Introduction

California is a varied state noted for its diverse topography, geology, plant communities, and native plants. Of the 173 or so native and naturalized vascular plant families, there are in excess of 5,800 species, around 1,000 of them introduced from other parts of the world. That is an impressive figure for an area our size.

How can a naturalist make sense of this tremendous diversity? The first step is to look at the big picture by learning to recognize plant families. Despite the intimidating number of those families, roughly 40 to 50 families contain more than 85 percent of our flora. Learning to recognize these keystone families goes a long ways toward the process of identification and allows you to create a framework for most of the genera and species you are likely to encounter. Although there are many versions of keys to these and other families, learning the major field characteristics (often with the aid of a good hand lens) saves a lot of time and makes the process more enjoyable. Close observation of habit, leaves, flowers, and fruits leads to important information that is useful in other ways. For example, it helps to explain pollination, adaptations to habitats, and life cycles.

This book was written with these ideas in mind. The families I have selected are those 50 important ones plus several others that help define our vegetation. For example, maples (family Aceraceae), California buckeye (family Hippocastanaceae), California bay (family Lauraceae), and alders (family Betulaceae) are such key components of woodlands and forests that I felt compelled to include them even though each family has only a few species.

Because there is already an excellent book on major desert families (*California Desert Flowers: An introduction to families, genera, and species* by Sia and Emil Morhardt, published by the University of California Press), I have tried to avoid delving into detail on desert plants, although it has been impossible to exclude them all. The major families selected for this book characterize the area we refer to as the *California Floristic Province*, which also coincides with a geographical realm known as *cismontane California*. Just what is meant by those terms?

Floristic provinces are assemblages of plants that belong to plant communities typical of regions that have a similar overall climate and geographical coherence. The plants in each

province form repeatable associations that show adaptations to their home and differ, sometimes dramatically, from plants from other floristic provinces. The California floristic province is one of the most distinctive in the world and represents one of five major areas with a Mediterranean climate—cool to cold, wet winters and warm to hot, usually dry summers. This province extends from the Rogue River in southwestern Oregon south through California into the northwestern fringe of Baja California. Most of it lies to the west of the main mountain crests of the Klamath Mountains, Sierra Nevada, Transverse Ranges, and Peninsular Ranges, a high backbone that delineates much of California. This region is also referred to as cismontane, that is, the region on the ocean side of the mountain crests. The transmontane region to the east is mainly desert and supports other floristic provinces.

As with other aspects of nature, the lines between provinces is often blurred so that various desert elements and families enter the coastal mountains of Southern California. As a consequence, I have included certain families such as the cactus family (Cactaceae) and spurge family (Euphorbiaceae), which are best represented in our deserts. In this endeavor, I have tried my best to be even handed and to balance important plants from all parts of the state.

IMPORTANT PLANT FAMILIES IN CALIFORNIA

California has around 173 different vascular plant families, some native and others introduced. The introduced ones may appear to grow on their own in natural habitats. Many of these nonnatives are accidental introductions brought in on bricks or ballast, as contaminants in cultivated crops, on domestic livestock, and by humans. Other plants have "escaped" from gardens and cultivated fields to grow on their own. Many of these are invasive and seriously threaten the diversity of our native flora.

We live in a time of rapid change in the world of biology. It is important to know that the state of defining plant families is changing more dramatically than at any previous time in history. Despite the inconvenience of a classification in a state of flux, think of these changes as an exciting challenge to learn more about the evolutionary relationships of all organisms. Certainly these changes are frustrating to those wishing to learn an unchanging system, but that is not the reality of what is going on.

The reason for this state of affairs is that many important lines of research are creating a more complete picture of how species and genera are related, and which families they belong to. In addition to the more classical lines of inquiry such as external form (morphology), anatomy, chromosome studies, and details of pollen, the growing arsenal of information includes studies of biochemistry involving pigments, poisons, perfumes, proteins, and many other compounds. Add to this the rapidly expanding field of DNA studies that plot the rate of changes in selected genes, and you have a far richer and more detailed story of true relationships. Computer-generated cladograms that display the degree of relatedness of plant groups present an evolutionary scheme displayed as a branched system. These cladograms are used to determine the limits of families and genera.

Consequently, several well-known and widely studied families are now in a state of change. I wish I could say that these changes will be permanent and all you need do is learn the new classifications, but as we continue to learn more and examine a larger array of genes, we will not only refine the now-current system but also make additional changes.

Some long-recognized families have been split into two or more separate families while others have been "lumped" together. Still others are so complex that totally new alignments are being made.

My approach in this book is somewhat conservative; because the current *Jepson Manual* is still the standard reference for workers and students and because so many other local floras follow a similar system for the families, I have continued to use many of the familiar family definitions. But I also alert you, the reader, to

changes that are proposed or have been accepted; future field books will eventually reflect these changes.

I have deviated from the older system(s) with the large, important lily family (Liliaceae), which is now considered to consist of many separate, sometimes unrelated families. Although I have not treated all of these splinter families here, I am describing some of the major ones that are easily recognized: the agave family (Agavaceae), onion family (Alliaceae), and brodiaea family (Themidaceae).

