Preface

The idea for this book arose from a conversation I had one day with two of my neighbors. Neither is a plant specialist but both are keen gardeners. One has in his garden a number of large trees of which not everyone is an unqualified admirer, including the other neighbor. For one thing, the trees shade adjacent gardens from direct sunlight for much of the day, including that of the second neighbor, a somewhat sensitive matter at this northerly latitude where there is a relatively short growing season. In the fall, immense numbers of leaves find their way into the general neighborhood often late in the season since some of these particular trees continue shedding leaves even after the first snow. The task of cleaning up frozen, congealed, decaying leaves is not universally appreciated.

Not for the first time, then, the owner of one of the shaded gardens was trying to persuade the tree-loving neighbor to remove his trees which, to the former, were obstacles to productive gardening. As the conversation developed it became obvious that the aggrieved party thought the main bulk of a tree came from the soil since he made repeated reference to the fact that the offending trees were taking in significant quantities of nutrients through their roots. Of course, plants do absorb many essential minerals and water from soil but we have known for a long time, for more than 300 years in fact, that air, not soil, is the source of the main building block (carbon) from which the bulk of green plants is manufactured.

This experience led me to wonder how many other aspects of the ways in which plants grow and develop are less than well known to non-specialists. Green plants (in particular, those growing on land rather than in water) have a highly specialized lifestyle due to the fact that they are generally fixed in one location throughout their lives. In addition, they contain a unique molecule, chlorophyll, which sets them apart from all other living organisms and gives them the option of manufacturing enormous quantities of their own food through photosynthesis.

Their general dependency on soil as an anchor and for essential mineral nutrients, as well as water, has led to the development of an elaborate root system with many unique functions. Like all living things, plants need water but, unlike many other organisms, they are not able to go searching for it beyond their immediate location. Thus, green plants have evolved a range of devices to obtain, transport and conserve water as well as ways to combat the effects of excessive wind, drought, cold, heat, and light from which they cannot hide.

Green plants face serious challenges due to the changing seasons. Flowering, seed production, dormancy, germination, leaf fall, and death, to name some of the more important milestones in the life cycle of plants, all are related to the seasons. Ways to measure time have evolved so that the activities of plants fit into the pattern of seasonal changes in their environment.

Green plants produce an enormous array of elaborate chemicals for only some of which a purpose is known. Plants use them to add color, fragrance, and flavor to their flowers and fruits, to wage war on predators and disease organisms, and to out-compete near neighbors. We make use of many of them ourselves, as cosmetics and pharmaceuticals for example.

These, and other features of green plants, together constitute what biologists would recognize as plant physiology – how plants work. My purpose here is to try to create an interest in and explain in straightforward language to the inquisitive layperson how plants function.

Green plants are all around us. They are the most successful of all living things evidenced by the fact that they are overwhelmingly the most abundant kinds of organisms on earth. We are absolutely dependent on them for food; we cultivate them for our pleasure; and we have used them in a vast number of ways down the centuries to our advantage. There is growing concern that we are following practices that are a serious threat to green plants. For example, we do not know what effect depletion of the ozone layer in our atmosphere will have on plants (or other creatures for that matter); the so-called 'greenhouse effect' is also an unknown quantity. We do know that we are destroying vast numbers of plants through practices such as the burning of forests, overgrazing by our domestic animals and overcropping. The advent of biotechnology and its use in agriculture is causing concern that we may be manipulating natural plant genetic processes in ways of which we are alarmingly ignorant. Overpopulation and the parallel outcome of more intensive agricultural and industrial practices (such as pollution) that go hand in hand with our bur-

geoning world population are a growing threat to the green plant world. Such problems should concern us all.

Here, I have tried to provide examples of some of the important aspects of how plants work with the rationale that the more people know about the lifestyle of plants, the more likely it is that they will appreciate what has to be done to preserve this component of the biosphere without which we could not survive on our earth. I also hope that people who read this will discover that knowing more about how plants work is not just useful but also fun.

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