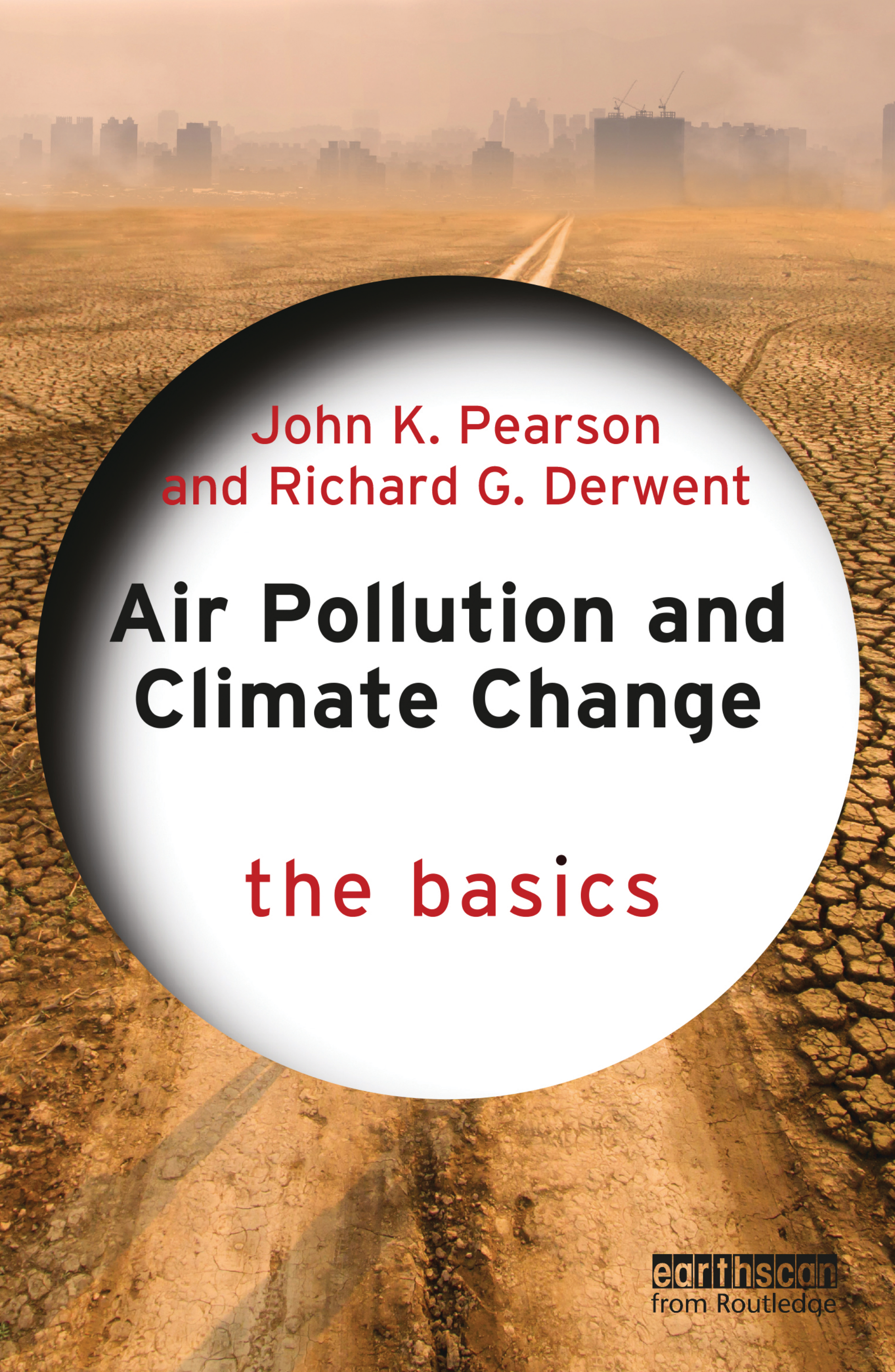

John K. Pearson
and Richard G. Derwent

Air Pollution and Climate Change

the basics

earthscan
from Routledge

AIR POLLUTION AND CLIMATE CHANGE

THE BASICS

This book identifies four key forms of air pollution: indoor, urban, regional and global. It discusses how these four types of pollution are manifest in today's society and examines the scientific and policy challenges that stand in the way of progress.

Writing in a style that balances scientific underpinnings with accessible language, Pearson and Derwent examine the sources and historical context of air pollutants, before dedicating a chapter to each of the key forms. Armed with these basics, they begin to address the challenges faced by improving indoor, urban and regional air quality, while reducing global warming in the years ahead. This leads to a greater understanding of the challenges of global climate change, with new proposals for reducing global warming. However, the authors conclude that it is only when we have a scenario of reforestation combined with reductions in emissions of all greenhouse gases that real progress will be made in the fight against climate change. Then, air pollution will also be consigned to history.

With a foreword written by Professor James Lovelock, this book will be of great interest to students and scholars of climate change and environmental policy, as well as air quality professionals working in this important field.

John K. Pearson enjoyed a 30-year career in research with Royal Dutch Shell, including two European assignments. Since his early retirement from Shell, John has been an air quality consultant to industry, working on the development of emissions inventories and exploring air quality opportunities, as well as encouraging research councils to promote user applied science. He is the author of the book *Improving Air Quality*, published in 2001, which builds upon his experience in both Europe and the United States on energy companies, motor manufacturers and legislators working together. His most recent scientific contribution in 2019 was 'Improving Solvent VOC Emissions Inventories', published in *Atmospheric Environment*.