HOW PLANT FAMILIES, GENERA, AND SPECIES ARE NAMED

All plants have names, and it is the name we turn to first when we want to learn more about a particular group. You will find that plants bear two kinds of names: trivial or common names that are in everyday use by the average person, and scientific or Latin names, that are used throughout the horticultural and botanical world. There are advantages and disadvantages to both kinds of names, but for greater precision, scientific names are preferred. Common names are not always standardized, and many plants and plant families—for example, Fagaceae, aka the oak or beech family—have more than one common name. Common names may also allude to relationships that do not exist. For example, the evening-primrose family (Onagraceae) and primrose family (Primulaceae) are not at all closely related; evening-primroses and their relatives belong to a different evolutionary line. Perhaps the first people to notice this beautiful family were struck by the showy flowers that they imagined looked like oversized primroses, but botanically, the two families differ by many traits (turn to pp. ooo for a description). When these sorts of common names have become so embedded in the language that they are permanent, the name is hyphenated to indicate that it represents a special combination. So we have corn-lily (*Veratrum* spp.) for a perennial wildflower that belongs to the lily family but is not a true lily (*Lilium* spp.), and Douglas-fir (*Pseudotsuga menziesii*) for a tree that despite its very different cones and bark reminded someone of a fir (*Abies* spp.).

Not every plant or plant family has a well-established common name, but since people want a common name, I have tried to provide them when possible. Not everyone will agree with my choice of common names, and some will disagree with my use of one common name over another. Where there is more than one well-known common name, I have included it.

Scientific names are based on carefully crafted rules for naming, and are in a latinized form. Because scientific names can be recognized by scientists throughout the world regardless of the language they speak, the names give a real sense of permanence and are immediately recognizable anywhere.

PLANT FAMILIES

Because this book focuses first and foremost on families, I will talk first about the rules for scientific family names. (Families are larger than genus and species, often embracing several different genera and many species, although some families are very small.) All family names end in -aceae and are based on a *type genus:* for example, we have Rosaceae (rose family) based on the type genus *Rosa;* Liliaceae (lily family) named for the type genus *Lilium*; and Orchidaceae (orchid family) from the type genus *Orchis*. Those examples are based on names that are cognates of common English names, but many family names are not recognizable, such as Ranunculaceae (buttercup family), Rhamnaceae (buckthorn family), and Scrophulariaceae (figwort family). Understanding the derivation of these names makes learning them much more enjoyable. Ranunculaceae refers to *little frogs,* because many buttercups live in wet areas, the habitats for frogs. Scrophulariaceae is named for the type genus *Scrophularia*, based on the belief that it cured the skin disease known as scrofula.

It is also important to understand that scientific names may change as more is learned about a particular group. For example, there is

considerable controversy over what belongs to the lily family (Liliaceae). Research indicates that there are several separate evolutionary lines in this family if you define it to include the broadest possible concept. Each line is often given a separate family name. But if you look at the bigger picture and choose to focus on the common ancestry to these evolutionary lines, you may prefer to lump all the species together into one very large, inclusive family.

I have usually followed the family concepts given in the *Jepson Manual* but as commented on above, new DNA research is turning many families topsy-turvy. In short, evidence from this research is causing an almost unprecedented reorganization of families. The Liliaceae mentioned above is now sliced into more than 16 separate families (not all of these are Californian). This reorganization is highly relevant to those studying evolutionary relationships but it raises havoc with conventional books for the amateur botanist and nature lover.

PLANT GENERA

Besides families, this book covers many important genera and even some species. After family comes genus (plural genera). A genus consists of closely related kinds of plants. For example, among wildflowers we have violets (genus *Viola*), daisies (genus *Erigeron*), Indian paintbrushes (genus *Castilleja*), buttercups (genus *Ranunculus*). Some genera have only one species; others have dozens or even hundreds. The kinds of violets or daisies are what we call species (singular and plural are the same). California is blessed with many species of violets, including *V. douglasii* (Douglas's violet), *V. pedunculata* (wild pansy), *V. adunca* (dog violet), *V. macloskeyi* (white meadow violet), *V. ocellata* (western heartsease), and many more.

PLANT SPECIES

Each scientific species name consists of two parts: a genus name, given first and capitalized; and a specific epithet, given second and starting with a lowercase letter. (Think of how most people use two names to identify themselves.) Both genus name and specific epithet are underlined or italicized. Although the initial reaction of the novice may be that scientific names are impossibly difficult, in fact English speakers have a decided advantage since many of the latinized names have cognates in English. A few examples of recognizable scientific names follow: *Lilium maritimum* (coast lily)—the genus name is the Latin version of lily, followed by a word that means coastal (maritime). *Viola purpurea* (pine or oak violet). The name *Viola* alludes to the violet color of many flowers in the genus, although this particular species happens to be yellow; *purpurea* means *purple*, perhaps because the underside of the mature leaves is purple. *Delphinium nudicaule* (scarlet larkspur): *Delphinium* comes from the Latin word for dolphin and is a cognate of our English word—larkspurs have a sleek, streamlined outline that is reminiscent of the body shape of dolphins; *nudi* means *naked* (nude), *caule* stem (think of the word *cauliflower*, meaning *stem flower*).

