PHILOSOPHY AND THE PRECAUTIONARY PRINCIPLE

Scholars in philosophy, law, economics, and other fields have widely debated how science, environmental precaution, and economic interests should be balanced in urgent contemporary problems such as climate change. One controversial focus of these discussions is the precautionary principle, according to which scientific uncertainty should not be a reason for delay in the face of serious threats to the environment or health. While the precautionary principle has been very influential, no generally accepted definition of it exists and critics charge that it is incoherent or hopelessly vague. This book presents and defends an interpretation of the precautionary principle from the perspective of philosophy of science, looking particularly at how it connects to decisions, scientific procedures, and evidence. Through careful analysis of numerous case studies, it shows how this interpretation leads to important insights on scientific uncertainty, intergenerational justice, and the relationship between values and policy-relevant science.

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Science, Evidence, and Environmental Policy

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CAMBRIDGE UNIVERSITY PRESS

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University Printing House, Cambridge CB2 8BS, United Kingdom

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781107078161

First published 2015

Printed in the United Kingdom by Clays, St Ives plc

A catalog record for this publication is available from the British Library

ISBN 978-1-107-07816-1 Hardback

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Preface

In the course of working on this book I have sometimes been asked (especially by other philosophers), "What's the precautionary principle? And how did you get interested in *that*?" The short answer to the first question is that the precautionary principle is an influential yet hotly debated premise of an extensive body of environmental law, especially at the international level. Its central aim is to promote timely and reasonable responses to serious threats to health and the environment even in the face of substantial scientific uncertainty. Yet there is no generally agreed-upon interpretation of the precautionary principle, nor even agreement that a coherent and informative interpretation is possible. The second question might be read in a more general sense (i.e., why should a *philosopher*, and a *philosopher of science* no less, be interested in the precautionary principle) or a more autobiographical one (i.e., what got *you* interested in this topic). The autobiographical backstory traces to a number of discussions with a colleague, Karen Chou, from the Department of Animal Science at Michigan State University, about how to assess risks related to nanotechnology. I was interested in this topic as an outgrowth of my previous work on extrapolating scientific results from one context to another, such as from animal experiments to humans (Steel 2008). In the course of these discussions, I learned about something known as "uncertainty factors," a technical device for erring on the side of caution when estimating acceptable exposure levels to potentially hazardous substances. It seemed to me then – and it still does – that uncertainty factors are an example of the precautionary principle operating at an epistemic level. Moreover, the case was interesting because it was an established and widespread procedure in risk assessment rather than the pet idea of some small subgroup of scientists. Furthermore, coping with uncertainty is an unavoidable aspect of any effort to apply scientific knowledge to complex problems, such as environmental policy. So this set me thinking about a range of big and difficult questions. How should "scientific uncertainty" be defined? Just how should the precautionary principle

be interpreted? How do epistemic manifestations of the principle connect to the topic, much debated in recent philosophy of science literature, of the role of values in science? I believe that the answers to these questions are very important to debates about how scientific knowledge should be brought to bear on a range of complex and pressing issues, such as climate change and processes for assessing the safety of chemicals and pharmaceuticals, to name a couple. And philosophy of science surely ought to have something helpful to say about such matters.

The literature on the precautionary principle (PP) is quite interdisciplinary. For instance, the legal scholar Cass Sunstein (2005) critically discusses the Rawls-inspired interpretation of PP proposed by the philosopher Stephen Gardiner (2006), and works by the philosopher Per Sandin (e.g., Sandin 1999) are widely cited in the literature on the precautionary principle within and without philosophy. Similarly, contributors to edited volumes on the precautionary principle hail from a variety of disciplinary backgrounds (see Fischer, Jones, and von Schomberg 2006; Raffensperger and Tickner 1999; Tickner 2003). This book leaps into this fray and engages with relevant literature regardless of the professional affiliations of its authors. As a result, the intended audience of this book includes anyone interested the interface of science and environmental policy in general and the precautionary principle and its implications in particular. Besides philosophers, these audiences include students and researchers in fields such as environmental economics, environmental law, and risk analysis among others.

Nevertheless, my own philosophical training and disciplinary association leaves a clear imprint on the book, both in terms of the issues raised and the lenses through which they are examined. Within philosophy, I expect the primary audiences for this book to be drawn from the ranks of philosophy of science and environmental philosophy. Among philosophers of science, the book should appeal to those interested in topics such as values in science and socially relevant philosophy of science. Interest in these topics appears to be growing, as suggested by a spate of recent philosophy of science books on policy-relevant science (Cranor 2011; Douglas 2009; Elliott 2011a; Kitcher 2011; Shrader-Frechette 2011). Interest in the precautionary principle among philosophers concerned with the intersection of science and environmental policies also appears to be rising (see Elliott 2010; Peterson 2006; Sprenger 2012; Steel 2013a; Steele 2006). For instance, a recent philosophy of science anthology includes a section on the precautionary principle (Bird and Ladyman 2012). And an article in a special issue of *Synthese* devoted to socially relevant philosophy of science

lists the interpretation of the precautionary principle as a significant topic for this field (Tuana 2010, p. 481).

