

## Chapter 2

# Getting Started in Teaching about Climate Change

The Earth is not our creation. It has no respect for us. It has no use for us. And its vengeance is not the fire in the cities but the fire in the sky.  
Ta-Nehisi Coates (2015, p. 150)

We might soon find that we were building a different sort of society, one emphasizing quality of life before raw statistics of economic growth and relentless consumerism . . . Life would go on, with all its trials and tribulations—and that, after all, is precisely the point. Unless we do constrain carbon, life will very largely not go on at all.  
Mark Lynas (2008, p. 302)

In the first chapter we explain why climate change is a critical issue, perhaps the most important challenge facing life on Earth. We describe the need to adopt a “climate change perspective” that recognizes the rapid advance of climate change, the human systems that cause it, its unequal impacts, and the urgency of individual and collective action. We describe climate change as not a purely scientific issue, but one that is critical for English language arts in that it raises social, moral, and ethical questions. Climate change requires essential language arts skills: understanding experiences of others, rethinking values, critically analyzing arguments and media representations, and reflecting on the past to better imagine alternative futures. Moreover, English teachers can help students to develop messaging skills and persuasive arguments that can contribute to change at local, national, and global levels.

In this chapter, we focus on how to begin addressing climate change in the English classroom. We share carefully selected examples from our classrooms along with comments, feedback, and suggestions from other language arts teachers. We talk about short stories, writing assignments, nonfictional essays, book chapters, and documentaries that can be quickly and easily integrated into your teaching of almost any secondary English language arts class, one or more pieces at a time as well as through the use of interdisciplinary instruction (Draper et al., 2010).

We describe a critical inquiry approach, sometimes called a critical inquiry stance, where students pose questions that matter and undertake meaningful research. Their inquiry includes reading diverse texts carefully, understanding multiple perspectives, imagining alternative futures through immersion in literature, and taking stands by writing persuasive and creative texts of various kinds. A crucial dimension of inquiry is envisioning, advocating, and enacting change. When it comes to climate change that means becoming part of the effort to educate others and to act together to save the Earth (Moore, 2013; Stephenson, 2015).

## FIRST STEPS

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Climate change is a daunting topic. This chapter is about first steps, and where they can take you. Step out from where you are currently teaching. The changes you make, small at first, will lead to new ideas and redesigned approaches. Subsequent chapters of the book will provide important frameworks, ideas, examples, and strategies that will help you carry forward the teaching about climate change that you will have already begun.

### STARTING POINT 1: TEACH A SHORT STORY (OR STORIES) ABOUT CLIMATE CHANGE

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Most English teachers teach literature at one point or another. Here we share our experiences, student responses, and teaching ideas for four short stories you could also use as starting points for addressing climate change. These four stories are all examples of “climate fiction,” “cli-fi” as it is popularly known, and come from two excellent collections: *I’m with the Bears: Short Stories from a Damaged Planet* (Martin, 2011) and *Winds of Change: Short Stories about our Climate* (Woodbury, 2015). (At our request the publishers have agreed to make these stories available to you and your students for free or at a special reduced price. The stories from *Winds of Change* are found free, full text at <http://eco-fiction.com/read>. To access a 40-percent reduced price paper copy, or 50 percent reduced digital copy of *I’m with the Bears*, go to the Routledge site for our book <http://tinyw.in/mftl> and look for the tab with code for Verso. More short story resources are described in Chapter 4.)

The twelve-page short story, “How Close to the Savage Soul” in *Winds of Change* by environmental writer John Atcheson (2015) depicts a frightening near future altered by climate change. A grandfather, a young father in our present day, takes his grandson from the fortified community where they live out to an Atlantic Ocean beach that had been beautiful and restorative. However, the water has risen and become acidic, increasing temperatures have devastated agriculture, and, outside their protected community, “adolescents without hope were turning the whole country into a real-world *Lord of the Flies*” (p. 36).

Allen’s students noticed that many small aspects of the depiction of the natural environment in the story portrayed the impact of climate change. They were especially interested in the description of what the country would be like after climate change disrupts normal social order. As they discussed the story, Maddie Reeves commented on the “gated off” areas for the “privileged.” Lauren Koch pointed out that the inequality of our own time becomes, in the aftermath of climate change depicted in the story, even more extreme. Jake Peters commented that the story might change people’s perspectives on money: the main character as a young man was wrapped up in getting ahead financially at any cost, but as an older man he regrets his choices.

There is much secondary students can do with “How Close to the Savage Soul.” As Allen’s students noticed, the short story makes claims about the effects of climate change that students can research. It provides a dystopic social vision that students can discuss and evaluate. There are flashbacks to the central character’s growing up, so there are possibilities for character and behavior analysis, as Jake suggests, looking at values and decisions. A motif in the story is “paying attention to warning signs,” that opens up inquiry into climate change “warning signs” in today’s world, and how we, in the present, might pay attention and act so as to avoid the dire future the story foretells.

