

Environmental Education and Human Adaptation to Climate Change: Considerations and Resources

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Abstract

Is education that accepts climate change as a given and incorporates how to adapt to a climate heavily impacted by humans consistent with the long standing goals of environmental education (EE)? Or does an education that focuses on how to live with—rather than attempting to prevent—climate change deviate from EE’s foundations of reducing human impacts and protecting environmental quality? In this report, we examine issues that climate adaptation raises for the field of EE. We first review scholarly literature on EE and climate adaptation, and present a compilation of existing educational resources on climate adaptation. We next point out approaches to adaptation education that are consistent with EE foundational principles, as well as those that—while crucial for individuals’ survival in the face of climate related risk—do not promote longer-term environmental quality. We close by suggesting implications of our literature and resource review for EE in the face of climate change.

Introduction

As the need not only to mitigate but also to adapt to climate change becomes ever more urgent, the role of environmental education (EE) in climate adaptation raises challenging questions. Throughout its history, EE has evolved in response to societal and environmental concerns and today encompasses a broad range of pedagogical strategies. At the same time, the field has maintained a focus on fostering pro-environmental behaviors; such behaviors can help to lower consumption, energy use, and the production of greenhouse gases and thus play a role in mitigating climate change.¹ However, whereas climate mitigation education is consistent with EE's goals to reduce human impact on the environment, education focused on climate adaptation in some cases may conflict with EE foundational principles and goals.

The need for climate change adaptation suggests a different goal for EE, i.e., learning to live with—rather than attempting to prevent—climate change. In addition to ethical concerns posed by climate change education more broadly, such as humanity's obligation to future generations and issues of social and environmental justice,^(30, 37) education for adaptation further challenges environmental educators to consider the following question: Is education that accepts climate change as a given and incorporates how to adapt to a climate heavily impacted by humans and our consumption patterns consistent with the long standing goals of EE? On the one hand, a focus on adaptation could divert attention from important consumption reduction and other environmental behaviors consistent with climate mitigation. On the other hand, does a focus on mitigation alone, and in particular changing individual behaviors, pose an ethical conflict in painting a false sense of optimism about the future and about our capacity to protect current ecosystems in light of the magnitude and immediacy of climate change? And might a focus on climate change, whether emphasizing climate science, adaptation, and/or mitigation, have the inadvertent effect of creating a sense of hopelessness that EE professionals are not prepared to address?⁽¹³⁾

The goal of this paper is to open a discussion about the role of EE in climate change adaptation education. As a first step toward addressing this goal, we reviewed existing documents that shed light on the ethical issues posed by climate adaptation for EE. We also compiled information about existing educational materials, programs, and policy statements on climate adaptation education. In this paper, we first provide an overview of scholarly literature relevant to EE and climate adaptation, following which we present a compilation of existing resources as an illustration of current climate adaptation in EE. We close with some implications of this discussion for EE as it ventures into climate adaptation education.²

¹ Considerable debate exists about the impact of individual behaviors on mitigating climate change and on the most effective means to change individual environmental behaviors. These issues are dealt with elsewhere and are not the focus of this report.

² While ecosystems and organisms of all sorts adapt to climate change, this report focuses on environmental education about human adaptation to climate change.

Literature Review

EE, Education for Sustainable Development, and climate change education

The US Environmental Protection Agency defines the goal of EE as “to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones.” Further, a “major goal of environmental education is to induce individual behavior change and inspire action, not just to impart scientific facts.”⁽¹¹⁾ Given its focus on behavior change and action, EE has the potential to play an important role in climate change education.

However, in his 2012 book, *Conceptual Challenges for Environmental Education*, Christopher Schlottmann claims that climate change “poses a challenge to the traditional purposes of environmental education, such as preservation of wild places, ‘biophilia,’ local protection, personal virtues, technological skepticism, anti-urbanism, and aesthetic experiences. These purposes evolved in response to a particular set of ethical concerns that sometimes conflict with, or might distract us from, a comprehensive response to climate change.” Schlottmann continues on to say that, in response to climate change, EE should adopt a different set of purposes including “justice, concern for global populations, and future generations of humans and other animals,” as well as a stronger emphasis on ethics education focused on collective action problems, global justice, and “decision-making, trade-offs, problem-solving, and multifaceted ethical problems (such as economic considerations).”⁽³⁰⁾

Counter to Schlottmann’s assumption, EE has expanded far beyond its roots in nature appreciation in the early twentieth century to encompass multiple practices including those focused on social justice⁽⁷⁾ and decision making⁽¹⁶⁾, and concern for future generations is foundational to EE (cf. ¹⁰). Further, social justice figures very prominently in Education for Sustainable Development (ESD), which is similar to EE in many ways,⁽²⁶⁾ yet gives equal treatment to social and economic alongside environmental concerns. Whereas EE has no global organization to champion its cause, ESD is a recognized UN program and thus may be able to garner more attention and resources as a home for climate change education, particularly in developing countries. For these reasons, several authors have claimed that ESD is a better home for climate change education than EE.^(1, 5) ESD may be particularly well-suited to a focus within adaptation education on disaster preparedness and risk reduction, which encompasses actions such as ensuring that school buildings are protected from flooding, and teaching young people about personal responses to disaster (e.g., how to swim).⁽³⁷⁾

Environmental Education has adapted to other societal and environmental issues in the past
Throughout its hundred year history, EE has evolved in response to social and environmental changes.⁽¹⁰⁾ The early twentieth century nature study movement which emerged out of concern that urban migration would result in children losing opportunities to learn through direct contact with nature^(4, 9) is generally credited as the beginning of EE in the US. After the failed agricultural practices and devastating droughts of the 1930s, EE incorporated a focus on conservation education for wise use of natural resources, and EE expanded further in the 1960s as concern for pollution spurred a problem-solving pedagogy^(28, 31, 32). Following Richard Louv’s 2006 book *Nature Deficit Disorder*,⁽²³⁾ EE began emphasizing its ability to connect children to nature, thus partially harking back to the goals of the original nature study movement a century

earlier. These evolving approaches can be summarized as: learning about ecological processes/problems; outdoor nature education; and education for the environment, which encompasses both direct efforts to change behaviors as well as attempts to empower individuals to make their own decisions.^(16, 24, 29, 39)

Given that EE has evolved in response to environmental and social change, the question arises as to whether climate change is different than severe drought and soil erosion, or toxic pollution, as drivers for change in EE. In evolving to meet the educational needs brought about by previous environmental changes, EE efforts were aimed at mitigating or preventing future drought (through conservation practices) and pollution (e.g., through reducing consumption and recycling). As opposed to the situation today, in the past, there appears to have been a sense that EE could contribute to reviving sound conservation practices and thus conserving ecosystems and ecosystem function, or to reducing pollution to significantly lower levels. In the case of climate adaptation education, however, EE is forced to accept the reality that, within the near future, ecosystems will be changed in unforeseen ways and that changing agricultural practices or reducing consumption will not avert this reality. Further, one form of adaptation education, preparedness education, shifts the focus from environmental conservation to such issues as safeguarding existing built infrastructure, and public health and well-being, and away from environmental concerns.^(3, 14) We turn next to a discussion of adaptation and the array of actions that are being used to address climate change impacts, with the goal of finding a way forward for EE that incorporates adaptation consistent with EE foundational principles.

