Preface

More than 99 per cent of the volume of the atmosphere is two gases, nitrogen and oxygen. The remainder is a group of trace gases among which carbon dioxide (CO_2) is one of the most abundant. The amount of carbon dioxide is important because, in contrast to nitrogen and oxygen, carbon dioxide absorbs radiant heat (infra-red energy). A change in the amount of CO_2 in the atmosphere has the potential for changing the amount of radiant energy retained in the atmosphere, thereby changing climates globally.

Over the past century or more the CO_2 content of the atmosphere has been increasing. The rise since 1900 is thought to have been 10–20 per cent, although it is not known with precision. In 1980 the total CO_2 in the atmosphere was about 336 p.p.m. by volume. If the present rate of increase continues we can expect about 600 p.p.m. in the atmosphere by the middle of the next century, possibly sooner. Such a rise is expected to cause a warming of the earth that may average as much as 1.5–4.0 °C. The warming will not be uniform. There will be little change in the tropics and a 6–8 °C rise in the polar regions. Such a change in temperature will shift climatic zones, disrupt agriculture, and, over a century or so, melt sufficient polar ice to raise sea-level one to five metres. Although absolute proof that these changes in climate will occur is lacking, and may not be available soon, there is powerful evidence for an influence of CO_2 on temperature of the magnitude indicated. Other factors such as the output of the sun and the amounts of particulate matter in the atmosphere may nonetheless dominate trends of climate.

The cause of the increase in CO_2 in the atmosphere is both the combustion of fossil fuels and the steady destruction of forests. The latter process has been under way for centuries but has recently been accelerated; the former is a product of the last two centuries of the industrial revolution.

The changes in climate that the increase in CO_2 threatens is ample reason for intensive efforts at improving predictions of future CO_2 concentrations. The accuracy of predictions is dependent in large part on knowledge of the sources of CO_2 released into the atmosphere. The amount released from combustion of fossil fuels is known with considerable precision. The amount from the biota and soils of the earth is uncertain. The growth of the human population to more than six billion by the year 2000 seems to assure a demand both for wood and for the continued expansion of agriculture onto

forested lands. The rate of these changes is the primary datum for appraising the importance of the biota in affecting the CO_2 content of the atmosphere. The question addressed in this book is how to determine that rate for the world as a whole.

The book is the product of a SCOPE conference* arranged by The Ecosystems Center and held in Woods Hole, Massachusetts in May, 1979. Further analysis, stimulated in part by the conference and in part by research suggested by the conference, led to substantial advances during the period of preparation of the report and this book. The Report of the conference has been published as DOE Publication *CONF-7905176* (1980). This book includes a series of review papers that carry the progress in research through 1982 into the early months of 1983.

Editor's note

Throughout this volume the term 'billion' is used to mean one thousand million.

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