change - a guide to educators*. Reports of the National Center for Science Education. Available at <https://ncse.org/rncse>. [Invited contribution]

4. **Busch, K.**, Stevenson, K., Green, K.<sup>+</sup>, Chesnut, L.<sup>+</sup> (2019). *Environmental education in North Carolina: Examining North Carolina's environmental education providers as a Community of Practice using social network analysis*. [White paper].
5. **Busch, K.** (2015). *Textbooks of doubt*. National Center for Science Education. Available at <https://ncse.com/blog/2015/11/textbooks-doubt-0016720>. [Invited contribution]
6. **Busch, K.**, LaRocque, L. (2014). *Environmental psychology & teaching strategies*. In L. Downey, S. J. Gentile, K.S. Hollweg, et al. (Eds.), *Advancing Climate Change Environmental Education: Resources and Suggestions*. Ithaca, NY: EECapacity, Cornell University Civic Ecology Lab and North American Association for Environmental Education. [White paper].

## PRESENTATIONS

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1. **Busch, K.**, Ayala, R.<sup>+</sup> (2022). *Adolescent framings of climate change, psychological distancing & implications for climate change concern and behavior*. Poster presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Vancouver, Canada.
2. **Busch, K.**, Chesnut, L.<sup>+</sup> (2022). *Social network analysis as a tool to operationalize communities of practice and document social learning*. Poster presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Vancouver, Canada.
3. **Busch, K.**, Chesnut, L.<sup>+</sup>, Ayala, R.<sup>+</sup>, Stevenson, K., Larson, L., Yelton, C. (2022). *Building capacity for collective evaluation across ISE centers: A tested model for a collaborative approach*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Vancouver, Canada.
4. Jadallah, C., Rajwade, A.<sup>+</sup>, Gibson, L.<sup>+</sup>, **Busch, K.**, Stevenson, K., Ballard, H. (2021). *Perspectives on community-level environmental literacy: Theories and operationalization*. Presented at North American Association for Environmental Education (NAAEE) Annual Research Symposium, virtual [COVID].
5. Sadan, N., Gibson, L.<sup>+</sup>, Pizmony-Levy, O., **Busch, K.** (2021). *Network theory: Methodologies that focus on connections*. Presented at North American Association for Environmental Education (NAAEE) Annual Research Symposium, virtual [COVID].
6. **Busch, K.**, Park, S., Kudumu, M.<sup>+</sup> (2021). *Pedagogical content knowledge for informal science educators*. Paper presented at Mid-Atlantic Association for Science Teacher Education (MA-ASTE), Blowing Rock, North Carolina.
7. Busch, K., Chesnut, L.<sup>+</sup>, Stevenson, K., Larson, L. (2021). *Building capacity for collective evaluation in science & environmental education centers across N.C.* Project presented at Environmental Educators of North Carolina (EENC) – Southeastern Environmental Education Alliance (SEEA) Research Symposium, Arden, North Carolina.
8. Patrick, P., Achiam, M., Ash, D., Sedawi, W., Striligwa, A., **Busch, K.** (2021). *Applying learning theories in research outside the classroom: How people learn science in informal environments*. Symposium discussant at European Science Education Research Association (ESERA) Biannual Conference, virtual [COVID].
9. Ward, R., **Busch, K.**, Cawley, M., Daniel, L., Maycock, T. (2021). *Climate change communication and education*. Panel presentation at Carolinas Climate Resilience Conference, virtual [COVID].
10. **Busch, K.**, Chesnut, L.<sup>+</sup>, Ayala, R.<sup>+</sup>, Stevenson, K., Larson, L., Yelton, C., Coscolluela, N. (2021). *Assessing participant learning outcomes in science museums: Building capacity for collective evaluation*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, virtual [COVID].
11. **Busch, K.**, Chesnut, L.<sup>+</sup>, Ayala, R.<sup>+</sup>, Stevenson, K., Larson, L., Yelton, C., Coscolluela, N. (2021). *Building capacity for collective evaluation of learning in museums*. Presented at North Carolina Museums Conference (NCCM) Annual Meeting, virtual [COVID].