If “How Close to the Savage Soul” is intense and frightening, a climate change short story that uses humor to make a serious point is “Hermie” by Nathaniel Rich (2011) in *I’m with the*

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*Bears*. This magical realist nine-page story works well with any grade level, from upper elementary through high school. The premise is that a marine biologist is about to give a lecture at an international conference when, in the hotel bathroom, he somehow encounters Hermie, the very Hermit crab that he used to play with at a Florida beach when he was a boy. Of course Hermie can talk, and he reminds the narrator of the times they had together in childhood and informs him about how the beach and sea life have been devastated by rising sea levels, poisoned water, and worsening storms, resulting in loss of species (Stracher, 2011).

The story personalizes the impacts of environmental degradation and Allen's students found it not only "cute" but also "an interesting way to bring up climate change." Blair LaCross was struck by the premise of "nature asking humans for help." The story is an entry point for learning about global warming, and Allen's student Jessica Poling pointed out that the story might seem strange if students knew nothing about climate change. So, again, this cli-fi short story invites inquiry and research. "Hermie" is also a mentor text for place-based creative writing: students could write about either real or imaginary interactions with a place or wildlife that they knew as children and then in a realistic, or perhaps magical realistic way as inspired by the story, project into the future and explore possible impacts of climate change.

A third story, "The Audit," by Rachel May (2015) (in *Winds of Change*), also set in the near future. International agreements mandate "audits" to reduce everyone's "climate footprint." The story focuses on an upper middle class American family with three teenage children living in the suburbs. Their audit informs them:

Your carbon footprint is 3.4 times the acceptable global mean. If everyone generated your level of greenhouse gases, 3.4 planet Earths would be required to accommodate the emissions. The terms of the Global Climate Accord require that you reduce your footprint as follows . . .

May (2015, p. 43)

"The Audit" is a perfect impetus for students to examine ways to learn about their own "carbon footprint." There are several websites where students can have their carbon footprint calculated. Thus, the story is a starting point to research the "carbon budget" that scientists tell us must be adhered to in order to avoid the worst impacts of climate change. Maddie pointed out that the story shows students methods for addressing climate change in their lives. "The Audit" opens discussion about how to make value choices, and creates opportunities for both self-reflective writing and writing to influence others.

Margaret Atwood's two-page "Time Capsule Found on the Dead Planet," is climate change flash fiction. Found in a cylinder of brass on a dry lake shore by travelers from a distant world, the time capsule tells of a civilization that worshiped money and created feasts and famine, towers of glass, and "ate whole forests, croplands, and the lives of children." Clara Peeters described the story as "poetic and powerful." Blair called it "a war memorial tombstone of the Earth."

The story presents a disturbing vision of where our planet might be if climate change is not addressed. It considers the natural environment in the long view, and invites young people to think about behavior and values from a climate change perspective. The story inspires discussion for additional learning about climate change, as well as serving as an inspiration for your students writing their own climate change flash fiction!

Each of these stories illustrates key points about teaching about climate change in English. "How Close to the Savage Soul" opens the door for student critical inquiry, research, and strategies for mitigating climate change. "Hermie" suggests ways to make the issue personal and local, and suggests some possibilities for students to suspend disbelief and use their creative

imagination. “The Audit” focuses on values, lifestyles, and not only the costs, but also the new, positive, possibilities that could come about as climate change is meaningfully addressed. “Time Capsule” puts human experience into a long view while fostering a sense of urgency and commitment. All of these dimensions of teaching about climate change will be developed in subsequent chapters.

Cooper Franks, a teacher in Southfield, Michigan, explains that:

In teaching tenth-grade English in an urban district in metro Detroit, my students had little exposure to the natural world, but significant exposure to other environmental issues, such as the recent Flint Water Crisis. These short stories provided the spark to begin discussion surrounding water issues, pollution, and other environmental issues that affected the students’ urban context.

Carly Fricano, a tenth-grade teacher in urban Memphis, Tennessee commented:

I really like the idea of using a short story as a jumping-off point for a unit on climate change. My unit would culminate (or be interspersed) with Socratic seminars where I would pose an argumentative statement about a climate change issue and ask students to use evidence from both the fiction and informational texts to support their points of view, beginning with “as human beings living on this planet, we are just as responsible for the impact our actions have on the Earth as we are for the lives of others.” We could also tie this topic into a bystander/upstander conversation.

Justin Boyd, a teacher in suburban Greeley, Colorado reports that:

My eleventh-grade students read these short stories. Through class discussions, it became clear that many students felt powerless in the face of climate change. They did not believe they could have an impact. To address that at the end of the unit, I asked students to work in groups to develop either solution-oriented infographics that visually explain a complex idea about global warming or alternative energy (i.e., what could a student do to lower their carbon footprint?). This paired nicely with the short story “The Audit.” (Examples of student work by Zilla & Sam at <http://tinyw.in/RnBp> and Vikki & Ren at <http://tinyw.in/Ejem>.)

