

# Tamara Shapiro Ledley

Dr. Tamara Shapiro Ledley is a [STEM education consultant](#), Earth and climate scientist, an [EnROADS Climate Ambassador](#), an Adjunct Professor at Bentley University, and Secretary of the Education Section of the American Association for the Advancement of Science ([AAAS](#)). She was a [2017 Harvard Advanced Leadership Initiative Fellow](#) where she explored her interests in improving climate change education efforts. She served as a senior scientist and chair of the Center for STEM Teaching and Learning at [TERC](#) for 20 years. She received her PhD from MIT in atmospheric and climate science and her BS from the University of Maryland in astronomy. Early in her career she led a research program in Earth system science and climate change at Rice University. She joined TERC in 1997 to pursue her science education interests. She led the development of the award winning [Earth Exploration Toolbook](#) and the [Climate Literacy and Energy Awareness Network \(CLEAN\) Collection](#) of rigorously reviewed climate and energy educational resources and has chaired of the [CLEAN Network](#), a professionally diverse community of climate and energy literacy stakeholders. She also led the [EarthLabs project](#) that focuses on development of curriculum materials, teacher professional development programs, and science education research focused enabling the effective teaching and learning of climate science. She is the [2013 American Geophysical Union's Excellence in Geophysical Education Awardee](#) for her work in bringing Earth science data and tools to teachers and students and for her leadership in climate literacy. She served as President and Chairman of the Board of Directors of the Earth Science Information Partners ([ESIP](#)). She currently serves on the CLEAN Network Leadership Board, the External Advisory Board of the [Byrd Polar Research Center at The Ohio State University](#), the Board of Advisors of the [Museum of Science Boston](#), the Board of Directors of the [Blue Hill Observatory and Science Center](#), and the Board of Directors of [Subject To Climate](#).



## Education

- Ph.D. Massachusetts Institute of Technology, Department of Meteorology and Physical Oceanography, Advisor: Professor Reginald E. Newell, Dissertation Title: A Sensitivity Study of Climate Using Energy Balance Cryospheric Models. <http://hdl.handle.net/1721.1/54296>
- B.S. University of Maryland (College Park), Major in Astronomy, Citation in General Honors

## Honors and Awards

- 2018 Fellow of the American Association for the Advancement of Science (AAAS) <https://www.aaas.org/news/aaas-honors-accomplished-scientists-2018-elected-fellows>, November 2018.
- 2018 Climate Literacy and Energy Awareness Network (CLEAN), Goldin Foundation Excellence in Education Exemplary Project Award, <http://goldinfoundation.org/ExemplaryProjects.htm> <http://goldinfoundation.org/CLEAN.htm>
- 2017 Climate Literacy and Energy Awareness Network (CLEAN) 2017 Friend of the Planet Award from the National Center for Science Education <https://ncse.com/news/2017/02/friend-darwin-friend-planet-awards-2017-0018458>, February, 2017.
- 2014 Climate.gov Teaching Climate Webby and Peoples Voice awards in the Green category from the International Academy of Digital Arts and Sciences, <http://webbyawards.com/winners/2014/web/general-website/green/>, April 2014.
- 2013 recipient of the [American Geophysical Union's Excellence in Geophysical Education Award](#), [Citation and Response](#) published in EOS, January 14, 2014
- 2013 Journal of Geophysical Education Outstanding Paper award for "A Model for Enabling an Effective Outcome-Oriented Communication Between the Scientific and Educational Communities" by Ledley, Taber, Lynds, Domenico, and Dahlman, <http://nagt-jge.org/doi/abs/10.5408/11-234.1>, August 2012.
- 2012 Federation of Earth Science Information Partners (ESIP Federation) Presidents Award for significant contributions to the ESIP Federation <http://www.esipfed.org/presidents-award>, <http://www.terc.edu/newsroom/1725.html>, January 2012.
- 2011 Science Prize for Online Resource in Education (SPORE Award) from Science Magazine for the Earth Exploration Toolbook <http://serc.carleton.edu/eet>, [http://www.eurekalert.org/pub\\_releases/2011-09/aaft-jg092311.php](http://www.eurekalert.org/pub_releases/2011-09/aaft-jg092311.php), September 2011.

The focus of Dr. Ledley's research at Rice University was to understand the role of sea ice and continental ice sheets in shaping global climate. Using energy balance climate and dynamic ice flow models she examined the impact of sea ice on the exchange of energy between the ocean and the atmosphere, the implications of changes in the sea ice cover for local and global climate, and the mechanisms that produced the growth and decay of ice sheets that define the 100,000 year ice age cycle

Dr. Ledley's early work in Earth system science education included developing museum exhibits that bring near real time images of the Earth to the public, contributing science content to planetarium shows, directing teacher training programs in the Earth sciences, developing Earth system science learning activities for the GLOBE program and serving as lead author of the Earth as a System investigation in the [GLOBE Teachers Guide](#), and developing scientific research programs for the participation of students.

