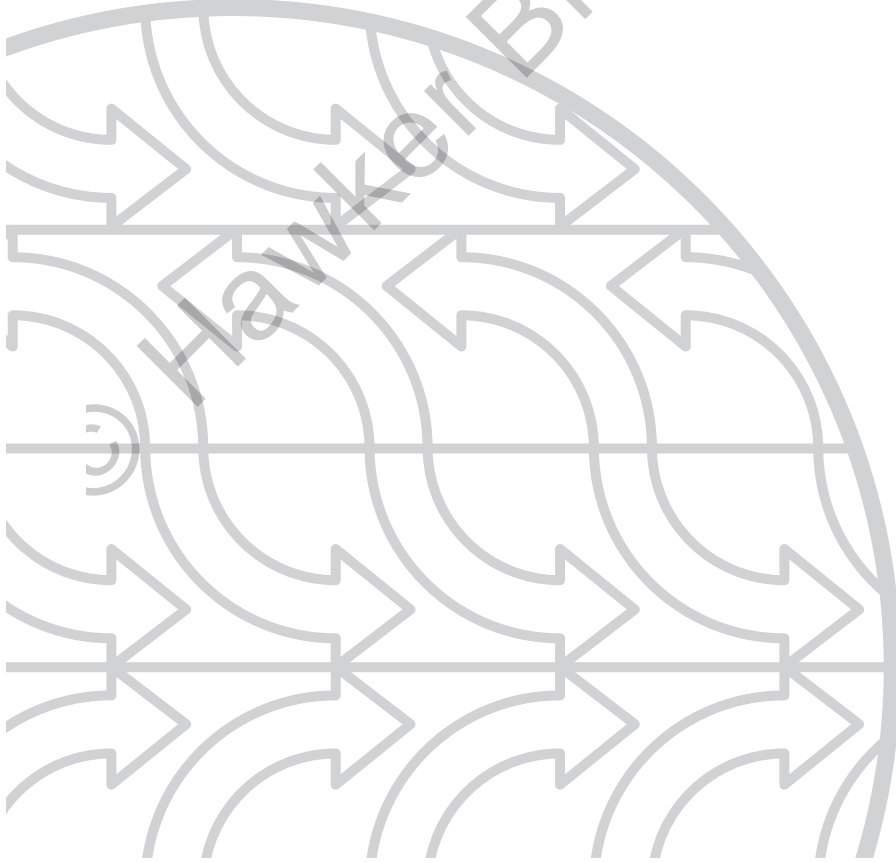


Climate Change From Pole to Pole:

BIOLOGY INVESTIGATIONS

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How to Use This Book

“One of the biggest obstacles to making a start on climate change is that it has become a cliché before it has even been understood.”

—Tim Flannery, *The Weather Makers*, 2005

“In order to understand scientific issues, you have to have a clear picture of what science is and what scientists do.”

—Moti Ben-Ari, *Just a Theory: Exploring the Nature of Science*, 2005

This book is about the *science* of climate change, not the political issues it has generated. Part of our goal in writing it is to help you and your students become more scientifically literate about an important global issue. In broader terms, we want to suggest ways you can use the topic of climate change to demonstrate the nature of science.

Part I, “The Science of Climate Change”, includes four chapters of background information on climate and how it is changing. The chapters in Part I are suitable as reference material for busy instructors who just want “the basics” or as classroom readings for advanced secondary school students or non-science majors. We have broken each chapter into short, relatively self-contained sections to make it easier to find specific topics. Chapter 1 introduces climate (including the natural greenhouse effect) and its importance to life on Earth. Chapter 2 outlines some of the methods and evidence used by scientists to detect and explain climate change. We focus on changes that have already occurred, rather than predictions of future change. Chapter 3 is an overview of the biological effects of climate change, from the responses of individual organisms to those of entire ecosystems. Chapters 2 and 3 also contain sidebars (Nature of Science boxes) about the nature of science that can help you integrate scientific processes and results in your classroom discussions about climate change. Chapter 4 is a student-friendly overview of the concepts in the first three chapters.



Topic: Nature of science, 9–12

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Part II, “Climate Change Case Studies”, includes six classroom investigations for use in secondary school or university-level science courses. Each investigation is a case study of a well-documented biological response to climate change. Students solve real-life scientific problems using guiding questions, data tables and graphs, short reading assignments and/or independent research. To emphasise the cooperative nature of science, all of the investigations require group work. Chapters 5 to 10 are each organised as follows:

- The introductory “At a Glance” comments give you a quick overview of the investigation.
- The teacher pages, which begin each chapter, include background information and teaching notes (i.e. materials, procedure, assessment and extensions) specific to the investigation.
- The student pages, which follow the teacher pages, include copy-ready data sets, readings and worksheets.

You can use as many or as few investigations as you want, and in any order. The table on page x can help you choose those that are most appropriate for your classroom. If you teach secondary school, you also can find how each activity addresses the Australian Curriculum in Correlations to the Curriculum, page 74.

Key terms are defined in the Glossary. They appear in **boldface** at their first mention in the background text. In Chapter 4, and the student pages of Part II, especially important key terms appear in boldface a second time.

The study of how climate and its natural cycles affect biological systems is more than 150 years old. The study of how *human-dominated* climate affects biological systems is relatively new. The vast majority of scientific information on this topic has been published only since 2003 and so is not available in popular books and news articles. Most of our references, therefore, are from the primary literature (i.e. articles from scientific journals) and the Fourth Assessment Report of the International Panel on Climate Change (Parry et al. 2007; Solomon et al. 2007).

There is broad consensus among scientists on how the climate is changing and why. We regularly monitored the scientific literature and a range of climate change blogs (e.g. <http://blogs.nature.com/climatefeedback>; www.globalwarming.org) to stay abreast of scientific developments and arguments “for” and “against” human-dominated climate change. Although a few scientists are not convinced by the data or analyses presented by their colleagues, in writing this book we have attempted to provide you and your students with the most up-to-date, mainstream science available. But as we write these words a scientist somewhere in the world is revising or adding to the larger

body of knowledge about climate change. It is our hope that you or one of your students will contribute to that body of knowledge in the future.

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Climate Change Case Studies (Chapters 5–10): Their Focus, Use and Curriculum Connections

	Chapter 5 “Now You ‘Sea’ Ice, Now You Don’t”	Chapter 6 “Population Peril”	Chapter 7 “Carrion: It’s What’s for Dinner”	Chapter 8 “Right Place, Wrong Time”	Chapter 9 “Ah-Choo!”	Chapter 10 “Cruel, Cruel Summer”
Focal Organism and Location	Adélie penguins, Antarctica	Polar bears, Canadian Arctic	Wolves, Wyoming, USA	Pied Flycatchers, Spain	Humans (allergies), Northern Hemisphere	Humans (heat wave mortality), Pole to Pole
Classroom Time (hours)	1–3.5	1.5–3.5	1–2.5	1.5–3	Minimum 2–3.5	Minimum 3–4
Relative Difficulty Level (1 = easiest; 3 = hardest)	1	1	2	2	3	3
Science Connections						
Scientific Process Skills	♦	♦	♦	♦	♦	♦
Biology	♦	♦	♦	♦		
Earth and Environmental Science	♦	♦	♦	♦	♦	♦
Health and Physical Education					♦	♦
Interdisciplinary Connections						
Mathematics			♦	♦		♦
Technologies					♦	♦
Humanities and Social Sciences	♦	♦	♦		♦	♦
English/The Arts (Visual Arts)		♦			♦	