Susan Waldie, a teacher in Richland, Michigan, explains that:

When I started a lesson on climate change with my sixth-grade students in a suburban middle school some students asked, “Ms. Waldie, why are we doing this in ELA?” After sending my students on a webquest that I created to help them learn more about climate change, <http://mswaldieccwebquest.weebly.com>, their thinking began to change. Soon they were not only engaged in our discussions with the short story “Hermie,” but outraged at how drastically their lives would be impacted. We finished by watching *The Lorax* and writing a paragraph in which many students made an oath to making small changes in their own lives to better serve our planet.

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## STARTING POINT 2: ASSIGN WRITING ABOUT CLIMATE CHANGE

As we suggested, the short stories above can be springboards for persuasive and narrative writing. If you are teaching persuasive writing, your students can research and attempt to persuade others about climate change or one of its aspects. As we know, students are most likely to learn writing or media skills when they are engaged with meaningful content and composing for real audiences.

After engaging in research on climate change, Allen had his students write as if they were members of a middle school or high school after-school environmental club that decided to focus on global warming. They were asked to write a letter to school administration, teachers, or parents in the community about why they need to support the creation of curriculum about climate change in the school. Cece Watry decided to write to the school board to make the case for addressing climate change across the curriculum:

Climate change may and should be introduced in a scientific way in the science classrooms because that is where the proof is. The science is honest, naked, and extremely clear as to why climate change is such a pressing matter for humanity . . . Another great classroom to teach climate change is history. Perhaps even create a climate change history course on its own, but a unit on climate change should definitely be incorporated into history classes . . . A great place to start is the English classroom. There are a multitude of short stories and novels, including fiction, nonfiction, and so on, that can be read in class and used as a source for discussion on climate change.

Another persuasive piece Allen asked his students to do (in small groups) was to create short videos (could be posted on YouTube) analyzing the greenwashing strategy of a particular company or the position of a climate change denier. Greenwashing is a form of marketing or “spin” that deceptively promotes an organization’s products, aims, or policies as environmentally friendly (Watson, 2016). Students enjoyed web searches to find examples of greenwashing and climate change denial, and sharing egregious examples (for examples <http://tinyw.in/ymoj>). Students can then create their own parody examples using VoiceThread or video production tools. Students can also use culture jamming and subvertising (Google it!) to exaggerate and mock patently ridiculous claims.

Creative writing offers another excellent starting point for addressing climate change. As an intro to writing poetry and short stories about climate change, Allen had his students write a series of diary entries of a middle-school or high-school student living in the year 2050—entries that showed the impact of climate change. As his student Ali Coutts points out, the assignment “places a student in the mentality of a young adult of similar age . . . [and] they can write creatively on how they think Earth would look.” It also “prompts them to do some baseline research on climate change.”

Maddie wrote a two-and-a-half-page story called “The Dive” <http://bit.ly/2bpKSHm> set in Sitka, Alaska in a climate-ravaged future where people have gone north. The story describes two young people from different parts of the country meeting each other as they watch people diving into an acidic ocean to search the remains of the city flooded by sea-level rise to retrieve lost personal effects:

“They go with no gear to try and grab stuff that’s been sitting in an acidic ocean for 2 years. They die down there if they swallow even a bit. This stuff will burn your insides up before you can even get back to land.”

“That explains the face scars, then.”

After writing their stories, Maddie and Rebecca Shell noted that: “Writing cli-fi stories is a great way to help students get creative while keeping climate change in mind. Students can have free rein with this activity, or they can have a guided writing session with different themes or elements in mind.”

Randall Seltz, a teacher at Jordan High School, Sandy, Utah, describes the importance of research in persuasive writing:

Another idea I think we could apply (that I’ve had success with using in argumentative writing units) is having students search local, national, and international media outlets for op/ed and letters to the editor about climate change. These are really interesting and show a great deal about how different regions take the problem more seriously. For example, New Orleans residents may find climate change “more real” than individuals who live in a landlocked desert valley. I may have students respond specifically to the writer of the piece they found or work to edit the piece to make it stronger by adding evidence or more logical arguments.

Cooper Franks, a teacher at Southfield Lathrup High School, Southfield, Michigan:

After providing students with a list of environmental issues, ranging from ocean acidification to genetically modified organisms, they were asked to craft a short story or a children’s book. The products were exceptional. Each written piece was engaged with the environmental issue in a creative way, and opened up interesting conversations from the audience at the reading we held.