Climate Adaptation

The UN defines adaptation as “adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts.”⁽³⁶⁾ Adaptation needs are “circumstances requiring information, resources, and action to ensure safety of populations and security of assets in response to climate impacts.”⁽¹⁵⁾ The 2014 IPCC report also refers to adaptation options, or “the array of strategies and measures available and appropriate to address needs.” The report goes on to state that “identifying needs and selecting and implementing options require the engagement of individuals, organizations, and governments at all levels” and that “the capacity to adapt is dynamic and influenced by economic and natural resources, social networks, entitlements, institutions and governance, human resources, and technology.” In that EE builds human resources, but also has impacts on social networks, natural resources, and even governance, we see a role for EE in climate adaptation, working in conjunction with other strategies and institutions operating at multiple levels.

Adaptation actions cross multiple sectors including infrastructure (e.g., building seawalls), individual behaviors (e.g., home level disaster preparedness), agriculture (e.g., changes in farming practices), and policy (e.g., changes in building regulations).⁽²⁵⁾ Some actions within these sectors may not be consistent with environmental values and goals or the provision of multiple ecosystem services. For example, building concrete seawalls may protect against sea level rise but does not help restore natural barriers such as oyster reefs or dunes, which in turn may foster biodiversity and provide water filtering, food, and recreational ecosystem services leading to additional human health benefits.

However, closer examination of the IPCC report can help clarify which adaptation options are most consistent with EE. IPCC lists three general categories of adaptation options: physical and structural (this category is further divided into engineering/built environment, technological, ecosystem-based, and service), social, and institutional. Within each of these major categories are strategies consistent with environmental values.

Within the *physical/structural* category, ecosystem-based adaptation is defined as the use of “biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities adapt to the negative effects of climate change at local, national, regional and global levels.”⁽³⁵⁾ It includes practices such as restoring and maintaining wetlands, mangrove swamps, and salt marshes to buffer against sea level rise and storm impacts, while also providing carbon sequestration and biodiversity benefits such as fish habitat.⁽¹⁵⁾ In cities, green infrastructure, including green roofs, porous pavement, and parks and community gardens, can reduce climate-related flood risk and high temperatures and has collateral benefits such as food production, recreation, and education. Note that ecosystem-based adaptation, such as green infrastructure, also brings mitigation benefits and thus is consistent with EE goals. Further, ecosystem-based approaches generally require cooperation between government, NGOs, and community organizations, and thus readily lend themselves to EE programs that are part of larger governance systems. Finally, these approaches can encompass hands-on stewardship as well as citizen science data collection to assess the impacts of interventions.

Small-scale ecosystem-based adaptation could be integrated with adaptation options within the *social* category, including community-based adaptation and education. Social adaptation options reduce risks among vulnerable populations and address social inequities, whereas community-based adaptation is the subset of social adaptation options that entail “generation and implementation of locally-driven adaptation strategies, operating on a learning-by-doing, bottom up, empowerment paradigm that cuts across sectors and technological, social, and institutional processes.”⁽¹⁵⁾ Work in civic ecology has demonstrated how locally-driven, hands-on stewardship practices address not only social but also ecosystem processes. Examples include community gardening, oyster reef restoration, dune restoration, streamside stewardship, community tree planting, and bioswale gardening.⁽²¹⁾ Note that in addition to community-based adaptation, education is included as a social adaptation option, in part because education programs that involve collaborative hands-on stewardship activities may foster social capital and social-ecological systems resilience.^(15, 19, 20) Community-based adaptation strategies are consistent with social learning approaches used in EE and ESD⁽³⁸⁾ including the incorporation of local knowledge and a focus on learning through interaction of diverse stakeholders.⁽¹⁵⁾

EE also can play a role in *institutional* adaptation strategies. For example, EE has a long tradition of involving participants in planning and advocacy, which could entail climate adaptation planning to encourage environmentally-friendly built infrastructure. Further, EE might engage students in multi-sector stewardship activities and use reflection to help students understand the institutional measures (e.g., incentives) that can be used to encourage such activities. Participants might also learn about the role of multiple levels of governance, from community-based to international organizations, in climate change mitigation and adaptation.

In short, ecosystem-based, community-based, and education adaptation strategies are all consistent with EE's environmental improvement and climate mitigation goals, and EE can provide opportunities for learning about other adaptation options including those focusing on built infrastructure and governance. It is also possible that, through preparedness education or through learning about adaptation strategies such as engineering options (e.g., building seawalls) or social options (e.g., switching livelihoods), EE participants may gain an awareness of the seriousness of climate change and be more likely to support mitigation strategies consistent with environmental values.

Human Adaptation to Climate Change Educational Resources and Events

We next turn to our compilation of examples of how EE materials and programs are currently incorporating climate adaptation. We used two methods to compile educational resources on human adaptation to climate change. From September 2013 to June 2014, we conducted Google searches using a variety of search terms and phrases including and related to "climate change adaptation education." We also used snowball sampling, asking environmental education professionals for examples of education about human adaptation to climate change. Although we do not claim that our list of resources is comprehensive, based on saturation of the categories of resources we encountered toward the end of our search, we are likely to have captured the broad categories of resources available during the time period of the study.

Our search revealed a wealth of curricula focusing on human adaptation to climate change. Resources were designed for both formal and informal education settings and for ages ranging from middle school to graduate education (Table 1). In addition, we found educational organizations or networks that included a focus on human adaptation to climate change (Table 2) as well as other resources and initiatives (Table 3) and specific events (e.g., workshops) focused on climate change adaptation education (Table 4). An examination of climate change education resources produced by key government environmental agencies and other major organizations revealed lessons and curricula about climate science or mitigation strategies, but failed to turn up resources on human adaptation to climate change (Table 5). Finally, we found policy statements from major international organizations about the need for education on human adaptation to climate change (Table 6). Note that a number of resources in this latter category talked about how vulnerable communities can respond to immediate risks such as flooding and threats to health and livelihoods.

Implications for EE in a Climate Change World

Given that adaptation education extends beyond EE's purview of environmental enhancement to encompass issues of personal safety and even climate-proofing school infrastructure, one possibility is for EE to carve out where it can most contribute, and form collaborations with other educational, resource management, and governance disciplines. The IPCC adaptation options, including ecosystem-based, community-based, and education, are a good starting point for assessing how EE can contribute to climate adaptation education in a manner consistent with its goals, and that integrates adaptation and mitigation. Where adaptation focuses more on issues of climate equity, collaboration with ESD should be considered, and where the focus is on disaster preparedness and personal and infrastructure safety, UN programs such as Education for All and specific adaptation education initiatives may provide opportunities for collaboration.