12. Gibson, L.<sup>+</sup>, Stevenson, K., Wheaton, M., DeMattia, L., **Busch, K.** (2020). *Conceptualizing community level scientific literacy*. Presented at North American Association for Environmental Education (NAAEE) Annual Research Symposium, virtual [COVID].
13. **Busch, K.**, Green, K.<sup>+</sup>, Chesnut, L.<sup>+</sup> (2020). *Seeing social learning: Using social network analysis to operationalize communities of practice*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Portland, Oregon [conference cancelled - COVID].
14. **Busch, K.**, Park, S., Kudumu, M.<sup>+</sup> (2020). *iPCK: Developing a framework for pedagogical content knowledge for informal science educators*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Portland, Oregon [conference cancelled - COVID].
15. Zummo, L., Donovan, B., **Busch, K.** (2020). *Influences of worldview and knowledge on climate change discourse: Evidence for ideologically-motivated reasoning among youth*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Portland, Oregon [conference cancelled - COVID].
16. Reynolds, W., Park, S., **Busch, K.** (2020). *Increasing candidate success on the edTPA through an NGSS-aligned science methods course*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Portland, Oregon [conference cancelled - COVID].
17. Stevenson, K.T., Hartley, J.<sup>+</sup>, Lawson, D., DeMattia, E., Peterson, M.N., **Busch, K.**, Carrier, S.J., Strnad, R.L. (2020). *Youth as community change agents: How marine and coastal education are shaping how communities view coastal challenges*. NOAA Social Coast Forum, Charleston, South Carolina.
18. Reynolds, W., Park, S., **Busch, K.**, Wright, G. (2020). *Meeting the challenges of the edTPA by developing candidates understanding and implementation of the NGSS science & engineering practices*. Paper presented at the annual international conference of the Association for Science Teacher Education, San Antonio, Texas.
19. **Busch, K.**, Ardoin, N., Gruehn, D., Stevenson, K. (2019). *Moving beyond a knowledge deficit perspective & towards a model for youth climate change behavior*. Poster presented at European Science Education Research Association (ESERA) Biannual Conference, Bologna, Italy.
20. **Busch, K.**, Stevenson, K., Green, K.<sup>+</sup>, Lawson, D. (2019). *Using social network analysis to improve a community of practice: A case study of environmental education centers*. Paper presented at European Science Education Research Association (ESERA) Biannual Conference, Bologna, Italy.
21. **Busch, K.** (2019). *Epistemic cognition: The role of uncertainty on youth's climate change behavior*. Paper presented in Investigating Epistemic Cognition in Relation to Food, Water, And Energy (FEW) Issues session organized by C. Lundholm at American Educational Research Association (AERA) Annual International Conference, Toronto, Canada.
22. **Busch, K.**, Pérez-Jöhnk, G., Miller, D., Green, K.<sup>+</sup> (2019). *The role of power and politics in education for sustainability in the Galapagos Islands*. Paper presented in Education for Sustainability: A Public-Private Partnership for Transforming Education in the Galapagos session organized by K. Busch at American Educational Research Association (AERA) Annual International Conference, Toronto, Canada.
23. Hartley, J.<sup>+</sup>, Stevenson, K. T., Peterson, N. M., DeMattia, E., Strnad, R., Carrier, S., **Busch, K.** (2019). *Intergenerational learning beyond the immediate family: Are students environmental change-agents in their communities?* Poster presented at Citizen Science Conference, Raleigh, NC.
24. Forbes, C., Stevenson, K., **Busch, K.** (2018). *Towards a national collaborative for food, energy, and water education (NC-FEW) research*. North American Association for Environmental Education (NAAEE) Annual Conference, Spokane, Washington.
25. **Busch, K.**, Stevenson, K., DeMattia, L. (2018). *Redefining and researching environmental literacy at the community level*. Facilitated discussion at North American Association for Environmental Education (NAAEE) Annual Conference, Spokane, Washington.

26. **Busch, K.**, Henderson, J. (2018). *Climate change education – What matters in research and public education*. Paper presented in What Matters in Climate Change Education roundtable organized by Reid, A., and M. McKenzie at American Educational Research Association (AERA) Annual International Conference, New York, New York.
27. Perez, G., Rossi, D., Roman, D., **Busch, K.**, Miller, D., Rahim, H., Agredo, H. (2018). *The culture of Pachamama: How science teachers contextualize the Ecuadorian science curriculum in Galapagos*. Poster presented in International Perspectives on Ecoliteracies: Work at the Intersection of Community, Environmental, and Scientific Issues session organized by Tzou, C. at American Educational Research Association (AERA) Annual International Conference, New York, New York.
28. Roman, D., Rossi, D., del Rosal, K., Perez, G., **Busch, K.**, Rouse, R., Rahim, H. (2017). *There is no conservation without education: Embedding social topics in the teaching of science in the Galapagos Islands*. Paper presented at European Science Education Research Association (ESERA) Biannual Conference, Dublin, Ireland.
29. **Busch, K.** (2017). *A symposium on teaching and learning about climate change: A framework for educators*. Symposium organized by Hirsch, A., Shepardson, D., and A. Roychoudhury at National Association for Research in Science Teaching (NARST) Annual International Conference, San Antonio, Texas.
30. Donovan, B., Semmens, R., **Busch, K.**, Keck, P., Brimhall, E., Edelson, D. (2017). *A human(e) genetics education: Teaching about human genetic variation can reduce racial bias amongst adolescents*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, San Antonio, Texas.
31. Osborne, J. \*, Borko, H., **Busch, K.**, Fishman, E., Million, S., Tseng, A. (2016). *Developing and using an instrument to assess the dialectic potential of whole-class discussions in teaching science*. Paper presented at American Educational Research Association (AERA) Annual International Conference, Washington, D.C. [Cited 6 times]
32. **Busch, K.**, D. Román, D. (2015). *Textbooks of doubt: Uncertainty and attribution of climate change in middle-school science*. Paper presented at European Science Education Research Association (ESERA) Biannual Conference, Helsinki, Finland.
33. Osborne, J. \*, Berson, E., Borko, H., **Busch, K.**, Zaccarelli, F., Million, S., Tseng, A. (2015). *Assessing the quality of classroom discourse and interaction in science teaching*. Paper presented at European Science Education Research Association (ESERA) Biannual Conference, Helsinki, Finland. [Cited 4 times]
34. **Busch, K.** (2015). *Talking climate science – How teachers frame climate change in the classroom & why it matters*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Chicago, Illinois.
35. **Busch, K.**, Berson, E., Osborne, J. \*, Borko, H. (2015). *Teachers talking about talk: What elementary science teachers identify as the value and barriers to science discourse pedagogy*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Chicago, Illinois.
36. **Busch, K.** (2014). *Polar bears or people? How framing can provide a useful analytic tool to understand and improve climate change communication in classrooms*. Poster presented at Fall Meeting of the American Geophysical Union (AGU), San Francisco, California. [Cited 1 time]
37. Osborne, J. \*, **Busch, K.**, Tseng, A., Berson, E., Borko, H., Khachatryan, E., Million, S. (2014). *Assessing the quality of classroom discourse and interaction in science teaching*. Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Pittsburgh, Pennsylvania. [Cited 3 times]
38. **Busch, K.** (2012). *Assessing current state science teaching and learning standards for ability to achieve climate science literacy*. Paper presented at Fall Meeting of the American Geophysical Union (AGU), San Francisco, California.
39. Berland, L. \*, **Busch, K.** (2012). *Negotiating STEM epistemic commitments for engineering design challenges*. Paper presented at American Society for Engineering Education (ASEE) Annual Conference, San Antonio, Texas.