Jonah Koski, who teaches high school in New York City, describes how his students study urban green spaces to prepare for research and creative writing:

I would assign my inner city students to research different ways that NYC is addressing issues of climate change/urbanization/shared green space. There are a plethora of different schools, programs, and organizations doing all sorts of urban gardening and park work that could be researched by the students, many of which are really cool and innovative. This would also draw students’ attentions to elements of nature in their everyday lives that they might not be aware of, but would certainly be affected by climate change. For example, the Bronx has more dedicated green space than any other borough, and students could visit any of a million different places in the city where nature is more prevalent than housing towers.

### STARTING POINT 3: ADD “INFORMATIONAL TEXT” ABOUT CLIMATE CHANGE

The Common Core Standards (2010) stress that English classes address “informational text.” Nonfiction about climate change can be studied as a topic/genre on its own or it can be paired with literary works. A key starting point for you and your students is accessible, reliable, and meaningful information. New research on climate change and valuable, readable articles, books,

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speeches, and documentaries addressing climate change are constantly emerging. At this point we want to share a small number of trusted and respected resources that you or your students may want to draw on to get started.

Perhaps the best researched and most concerning book on climate change for a public audience is *Six Degrees: Our Future on a Hotter Planet* by Mark Lynas (2008). Written in an appealing journalistic style, the book goes degree Celsius by degree Celsius into what will happen to the Earth as the planet warms from human causes. Lynas points out that “Human releases of carbon dioxide are possibly happening faster than any natural carbon releases since the beginning of life on Earth” (p. 260). The title *Six Degrees* comes from the consensus prediction of the hundreds of scientists who work with the Intergovernmental Panel on Climate Change (IPCC) that, if the world follows a “business as usual” path, by the year 2100 it will be 4 degrees warmer, and, depending on “climate sensitivity,” the Earth could warm by as much as 6 degrees. As noted in Chapter 1, the difference between 2 degrees and 4 degrees “is human civilization” (Marshall, 2015, p. 241). And if we continue with “business as usual,” warming will not stop at 4 degrees. What will then happen?

The following are the effects with each increase in degrees:

- *One Degree and Two Degrees*, now inevitable, entail droughts, over-taxed aquifers, major agricultural impacts around the world, severe famines, severe flooding from torrential rains, fires, death from heat stroke, a melting polar ice cap, rising seas inundating large cities, and the extinction of a third of all species.
- *Three Degrees*, one degree hotter than hoped for in the Paris Climate Agreement, will result in eventual 25 meters of sea-level rise, even more devastating drought and flooding, the end of the Amazon rain forest, huge hurricanes, the Sahara extending as far north as France, tropical temperatures that result in disaster; as Lynas notes:

With structural famine gripping much of the subtropics, hundreds of millions of people will have only one choice left other than death for themselves and their families: They will have to pack up their belongings and leave. The resulting population transfers could dwarf those that have historically taken place owing to wars or crop failures.

Lynas (2008, p. 180)

The 3 degrees’ increase will also result in freeing substantial methane from a warming tundra. Methane, eighty times more powerful as a greenhouse gas than CO<sub>2</sub>, could create a runaway warming scenario beyond human ability to control.

- *Four Degrees* will result in tremendous heat waves hotter than anything in the millions of years of human evolution, the loss of all polar ice, collapse of food production in China, the western half of India, southern Africa, Australia, and the western United States, and large areas surrounding the Mediterranean Sea necessarily abandoned.
- *Five Degrees and Six Degrees* will result in the Earth returning to a time when the Antarctic was covered with forest and vast swaths of the Earth were simply uninhabitable. Six degrees caused the Permian extinction when 95 percent of life on Earth, on land and in the seas, was wiped out likely by exploding fireballs of methane released from sea beds—“a major oceanic methane eruption . . . would liberate energy . . . around 10,000 times greater than the world’s stockpile of nuclear weapons”

Lynas (2008, p. 257)

Allen’s student Ali Coutts says of the book, “By the time I got to the sixth chapter it has a post-apocalyptic feel to it, almost as though I am reading a fiction novel.” Teams of students can

read individual chapters and use a jigsaw or other approach to report back to the class about what climate change looks like at different temperatures. This source, like any on the topic, can lead to further questions and research (Moore, 2014; Stephenson, 2015).

Bill McKibben has been called America's leading environmentalist. Allen's students particularly liked Chapter 1 of his book *Eaarth* (2010) (for a pdf of this chapter <http://tinyw.in/65B5>). McKibben doesn't predict the future; instead he focuses on how climate change has already impacted Earth in the present day. He argues that, "The world hasn't ended, but the world as we know it has—even if we don't quite know it yet" (p. 2). He explains,

This [the present day] is one of those rare moments, the start of a change far larger and more thoroughgoing than anything we can read in the records of man, on a par with the biggest dangers we can read in the records of rock and ice.

