Human activities are transforming the global environment, and these global changes have many faces: ozone depletion, tropical deforestation, acid deposition, and increased atmospheric concentrations of gases that trap heat and may warm the global climate. For many of these troubling transformations, data and analyses are fragmentary, scientific understanding is incomplete, and long-term implications are unknown. Yet, even against a continuing background of uncertainty, it is abundantly clear that human activities—burning fossil fuels, emitting pollutants from industry, and clearing forests that are the habitats for plant and animal species, for example—now match or even surpass natural processes as agents of change in the planetary environment. Understanding the nature and possible consequences of global change is an urgent challenge to the natural sciences, social sciences, and engineering, and to the world community of nations and their citizens.

Global environmental change is interwoven with a complex web of social, economic, political, and scientific implications. Recent natural fluctuations in weather and climate, while not necessarily attributable to climate change due to human activities, nevertheless illustrate the magnitude and broad scope of environmental impacts on our intricately intertwined global economy. Widespread droughts in the early 1970s set the stage for major worldwide swings in grain prices. Persistent droughts in Africa have caused unspeakable suffering for millions of people. Damage caused as pollutants travel across national boundaries and result in acid deposition has created major political tensions in North America.

The diverse faces of global environmental change are linked both scientifically and politically. Scientifically, the ability to predict future changes in the environment requires an understanding of the physical, chemical, biological, and social processes that govern the earth, and of the interaction of these processes throughout the earth system. Politically, policy options to address these problems highlight the need for coordinated international policies relating to energy, technology, land use, and economic development.

Thus difficult policy decisions must be made on the basis of judgments between dimly perceived future risks and possible economic or other consequences that may be more immediate. While these decisions must be based on the best information that science has to offer, scientists are no better qualified than other individuals to hammer out these difficult judgments. It is important that the public also become informed and involved in making these choices and shaping the necessary policy decisions.

It was with a realization of the indispensable role of an informed public that the 1989 Forum on Global Change and Our Common Future was conceived. The forum’s goal was to promote and enhance understanding and dialogue on a broad range of issues related to global environmental change and the dynamic interactions among the physical, chemical, biological, and social systems that make the earth’s environment so uniquely hospitable to life. The presentations and discussions during the eventful three days of the forum provided the stimulus and the basis for this book.

The forum is but one of many activities related to these
complex issues. For example, in the fall of 1988 the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine prepared recommendations on global environmental change for then President-elect George Bush. That document, which may be found in Appendix D, is the current position of the Academies and the Institute in this area. In addition, at the request of Congress, the U.S. Environmental Protection Agency commissioned a study on policy implications of greenhouse warming by the Committee on Science, Engineering, and Public Policy of the councils of the two Academies and the Institute. The report of that panel, which is expected to be available by the end of 1990, will be the next major statement of the Academies and Institute in this area. Within this context, this book is intended as a contribution to the active global dialogue that will shape the future of our species and our planet.

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The photographic images relayed to a rapt earth-bound audience in 1969, when a human first set foot on the moon, were rapidly inscribed on the human psyche. Seen from space, our planet was breathtaking in its loveliness, startling in its solitude. The image brought home as never before that our home is, after all, a planet—small, self-contained, and in some ways perhaps, fragile.

In the ensuing 20 years, that image of the earth has become a cliché, but the ramifications of those hard-won insights persist. The earth’s land masses, oceans and atmosphere, and biological communities are increasingly seen by scientists, as well as by the public, as part of a unified system. Consequently, scientists can no longer adhere to the academic definitions of the classical scientific disciplines. Scientists are turning for help to colleagues in diverse fields, and integrating their studies as they develop a science of the earth.

As the pervasive effects of human activity on the earth system become clear, the world’s scientists face an urgent challenge: Can they apply the scientific understanding and technology that