Foreword

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All major scientific sources—the U.S. National Academy of Sciences and the Royal Society (2014), the U.S. National Research Council (2010a, 2010b, 2010c, 2010d, 2012a, & 2013), the American Association for the Advancement of Science (http://whatweknow.aaas.org), the Intergovernmental Panel on Climate Change (2013), the National Climate Assessment (http://nca2014.globalchange.gov), multiple associations of scientists, *Science, Nature*, and other major scientific journals—concur: The best scientific information points unequivocally to recent rapid warming and a multitude of related environment perturbations of the planet. The climate has been changing since the advent of the Industrial Revolution and especially since the last half of the 20th century. Change continues unabated during this century.

What are the consequences of this climate change? Already we have seen an increase in ocean acidification and its effect on marine organisms such as corals, rising sea levels, and more extreme weather. A warmer planet has important and not yet fully understood consequences for human well-being: Where will coastal populations move as sea rise makes their habitat unsuitable? How will the population movements necessitated by sea rise affect the economy, resources, and security of surrounding nations?

Climate change results in shifting biomes, and temperature affects where and what kinds of crops can be grown. Alterations in the ranges of agricultural pests and diseases will impact human health and well-being as warmer temperatures allow the spread of insects and microorganisms previously held in check by seasonal cold. Climate change does not affect only agents of agricultural diseases; we are finding that agents of human diseases also are changing their ranges. The living things with which we share the planet similarly are experiencing and will in the future experience profound changes in habitat, which will affect their adaptations, migratory patterns, and in some cases, their survival.

The previously referenced scientific sources that agree that the planet is warming also concur that an increase in atmospheric CO_2 and other greenhouse gasses stemming from the combustion of fossil fuels have been the major cause of the post-Industrial Revolution heating of the planet. Coping with climate change is therefore linked to accommodating human energy needs, as both the numbers of people and their demands for higher living standards increase the need for more and cheaper energy. But if that additional energy continues to be derived from fossil fuels, the problem of global climate change will be exacerbated. What energy sources will we find to replace them?

During the next couple of decades as climate change and energy needs become increasingly important social and political issues, individual citizens, industries that emit large

amounts of carbon into the atmosphere, and governments will need to make important economic, political, social, and ethical decisions. These decisions must be informed by and grounded in accurate and up-to-date science.

Yet the young people who are most likely to be responsible for these decisions in the near future exhibit little understanding of climate science (Leiserowitz, Smith, & Marlon, 2011). One reason for this lack of knowledge is that climate science is rarely taught comprehensively in our schools (National Research Council, 2012b). In some cases, it may not be discussed at all because teachers feel pressure from school officials, boards of education, and citizens groups to avoid addressing this and other "controversial" topics. There is evidence that in several countries outside of the United States, climate science education is assuming a more prominent place in the curriculum (Gardiner, 2014), but climate science instruction in the United States still lags behind.

The good news is that the United States may be beginning to catch up. The Next Generation Science Standards, released in 2013, call for increased coverage of climate change in middle school and high school. For those states that adopt the NGSS, climate science will become more accepted and expected as part of the science curriculum. As more climate science is taught, the number of exemplary programs and classroom resources will increase. Yet because most teachers do not encounter systematic instruction in climate science in their preservice or inservice education and many are or perceive they are restricted in what they are permitted to teach, few are prepared to adequately teach this important science.

Climate Smart & Energy Wise provides a road map to teachers to assist them in acquiring the background and resources to bring climate and energy education into their classrooms. Basic climate and energy sciences—as well as a thoughtful discussion of approaches utilized by those who deny climate change—are accompanied by pedagogical suggestions on best practices for bringing climate change into the classroom. In addition to the important task of preparing future citizens to make critically important decisions about our future, incorporating the topic of climate change into the classroom provides advantages for a harried teacher with a long checklist of expectations: It's an ideal topic to use in addressing science education standards, integrating mathematics into the science curriculum, teaching critical thinking and connections between science and society, integrating STEM (National Academy of Engineering and National Research Council, 2014), and many other responsibilities. Climate science crosscuts many educational disciplines both within and beyond the sciences and can thus promote integration across the curriculum as called for in the NGSS (http://www.nextgenscience.org) and the Common Core State Standards (http://www.corestandards.org). McCaffrey's book provides a wealth of information to help teachers find resources, including the very useful *Climate Literacy* and *Energy Literacy* frameworks, developed by scientists and master teachers. This book is packed with suggestions for where a teacher can find more information and classroom guidance for the teaching global climate change.

Educators will find inspiration in the successes of their colleagues in Chapter 6, "Programs That Work." Others have done it, so can you!

In the *Climate Literacy* Framework can be found the *Climate Literacy* "Guiding Principle," which is a simple idea with profound consequences: *Humans can take actions to reduce climate change and its impacts.* Individually and collectively, we *can* make a difference. As scientists

and educators, we believe that basing those actions on a firm foundation of climate science literacy will result in better outcomes. Science cannot dictate what actions we take, but scientific evidence surely needs to inform our actions, if they are to be effective.

The *Climate Literacy* "Guiding Principle" is a simple idea that also has profound consequences for science education: Teachers can help students acquire the scientific background that will help them both understand and deal with what may be their greatest challenge as citizens. McCaffrey's book is a quick start to help teachers teach and students learn about the important topic of climate change. We hope you explore it fully.

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