40. **Busch, K.** (2012). *The effect of the GK-12 program on teachers: Evaluating reciprocal coaching as a differentiated professional development strategy for experienced teachers.* Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Indianapolis, Indiana.
41. Rogers, S., **Busch, K.** Berland, L.\* (2012). *Understanding the role of context and activity in students' argumentation practice: Variation in how individuals argue about scientific and socioscientific questions.* Paper presented at National Association for Research in Science Teaching (NARST) Annual International Conference, Indianapolis, Indiana.

## EXTERNAL AND INTERNAL RESEARCH FUNDING

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### Funded, Current

*Redefining Scientific Literacy at the Community Level – Researching Science Learning using a Social Network Approach*  
NSF CAREER Grant, AISL and ECR Programs, 2021–2026

Total award: \$1,103,218

Principal Investigator

Purpose: The goal of this project is to develop an empirically-based conceptual model and metrics for community level scientific literacy. A theory-building through multiple case study research design is used in which three North Carolina coastal communities of place, faced with the need to make scientifically-informed adaptation decisions to combat the effects of sea level rise, serve as bounded cases to be studied sequentially. A convergent mixed methods design is employed, in which qualitative and quantitative data collection and analyses are performed concurrently. In particular, this project uses qualitative research methods, including document analysis, observation, and interviews, to understand and describe the case contexts. Social network analysis (SNA) is used to quantitatively measure the features of community organization (such as relationships between individuals) of the community cases. Expected products include conference presentations, journal articles, community reports, and a book prospectus.

Results: The results of the year 1 activities are currently being prepared in a manuscript.

*Developing a Model for Supporting Coastal Resiliency through Youth-led Coproduction*

NOAA North Carolina Sea Grant, 2021–2023

Total award: \$120,000

Co-Principal Investigator (PI: K. Stevenson, NCSU)

Purpose: The objective for this project is to collaboratively create and test a curricular framework that supports coastal resiliency through schools. The framework will address ecological resiliency through field work in collaboration with scientists, social resiliency through developing and leading community engagement events, and personal resiliency through fostering personal connections, hope and efficacy – all components and practices consistent with building environmental literacy. Grant activities include forming a curriculum advisory committee of teachers, students, and community partners and facilitating meetings with scientists, planning boards, and local officials to learn about local coastal hazards and resiliency strategies; co-creation of a curricular framework for grades 8-12 that builds in mechanisms for students to identify local resiliency challenges and solutions; train teachers through a two day in-person workshop, after which teachers will implement curriculum to their respective classes, resulting in 500-750 youth participating in ecological resiliency projects and building social and personal resiliency through community-engagement events.