McKibben (2010, p. 3)

Allen's student Shane Stover commented:

What surprised me the most from reading this chapter, was that these effects that we were all warned about are no longer predictions but are results and are here right now. I remember learning in grade school science that the ice on the poles was starting to melt and was going to continue until we did something about it. What I did not realize was how serious and abruptly approaching this problem has become.

McKibben's essay in *Rolling Stone Magazine* (2012) "Global Warming's Terrifying New Math" is a starting point for thinking about the basic facts we need to know about fossil fuels and carbon consumption to address the problem. His 2016 essay in *The New Republic* "A World at War" sets forward what America must do to address the problem.

If you are looking for something quick and easy for your students, you won't do better than the four-page "Four Degrees," the final chapter of *Don't Even Think About It* by George Marshall (2014) (available at <http://tinyw.in/PU2q>). Avoiding statistics, Marshall focuses on heat waves, extinctions, and food yields. While he says that the timescales are uncertain, at 4 degrees "two-thirds of the world's major cities, and all of Southern Bangladesh and Florida would end up underwater" (p. 241) (other chapters from this book, all of them short and easy to read, are also good resources to help students think about why our society is not adequately addressing the topic of climate change).

Carly Fricano, a tenth-grade teacher in urban Memphis, Tennessee suggests:

I can see having students read multiple informational texts and asking them to make a claim about climate change and use evidence from two-three texts to support their claim, address, and then refute a counterargument.

Randall Seltz, a teacher at Jordan High School in Sandy, Utah posits:

I might also choose ten topics under the umbrella of climate change and assign them to different groups of students. I might include things like the Great Pacific Garbage Patch, El Niño, rising ocean levels, polar ice cap melt, ozone depletion, endangered species, and so on. I want high-interest topics that may not have an obvious connection so that once students start researching and discussing they start to build those connections and ask deeper questions. I would also

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link to other topics we may have discussed during the school year, like, what are the connections between climate change and racism or socio-economics? How does climate change disproportionately affect different socio-economic populations? How does climate change affect economic opportunity? How does a scarcity in necessary resources affect morality? (E.g., is it okay to hurt others to obtain provisions for your family during a natural disaster?) I think these kinds of philosophical questions help students search for very personal meanings in otherwise difficult to comprehend data and information.

Dave Saltman, San Jose Conservation Corps and Charter School, San Jose, California explains:

The active climate-change solutions, such as solar power, constitute an important part of my largely-Latino, mostly adult-age, continuation-school-students' job-training at our program. Activities, such as pre-reading tasks (reviewing and responding in writing to headlines, subheads, captions), help students get comfortable with sophisticated topics like photovoltaics and reverse-metering that come up in nonfiction texts, and for which I scaffold vocabulary, and discuss roots and compound word meanings with them. Close-reading tasks, like setting a purpose for reading, identifying words and phrases that stand-out to them personally and why, and asking them to reflect on what they've heard or know about solar power and its role in managing climate change are used extensively as we explore a series of current periodical articles about climate change and related topics.

#### STARTING POINT 4: INCORPORATE DOCUMENTARIES AND IMAGES ABOUT CLIMATE CHANGE

Documentaries and images are also excellent ways to bring information about climate to the ELA classroom, something we discuss in more detail in Chapter 6. Documentaries can be combined with literature, writing, and essays to develop curricular units, or serve as the focus for "literature circles" or individual research. In addition to providing information and stimulating questions and research, students can look carefully at short clips and analyze how the documentary seeks to be effective.

The best-known documentary about climate change is *An Inconvenient Truth* featuring Al Gore (Guggenheim, 2006), that won the 2006 Academy Award for best documentary and remains a good introduction to the topic. Students can investigate to what extent Gore's claims from more than 10 years ago remain—or are more—persuasive. Allen's student, Thomas White, says,

One really interesting thing about watching this movie is seeing how things have changed since this film came out in 2006. How some things have gotten better, like fuel efficiency of automobiles and forms of alternative energy. Also seeing how some things have still trended in a negative slope, like the fact that each year has still gotten warmer and the ice caps are still melting at a record rate.

In February 2016, Gore followed up on the film with a 25-minute Ted Talk <http://tinyw.in/gIvP> that summarizes recent research, and describes positive news about wind and solar energy, and social movements to address climate change.

Another valuable documentary is *Six Degrees Could Change the World* (Bowman, 2008) based on Lynas' book, produced by National Geographic, narrated by Alec Baldwin, and available free online. Allen's student Brandon Loiselle comments:

One quote from this documentary is, "the warmer it gets, the faster it gets warmer." Basically, there is a tipping point for global warming, a point of no return. Whether that point is at two or three degrees, it does not matter. If humans do not find a way to reduce the amount of greenhouse gases in the air, we will hit that point.

Maddie Reeves adds, "I think this would be a great film to show every human on the planet, because while it is sad and scary, it gets the message across, and that's what our world needs most right now."