In addition to its focus on decision-making and taking action, EE's work in connecting children and adults with nature should be considered among its potential contributions to climate adaptation education. Despite comments such as Schlottmann's that suggest nature education is not relevant to climate education, several pathways exist through which connection with nature may lead to action that addresses climate change and other environmental issues. First, research has shown that those who demonstrate environmental behaviors as an adult often were influenced by spending time in nature as a child.^(8, 40) In addition, through fostering mental well-being,^(17, 34) nature contact can enable children and adults to be civically engaged including on issues related to the environment. However, given that the majority of people live in cities, much nature contact may be in the form of visiting and caring for urban green spaces through such activities as community gardening, habitat restoration, wildlife restoration, and similar stewardship activities in urban and other disturbed systems, rather than in more remote wilderness areas. Such stewardship work may have additional benefits related to climate adaptation and mitigation, including provision of ecosystem services, and fostering self and collective efficacy and sense of place among volunteers, which could lead to further action.^(21, 22)

A subset of resources focusing specifically on climate adaptation encompass issues beyond the scope of EE. For example, UNICEF, which works with the 90% of the world's children who live in poor countries and thus are most vulnerable to climate change, seeks "an approach to adaptation that encompasses current risks and uncertainties, and also fosters the adaptive capacity of the most vulnerable." These risks include direct effects on school buildings and ability to attend school associated with increasing incidence of severe weather events and sea level rise, as well as effects on livelihoods of changes in seasonal patterns, desertification, soil erosion, species loss, and salinization, which in turn impact both household expenditure on schooling and children's nutritional status. Adaptation education needs to consider a broad suite of health issues aggravated by climate change, such as vector-, food-, and water-borne diseases, physical injuries such as drowning and heat stress, and malnutrition related to agricultural failure.⁽³⁷⁾ Similarly, disaster risk reduction education is part of adaptation education and focuses on such fundamental issues as ensuring the safety and continuity of education that may be disrupted by reduced household income for school fees, the destruction of school buildings during floods, and other climate related impacts.^(2, 37)

Examples of integrating disaster risk reduction and preparedness with environmental stewardship exist, such as using sustainability principles in redesigning schools to reduce vulnerability to flooding.^(1, 37) However, in cases where the focus is on saving lives through such activities as becoming familiar with early warning systems, disaster simulation, and drills and learning first aid and water safety, adaptation education, while critical to children's safety and survival, does not focus on environmental quality outcomes per se.

Recognizing the vulnerability of children to climate change, Bangay and Blum⁽⁵⁾ propose both a short-term and long-term solution: "The immediate challenge is to climate proof education systems (adaptation), while the longer and even more challenging task is to develop education systems that equip learners with the requisite skills..." Short-term actions focus on adaptation and include such things as climate "proofed" school design, adapting the school year to seasonality changes, ensuring the capacity to minimize schooling disruptions when responding to children displaced by disasters, and increasing the scientific capacity to transfer existing

technologies. Longer-term actions are consistent with mitigation and include such things as adopting low carbon technologies, and pedagogy that promotes higher-order thinking in support of sustainable livelihoods. These perspectives from UNESCO and others concerned with children's well-being emphasize the challenge brought about by climate change—vulnerable populations require immediate “adaptation” rather than mitigation responses. Yet the longer we wait for more long-term mitigation responses, the greater the need for short-term adaptation. Thus, thinking of short-term adaptation and longer-term mitigation may in the end work against both goals.

Conclusion

Although books such as *The Failure of Environmental Education*⁽⁶⁾ implicate EE in the inability of society to address major environmental problems, EE is only one of a constellation of education, resource management, and governance efforts operating at multiple levels that address climate change mitigation and adaptation. Based on climate adaptation options outlined by the IPCC, a number of adaptation scenarios exist in which EE can play a role and that are consistent with a focus on environmental equality and climate mitigation. At the same time, other adaptation actions, including those focused foremost on equity and personal safety, may fall under the purview of ESD and Education for All. In this case, collaboration among complementary efforts is called for. Going one step further, EE should consider its role in larger stewardship or environmental governance networks^(12, 33) or systems of adaptive co-management⁽²⁷⁾, as EE is only one of multiple efforts needed to try to avert and address climate change impacts.

Given the urgency and potential scale of climate change impacts, we suggest that adaptation education needs to take place simultaneously with mitigation education. We also are wary of authors who talk about climate change as neutral, claiming that humans will adapt and in some cases benefit. This line of reasoning leaves out the many other organisms that do not have the human capacity to adapt to changes outside their control. Finally, while broadly suggesting that EE address adaptation in ways consistent with mitigation, we leave it to a second report⁽¹⁸⁾ and larger discussion to address EE practices that have the greatest potential for averting climate change.

Human Adaptation to Climate Change: Educational Efforts and Resources

Table 1: Curricula that include focus on Human Adaptation to Climate Change

Level	Author	Focus	Reference
U.S. grades 3-12	Will Steger Foundation	“Arctic Peoples” has free online handouts and asks students to consider what adaptations they would have to make with a changing climate.	http://www.willstegerfoundation.org/curricula-resources/arctic-community-curriculum/arctic-peoples
U.S. middle school	Stanford University Climate Change Education	“Impact, Adaptation, and Mitigation of Climate Change”: students analyze climate data and identify, compare, and contrast adaptation and mitigation strategies.	https://pangea.stanford.edu/programs/outreach/climatechange/curriculum/4-impact-adaptation-and-mitigation-climate-change
U.S. middle school	NOAA’s Ocean Sciences Curriculum Sequences	3 units on the Ocean–Atmosphere Connection and Climate Change. In Unit 3, students “brainstorm, learn about, and communicate with others about personal, local, and global solutions and adaptations to climate change.”	http://mare.lawrencehallofscience.org/curriculum/ocean-science-sequence
Kiribati grade 8	Kiribati Ministry of Education	In Kiribati, one of the 14 curriculum outcomes on climate change focuses on adaptation to climate change in a social science (history) context.	http://jsd.sagepub.com/content/6/2/219.full.pdf+html (Article: Using Education to Bring Climate Change Adaptation to Pacific Communities, <i>Journal of Education for Sustainable Development</i> , 2012, 6: 219-235)
Canada secondary/middle	Jackie Oblak / Green Teacher	Students consider future human adaptations needed in different world regions, including locally for students.	http://greenteacher.com/is-climate-change-good-for-us/
U.S. secondary/middle	PBS Teachers	“Connecting Global Climate Change with Engineering” explores the importance of engineering solutions to the management of climate change by brainstorming ways to remove CO ₂ from the atmosphere and store it in a form that does not promote global warming. The module also provides resources for students to learn about engineering careers related to climate change.	http://www.pbs.org/teachers/stem/professionaldevelopment/050/
U.S. secondary	Project Learning Tree	“Southeastern Forests and Climate Change” helps students “Recognize that individual and community actions can help mitigate and adapt to climate change.”	http://www.pinemap.org/education/secondary http://sfrc.ufl.edu/extension/ee/climate
U.S. secondary	Southeast Project Learning Tree and the University of Florida	Students consider connections between forests, climate change impacts, and management strategies for creating resilient forests.	sfrc.ufl.edu/extension/ee/climate (Section 2, Activities 4 & 5). See also PLT <i>Focus on Forest</i> module.
Canada grade 9	Ontario EcoSchools	“Mapping Climate Change Impacts and Actions” curriculum	http://ontarioecoschools.org/curriculum_reso