Dr. Ledley is a founding member and was chair of the CLEAN Network (Climate Literacy and Energy Awareness Network (<https://cleanet.org/clean/community/index.html>)). This work has led to a number of projects. The first is an NSF National Science Digital Library (NSDL, <https://nsdl.oercommons.org/>) and Climate Change Education grant to develop the "Climate Literacy and Energy Awareness Network (CLEAN) Pathway" (<http://cleanet.org>), a stewarded collection of inquiry-based educational resources that will help learners understand the Essential Principles of Climate Science (<http://cleanet.org/cln/climateliteracy.html>). This work has received continuing funding for CLEAN Core services from NOAA. The second is an NSF DRK12 and Climate Change Education grant, "Confronting the Challenges of Climate Literacy" project to develop a set of three EarthLabs modules (<http://serc.carleton.edu/earthlabs>) on climate change that serves as the laboratory component of a high-school capstone course in Earth and space science; and conduct a study, using those modules of the obstacles to student understanding of change over time and how to overcome those them. Others include the NASA Global Climate Change Education Program funded "Earth System Science: A Key to Climate Literacy" project, and the NSF funded project "Facilitating a Deeper Student Understanding of Change in the Earth System on Multiple Time Scales" project.

Dr. Ledley has also been involved in a spectrum of projects that focus on the facilitation of the use of Earth science data in educational contexts and leverage the national digital library efforts. She received NSF NSDL grants to develop the Earth Exploration Toolbook (EET, <http://serc.carleton.edu/eet>), an online resource that provides step-by-step instructions for the use of an Earth science dataset and data analysis tool by teachers in the classroom; and to run innovative professional development workshops focused on specific datasets and analysis tools in the EET (<http://serc.carleton.edu/eet/workshops.html>). She also received NSF grants to lead the Digital Library for Earth System Education (DLESE) Data Services and AccessData (<http://serc.carleton.edu/usingdata/accessdata>) projects that focused on bridging the communication gap scientific and educational communities to make more Earth science datasets accessible and available to teachers and students; and the Tools for Data Analysis in the Middle School Classroom (DataTools, <http://serc.carleton.edu/eet/msdatatools>) project that facilitates middle school teachers learning and adapting IT tools and Earth science data for use in the classroom.

Dr. Ledley served as President and chair of the Board of Directors of the Earth Science Information Partners (ESIP, <http://www.esipfed.org/>), and was the founding chair of ESIP's Standing Committee for Education. She is Secretary of the Education Section of the American Association for the Advancement of Science (AAAS), and an adjunct professor at Bentley University where she teaches Global Climate Change. She is also a member of the Board of Directors of the Blue Hill Observatory and Science Center, the External Advisory Board for the Byrd Polar Research Center at the Ohio State University and the Board of Advisors of the Museum of Science, Boston.

Dr. Ledley is an En-ROADS (Energy Rapid Overview and Decision Support) Climate Ambassador. In that capacity she has run 50+ Climate Solutions Workshops and Climate Action Simulations helping participants explore the relative impacts of various solutions to mitigate climate change. Some of these include Bentley University, Blue Hill Observatory and Science Center, University of Massachusetts Lowell – Teacher Workshop, MIT Alumni for Climate Action (MACA), Earth Science Information Partners (ESIP) – Teacher Workshop, Camp Rising Sun Alumni Program, Climate Literacy and Energy Awareness Workshop (CLEAN) – Teacher Workshop, and Prince Georges County Public Schools in Maryland.

Dr. Ledley was a member of the National Research Council Roundtable on Climate Change Education. In her role as chair of the CLEAN Network she has coordinated multiple interdisciplinary and transdisciplinary sessions for the AGU and GSA annual meetings. She has also served as the chair of the Committee on Global and Environmental Change of the American Geophysical Union (AGU) and chair of the panel to develop the original AGU position statement on Climate Change and Greenhouse Gases in 1998; and as chair of the panel for GSA to develop a position statement titled Promoting Earth Science Literacy for Public Decision Making in 2012.