*Building Capacity for Collective Evaluation across North Carolina Science Museums*

Institute of Museum & Library Services (IMLS) Leadership Grant, 2019–2022

Total award: \$465,149; NCSU subaward: \$356,750

Principal Investigator (Co-PIs: C. Yelton, NC Museum of Natural Sciences; L. Larson, NCSU; K. Stevenson, NCSU)

Purpose: For this research, we will build on the emerging work surrounding collective evaluation in informal learning contexts to develop a Community of Practice among the 54 informal science education centers in North Carolina, enhancing capacity for collective impact. Over three years, we will design and implement a series of regional professional development workshops and subsequent program evaluations that will: 1) create a shared sense of purpose for informal programming and evaluation, 2) build capacity among science museum educators to conduct evaluation for their informal programs, and 3) establish a set of common metrics and methodologies for collective evaluation of informal science learning across the state. The process will be documented to inform other efforts to build collective evaluation systems and foster cultures of evaluation in museums and informal science education providers across the nation.

Results: Preliminary results have been presented at state and international conferences. As the project is now nearing completion, two manuscripts are in preparation as well as a guide to implement the project in other settings.

*Strengthening Community Networks for Environmental Learning and Resilience through Children*

NOAA North Carolina Sea Grant, 2020–2022

Total award: \$119,998

Co-Principal Investigator (PI: K. Stevenson, NCSU)

Purpose: For this research, we will conduct an online Delphi study, a structured communication technique, to improve definitions of community-level environmental literacy (CLEL) and means to measure it. In addition, we will train 30 middle and high school teachers in a citizen-science and school-based environmental education program around water quality that is specifically designed to build CLEL through intergenerational learning. From these two objectives, we will test how this curriculum boosts individual environmental literacy among students, teachers, parents, and community members, and how these changes express themselves at the community-level in North Carolina.

Results: This project is currently being implemented and has been affected by the COVID pandemic. Products are in preparation.

*The Role of Education in Climate Change Adaptation*

Spencer Foundation Conference Grant, 2020–2022

Total award: \$49,850

Principal Investigator (Co-PIs: J. Henderson, Paul Smith College; D. Haas, PRI)

Purpose: In January 2021, we held a virtual conference to springboard the Climate Change Education Collective. The conference brought together nearly 70 researchers, educators, and policy-makers whose expertise is climate change education in order to summarize, develop and advance research agendas in the emerging area of climate change education.

Results: A conference whitepaper and an accompanying website forms the foundation for a network of climate change education researchers, practitioners and policy makers.

**Funded, Completed***Building a Culture and Capacity for Environmental Education Evaluation 2.0*

Pisces Foundation, 2020–2021

Total award: \$29,626

Co-Principal Investigator (PI: C. Clark, Duke University)

Purpose: Using interviews with thought-leaders and case studies of existing programs, we identified practices for successful collective evaluation in environmental education and identified paths forward toward a culture and capacity of evaluation.

*Improving Environmental Decision Making in Coastal Communities through giving Children a Voice: Building Science Literacy, Civic Engagement, and Coastal Resilience through K-12 Citizen Science*

NOAA North Carolina Sea Grant, 2018–2021

Total award: \$119,998

Co-Principal Investigator (PI: K. Stevenson, NCSU)

Purpose: We partnered with Duke University Marine Lab to scale up two citizen science-based environmental education projects, designed to enhance intergenerational transfer. We expanded the projects to 32 middle grade classrooms across the CAMA counties and experimentally tested impacts on knowledge of coastal environmental challenges, environmental self-efficacy, pro-environmental behavior, and interest in STEM careers among students; comfort using citizen science among teachers; and increased salience of coastal environmental issues and importance of using scientific data in environmental decision makers in the eyes of decision makers and community members.

Results: This project has been disseminated through publication (e.g., *Marine Pollution Bulletin*), a manuscript in preparation, and conference presentations.

*Defining and Measuring Community-Level Learning to Support Environmental and Science Education Innovation*

NCSU Faculty Research &amp; Professional Development Fund, 2019–2020

Total award: \$5,800

Co-Principal Investigator (PI: K. Stevenson, NCSU)

Purpose: To make progress in the conceptualization and measurement of community-level science and environmental literacy, we brought together EE experts to participate in a convening held at NC State. During the event, we engaged participants in structured consensus-building activities around definitions and indicators.

Results: The product from this work is an article in revision with *Environmental Education Research*. The results of this project have also been incorporated into current Sea Grant-funded research (Strengthening Community Networks for Environmental Learning and Resilience through Children).

*Examining North Carolina Environmental Education Providers as a Community of Practice using Social Network Analysis*



NCSU Faculty Research & Professional Development Fund, 2018–2019

Total award: \$7,500

Principal Investigator (Co-PIs: K. Stevenson, NCSU; B. Cutts, NCSU)

Purpose: In this research-practice partnership project, we collaborated with three state-wide organizations that have as their central mission to promote excellence in environmental education (EE) by fostering networking and collaboration among the EE community. Social network analysis methods were used to examine and interpret in what ways EE providers across the state exemplify a successful Community of Practice through a shared sense of enterprise, opportunities for mutual engagement, and a shared repertoire of resources.

Results: A report was created for project partners provide stories of success and recommendations for improvement to further educational research efforts about how organizational networks function as social learning structures at a regional scale. This research was presented as a stand-alone paper at ESERA and as a research manuscript in preparation. The methods for this study were used as a pilot for aspects of other grant proposals, including the IMLS awarded grant.