*Drop in the Ocean? Ireland and Climate Change* (Whelan & Rice, 2015) <http://tinyw.in/asG1> focuses on climate change in Ireland but makes global connections. By looking at different reactions to global warming by diverse people in Ireland, it opens up opportunities for students to discuss how their own country compares. Allen's student Emma Garber explains,

The initial responses from people who live in Ireland are that they associate climate change with people suffering in Africa and never pay attention to it. They honestly feel that they have more important things to focus on in their daily lives because climate change has not directly hurt them . . . As the video continues they also interview people living in Africa who are witnessing and feeling the damages climate change is leaving on the planet . . . [and they] speak out about how outraged they are about the actions of the rich countries.

*This Changes Everything* (Lewis, 2015) is a documentary film based on Naomi Klein's book with the same title and addresses global inequality, the role of capitalism in the crisis, environmental activism, and possibilities for positive change to create a more just world. Allen's student Ali Coutts noted:

In the introduction Klein proposes a single important question that attempts to be answered throughout the whole movie, "what if the problem is a story we've been telling ourselves for 400 years?" In this story, humankind sees itself as having dominion over the Earth and using it as the mother-load, constantly over consuming its resources when we should be seeing it as a mother figure, fearing its capabilities.

Three more excellent documentaries: *Chasing Ice* (Orlowski, 2012) is about the problem of envisioning climate change that uses amazing photography and videos to show the rapid recession of glaciers; *Do the Math: Bill McKibben & the Fight against Climate Change* (Nyks & Scott, 2013) <http://tinyw.in/IH3L> portrays McKibben's powerful description of the challenge of climate change; and, *Before the Flood*, Leonardo DiCaprio's 2016 documentary on climate change.

You can also provide students with images and graphics from online repositories such as National Geographic, NASA, NOAA, Inside Climate News, and so on (for other image resources: <http://tinyw.in/JLhJ>). The book, *Dire Predictions: Understanding Climate Change: The Visual Guide to the Findings of the IPCC* (Mann & Kump, 2015) contains hundreds of visual infographics, charts, and photos portraying climate change causes and effects, as well as methods for addressing climate change.

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Dave Saltman, San Jose Conservation Corps and Charter School, San Jose, California:

Because so many of my continuation students read below grade level, struggle with English as a second language, or are working with a variety of learning disabilities, I use smaller clips and animations, rather than the climate "blockbusters" we use as cultural and intellectual touchstones (i.e., *An Inconvenient Truth*) to get across more narrowly defined climate change concepts, such as "carbon footprint" and "greenhouse gases." I need to ground everything about climate change in more personal terms to convince my students to engage with the material. I may also ask them to draw or find an Internet image and to caption that image as a reading-response activity. Images, especially infographics, and animations—are incredibly useful for assisting students to assimilate the science behind climate problems and solutions—the animation of . . . the fusion reactor in France comes to mind, as do carbon-extraction graphics.

Randall Seltz, Jordan High School, Sandy, Utah:

Knowing that my former school boundaries included the world's largest open pit copper mine (Kennecott Utah Copper Mine) changes which movies I show, as many of the parents and community partnerships my school has are connected to the mine, even if it is the number 1 contributor of pollution to the valley we live in. A significant number of students in my classroom come from families that own livestock like horses and have family members who have ranches. Knowing that, I might select a movie that is somehow linking water shortages (which we experience every summer in Utah) to an increased difficulty in sustaining a farm/ranch in the desert. When I taught ninth grade, the textbook had a text selection from *An Inconvenient Truth* and several key pieces of literature about the environment, like *The Birds* by Daphne de Maurier. The only piece of text I had any parent/student objections to was Gore's "Truth." *The Birds* is really disturbing and gory, but Gore's work was labeled as "propaganda."

## ENGAGING IN CRITICAL INQUIRY QUESTIONING TO FRAME LEARNING

To engage students, you can employ critical inquiry questioning that frames students interrogation of different aspects of climate change.

Lauren Oakes describes a workshop she developed for senior high-school students at Castilleja School in Palo Alto, California: A central focus of this workshop was the use of "What can we actually do to protect species in a changing climate?" "How do ecological impacts of climate change affect plants and people?" In order to address these complex questions, students participating in the workshop needed to tackle topics including: the effects that forests have on the climate system; the ways in which climate change affects forest dynamics; the benefits, or "ecosystem services" that forests provide people; and the challenges that climate change poses to forest managers and conservation planners. The central objectives of my approach, however, were for students to develop critical thinking skills across disciplines on climate-related issues, and to engage with various topics of climate change impacts occurring in their own local environment.

The first part of the workshop focused primarily on ecological content so that students could gain a foundational understanding for later assessing how changes occurring may affect people. In lecture and discussion, we addressed questions such as, *What is the role of forests in the carbon cycle? How does climate shape forest dynamics and what kind of feedbacks do forests have on the climate system? In what ways is climate change affecting plants?* Students learned about the relationships between climate change and shifts in species distributions, invasive species, forest mortality events, and the emergence of novel plant communities.