## Positions

- 2018-present, Adjunct Professor Bentley University
- 2017-present, STEM Education Consultant, Earth and Climate Science, [Sustaining Science Consulting](#)
- 2020-2021 - President and Chair of the Board of Directors of the Earth Science Information Partners
- 2017 Harvard Advanced Leadership Initiative Fellow
- TERC, Cambridge, Massachusetts, Senior Scientist, 1997-2017, Center for Science Teaching and Learning: Chair 2011-2016, Co-Director 2006-2016.
- Adjunct Professor, University of Massachusetts Dartmouth, 2008-2009
- Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts, Visiting Scientist, 1997-98
- Department of Space Physics and Astronomy and the Earth Systems and The Energy and Environmental Systems Institute, Rice University, Houston, Texas, 1983-98, Senior Faculty Fellow (1990-98), Assistant Research Scientist (1985-1990), Research Associate (1983-1985), Lecturer on Space Physics & Astro. (Spring 1990 & 1991)
- Department of Mathematics and Sciences, Babson College, Babson Park, Massachusetts, Lecturer, Spring 1997
- Department of Meteorology, Texas A&M University, College Station, Texas, Associate Research Scientist, 1995-1996
- Department of Geology and Geophysics, Rice University, Houston, Texas Spring 1993, Visiting Lecturer in Geology and Geophysics

## Editorships and Associations

- American Association for the Advancement of Science (AAAS) - member 1977-present
  - Secretary, Education Section 2020-present

- Member-at-large, Education Section 2014-2018
  - Electorate Nominating Committee 1995-1998
- Climate Literacy and Energy Awareness Network (CLEAN), 2008-present, chair: 2008-2016, Leadership Board member 2017-present
- Geological Society of America (GSA) - member 2007-present
  - Chair Panel on Promoting Earth Science Literacy for Public Decision Making: 2011-2012
- National Association of Geoscience Teachers (NAGT)
  - Counselor-at-Large, NAGT, 2011-2014
  - Liaison to the NAGT New England Section 2011-2014
  - Liaison to AAAS 2014-2018
- Byrd Polar Research Center External Advisory Board Member - 2012-present
- Museum of Science Boston - Board of Advisors Member - 2014-present
- Blue Hill Observatory - Board of Directors - 2017-present; Chair, Program Committee - 2020-present
- Subject to Climate - Board of Directors - 2021-present.
- AGU, Member 1983-present
  - Committee on Global Environmental Change: 1993-2000, Chair 1996-2000
  - Chair of AGU Panel for Global Change and Greenhouse Gases Position Statement: 1998-1999
  - Public Information Committee: 2000-2002
  - Cowen Award Committee: 2008-2010
  - Coordinator of Climate Literacy sessions at Fall AGU meetings - 2011-2016
  - Fall AGU Meeting Planning Committee - Education Chair - 2014-2016
- Earth Science Information Partners (ESIP): 1998-present
  - President and Chair of the Board of Directors, 2020-2021
  - Foundation of Earth Science Board of Directors - 2004-2017
  - Chair, Constitutions and ByLaws Committee, 2013-2014
  - Vice President, 2004-2006
  - Chair, Standing Committee for Education, 2002-2004, 2006-2009
  - Application Partners (Type III) Representative, 2009-2010
  - Vice Chair, Standing Committee on Community Engagement, 2000-2002
  - Lead, Education Cluster, 2000-2002
- Digital Library for Earth System Education (DLESE): 2000—2007
  - DLESE Management Council—Member—2003-2006
  - DLESE Data Services and AccessData PI, 2003-2011
  - Planning Committee for DLESE Annual Meeting
    - Chair 2002-2003, Program sub-committee chair 2001-2002, Member 2003-2004
  - Data Access Working Group—member: 2001, facilitator: 2003-2006
- Journal of Geophysical Research-Atmospheres, 1993-1996, Associate Editor

## Selected Publications

[Click here for full list of publications](#)

[Click here for full list of abstracts](#)

[Click here for full list of invited lectures and keynote presentations](#)

Molthan-Hill P., Blaj-Ward L., Mbah M.F., Ledley T.S. (2021) Climate Change Education at Universities: Relevance and Strategies for Every Discipline. In: Lackner M., Sajjadi B., Chen WY. (eds) *Handbook of Climate Change Mitigation and Adaptation*. Springer, New York, NY. [https://doi.org/10.1007/978-1-4614-6431-0\\_153-1](https://doi.org/10.1007/978-1-4614-6431-0_153-1).

McNeal, K.S., J.C. Libarkin, T.S. Ledley, K. Ellins, EarthLabs: A Model for Supporting Undergraduate Student Inquiry about Change over Time and Space, chapter in *Active Learning in College Science, The Case for Evidence-Based Practice*, Joel J. Mintzes and Emily M. Walter, Editors, Springer Nature, Publishers, 2020.