*Learning STEM in Informal Contexts*

NCSU STEM Education Initiative Grant, 2018–2019

Total award: \$13,925

Principal Investigator

Purpose: To engage NC State students in the processes and practices of STEM learning that happens outside of school, this project supported the development of a Learning STEM in Informal Contexts course offered in the spring semester of the 2018-19 academic year.

Results: The line of coursework has been expanded to include two new courses to the department and a pending graduate certificate in Learning in Informal Contexts. Additionally, this project supported research to create a model for Pedagogical Content Knowledge for informal educators (ISE-PCK) in collaboration with Soonhye Park. The research was shared via conference presentation and as a published article in *Research in Science Education*. Currently, we are preparing an NSF grant to continue this line of research.

*Why Words Matter: Framing of Climate Change in School Science*

Stanford University Graduate School of Education Dissertation Support Grant, 2015–16

Total award: \$6,000

Principal Investigator

**In Review**

*Large-Scale CoPe Hub: The Collaboratory for Coastal Adaptation over Space and Time (C-CoAST) Hub for Transdisciplinary Understanding of Coupled Human-Natural Coastal Dynamics*

NSF Coastlines and People (CoPe) Large-Scale Hub, December 2021

Researcher (PI: L. Moore, UNC–Chapel Hill)

**Not Funded**

*Large-Scale CoPe Hub: The Collaboratory for Coastal Adaptation over Space and Time (C-CoAST) Hub for Transdisciplinary Understanding of Coupled Human-Natural Coastal Dynamics*

NSF Coastlines and People (CoPe) Large-Scale Hub, October 2020, declined

Bridging Team Member, Team Lead, Project Lead (PI: L. Moore, UNC–Chapel Hill)

*Immersive, Multi-modal Learning Experiences about Coastal Environmental Hazards to Promote Emotional Mediation of Content Understanding and Behavior*

NSF AISL Grant, January 2021, declined

Co-Principal Investigator (PI: L. Moore, UNC–Chapel Hill)

*An Informal Education Initiative to Promote Environmental Learning and Informed Engagement in Decision-making about our Coasts*

NSF AISL Grant, 2020, declined

Co-Principal Investigator (PI: L. Moore, UNC–Chapel Hill)

*Leveraging Emotion through Immersive Science Experiences: A STEAM Initiative to Promote Environmental Learning and Informed Decision-making about our Coast*

NSF AISL Grant, 2019, declined [recommended for funding by PO but then declined internally; rated: competitive].

Co-Principal Investigator (PI: L. Moore, UNC–Chapel Hill)

*Researching Community-level Scientific Literacy using a Social Network Approach*

NCSU RISF Grant, 2019, declined

Principal Investigator (Co-PIs: K. Stevenson, NCSU; B. Cutts, NCSU)

*Redefining Scientific Literacy at the Community Level – Researching Science Learning using a Social Network Approach*

NSF CAREER Grant, 2018, declined

Principal Investigator

*Engaging Undergraduate Learners through Curricular and Co-curricular Citizen Science Initiatives*

NSF IUSE Grant, 2018, declined

Co-Principal Investigator (PI: K. Mulvey, NCSU)

*PPSR: A conference to Integrate Citizen Science and Communication Research*

NSF Decision, Risk, and Management Science Conference Grant, 2017, declined

Co-Principal Investigator (PI: J. Goodwin, NCSU)

*Climate Change and Educational Research*

AERA Conference Grant, 2017, declined

Principal Investigator (Co-PIs: J. Henderson, Paul Smith College; D. Haas, PRI; D. Kahan, Yale University)

*Climate Change and Educational Research*

AERA Conference Grant, 2016, declined

Principal Investigator (Co-PI: J. Henderson, Paul Smith College)

**SCHOLARLY AND PROFESSIONAL HONORS**

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Goodnight Early Career Innovators Award, Nominated, 2021–22

NC State Graduate School's Outstanding Graduate Faculty Mentor Award, Nominated, 2021–22

NC State Alumni Association Outstanding Teaching Award, Awarded, 2019–20

NC State University Outstanding Teaching Award, Awarded, 2019–20

NC State University Outstanding Global Engagement Award, Nominated, 2017–18, 2018–19

Stanford Woods Institute, Rising Environmental Leaders Program, Fellow, 2016

Stanford Interdisciplinary Graduate Fellowship, Awarded, 2015–16

Stanford Gerald J. Lieberman Fellowship, Awarded &amp; Declined, 2015–16

Stanford Graduate Women's Voice &amp; Influence Program, Fellow, 2014–15

NSF Community for Advancing Discovery Research in Education (CADRE), Fellow, 2013–14

NSF Graduate Research Fellowship Program, Honorable Mention, 2012

**POST-SECONDARY TEACHING EXPERIENCE**

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**North Carolina State University**