We discussed examples of local species such as coast redwood (*Sequoia sempervirens*) that may be affected by changes in fog patterns and drought. We discussed examples of climate-induced tree death, such as aspen (*Populus tremuloides*) in Colorado, and plants like Joshua tree (*Yucca brevifolia*) experiencing range contraction and fragmentation in and around Joshua Tree National Park. Students brainstormed the many ways in which climate dynamics like changes in precipitation, snow cover, snow melt, growing seasons, and the frequency of “extreme” events could affect plant communities.

I then introduced the students to “ecosystem services,” a framework that, in recent years, has been used to assess the benefits of environmental services—including the impacts of environmental changes, such as climate change—on people. The term broadly encompasses the use values, which may be derived directly through extractive or non-extractive uses of nature, such as tourism, or indirectly through intangible values, such as aesthetic appreciation. We discussed the four categories of this framework (supporting services, provisioning services, regulating services, and cultural services) in terms of forests and then students worked in pairs to assign the categories to specific services. Trees, for example, provide cultural services through spiritual values; provisioning services through wood people use; regulating services like carbon sequestration; and supporting services through photosynthesis.

To integrate these social and ecological concepts and apply them to current issues in conservation and resource management, our workshop culminated in a group exercise. I chose two species of interest in nearby California ecosystems (Joshua tree and coast redwood) and told the students they were researchers that had spent years studying the impacts of climate change on these species. They had a short amount of time to use the Internet and other resources I collected on these issues (e.g., media coverage; YouTube videos by research teams, educators, and non-governmental organizations; peer-reviewed publications; and online resources) to make arguments for adaptation strategies and mitigation.

Groups of three to five students used the following guiding questions and presented their findings to the class:

1. How has climate change affected your species of interest and its broader ecosystem, and what do you expect to see in the future?
2. What kinds of benefits (i.e., ecosystem services) are people deriving from these species? How might these services be impacted and where?
3. Based on the ecosystem services you identify, who are the stakeholders? (Think across scales, such as local, regional, or global.)
4. What recommendations would you make to stakeholders and resource managers for adaptation? Do your recommendations for adaptive practices differ between protected areas, like National Parks, and the “human-dominated landscape”?
5. Applying what you have learned, how would you argue for climate change mitigation?

Each group then developed a comprehensive “map” or diagram of the ways in which the impacts these species experienced, or might experience in the future, affect the benefits they

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provide people. Students made recommendations for local management strategies, such as planting trees in habitats where future climate may be more suitable.

## STUDENTS' EMOTIONS, HOPE, AND ACTION

Studying climate change can also inspire uncertainty, confusion, anxiety, or helplessness. Ali Coutts admitted that, "This first chapter of [McKibben's] *Eaarth* definitely left me feeling overwhelmed and paralyzed." These various emotions students have can be used to identify issues, learn more, and figure out what to do next. Allen's student Jacob Colegio wrote,

At first I was suspicious of a lot of McKibben's claims. I've heard both sides of the story he's telling—some say that climate change will doom us if we don't take immediate action, while others argue that such thinking is overly dramatic and climate change statistics are skewed to look more daunting than they actually are. I fell in the latter camp, either because I actually think they're overreacting or because I don't want the terrifying facts about climate change to be true, or a combination of both.

After reading that first chapter Allen wrote his students' questions on the whiteboard:

- McKibben's book was written 8 years ago. Is what he says still true? What has happened since then? Has global warming been speeding up?
- Is it possible that wind and solar could provide the energy we need?
- How does agriculture impact climate change?
- How is increased flooding related to global warming?
- Will the Paris Agreement keep warming to 2 degrees C?
- Why are people having such a hard time believing that climate change is real?
- What is happening with Arctic sea ice?
- Where does the average American's emission of CO<sub>2</sub> come from? How do I make a difference?
- To me, the most threatening aspect of global warming is disease . . . The real question becomes, are we going to die because of chlorofluorocarbons depleting the ozone, or because of a small, itchy mosquito bite [carrying malaria or the zika virus]?
- How do people who live in poor countries feel about the fact that they aren't responsible for climate change, but will suffer the most? What can be done about that?

Rather than provide answers, Allen asked his students to research their questions on the Internet, write a post on their blogs about what they found out, and make short PowerPoint presentations to the whole class. Doing their own research and listening to each other's PowerPoints, riveted students' attention to the problem. Perhaps because they were learning from each other and their own inquiry, rather than from a teacher's lecture or even a textbook, doubts about the reality of human-caused climate change evaporated, even for students from politically conservative families.