Ledley, T.S., J. Rooney-Varga, F. Niepold, Addressing Climate Change Through Education, *Encyclopedia of Environmental Science*, Oxford University Press, 2017, DOI: 10.1093/acrefore/9780199389414.013.56.

Gold, A.U., T.S. Ledley, S.B. Sullivan, K.B. Kirk, M. Grogan, Supporting Energy Education Online: Climate Literacy And Energy Awareness Network (CLEAN), *The Journal of Sustainability Education*, January 2015, [http://www.jsedimensions.org/wordpress/content/supporting-energy-education-online-climate-literacy-and-energy-awareness-network-clean\\_2015\\_01/](http://www.jsedimensions.org/wordpress/content/supporting-energy-education-online-climate-literacy-and-energy-awareness-network-clean_2015_01/).

Kirk, K, S.B. Sullivan, A.U. Gold, T.S. Ledley, C.A. Manduca, D. Mogk, K. Wiese, Undergraduate Climate Education: Motivations, Strategies, Successes, and Support, *Journal of Geoscience Education*, vol 62, No. 4, pp. 538-549, November 2014, doi: 10.5408/13-054, <http://nagt-jge.org/doi/full/10.5408/13-054>.

McNeal, K, J.C. Libarkin, T.S. Ledley, E. Bardar, N. Haddad, K. Ellins, S. Dutta, The Role of Research in On-line Curriculum Development: The Case of *EarthLabs* Climate Change and Earth System Modules, *Journal of Geoscience Education*, Vol. 62, No 4, pp. 560-577, November 2014,

doi: 10.5408/13-060.1, <http://nagt-jge.org/doi/full/10.5408/13-060.1>.

Sullivan, S., T.S. Ledley, S. Lynds, Navigating Climate Science in the Classroom: Teacher Preparation, Perceptions and Practices, *Journal of Geoscience Education*, Vol. 62, No. 4, pp. 550-559, November 2014, doi: 10.5408/12-304.1, <http://nagt-jge.org/doi/full/10.5408/12-304.1>.

Ledley, T.S., A.U. Gold, F. Niepold, Enabling Climate and Energy Literacy – A Shared Effort, *Eos*, v95, 36, 325-326, September 2014, DOI: 10.1002/2014EO360002.

Ledley, T.S., A.U. Gold, F. Niepold, M. McCaffrey, S.B. Sullivan, C.A. Manduca, S. Fox, Moving Toward Collective Impact in Climate Change Literacy – The Climate Literacy and Energy Awareness Network (CLEAN), *Journal of Geoscience Education*, vol.62, No. 3, pp. 330-342, Sept 2014, doi: <http://dx.doi.org/10.5408/13-057.1>.

Ellins, K.K., T.S. Ledley, N. Haddad, K. McNeal, A. Gold, S. Lynds, J. Libarkin, EarthLabs: Supporting Teacher Professional Development to Facilitate Effective Teaching of Climate Science, *Journal of Geoscience Education*, vol.62, No. 3, pp. 307-318, Sept 2014, doi: <http://dx.doi.org/10.5408/13-059.1>.

Ledley, TS, E Bardar, N Haddad, EarthLabs – StudentCentered Labs to Engage High School Students, *In the Trenches*, vol 3, no 3, pages 1-2, July 2013. Ledley, T.S., Promoting Climate Literacy, Public Gardens, *Journal of the American Public Garden Association*, v.27, 39-40, <http://www.publicgardens.org/files/images/2012Vol2-3/index.html>, Summer/Fall 2012.

Ledley, T.S., N. Haddad, E Bardar, K. Ellins, K. McNeal, J. Libarkin, EarthLabs – An Earth System Science Laboratory Module to Facilitate Teaching About Climate Change, *The Earth Scientist*, v.28, n.3, p19-24, <https://www.nestanet.org/cms/content/publications/tes>, September 2012.

Gold, Anne U., T.S. Ledley, S.M. Buhr, S. Fox, M. McCaffrey, F. Niepold, S. Lynds, Peer-Review of Digital Educational Resources: A Rigorous Review Process Developed by the Climate Literacy and Energy Awareness Network (CLEAN), *Journal of Geoscience Education*, v.60, 295-308, <http://dx.doi.org/10.5408/12-324.1>, 2012.

Ledley, T.S., M.R. Taber, S. Lynds, B. Domenico, L. Dahlman, A Model for Enabling an Effective Outcome-Oriented Communication Between the Scientific and Educational Communities, *Journal of Geoscience Education*, v.60, no. 3, pp 257-267, doi: 10.5408/11-234.1, <http://nagt-jge.org/doi/abs/10.5408/11-234.1>, August 2012.