		includes investigating the science and policy of climate change and planning adaptations for towns and cities across Canada.	urces/downloads/1EN_Geo_9FIN.pdf
U.S. – adaptable to different levels [aligns with Life and Environmental Science Standards F.8.9, F.8.10, F.12.7, F.12.8]	Finn Ryan: producer, script. Threehouse Media: illustration, animation. Ted Leonard: voice. Alison Coulson: background essay.	“Climate Wisconsin: Stories from a State of Change – Adaptation and Mitigation” has students watch a 3-min. video clip, research whether international climate change efforts focus more on adaptation or mitigation, and interview local natural resource managers to see how they are adapting to climate change.	http://climatewisconsin.org/story/adaptation-mitigation
Canada senior 2 science	Manitoba Education	“Teacher’s Guide for the Video Sila Alangotok—Inuit Observations on Climate Change”: learners consider how changing environments affect traditional livelihoods and adaptation abilities.	http://www.edu.gov.mb.ca/k12/docs/support/sila_video/ , http://www.iisd.org/casl/projects/inuitobs.htm
U.S. secondary	Stanford University Climate Change Education	“Consequences of Climate Change & Adaptation”: students analyze climate data and identify adaptation strategies.	https://pangea.stanford.edu/programs/outreach/climatechange/curriculum/5-consequences-climate-change-adaptation
Benin secondary	CC-DARE Programme in Sub-Saharan Africa	Aims “to remove barriers and create opportunities for integrating climate change adaptation into national development agendas of partner countries.” Outcome goals: “enhanced knowledge, skills and partnerships in systematic mainstreaming of climate change.”	http://unfccc.int/files/cooperation_and_support/education_and_outreach/application/pdf/a6dialogs3p02.pdf - This PPT describes the development of a climate change integrated secondary school curriculum in Benin and a school rainwater harvesting plan as a climate adaptation strategy in Seychelles.
undergraduate geography course	University of Wisconsin-Madison	Geog/NIES 339 had a unit on climate change, partly on adaptation, involving a student project to create a combination mitigation/adaptation plan for one of three cities (Milwaukee, Niamey, or Phnom Penh).	Personal communication with 2013-2014 class TA Catherine Day: ctday@wisc.edu
Interdisciplinary undergraduate course (freshmen and sophomores)	Tulane University (Fall 2010)	Included Unit 4 (weeks 13-15) on adaptation including adaptation plans, New Orleans and the Deltaic Plain, and Next Steps: Adaptation & Sea Level Rise.	http://www.camelclimatechange.org/view/article/51cbf1ac7896bb431f6a65a8/?topic=51cbfc8ef702fc2ba812d44e
Undergraduate and graduate degree programs + short courses	University of the Sunshine Coast, Australia	Offers a B.S. in Climate Change Adaptation, Masters of Climate Change Adaptation, and other related degrees. Offers a short course in “Adapting to Changing Climate: Impacts on Water Management” that demonstrates the tools for climate adapting and examines livelihood responses locally and globally.	http://www.usc.edu.au/university/faculties-and-divisions/faculty-of-science-health-education-and-engineering/faculty-research/climate-change-education-and-research , http://www.icewarm.com.au/short-courses/courses/10ACC/register
Masters and PhD degree programs	The University of the South Pacific	Coursework includes developing, analyzing, and/or evaluating community adaptation projects and adaptive capacity developing in specific communities/sectors. Includes the course	http://pace.usp.ac.fj/education/mastersandphd/inclimatechange.aspx

		“Climate Change: Impacts, Vulnerability and Adaptation” for planners and policy-makers.	
Graduate / continuing education	Smithsonian-Mason School of Conservation	“Intensive residential course for graduate credit or continuing education units (Oct. 20-31, 2014): Applied Climate Change: Gaining Practical Skills for Climate Change Adaptation.”	http://smconservation.gmu.edu/programs/graduate-and-professional/professional-training-courses/mccs-0509-applied-climate-change-gaining-practical-skills-for-climate-change-adaptation/
free online Coursera MOOC	University of British Columbia, Drs. Sarah Burch and Sara Harris	“Climate Literacy: Navigating Climate Change Conversations” focused on the science of climate change and also covered mitigation and adaptation, including some ways in which adaptation measures were being implemented. Modules included “Climate change adaptation: dealing with the effects” and “Policy tools for mitigation and adaptation.”	https://www.coursera.org/course/climateliteracy

Table 2: Online Networks with Resources for Adaptation Education

Online Resource	Reference
Teachers' Domain , a “free digital media service for educational use from public broadcasting and its partners,” contains a collection of national and international case study-based videos on “Human Responses to Climate Change: Adaptation Strategies” such as “Discover how climate change is impacting ice fishing in Wisconsin” (for grades 3-12).	http://www.teachersdomain.org/special/climlit/climlit.response.adaptation/
The Climate Adaptation Knowledge Exchange (CAKE) provides case studies, a virtual library of “quality-confirmed literature and information focusing on adaptation relevant to your adaptation planning,” tools (Facebook group, e-newsletter), a directory of practitioners, and a community forum.	www.cakex.org
The Tribes & Climate Change website contains “information and resources tailored to helping Native people gain a better understanding of climate change and its impacts on their communities.”	http://www4.nau.edu/tribalclimatechange/resources/adaptation.asp#tools
The Climate Literacy and Energy Awareness Network (CLEAN) has “scientifically and pedagogically reviewed digital resources for teaching about climate science, climate change, and energy awareness” including videos and activities on climate change adaptation and mitigation.	http://cleanet.org/clean/educational_resources/index.html?search_text=adaptation&Search=search
The Georgetown Climate Center’s Adaptation Clearinghouse “seeks to assist state policymakers, resource managers, academics, and others who are working to help communities adapt to climate change.” The center itself “strives to help communities meet these challenges by addressing the legal barriers that communities face when adapting to rising sea levels, and seeks to help localities prepare for the increased frequency, scope, and severity of heat events and extreme weather. The Center also strives to help communities spend disaster relief funds wisely by preparing for the next big storm – not just rebuilding to meet the status quo.”	http://www.georgetownclimate.org/adaptation/clearinghouse
Climate Interpreter , an online community to enable informal science education centers addressing climate change to collaborate, has an online Energy and Climate Literacy training module. “In order to make change to mitigate and adapt	http://climateinterpreter.org/resource?topic=63

to climate change, we must examine our use of energy and change how we handle energy resources.” A “simple video on climate change explains how humans impact climate and how climate impacts us. It explains what adaptation and mitigation mean and how we can be part of the solution.” It also has links to videos on topics such as improving energy efficiency, home solar water heaters and to a video on “Planning for Maryland’s Future Sea Level Rise” including adaptation info.	
Climate Access is an online community that “facilitates the rapid peer-to-peer exchange of information, bringing together those working on climate communications from various organizations and institutions. As such, Climate Access serves as a network of networks that fosters connection and collaboration and helps turn ideas into action.” Its Resource Hub contains “essential research, news articles, and commentary on climate change communications, behavior change, and public opinion.” It provides climate change messaging resources and an Adaptation Resources Collection, “A collection of reports and communication guides on public attitudes toward climate adaptation and how organizations can engage communities in the preparation process to increase resilience to climate impacts.”	http://www.climateaccess.org/resource/collection/adaptation-resources
Climate Adaptation Mitigation E-Learning (CAMEL Climate Change Education) is “a free, comprehensive, interdisciplinary, multi-media resource for educators” with module-based learning resources, community building, and social media interfacing.	http://www.camelclimatechange.org/#sthash.oilF5A3X.dpuf
The Ohio State University / Ohio Sea Grant has curriculum resources on climate change in the Great Lakes region including a webinar on how forest managers and landowners are adapting to climate change, focus group results on coastal communities planning adaptive strategies, and “Climate Ready Great Lakes” with modules on “What Am I Adapting To?”, “What is an Adaptation Plan?”, and “What Tools are Available to Help Me?”	http://climategreatlakes.com/tag/adaptation/