Semester	Course Title	Enrollment	Evaluation <sup>^</sup>
Spring 2022	EMS 731: Fundamentals of Research in Science Education	17	
Fall 2021	EMS 594: Evaluation of Learning in Informal Contexts	13	5.0
Spring 2021	EMS 594: Learning in Informal Contexts	18	4.8
Fall 2020	EMS 521: Advanced Methods of Science Education I	30	4.9
Fall 2020	EMS 775: Foundations of Science Education	13	NA
Spring 2020	EMS 505: Methods of Teaching Science I	15	NA
Fall 2019	EMS 594/794: Evaluation of Learning in Informal Contexts	15	5.0
Fall 2019	EMS 791: Contemporary Research and Critical Issues in STEM Education	13	4.9
Spring 2019	EMS 594/794: Learning in Informal Contexts	16	4.9
Fall 2018	EMS 475: Methods of Teaching Science II	6	4.7
Spring 2018	EMS 594: Learning in Informal Contexts	11	5.0

Fall 2017      ED 730: Introduction to Qualitative Research Methods in Education      11      5.0

^ Overall teaching effectiveness score on student evaluations, score range 1–5; NA no quantitative data due to COVID-19

### **Stanford University**

#### *Instructor of Record*

STEP Science Curriculum & Instruction (instructional methods course), Master's, Winter Quarter 2016

#### *Teaching Assistant*

Qualitative Methods in Education, Graduate, Spring Quarter 2015

Theory & Practice of Environmental Education, Undergraduate & Graduate, Spring Quarter 2015, 2016

STEP Science Curriculum & Instruction (instructional methods course), Master's, Winter Quarter 2015

STEP Science Curriculum & Instruction (instructional methods course), Master's, Fall Quarter 2014

### **GRADUATE COMMITTEE MEMBERSHIPS**

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#### **PhDs completed as Chair or Co-Chair**

1. Shannan George, Ph.D. Science Education, Co-chair, 2019

#### **PhDs in progress as Chair or Co-Chair**

1. Mwenda Kudumu, Ph.D. Science Education, Co-Chair, expected 2022
2. Lynn Chesnut, Ph.D. Science Education, Chair, expected 2022
3. Stephanie Teeter, Ph.D. Science Education, Co-Chair
4. Aparajita Rajwade, Ph.D. Science Education, Chair
5. Regina Ayala Chávez, Ph.D. Science Education, Chair
6. Katlyn May, Ph.D. Science Education, Chair
7. Dana Haine, Ph.D. Science Education, Chair

#### **PhDs completed as Committee Member**

1. Kimberly Pigford, Ph.D. Science Education, 2018
2. Casey Holmes, Ph.D. Teacher Education and Learning Sciences, 2021
3. Teena Coates, Ph.D. Technology & Engineering Education, 2021
4. Jenna Hartley, Ph.D. Parks, Recreation, and Tourism Management, 2022
5. Megan Morin, Ph.D. Technology and Engineering Education, 2022
6. Aimee Fraulo, Ph.D. Teacher Education and Learning Sciences, 2022

#### **PhDs in progress as Committee Member**

1. Pamela Huff, Ph.D. Science Education, expected 2022
2. Lili Wang, Ph.D. Teacher Education and Learning Sciences, expected 2022
3. Haley Smith, Ph.D. Fisheries, Wildlife and Conservation Biology
4. Lauren Gibson, Ph.D. Parks, Recreation, and Tourism Management
5. Madeline Hinckle, Ph.D. Science Education
6. Karen Collier, Ph.D. Science Education
7. Jennifer Sollinger, Ph.D. Science Education
8. Vallari Sheel, Ph.D. Fisheries, Wildlife and Conservation Biology

#### **MSs (with thesis) completed as Committee Member**

1. Maria Sharova, M.S. Fisheries, Wildlife & Conservation Biology, 2019

## OUTREACH & EXTENSION ACTIVITIES

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### Leadership and Synergistic Organizations

Climate Change Education Collective, Co-Founder, 2020–present

Collaboratory for Coastal Adaptation over Space and Time (C-CoAST), Advisory Board, 2020–present

Coastal Resilience and Sustainability Leadership Group, NCSU Office of the Executive Chancellor and Provost, Selected Faculty Member, 2019–present

Southeast Climate Adaptation Science Center, U.S.G.S. Department of the Interior, Faculty Affiliate, 2017–present

Network of STEM Education Centers: National Collaborative for Research on Food, Energy, and Water Education (NC-FEW), Informal Learning Group Leadership, 2017–2021

BSCS Climate Education Pathways Project (NSF AISL #2100808), Advisory Board, 2021–2025

BSCS OpenSciEd unit on Natural Resources & Human Impact, Advisory Board, 2020–2021

Education for Sustainability in Galapagos: A Public-Private Partnership with The Ecuador Ministry of Education, Galapagos Conservancy, the Galapagos Governing Council, and Fundação Scalesia, Science Education Advisor, 2016–2020

Innovating Teaching and Learning at the Food-Energy-Water Nexus, National Collaborative for Research on Food, Energy, and Water Education (NC-FEW), Washington D.C., 2017