HOW TO USE THIS BOOK

If you already know the name of the plant but are curious about the family it belongs to or are simply trying to organize your knowledge better, turn directly to the main section of the book, where each family is listed alphabetically by its scientific name. If you know only the common name of the family, consult the index. If you have a plant to identify and have no idea what it is, refer to the family key (below).

CALIFORNIA PLANT FAMILY ACCOUNTS

Each family entry starts with a short statement about recognition at a glance—what to look for as a first step to identifying the family. When this does not suffice—or if you are anxious to learn more—a series of descriptions expands on other family traits including the habit, leaves, branches, flower shape and arrangement, flower parts—numbers of sepals, petals, stamens, and pistils—and fruits. The term *habit* describes the form of a plant, such as shrub, tree, herbaceous perennial, annual, or bulb.

Because many families look alike or are closely related, there is a section dealing with similar-looking families (which are not always closely related despite a superficial resemblance), with quick suggestions to distinguish them from the family you are learning.

The *statistics* entry alerts you to the distribution, habitat preferences, size, and economic uses of the family.

Finally, there is a section on California genera and species. For small families, I have tried to be as inclusive as possible so that, for example, you will learn about all four tree species that belong to the maple family (Aceraceae). For large families with dozens to hundreds of species, a comprehensive breakdown of the family is beyond the scope of the book, but I have included a fair sampling of genera and species that I consider typical, common, or interesting. These examples are presented under logical categories that act as a guide or simplified key to separate the given genera.

CALIFORNIA PLANT FAMILY KEY

The key is designed to minimize technical features, although many details such as types of fruits and the ways anthers shed their pollen are necessarily mentioned. A good 10x hand lens is a valuable and necessary adjunct to see many of these traits. I often include more than one trait for each step in the key but sometimes the second trait given is not necessary to successfully use the key. (Second or third traits at each step are there to help confirm your decision.)

Although I have attempted to take into consideration exceptions to the general family characteristics, there will doubtless be some that I have missed; the key should work to identify a plant to family most of the time.

If you have a plant to identify, you will want to use the simplified key and carefully follow the choices at each step. To start keying, choose one of the three groups—conifers, monocots and monocotlike plants, or dicots—then turn to that group and proceed from there. Most steps in the key have two choices but a few have three or rarely more.

If you are new to keying, here are some pointers to bear in mind:

- Keys are imperfect because nature is not always consistent.
- Be sure to note as many features about the plant as possible if you do not have a fresh specimen in hand. You will want to note the leaf shape, arrangement, and form (simple or compound), the habit of the plant (herb, shrub, or tree), the arrangement of the flowers, and the details of the flowers and their parts, including shape and any special features. If your specimen has fruits or seeds, those should also be noted.
- Write down the choices you have made so that when a particular choice is not clear you can backtrack if the family you choose does not fit the description of your plant.
- Try working the key backwards, starting with a family whose name you know. By following the steps that lead to the family name, you will learn more about how the key works.
- Practice makes perfect, and the more repetitions you do, the easier the process becomes.
- Consult the glossary at the back of the book for terms that are not familiar. Learning these terms is like learning a new language.
- Consult the illustrations of flower parts located in the glossary.

As you peruse family traits you may find certain unfamiliar terms. Technical terms are useful when they replace an otherwise sentence-long description. The glossary will help make sense of these terms. Be sure to study the line drawings to see how the language translates visually.

Similar-looking families may seem confusing to separate. (Examples include the borage and waterleaf families, the morning glory and nightshade families, and the onion and brodiaea families.) In such cases, check the description of the look-alike family. I comment on families

that might be confused with one another and compare them.

Finally, note that no single trait ever serves as a sure means of recognizing a family; rather, you need to look at a combination of traits. For example, knowing that the Onagraceae (evening-primrose family) is characterized by an inferior ovary does not allow you to separate it from other families with inferior ovaries. But when you note that your plant also has four petals, four sepals, four or eight stamens, and a capsule-type fruit, you can be confident that the plant belongs to this family and no other.

Families sometimes differ in their variability. For example, the Asteraceae (daisy family) and Apiaceae (parsley family) are intuitively easy to recognize because of the appearance of their flowers: Daisies have many flowers packed together in a head that resembles a single flower; parsleys bear many tiny flowers in compound umbels. By contrast, the Rosaceae (rose family) varies in just about every feature from leaf design to flower arrangement, from plant habit to stamen number, and from habitat to ovary position. Yet, even this large family offers important clues to its identity such as the presence of a hypanthium, a single-rose-like flower design, specific types of fruits, the frequent presence of stipules on the leaves, and sepal-like bracts that alternate with the true sepals on flowers of the nonwoody species.

Remember: Practice makes keying go faster and more smoothly. Use this book often and you will grow more proficient at keying and find satisfaction in your new skills.