Table 3: Other Climate Adaptation Education Resources and Initiatives

Resource/Initiative	Reference
The Climate Change Environmental Education POLCA (Project-based Online Learning Community Alliance) surveyed environmental educators about their climate change education focus including adaptation and collected examples of climate change standards.	http://www.naaee.net/climatechange-POLCA
The “ Great American Adaptation Road Trip : Uncovering stories of people and places using their wits and resources to adapt to the impacts of climate change” project happened in Summer 2013, when two women traveled 17,000+ miles around the United States, visiting 31 states, to document on-the-ground examples of climate resilience—uncovering stories of people and places adapting to the impacts of climate change.	http://adaptationstories.com/
RISE: Climate Change and Coastal Communities tells the story of climate change and coastal communities from the perspective of local people in the San Francisco Bay Area through podcasts, videos, photos, and “webstories.”	http://newswatch.nationalgeographic.com/2013/03/29/rise-climate-change-and-coastal-communities/ , https://www.prx.org/accounts/7778-claireschoen/pieces
“ First Stewards Inc seeks to unite indigenous voices to collaboratively advance adaptive climate change strategies to sustain and secure our cultures and strengthen America’s resiliency and ability to adapt to climate change by holding	http://www.firststewards.org/

symposia, and cultivating sustainable projects and educational opportunities within indigenous communities.”	
The Kresge Foundation aims to build the field of climate change adaptation and “help develop new knowledge and practices that will enable and encourage society to prepare for the impacts of climate change on people and nature” and wants to “invest in the development of informational resources, networks and communication tools that promote learning about climate-change adaptation,” but it specifically doesn’t fund “environmental education programs or the development of curricula.”	http://kresge.org/programs/environment/adaptation-climate-change
The Wisconsin Initiative on Climate Change Impacts (WICCI) , a university/government collaboration, aims “to generate and share information that can limit vulnerability to climate change in Wisconsin and the Upper Midwest.” It recognizes that “Climate adaptation is usually NOT the most pressing consideration. BUT, failure to consider climate change may be disastrous.... WICCI’s role is to produce information that enables climate adaptation that is sustainable.”	http://www.wicci.wisc.edu/ , http://changingclimate.osu.edu/webinars/ppt/dvimont-dliebl-2013.pdf
The United Nations Development Programme (UNDP) has a funded project on “Building Adaptive Capacity and Resilience to Climate Change in the Water Sector in Cape Verde: To increase resilience and enhance key adaptive capacity to address the additional risks posed by climate change to the water sector in Cape Verde.”	http://www.adaptationlearning.net/project/building-adaptive-capacity-and-resilience-climate-change-water-sector-cape-verde
The Monterey Bay Aquarium “Launched ‘Change for the Oceans,’ an animated short on animal and human adaptation to climate change (co-created with Free Range Studios), 2010; finalist for the Best Short Shorts Award at the Jackson Hole Wildlife Film Festival, 2011.”	http://climateinterpreter.org/partner/monterey-bay-aquarium
The Chicago Zoological Society developed MyWaterFootprint to encourage citizens to conserve and protect water, especially in the Great Lakes area, which is a climate adaptation strategy though not labeled as such.	http://www.mywaterfootprint.org/Use-Water-Wisely.aspx
The Institute at the Golden Gate’s Climate Change Education & Parks program “supports and accelerates the role parks and protected areas play as resources and venues for climate change education.” It holds “the position that human-induced climate change is occurring and that parks have an opportunity to help the public understand this fact in a manner that produces dialog, understanding, and action.... Through direct education, training, and partnerships... parks... are encouraging the public to become stewards of a changing world.” It published a report highlighting strong park climate change education programs and trainings around the world.	http://www.parksconservancy.org/conservation/sustainability/climate.html , http://www.parksconservancy.org/assets/conservation/environmental-sustainability/pdfs/climate-in-the-parks-report.pdf
This video on Bangladesh: Rising tides force climate migration shows how “Climate migration has already begun in Bangladesh. In the first of two films, two families struggle to cope with their new environmental reality - one abandoning the village, the other struggling on against the tides.”	http://www.theguardian.com/environment/video/2009/nov/30/bangladesh-climate-migration
The Rockaway Waterfront Alliance works as a Preparedness Network: “We are working with youth, senior citizens and immigrants to improve the way we prepare for, respond to, and rebuild after natural disasters. We’re also building tools that use solar power, mobile devices, and social media to communicate vital information during emergency situations.”	https://www.rwalliance.org/call2action/
The Climate Change Education Partnership (CCEP) Alliance at the University of Rhode Island Graduate School of Oceanography is a network of six multi-institutional projects funded by the National Science Foundation. It aims to empower K-14 educators in teaching and learning about climate. It funds proposals, which “may incorporate content related to climate change mitigation and adaptation, but the emphasis should be on improving public understanding of: 1) the fundamental processes of the climate system; 2) the role of human systems in climate change; and, 3) the potential impacts and implications of climate change for human systems.”	http://www.nsf.gov/pubs/2012/nsf12523/nsf12523.htm
A large project led by the University of Wisconsin-Madison involves researchers and extension staff from seven	http://www.uwpowerswi.com/10-

<p>universities, five federal labs of the U.S. Departments of Agriculture and Energy, and the Innovation Center for U.S. Dairy: “Agricultural scientists from across the nation are embarking on a new five-year, \$10 million, USDA-funded effort to identify dairy production practices that minimize the emission of greenhouse gasses (GHG) and will be more resilient to the effects of a changing climate... There is also an educational component. Science educators will work with public school districts to develop curricula that integrate food and agriculture with cutting-edge approaches to science, technology, engineering and mathematics. That effort includes a partnership with the Milwaukee Public Schools anchored at Vincent High School.”</p>	<p>million-uw-madison-led-project-will-adapt-dairying-to-climate-change/, also http://sustainabledairy.org/2014/04/28/k-12-urban-agriculture-and-the-dairy-cap/</p>
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Table 4: Educational Events and Campaigns that include Adaptation

Event	Reference
<p>The California Academy of Sciences & The Nature Conservancy held a 2-day symposium exploring the connections between biodiversity, human wellbeing, and climate change on “Biodiversity, Human Wellbeing and Climate Change: What do we know, and what do we need to know?” Day 2 included sessions on “The Global Need for Resilience: Catalyzing Effective Adaptation” and “Synthesis and Next Steps—a facilitated discussion. Developing an Agenda for Effective Adaptation-Mitigating the Impacts of Climate Change on Human Health and Biodiversity.”</p>	<p>http://research.calacademy.org/biodiversityforum</p>
<p>The Center for Neighborhood Technology (CNT) and Let’s Go Chicago hosted a “Gross Gathering event for victims of urban flooding to share their stories and meet with contractors and officials, and discuss community-led solutions to flooding problems in the Chicago area.” “WHO: Urban flooding victims from the Rogers Park area; Harriet Festing, CNT’s Water Program Director; representatives from Let’s Go Chicago; flood mitigation contractors; elected officials (TBD).”</p>	<p>http://www.cnt.org/2013/09/12/media-alert-urban-flooding-victims-convene-at-the-gross-gathering-in-rogers-park/</p>
<p>GreenMapNYC and Time’s Up! offered a NYC Climate Week Adapting to Change Cycling Tour: “Sandy’s storm waters surged into Manhattan, heralding a new 21st century reality. Bike with us to explore both the aftermath and solutions generated on the LES, East Village and East River Park that respond to the realities of climate change. This Lower East Ride includes discussion of practical responses that increase livability as well as long term options for a more resilient NYC.”</p>	<p>https://www.facebook.com/events/314474965364085/permalink/334466310031617/</p>
<p>NYC CoolRoofs, a collaboration between NYC Service and the NYC Department of Buildings, holds roof coating service activities to “promote and facilitate the cooling of New York City’s rooftops. Applying a reflective surface to a roof helps reduce cooling costs, cut energy usage and lower greenhouse gas emissions. Join us as we coat New York City rooftops to make a greener, greater New York!”</p>	<p>http://www.nyc.gov/html/gbee/html/initiatives/coolroofs.shtml</p>
<p>Scientists at The Field Museum of Chicago held a “Climate Clinic” workshop on March 1, 2011 with nineteen leaders from four diverse Chicago communities. “Participants explored what climate change is, how it is impacting the Chicago region, and what people can do to lessen its impact (“mitigation”) and prepare to deal with changes that are already underway (“adaptation”).”</p>	<p>http://www.fieldmuseum.org/science/blog/making-climate-change-local</p>
<p>Minneapolis held Climate Adaptation & Resilience Workshops: Connecting Local Government Decision-Makers with Climate Adaptation Science - May 22, 2013</p>	<p>http://www.minneapolismn.gov/sustainability/reports/WCMS1P-108792</p>