International Policy Forum: Advancing, Monitoring, Evaluation, and Research on Sustainability in Education. Sponsored by the Sustainability and Policy Network, Vancouver, Canada, 2017

NAAEE & National Issues Forums, *Climate Choices Issue Guide for Classrooms*, Contributing Author, 2016

Framing Scientifically Complex Issues for Public Deliberation Research Exchange. Sponsored by The Kettering Foundation and NAAEE, Dayton, Ohio, 2015

NAAEE Climate Change Education Project-Based Online Learning Community Alliance (POLCA), Contributing Author, 2012–2013

### Speaking Events, Invited

1. NCSU, Strengthening the Impact of Research (STIR) Program, “Assessing Broader Impacts,” 22 participants (Mar 8, 2022).
2. NCSU, Coastal Resilience and Sustainability Initiative, Panel, “The power of interdisciplinary, inter-institutional collaboration: the C-CoAST experience and a broader discussion of what else might be possible,” 20 participants (Feb 22, 2022).
3. International Consortium for Interdisciplinary Education about Health and the Environment, Winter Meeting on Interconnected Climate Risks & Opportunities in Health, Environment, and Education, “The Social Side of Climate Change Education for Youth,” 62 participants (Jan 15, 2022).
4. NCSU, College of Education, Research Café, Panel, “Community Engaged Approaches to Educational Research and Practice,” 23 participants (Nov 4, 2021).
5. NCSU, Coastal Resilience and Sustainability Initiative, Panel, “Community Engagement and Co-production of Research,” 41 participants (Oct 27, 2021).
6. NCSU, EMS 350 Environmental Education, Dr. Gail Jones, “Communicating about Climate Change,” 15 participants (Oct 26, 2021).

7. Maine EE, Research Symposium, “Why We think what we think about climate change,” 15 participants (May 11, 2021).
8. NCSU, Strengthening the Impact of Research (STIR) Program, “Assessing Broader Impacts,” 24 participants (Apr 20, 2021).
9. SECASC, Global Change Seminar panel, “Intergenerational Learning: How Children are Changing Past Generations' Environmental Perceptions,” 62 participants (Apr 13, 2021).
10. Cornell University, Network Climate Action MOOC, Dr. Marianne Krasny, “The Climate Change Education Collective & Related Efforts to Support Climate Education,” w/ Dr. Don Haas, 70 participants (international) (Mar 17, 2021).
11. NCSU, FW221 Conservation of Natural Resources, Dr. Caren Cooper, “Why we think what we think about climate change,” 250 participants (Feb 16, 2021).
12. NC Museum of Natural Sciences, Teen Science Café, “Why you think what you think about climate change,” 50 participants (Jan 15, 2021).
13. SECASC, “Evaluation 101 & Actionable Science,” w/ Dr. Lincoln Larson, 20 participants (Nov 10, 2020).
14. NCSU, EMS 350 Environmental Education, Dr. Gail Jones, “Communicating about Climate Change,” 25 participants (Oct 13, 2020).
15. NCSU, EMS 732 Theoretical and Critical Perspectives of Science Education, Dr. Cesar Delgado, “Complex influences of mechanistic knowledge, worldview, and quantitative reasoning on climate change discourse: Evidence for ideologically motivated reasoning among youth,” 10 participants (Sep 7, 2020).
16. SECASC, Global Change Seminar, “Faith & Reasoning in Climate Change Views,” w/ Reverend Susan Tuttle, 60 participants (Mar 5, 2020).
17. NCSU, EMS 792 Foundational Learning Theories in STEM Education, “Framing Theory,” Dr. Gail Jones, 20 participants (Mar 2, 2020).
18. NCSU, EMS 732 Theoretical and Critical Perspectives of Science Education, Dr. Cesar Delgado, “Textbooks of doubt, tested: The effect of a denialist framing on adolescents’ certainty about climate change,” 10 participants (Fall, 2019).
19. NCSU, EMS 350 Environmental Education, Dr. Gail Jones, “Communicating about Climate Change,” 25 participants (Fall, 2019).
20. NCSU, Leadership in Public Science Cluster, “Evaluation 101,” 40 participants (Sep 16, 2019).
21. NCSU, FW221 Conservation of Natural Resources, Dr. Caren Cooper, “Framing Climate Change,” 250 participants (Feb 26, 2019).
22. NC MNS, Non-formal Educators Meeting, “Evaluation Clinic,” w/ Dr. K. Stevenson, 50 participants (Dec 13, 2018).
23. SECASC, Global Change Fellows Meeting, “Communicating about Climate Change,” 15 participants (Feb 14, 2019).
24. NCSU, EMS 732 Theoretical and Critical Perspectives of Science Education, Dr. Meg Blanchard, “Communicating about Climate Change,” 12 participants (Nov 12, 2018).
25. NAAEE, “Evaluation Clinic,” w/ Dr. K. Stevenson, 45 participants (Oct 12, 2018).
26. Environmental Educators of North Carolina (EENC), “Evaluation 101,” w/ Dr. K. Stevenson, 50 participants (Sep 29, 2018).