Making sense of climate change called for taking steps to address it. In the midst of confusion students also sought hope. Jessica Poling told this story:

Destruction of Earth seems to be McKibben's topic of choice. In fact, he proposes so many negative outcomes in life, that I am beginning to doubt every action I take. While getting my hair cut, I spent half of the time discussing global warming with my hairdresser! The other half was spent talking about cancer. It's no wonder she gave me the number of a counselor, even if the number wasn't for me. Global warming is taking over our lives

faster than we can control it. But I have decided that, like the Centers for Disease Control and Prevention, our aim should be to prevent outcomes from ever occurring, rather than try to find solutions to pick up and control what's left in the aftermath. Although a rise in temperature has already created irreversible damage to our world, there is still some fragment of hope, and I hope that in the near future, members of our society will be active creating a new, cleaner version of Earth.

Seeking to understand possibilities to make a difference Allen's student Blair watched the documentary, *The Future of Energy: Lateral Power to the People* (Mazurek, 2015) <http://tinyw.in/b3KI>. He describes how finding out about what others were doing gives him a sense of possibility:

[The documentary is about] the budding green energy movement occurring across the United States. Its creators searched high and low for grassroots clean energy movements in a town near you, and what they found was rather exciting. Entire cities were going green, and it was happening at a local level—exciting stuff.

Take, for example, Lancaster, California, a town that mandated that all new buildings be fitted with solar technology. This city has been able to reach nearly net zero emissions in doing so and, as mayor R. Rex Parris puts it, "we now have the ability to save the planet, increase the standard of living and the well being of everyone." This film certainly argues that green energy isn't just environmentally responsible, but also socially and economically viable. In fact, one woman in the film calls the green energy movement, "the largest social movement in human history." It seems, according to this film, that green energy will help stave off our environmental woes and help lift people out of the darkness of poverty.

The film led Blair to further inquiry leading him to read a *Huffington Post* article, "How Renewable Energy Solutions Reduce Poverty Around the World" <http://tinyw.in/Zmhr>.

Through posing questions and sharing their research, Allen's students came to better understand climate change and position themselves as critical thinkers ready to learn more. Sharing their research helped them update their knowledge and better understand the causes and potential solutions to climate change (National Research Council, 2012). Their inquiry took them a long way toward addressing confusion, anger, and helplessness.

As the climate change course progressed, Allen's students started publishing findings on their individual blogs and the class wiki devoted to supporting English teachers <http://tinyw.in/I6f4>. Since their writing was public and directed to a specific audience, their work was not only useful for themselves but potentially educating others. By the conclusion of the course their knowledge, passion, and concern had led to a series of actions in their community, actions we describe in Chapter 9. The students also thought about how their knowledge of climate change might impact their future choices so they wrote blog posts about how in the careers they envisioned for themselves they would address climate change. Critical inquiry positioned Allen's students as active learners, through acquiring knowledge and seeking to make change.

## AND THE TEACHER?

Teaching about climate change should foster critical inquiry where students' questions guide further learning. Justin Boyd, teaching in Greeley, Colorado, describes the advantage of bringing the starting points in this chapter together:

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Each of these four steps (short stories, writing assignments, information texts, and documentaries/images) can easily fit into the curriculum of a language arts class. This multilayered approach provides excellent source material for rich discussions, the development of critical thinking skills, synthesizing resources, project-based learning, social activism, and so on. Best of all, climate change is a topic my students can quickly buy into; they see the impact it has on their own lives each day.

Teaching about climate change raises questions for us teachers, as well. As we care about the Earth and the future our students will have on it, we have to think about our own responsibility as role models. As Allen explains:

I shared with my students my own commitment to address the problem. I was teaching about it; we were going to learn about it together and do something. I modified my own lifestyle. I educated myself and supported candidates who addressed climate change. I attended related community events. I was determined to share my concern with other teachers by speaking at conferences and writing this book—and they were going to help me with it.

Taking the step to teach about climate change positions teachers as part of the movement to do something about it. Finding ways to reach out to that movement, to connect our teaching with others is one of the themes we explore in this book.

In reading an early draft of this chapter, Carly Fricano, cited above, describes the evolution of her thinking and her motivating awareness of climate change as a social justice issue:

I was skeptical when I got your first email about teaching climate change. I didn't really see how I could sell it to the kids, as I don't really know much about it, and I am so passionate about teaching social justice material. I just didn't think I could fit it in. As I read the chapter it strikes me that as human beings we are just as responsible for the care and conservation of our planet as we are for taking an active role in democracy and standing up for equity and civil rights. Now, I'm super excited to check some of this stuff out and create a unit!

We hope this chapter has given you, like Carly, new ideas and enthusiasm. We also hope that it has whetted your appetite not only for first steps, but also for the rest of this book. Chapter 3 fosters further thinking about how to meaningfully frame and develop climate change in English language arts curriculum.

For additional resources, activities, and readings related to this chapter, go to <http://tinyw.in/Zuov> on the book's website.

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