<p>The Climate Adaptation Partnership held a conference on “Preparing Minnesota for Climate Change: A Conference on Climate Adaptation” at the Science Museum of Minnesota, St. Paul (including university, government, museum, and McKnight Foundation partners), on November 7, 2013 from 9:00 am - 5:30 pm. The conference was designed for Local Officials, Planners, Engineers and Natural Resource practitioners to learn about other communities' early successes in developing adaptation strategies in areas such as transportation infrastructure, natural resources, human health, and agriculture.</p>	<p>http://wrc.umn.edu/news/PreparingMinnesotaforClimateChangeAConferenceonClimateAdaptation/</p>
<p>Jamaica’s public awareness and education (PAE) campaign, part of the 30-month European Union funded Climate Change Adaptation and Disaster Risk Reduction project, aimed to target and educate decision- and policy-makers as well as the public about climate change issues. “Partnered with “Voices for Climate Change,” a national public awareness initiative that utilizes the “expertise, talents and influence” of 30 or so established popular entertainers to break down social barriers and educate Jamaicans on adaptation techniques.”</p>	<p>http://www.ipsnews.net/2012/04/jamaica-to-galvanise-public-on-climate-adaptation/, http://www.gcca.eu/national-programmes/caribbean/gcca-jamaica</p>
<p>The Association of Natural Resource Extension Professionals (ANREP) and the University of Minnesota Cooperative Extension held a National Extension Climate Science Initiative Conference in 2013 with one goal being to “Assist and guide participants to incorporate climate science into Extension programs without having to create new ones, using appropriate communication, adaptation and mitigation actions and strategies.”</p>	<p>http://sfec.cfans.umn.edu/Conference/index.htm</p>
<p>From November 7 – 9, 2013 The Institute at the Golden Gate’s Climate Change Education & Parks program “convened Parks: The New Climate Classroom, which brought together innovators and practitioners from the parks, education, communications, and other related fields to consider ways to accelerate and deepen the connection between parks and public education on climate change”, including ideas to engage learners and increasing effectiveness.</p>	<p>http://instituteatgoldengate.org/climate</p>
<p>The New York Sea Grant held a workshop on Living Shorelines for Coastal Erosion Protection in a Changing World “on Long Island to provide attendees with practical information on the use of living shorelines as an erosion control alternative. The meeting focused on smaller scale projects that have erosion protection as the primary objective.”</p>	<p>http://www.seagrant.sunysb.edu/articles/t/workshop-living-shorelines-for-coastal-erosion-protection-in-a-changing-world-marine-coastal-processes-facilities-marinas-news</p>
<p>To jointly address the need for improved climate literacy, NOAA’s National Sea Grant Office partnered with NIFA’s Institute of Bioenergy, Climate, and Environment to hold the first Climate Extension Summit (Summit) on March 13-14, 2012 in Silver Spring, MD. The Summit convened a small group of invited experts from both national networks to devise broad strategies and approaches to better engage the nation on issues concerning climate change and climate variability. June 2013.</p>	<p>http://www.nifa.usda.gov/nea/nre/pdfs/climate_ext_summit.pdf</p>
<p>A Ohio State University Climate Change Outreach Team webinar by Lyndsey Manzo: “Learn about integrating climate change education into your classroom or informal education programming, get an introduction to regionally relevant climate science, and hear about how other educators have used these materials. The webinar will be presented by educators who have used the resources in their own teaching, both in the classroom and in place-based education. The presentation will cover: Ohio Sea Grant’s updated Great Lakes Climate Change Curriculum, climate and Great Lakes literacy principles, and informal resources to supplement and expand lesson plans.”</p>	<p>http://changingclimate.osu.edu/webinars/archives/2013-07-11/</p>
<p>The New York Hall of Science held a free Climate Change Communications Workshop for organizations “interested in learning how climate change might affect their audience” on 10/10/2013 including adaptation issues.</p>	<p>http://blog.nysci.org/post/61506813109/free-climate-change-workshop</p>

The Greater Saint Paul Building Owners and Managers Association and the Science Museum of Minnesota offered a seminar for the commercial real estate industry on “Preparing Buildings for a Changing Climate” on topics including “Creating Plans to Mitigate and Adapt to Climate Change.”	http://bomasaintpaul.org/images/downloads/Newsletters/49893_boma_sept_2013_web.pdf
The US EPA and Antioch University's Department of Environmental Science held an Educators Summit as Day 3 of the Local Solutions: Northeast Climate Change Preparedness Conference. It aimed to help middle and high school teachers and community leaders engage students as citizen scientists working to better prepare their natural and human-built communities for the impacts of climate change.	http://www.antiochne.edu/innovation/climate-change-preparedness/educators-summit/
The Tompkins County Cornell Cooperative Extension Education Center held a 2-hour workshop on “Climate Change and Gardening in NYS” on 7/30/14 on how climate change will affect life and gardening in upstate NY, the Cornell Climate Change website, and how gardeners can adapt by selecting different plants or varieties and by devising means to control, store, and deliver water.	https://groups.google.com/forum#!topic/fcna-ithaca/pVwy_9JvzF4

Table 5: Climate Change Education Resources that Do Not Focus on Adaptation [Note: It is possible that after 7/21/14, these resource added a focus on human adaptation to climate change.]

Lesson Type	Author or Site Host	Focus	Reference
climate science	Climate Change Collection	Science education web-based resources covering natural climate dynamics as well as human impacts on the climate system. A suite of 40 digital library resources, the Climate Change Collection has been reviewed and ranked by the review team who considered the scientific accuracy, currency and effective and efficient educational potential. Using a five star rating system, all resources included in the collection have an average rating of at least 3.5 stars from two or more reviewers. Not adaptation-focused, but include a few links relevant to adaptations.	http://serc.carleton.edu/climatechange/summary.html
climate science	NOAA	Education Resources on Climate Change Impacts – introductory page mentions that agriculture can adapt.	http://www.education.noaa.gov/Climate/Climate_Change_Impacts.html
climate science	EPA	Teacher Resources and Lesson Plans	http://www.epa.gov/students/teachers.html#epacclimate
climate science	NASA	“Climate Kids”: Big Questions on climate change science, science crafts and games, environmental careers interviews	http://climatekids.nasa.gov/
climate science	National Academy of Sciences	Science education standards incorporate climate change but not adaptation	http://nextgenscience.org/
climate science	United States Global Change Research	Climate Literacy: The Essential Principles of Climate Science – “This guide presents information that is deemed	http://downloads.globalchange.gov/Literacy/climate_literacy_lowres_english.pdf