Richard (Dick) G. Derwent took an MA degree and a PhD in physical chemistry from Queens' College in the University of Cambridge. He has spent much of his scientific career studying air pollution and atmospheric chemistry. Dick is one of the foremost experts within the fields of air pollution, atmospheric chemistry and global climate, and has published over 550 peer-reviewed scientific papers, reports and book chapters. He is the joint author of two books: *Atmospheric Pollution and Environment Change* and *Mechanisms of Atmospheric Oxidation of the Alkanes*. He is a visiting professor in the School of Geography, Earth and Environmental Sciences at the University of Birmingham.

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THE BASICS

John K. Pearson and Richard G. Derwent

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James Lovelock CH CBE FRS

Physics is often regarded as the queen of the sciences, and it was not surprising to find the prediction of something as important as the Earth's future climate treated as a problem in physical meteorology. In reality we now think that the climate of the Earth is dependent not only on atmospheric physics but also on human and biological changes in the Earth's surface and atmosphere. As discovered by Edward Lorenz, even purely physical attempts to explain climate by mathematical models can give chaotic solutions, which are useless for prediction. Lotka suggested that prediction would be easier if the biological part of the environment was included along with the physical. This conjecture was confirmed in the 1960s, when fast computers became available, by Lovelock and Watson.

This book by Pearson and Derwent clearly shows how much more complex is the real Earth. It lists various factors such as the physics and chemistry of the oceans, and similarly the growing influence on the climate, of people in their cities and by their agriculture, and how in turn this changes the climate. Also, how these changes should be measured.

It is a book for politicians and government servants who really want to know what affects the climate and how they might ameliorate adverse change modestly and without ruinous expenditure.

PREFACE

We have devoted a significant part of our scientific careers to understand the challenges posed by air quality and global warming. John, for his part, has worked in industry to inform his colleagues about these issues and to formulate strategies that will lead to air quality improvement. Dick, for his part, has worked on the basic science underpinning urban, regional and global air quality. Both of us fervently believe that it is not possible to understand air quality and global climate issues fully, unless and until you can put numbers into some basic mathematical equations that describe them. Despite the complexity, there are some hidden basic truths and principles that are worthy of description. These are the basis of our monograph, where we seek to quantify the link between air quality and global warming.

In writing our monograph, we have drawn material from some key basic reference sources, which are listed at the end of each chapter. In addition, we have taken material from a large number of literature papers and web sources. We have checked all these sources as best we can, but we take full responsibility for any errors and mistakes that still remain. Over the years, we have learned much from our scientific colleagues and are grateful for their inspiration. We hope this monograph, in some small way, repays our debt of gratitude to our colleagues.

ACKNOWLEDGEMENTS

After long careers in industry and government, we decided to spend most of our time during the Covid lockdown researching and writing this monograph on the link between air quality and global warming. There are many documents on air pollution and papers on global warming, yet few had examined the link in detail or explored both by means of mathematical calculations. Quantifying this link has been our challenge, with the objective of demonstrating that global warming can be reversed given time.

Over many years, we have worked within many teams of experts from the energy and chemical industries, from international organisations and from individual governments. It has been our privilege to share our knowledge with, and to learn from, many gifted scientists, industrialists, and environmental experts.

We have particularly appreciated detailed technical discussions with Nadine Allemand of CITEPA, Paris, Zig Klimont of IIASA, Vienna, Luc Turkenburg of the European Chemical Industry, Alan Curtis of AERE Harwell, Michael Jenkin of Atmospheric Chemical Services, Okehampton, Harvey Jeffries of the University of North Carolina, Chapel Hill, Tom Wigley of the University of East Anglia and Michael Prather of the University of California Irvine.

Our thanks go to Alan Wilson, who has recommended improvements to our monograph as we have progressed.

We record our deep appreciation to James Lovelock CH CBE FRS for writing the Foreword to our monograph.

It takes enthusiasm and perseverance to write a book and we express our gratitude to our own families for their encouragement and interest.

Air pollution and global warming encompass many fields of science, as well as economics and politics. It has been our privilege to explore how our planet will overcome the fundamental challenges of improving air quality and reducing global warming.

ABOUT THE AUTHORS

JOHN K. PEARSON

John K. Pearson was born in St Andrews in Scotland. He returned to read applied mathematics at the university, and was awarded a United College Bursary in Science, graduating in 1969 as well as winning a class medal in applied mathematics.

He enjoyed a 30-year career in research with Royal Dutch Shell including two European assignments. He was project leader for gasoline specification development in the mid-1980s when he published and presented papers to the Society of Automotive Engineers in the United States and Canada. During this period, he had been responsible for liaison with European vehicle engine manufacturers on fuel developments as well as being chairman of the Fuels Committee of the British Technical Council.

Bilingual in French and English, John was group leader for fuel and lubricant research and development for Shell in France in the early 1990s, responsible for a large international team.

The final five years of his Shell career were his most challenging as principal scientist responsible for air quality research. In this role, he was directly involved in the European Auto Oil Programme and worked closely with legislators and European member states on the EC Ozone Directive in the late 1990s.

Since his early retirement from Shell, John has been an air quality consultant to industry, working on the development of emissions inventories and exploring air quality opportunities, as well as encouraging research councils to promote user applied science. He has