There is no sharp boundary dividing philosophy of science and environmental philosophy, as traditional philosophy of science topics are often deeply intertwined with environmental controversies. However, unlike philosophers of science, many if not most environmental philosophers approach their topic from a background of ethical theory. Nevertheless, this book is relevant to the interests of environmental philosophers of this sort. First, the precautionary principle is a recognized topic in environmental philosophy generally, as indicated by numerous publications on the topic (see Gardiner 2006; Hartzell-Nichols 2012; Manson 2002; McKinnon 2009; Munthe 2011; Sandin 1999). Second, since my approach to the precautionary principle integrates decision and epistemic aspects, it can appeal to philosophers whose primary interest lies in ethical dimensions of environmental issues. The book is written at a level that will make it useable as a text in upper-level undergraduate courses and graduate seminars. While engaging in depth with current philosophical discussions of PP and related topics (e.g., values in science), I generally avoid mathematical formalism in the main text and strive to explain central concepts in logical yet intuitively graspable ways. However, for those who wish to see the technical details, a formalized presentation of the interpretation of the precautionary principle advanced here, along with a few basic results, is provided in the Appendix.

Writing this book has been a long road, with many delays and unexpected turns. One pleasant consequence of this lengthy process is that there are many people for me to thank. My most significant debt of gratitude is unquestionably to my partner in life, Guofang Li, and our three children, Francis, Patrick, and Qiqi. The initial conception of the book predates my marriage to Guofang in June 2008 and our children's births. And its writing was so thoroughly enmeshed with these events and their aftermaths as to make it difficult for me to conceive the book separately from them. My best ideas can be unhesitatingly credited to the wonderful smiles and joy my family has given me. (I accept full responsibility for the mistakes!) And Guofang's love, support, and helpful advice on the ins and outs of academic publishing have been invaluable.

In addition, I would like to thank Kevin Elliott for reading and providing helpful comments and encouragement on drafts of most of the chapters. I am also grateful to Marion Hourdequin for serving as the commentator on a version of Chapter 2 presented at a Pacific American Philosophical Association session in 2013 and for stimulating philosophical

discussion over Thai food afterward. This interaction helped sharpen ideas in Chapter 2 and inspired some of the discussion in Chapter 4. Thanks are due as well to Derek Turner for a commentary in *Ethics, Policy and Environment* (Turner 2013) on a paper (Steel 2013a) that is the backbone of Chapter 2. I am grateful to Kristie Dotson for reading and providing encouraging feedback on a draft of Chapter 6. I thank Paul Thompson for help with the bovine growth hormone example in Chapter 9. I thank Kyle Whyte for his collaboration on an article (Steel and Whyte 2012) whose ideas fed into Chapter 8. I am grateful to students in a graduate seminar taught at Michigan State University in 2011 on topics relevant to this book for their helpful feedback and to Kevin Elliott and Heather Douglas for speaking at Michigan State in connection with this seminar. I would also like to thank Michigan State University for an Intramural Research Program grant (IRGP-1448) awarded in 2008 that supported the early stages of this project. I would also like to thank audiences in various venues and locations who have heard and responded to presentations of work linked to this project. These include the Philosophy of Social Science Roundtable in 2009, the Department of History and Philosophy of Science at the University of Pittsburgh in 2011, the Three Rivers Philosophy Conference at the University of South Carolina in the same year, the Great Plains Society for the Study of Argumentation Conference at Iowa State University in 2012, the Biennial Meeting of the Philosophy of Science Association in 2012, the workshop on Cognitive Attitudes and Values in Science at the University of Notre Dame in 2012, the Pacific APA in 2013, and the Institute for Resources Environment and Sustainability at the University of British Columbia in 2014.

Finally, express my thanks to everyone at Cambridge University Press who helped this book become a reality. I am grateful to the two anonymous reviewers of the manuscript, especially the initially skeptical one who pushed me to express the central ideas of the book more perspicuously and to develop some arguments with a greater degree of rigor. Thanks also to Hilary Gaskin for prodding me to think of an improved title.

The work in this book is largely previously unpublished. Six of the nine chapters – specifically, Chapters 1, 3, 4, 5, 6, and 9 – appear here in their entirety for the first time. Nevertheless, the other chapters draw upon already published material, although this work is usually reorganized, rearranged, and often rewritten. Chapter 2 and much of discussion in ensuing chapters develops ideas from Steel (2013a), Chapter 7 reuses ideas and material from Steel (2010) and Steel (2013b), and Chapter 8 borrows

from Steel (2011) and Steel and Whyte (2012). The copyright holders of these articles are as follows:

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