	Program	important for individuals and communities to know and understand about Earth’s climate, impacts of climate change, and approaches to adaptation or mitigation. Principles in the guide can serve as discussion starters or launching points for scientific inquiry. The guide aims to promote greater climate science literacy by providing this educational framework of principles and concepts. The guide can also serve educators who teach climate science as a way to meet content standards in their science curricula.” It mentions adaptation several times.	
climate science and societal impact	Wisconsin Dept. of Natural Resources	The teachers’ guide “Climate Change: A Wisconsin Activity Guide” (grades 7-12) discusses climate change’s causes, ecosystem impacts in WI, social and cultural perspectives, and related crafts and other actions. Contains an activity where students explore how climate change will impact their assigned character (e.g., cranberry farmer or NGO staff) but does not focus on adaptation.	http://dnr.wi.gov/org/caer/ce/eeek/teacher/Climateguide/PDF/WisCCGuideALL.pdf
mitigation	Center for Environmental Education	Reducing waste and mitigation	http://www.cceonline.org/
	UC-Davis (Prof. Arnold J. Bloom)	Free online MOOC - Climate Change Causes, Consequences and Solutions - “examines (1) the factors responsible for climate change; (2) the biological and sociological consequences of such changes; and (3) the possible engineering, economic, and legal solutions to avoid more extreme perturbations. It includes weekly themes, daily mini-lectures, data visualizations, quizzes, exams, weekly assignments, a textbook, and readings.” Its focus is on scientific concepts with some mitigation.	http://www.climatechangecourse.org/index.html
mitigation	Cool The Earth	Cool The Earth “is a free, ready-to-run climate change assembly program that educates K-8 students and their families about climate change and inspires them to take simple actions to reduce their carbon emissions. The program is successful because it’s fun and empowering for the kids, and their enthusiasm is contagious!”	http://www.cooltheearth.org/pages/our-programs/what-is-cool-the-earth
mitigation	Facing The Future	“ The Climate Change Action Project Database includes more than 25 ready-to-use action projects that will prepare students to understand and take action on climate change.”	http://www.facingthefuture.org/ServiceLearning/ClimateChangeActionProjects/tabid/350/Default.aspx#.U2BbjIFdVjt
religious	Interfaith Climate Change Network	While most of this 3-4 week adult education program on climate change focuses on themes other than adaptation,	http://interfaithpowerandlight.org/wp-content/uploads/2009/11/CryOfCreation.pdf

		<p>one activity does touch on adaptation directly:</p> <p>“Many of the statements from various religious traditions emphasized global warming as a justice issue. Similarly, the IPCC’s 2001 Synthesis Report stated that, “Those with the least resources have the least capacity to adapt and are the most vulnerable. The poor are expected to disproportionately bear the burden of future changes in climate extremes.” How do such statements affect your perception of your faith’s connection to climate change?”</p>	
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Table 6: Organizational Statements on the Need for Education on Human Adaptation to Climate Change

Statements	Reference
<p>UNICEF has a resource manual “Climate Change Adaptation and Disaster Risk Reduction in the Education Sector” (see p. 139 on Implementation - www.unicef.org/cfs/files/UNICEF-ClimateChange-ResourceManual-lores-c.pdf) and a web page with these statements:</p> <ul style="list-style-type: none"> • Quality education is absolutely necessary to achieve sustainable progress on climate change adaptation by creating an empowered and capable citizenship with the knowledge, skills and values needed for local innovation and scale up of adaptation projects. While funding runs out and physical structures disintegrate, education creates a sustainable source of local capacity and local solutions far into the future. • While children are among the most vulnerable to climate change, they should not be considered passive or helpless victims. Children are powerful agents of change, and studies have found that many children can be extraordinarily resilient in the face of significant challenges. Providing children with empowering and relevant education on disasters and climate change in a child-friendly school environment can reduce their vulnerability to risk while contributing to sustainable development for their communities. Educating girls and women is one of the best ways of strengthening community adaptation to climate change, as shown by recent studies. • UNICEF works on scaling up and mainstreaming climate change adaptation and disaster-risk reduction plans into the education sector. This work is based on the principles of child-friendly education and aims to integrate climate change, disaster risk and environmental issues across the education system, including within policies and legislation, education sector plans and budgets, curricula and examinations, teacher education, school infrastructure and facilities, learning environments, and school governance and management. • Incorporating climate change and environmental education, including education on disaster-risk reduction, into a child-friendly education curriculum ensures the realization of children’s environmental rights as enshrined in many articles of the Convention on the Rights of the Child. 	<p>http://www.unicef.org/education/bege_61668.html</p>
<p>The Higher Education Climate Adaptation Committee prepared a report on “Higher Education’s Role in Adapting to a Changing Climate” that outlines key needs for higher education to take leadership on adaptation to climate change through curricula, research, operations and infrastructure, and local communities:</p>	<p>http://www.camelclimatechange.org/files/201001_201100/201022/</p>

<ul style="list-style-type: none"> Climate change poses serious threats to human civilization, yet it offers opportunities to create a better future. Colleges and universities face clear and growing risks from climate disruption, and it is critical that presidents, trustees and those with fiduciary responsibility for these institutions be aware of these risks. Addressing these risks can provide the opportunity to recreate institutions of higher education for the 21st century, equipping them to be safe and secure in the face of change, more actively engaged in solving real-world problems, and reorganized to better provide the education and research needed to create and maintain a sustainable society.... The report recommends that college and university presidents, trustees and other senior administrators, particularly business officers, take a proactive approach to climate change adaptation, including the following actions: <ol style="list-style-type: none"> 1. Understand the expected impacts of climate disruption in their region. 2. Conduct an analysis of what financial and human health and safety risks these impacts pose to the institution. 3. Identify and prioritize strategies for reducing these risks that whenever possible also contribute to mitigating greenhouse gas emissions, and integrate those strategies and actions into the institution’s climate action plans and campus master plan. 4. Evaluate academic offerings on climate adaptation and expand as needed to ensure all graduates have a sufficient understanding of the risks and how to address them in their personal and professional lives. 5. If applicable, evaluate research activities and pursue opportunities for generating new knowledge that will help society adapt to climate disruption. 6. Engage leaders in local communities in a dialogue to identify opportunities for the institution to provide education, research, and pilot projects on adaptation; and for larger projects that can be pursued in collaboration to improve the resiliency of the region’s infrastructure, energy systems, water system, food systems, and transportation systems. 7. Take leadership in assuring that communities in the institution’s region have access to credible, informative science, and that access is extended particularly to communities that are likely to be most impacted by the effective [sic] of climate change. 	higher-education-s-role-in-adapting-to-a-changing-climate.pdf
<p>The U.S. National Fish, Wildlife and Plants Climate Adaptation Strategy aims “to inspire and enable natural resource administrators, elected officials, and other decision makers to take action to adapt to a changing climate. Adaptation actions are vital to sustaining the nation’s ecosystems and natural resources—as well as the human uses and values that the natural world provides.</p> <ul style="list-style-type: none"> • Strategy 6.1: increase public awareness and understanding of climate impacts to natural resources and ecosystem services and the principles of climate adaptation at regionally-and culturally-appropriate scales. • To ensure success and gain support for adaptation strategies, a high priority must be placed on public outreach, education, and engagement in adaptation planning and natural resource conservation. • Development and implementation of effective adaptation policies and practices requires that interested constituencies and key stakeholders understand the fundamentals of climate change adaptation. Practical education and outreach efforts and opportunities for participation should be developed and implemented whenever possible. 	http://www.wildlifeadaptationstrategy.gov/pdf/NFWPCAS-Final.pdf
<p>The global insurance industry has developed a statement on adapting to climate change in developing countries and states: “The insurance industry can support adaptation efforts through [among other points]: Raising awareness among the many stakeholders of the insurance industry – including governments and regulators, clients and business partners, business and industry, civil society and academia – about the impacts of climate change, the adaptation needs of those most at risk, and the role that the insurance industry can play in advancing adaptation, as described in this Statement.”</p>	https://www.genevaassociation.org/media/15366/2009-global_insurance_industry_statement.pdf
<p>An opinion piece on how countries like Japan can mitigate risk to natural disasters states that, “In order to prepare populations to adapt to climate change and respond to disasters around the world in a way that minimizes loss of human life as well as damage to</p>	http://www.brookings.edu/research/opinions/