Taber, M.R., T.S. Ledley, S. Lynds, B. Domenico, L. Dahlman, Geoscience Data for Educational Use: Recommendations from Scientific/Technical and Educational Communities, *Journal of Geoscience Education*, v 60, no. 3, pp249-256, doi: 10.5408/12-297.1, <http://nagt-jge.org/doi/abs/10.5408/12-297.1>, August 2012.

Ledley, T.S., N. Haddad, E Bardar, K. Ellins, K. McNeal, J. Libarkin, EarthLabs – An Earth System Science Laboratory Module to Facilitate Teaching About Climate Change, *The Earth Scientist*, v.28, n.3, p19-24, <https://www.nestanet.org/cms/content/publications/tes>, September 2012.

Gold, Anne U., T.S. Ledley, S.M. Buhr, S. Fox, M. McCaffrey, F. Niepold, S. Lynds, Peer-Review of Digital Educational Resources: A Rigorous Review Process Developed by the Climate Literacy and Energy Awareness Network (CLEAN), *Journal of Geoscience Education*, v.60, 295-308, <http://dx.doi.org/10.5408/12-324.1>, 2012.

Ledley, T.S., Promoting Climate Literacy, Public Gardens, *Journal of the American Public Garden Association*, v.27, 39-40, <http://www.publicgardens.org/files/images/2012Vol2-3/index.html>, Summer/Fall 2012.

Ledley, T.S., L. Dahlman, C. McAuliffe, N. Haddad, M. Taber, B. Domenico, S. Lynds, M. Grogan, Making Earth Science Data Accessible and Usable in Education, *Science*, vol 333 no. 6051 pp1838-1839, DOI: 10.1126/science.1199348, <http://www.sciencemag.org/content/333/6051/1838.summary>, September 30, 2011.

Ledley, T.S., A. Prakash, C.A. Manduca, and S. Fox, "Recommendations for Making Geoscience Data Accessible and Usable in Education" *EOS*, v89, n32, p291, August 5, 2008, (DOI: 10.1029/2008EO2003) <https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2008EO320003>.

Ledley, T.S., L. Dahlman, C. McAuliffe, N. Haddad, The Earth Exploration Toolkit: Facilitating Access to Scientific Data and Tools, *Journal of Geoscience Education*, 54 n.3, 223-229, 2006.

Ledley, T.S., L Dahlman, B. Domenico, and M.R. Taber, "Facilitating the Effective Use of Earth Science Data in Education through Digital Libraries: Bridging the Gap between Scientists and Educators" , *IEEE Technical Committee on Digital Libraries Bulletin*, v 2, no 1, <http://www.ieee-tcdl.org/Bulletin/v2n1/ledley/ledley.html>, 2005.

Ledley, T.S., C. McAuliffe, L. Dahlman, Earth Exploration Toolkit: Educational Uses of Earth System Science Datasets and Tools, ), *Focus on Earth Science; NSDL as a Research Tool, Project Kaleidoscope Volume IV: What Works, What Matters, What Lasts*, [http://www.pkal.org/template2.cfm?c\\_id=1413](http://www.pkal.org/template2.cfm?c_id=1413), August 27, 2004.

Ledley, T.S., N. Haddad, J. Lockwood, D. Brooks, Developing Meaningful Student-Teacher-Scientist Partnerships, *Journal of Geoscience Education*, 51, 91-95, 2003.

Ledley, T.S., Energy Balance Model: Surface, *Encyclopedia of Atmospheric Sciences*, Elsevier Science Ltd, London, 747-754, 2003.

Ledley, T.S., E.T. Sundquist, S.E. Schwartz, D.K. Hall, T.L. Killeen, and J.D. Fellows, *Climate Change and Greenhouse Gases*, EOS, 80, 453-454 & 457-458, 1999.

Ledley, T.S. and Z. Huang, A Possible ENSO Signal in the Ross Sea, *Geophysical Research Letters*, 24, 3253-3256, 1997.

Ledley, T.S. & S. Chu, The Initiation of Ice Sheet Growth, Milankovitch Solar Radiation Variations, and the 100 KYR Ice Age Cycle, *Climate Dynamics*, 11, 439-445, 1995.

Ledley, T.S., Summer Solstice Solar Radiation, the 100 KYR Ice Age Cycle, and the Next Ice Age, *Geophysical Research Letters*, 22, 2745-2748, 1995.

Ledley, T.S. and S. Chu, Global Warming and the Growth of Ice Sheets, *Climate Dynamics*, 9, 213-219, 1994.