27. NCSU, EMS 350 Environmental Education, Dr. Gail Jones, “Framing of Climate Change,” 12 participants (Sep 24, 2018).
28. NCSU, Leadership in Public Science Cluster, “Qualitative Methods,” 35 participants (Sep 24, 2018).
29. NIEHS Fellows, “Communicating Risk,” 12 participants (Aug 12, 2018).
30. NCSU, College of Education, PGU, “Why words matter - Hidden messages in texts,” 10 participants (Apr 5, 2018).
31. NCSU, College of Education, Research Café, “Community Science Literacy,” 20 participants (Mar 1, 2018).
32. NCSU, Parks Scholars, “Writing OpEds,” 100 participants (Feb 28, 2018).
33. University of Vermont, Environmental Education course, Dr. R. Gould, “Framing of Climate Change,” 15 participants (Nov 28, 2017).
34. NC GAP Conference, “Implementing Argumentation & Debate in your science classroom,” w/ Dr. Jean Goodwin, 70 participants (Oct 24, 2017).
35. NCSU, NR 595 Out in the Open: The Principles of Public Science course, Drs. M. Katti and C. Cooper, “Science Communication Principles,” 10 participants (2 classes Oct, 2017).
36. Sustainability and Policy Network International Policy Forum, “Climate Change Education Research & Environmental and Sustainability Education Policy,” 40 participants, Vancouver, Canada (Sept 7, 2017).

### **Selected Media Engagement and Coverage**

Scripps National News. (2021). Climate learning program looks to educate workers and encourage action.  
<https://www.youtube.com/watch?v=aFjomRlggsA>

Teen Vogue. (2019). Textbooks are lying to students about climate change.  
<https://www.teenvogue.com/story/how-climate-change-taught-schools>

The Guardian. (2015). California school textbooks mislead students on climate, study says.  
<http://www.theguardian.com/us-news/2015/nov/23/california-public-school-textbooks-mislead-students-climate-study-says>

Science Daily. (2015). California 6<sup>th</sup> grade science textbooks: Climate change a matter of opinion not scientific fact.  
<https://www.sciencedaily.com/releases/2015/11/151110120441.htm>

Phys.org. (2015). California 6<sup>th</sup> grade science books: Climate change a matter of opinion not scientific fact.  
<http://phys.org/news/2015-11-california-6th-grade-science-climate.html>

SFGate. (2015). California school textbooks seen as spineless on climate change.  
<http://www.sfgate.com/bayarea/article/Study-California-school-textbooks-spineless-on-6652861.php>

### **PROFESSIONAL SERVICE**

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#### **On campus**

Department of STEM Education, Development of Informal Education coursework and certificate, Current

College of Education, Louis D. Hunt Service Leadership Award Committee, 2022–present

College of Education, DEI in Teaching Class Evaluation Item Task Force, 2022–present

College of Education, Vice Chairperson of the Faculty, nominated & elected, 2021–present

NCSU Office of the Executive Chancellor and Provost, Coastal Resilience and Sustainability Leadership Group, Selected Faculty Member, 2019–present

College of Education, Student Scholarship Committee, 2018–present

College of Education, Goodnight Endowed Professor of Education Innovation, Search committee member, 2018–2019

College of Education, Computer & Technology Committee, 2017–2018

### **Off campus**

NARST, Membership Committee member, 2020–present

ESERA, Special Interest Group 3: Science Education outside the Classroom, Co-Coordinator, nominated & elected, 2019–present

Ad hoc Journal Article Peer Reviewer: *Environmental Education Research* (26), *International Journal of Science Education* (11), *Journal of Research in Science Teaching* (6), *Science Education* (5), *International Journal of Science Education Part B* (3), *Science Communication* (2), *International Journal of STEM Education* (2), *Applied Environmental Education & Communication* (2), *Citizen Science Theory and Practice* (1), *Environmental Communication* (1), *Sustainability* (1), *BioScience* (1), *SAGE Open* (1), *PLOS One* (1), *The Educational and Developmental Psychologist* (1), *Climatic Change* (1), *Children Youth & Environments* (1), *Evaluation and Program Planning* (1), 2015–present

Ad hoc Conference Proposal Reviewer: North American Association for Environmental Education (NAAEE), National Association for Research in Science Teaching (NARST), 2015–present

NSF Division of Research on Learning in Formal and Informal Settings, Proposal Review Panelist, 2022

### **Membership in professional organizations**

American Educational Research Association (AERA), current

European Science Education Research Association (ESERA), current

National Association for Research in Science Teaching (NARST), current

North American Association for Environmental Education (NAAEE), current

Environmental Educators of North Carolina (EENC), current

North Carolina Museums Council (NCMC), current

American Association for the Advancement of Science (AAAS), not current

American Geophysical Union (AGU), not current