social, economic and environmental systems, there is an urgent need for climate change education that integrates disaster risk reduction and preparedness as well as environmental stewardship. Learning about environmental stewardship should include not only environmental education, but also climate change and scientific literacy, and education for sustainable lifestyles and consumption. Learners need a basic understanding of scientific concepts with a deeper level of systems thinking, such as knowledge of the history and causes of climate change; knowledge of and ability to distinguish between certainties, uncertainties, risks and consequences of environmental degradation, disasters and climate change; knowledge of mitigation and adaptation practices that can contribute to building resilience and sustainability; and understanding of different interests that shape different responses to climate change and ability to critically judge the validity of these interests in relation to the public good.”

[2011/03/14-japan-disaster-education-anderson](#)

Literature Cited

1. Anderson, A., "Combating Climate Change through Quality Education," (Washington, DC: Brookings Institution, 2010).
2. ---, "Learning from Japan: Promoting Education on Climate Change and Disaster Risk Reduction," (Washington, DC: Brookings Institution, 2011).
3. Antioch University, "Center for Climate Preparedness and Community Resilience," (2014).
4. Bailey, L.H. *The Nature Study Idea*. New York City, NY, USA: MacMillan Co, 1909.
5. Bangay, C. and N. Blum, "Education Responses to Climate Change and Quality: Two Parts of the Same Agenda?," in *International Journal of Educational Development* (2010).
6. Blumstein, D.T. and C. Saylan, "The Failure of Environmental Education (and How We Can Fix It)," (2007).
7. Bowers, C.A., "Toward an eco-justice pedagogy," in *Environmental Education Research* (2002).
8. Chawla, L., "Learning to Love the Natural World Enough to Protect It," in *Barn* (2006).
9. Comstock, A.B. *Handbook of Nature Study*. Ithaca NY, USA: Cornell University Press, 1911.
10. Disinger, J.F., "Tensions in environmental education: Yesterday, today, and tomorrow," in *Essential Readings in Environmental Education*, ed. Hungerford, H.R., W.J. Bluhm, T.L. Volk and J.M. Ramsey (Champaign IL USA: Stipes Publishing LLC, 2001).
11. EPA, "What is Environmental Education?," (2014).
12. Fisher, D.R., L. Campbell, and E.S. Svendsen, "The organisational structure of urban environmental stewardship," in *Environmental Politics* (2012).
13. Fraser, J. and C.B. Brandt, "The emotional life of the environmental educator," in *Trading Zones in Environmental Education: Creating Transdisciplinary Dialogue*, ed. Krasny, M.E. and J. Dillon (New York City, NY, USA: Peter-Lang, 2013).
14. Harvard University, "Climate Preparedness," (2013).
15. IPCC. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]*. New York: Cambridge University Press, 2014.
16. Jensen, B.B. and K. Schnack, "The action competence approach in environmental education," in *Environmental Education Research* (1997).
17. Kaplan, S. and R. Kaplan, "Health, supportive environments, and the reasonable person model," in *American Journal of Public Health* (2001).
18. Krasny, M., J. Carey, B. DuBois, C. Lewis, J. Fraser, K. Fulton, B. Spitzer, L. Leou, J. Braus, A. Ferguson, J. Marcos-Iga, and A. Price, "Climate Change and Environmental Education: Framing Perspectives," (Ithaca NY: Cornell University, 2015).
19. Krasny, M., L. Kalbacker, R. Stedman, and A. Russ, "Measuring social capital among youth: applications in environmental education," in *Environmental Education Research* (2013).
20. Krasny, M.E., C. Lundholm, and R. Plummer, eds., *Resilience in Social-Ecological Systems: the Role of Learning and Education*. (New York City, NY, USA: Taylor and Francis, 2011): Pages.
21. Krasny, M.E. and K.G. Tidball. *Civic Ecology: Adaptation and Transformation from the Ground Up*. Cambridge, MA, USA: MIT Press, 2015.
22. Kudryavtsev, A., M.E. Krasny, and R. Stedman, "The impact of environmental education on sense of place among urban youth," in *Ecosphere* (2012).

23. Louv, R. *Last Child in the Woods: Saving our Children from Nature-Deficit Disorder*. New York City, NY, USA: Algonquin Books, 2006.
24. Lucas, A.M., "Environment and environmental education: Conceptual issues and curriculum implications," (Columbus OH, USA: Ohio State University, 1972).
25. Matthews, J. and P. Waterman, "Sustainable Literacy and Climate Change: Engagement, partnerships, projects," in *Universities and Climate Change: Introducing climate change to university programmes*, ed. Filho, W.L. (Heidelberg: Springer, 2010).
26. Monroe, M., "The co-evolution of ESD and EE," in *Journal of Education for Sustainable Development* (2012).
27. Olsson, P., C. Folke, V. Galaz, T. Hahn, and L. Schultz, "Enhancing the fit through adaptive comanagement: Creating and maintaining bridging functions for matching scales in the Kristianstads Vattenrike Biosphere Reserve Sweden," in *Ecology and Society* (2007).
28. Sauv , L., "Currents in environmental education: Mapping a complex and evolving pedagogical field," in *Canadian Journal of Environmental Education* (2005).
29. ---, "Environmental education between modernity and postmodernity: Searching for an integrating educational framework," in *Canadian Journal of Environmental Education* (1999).
30. Schlottmann, C. *Conceptual Challenges for Environmental Education*. New York, NY: Peter Lang, 2012.
31. Stapp, W.B., "The concept of environmental education," in *Journal of Environmental Education* (1969).
32. Stapp, W.B., A. Wals, and S.L. Stankorb. *Environmental Education for Empowerment: Action Research and Community Problem Solving*. Dubuque, IA, USA: Kendall Hunt, 1996.
33. Svendsen, E.S. and L. Campbell, "Urban ecological stewardship: Understanding the structure, function and network of community-based land management," in *Cities and the Environment* (2008).
34. Ulrich, R.S., "View through a window may influence recovery from surgery," in *Science* (1984).
35. UNEP, "Climate Change Adaptation," (n.d.).
36. UNFCCC, "Adptation," (2014).
37. UNICEF, "Climate Change Adaptation and Disaster Risk Reduction in the Education Sector: Resource Manual," (New York: UNICEF, 2012).
38. Wals, A.E.J. *Social learning towards a sustainable world: Principles, perspectives, and praxis*. Wageningen, The Netherlands: Wageningen Academic Publishers, 2007.
39. Wals, A.E.J., F. Geerlin-Eijiff, F. Hubeek, S. van der Kroon, and J. Vader, "All mixed up? Instrumental and emancipatory learning toward a more sustainable world: Considerations for EE policymakers," in *Applied Environmental Education and Communication* (2008).
40. Wells, N.M. and K.S. Lekies, "Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism," in *Children, Youth and Environments* (2006).