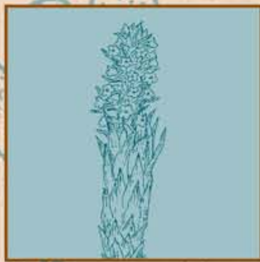
WILD PLANTS OF THE SIERRA NEVADA



Ray S. Vizgirdas AND
Edna M. Rey-Vizgirdas

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of the Sierra Nevada

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Ray S. Vizgirdas and Edna M. Rey-Vizgirdas

Illustrations by Edna M. Rey-Vizgirdas

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While this book documents the many uses of wild plants found within the Sierra Nevada, the publisher and authors disclaim any liability for injury that may result from following the instructions for collecting, preparing, or consuming plants described in this guide. Efforts have been made to ensure that the descriptions and drawings of plants represented are accurate representations of the family, genus, and species noted. It should be understood that growth conditions, improper identification, and varietal differences, as well as an individual's own sensitivity or allergic response, can contribute to a hazard in sampling or using a plant. Furthermore, the reader is encouraged to seek assistance from experienced botanists in identifying any of the plants discussed in this book.

For Tomas,
from Mom and Dad

We are losing our
ancestral knowledge
because the technicians
only believe in modern
science and cannot read
the sky.

—Andean peasant expression

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Preface
Ray S. Vizgirdas

I wrote this book because, after thirty years of exploring the Sierra Nevada and its forests as a student, teacher, professional naturalist, and field biologist, I believed that I should impart some of my own enjoyment and appreciation of these mountains to all those—young and old, amateur and professional—who want to learn more about the richly diverse wild plants of this important mountain range and the exceptionally wide variety of plant habitats enfolded within its expanse. My objective is to provide a comprehensive inventory of all the wild plants endemic to the range—more than 400 plant taxa, over half of which are considered rare. I also provide information that will help readers identify individual plant species, as well as information on the traditional and modern uses of Sierra plants—for example, as food or beverage, medicine, tools, or containers.

Additionally, I want to guide readers to additional information about Sierra plants, and to this purpose I provide an extensive list of suggested readings and other sources of information about the plants, their habitats, and their uses. To encourage readers to practice conservation and to respect the flora they are observing, I identify endangered plants when they are described in the text and I list them in one of the appendices.

My interest in the outdoors started when I was young and demanded to be told the names of all the plants and animals I saw within and around the campsites during family vacations. My curiosity only grew with time as I acquired the skills and knowledge that enabled me to live comfortably in the mountain environment. This ability eventually grew to the point where I was able to explore the Sierra Nevada (and northern Rockies) for weeks and months at a time, sustained by my knowledge of plant (and animal) uses. I also learned to respect these mountains and their fragile resources, and I always had a conservation ethic foremost in my mind as I was learning and practicing my outdoor skills. I understood early on that to wantonly destroy plants, animals, or other resources is unwarranted, as no animal or plant that lives in the mountains destroys the resources it depends on. These lessons I continue to apply to my present life.

The introduction offers a brief overview of the Sierra Nevada's biological, geological, and cultural significance; introduces the reader to the science of ethnobotany; and gives some insight into the nutritional value of wild plants. It also takes you on a trek across the Sierra Nevada to examine the many and extremely diverse plant habitats and communities found in this range. The heart of the book, "Major Plant Groups," surveys the major vascular plant groups, including ferns and their allies, gymnosperms, and flowering plants, both dicots and monocots. Within each group, the families (and genera and species therein) are arranged in alphabetical order. Information in these groupings includes a brief description of the plants, noting any special characteristics and any interesting natural history information, as well as their uses—be it traditional uses by the Native American people who once made the Sierra Nevada their home, or more contemporary uses, or both. The book also includes a number of "quick keys" to help readers differentiate between similar species.

Appendix 1 of the book has been created to make the book more useful for people in the field. It is a table that identifies the major plant communities of the range (from west side to east side) and lists the plants commonly associated with them. Once you've chosen a plant about which you want to learn more, simply refer back to "Major Plant Groups" to read more about it. Appendix 2 provides a list of rare and endangered plants found in the Sierra Nevada. Readers should be aware of these plants and make efforts to protect and conserve them during excursions to the mountains. The indices in appendix 3 are designed to allow the reader to locate information about Sierra Nevada plants by cross-referencing their common and scientific names. There is also a glossary defining many of the common terms used in botany, ethnobotany, and medicine.

The book includes eighty-two line drawings of all the major plant species, intended to help readers identify plant specimens. They were done by my wife, Edna Rey-Vizgirdas.

Albert Einstein once said that he never had an original idea. Rather, his ideas were built upon the ideas of others. In much the same way, this book is not an original idea but rather an assemblage of information that has been passed down to us from people of many previous generations, including the Native Americans who inhabited these mountains for millennia and the European and Asian pioneers who settled there later. All that I have done is gather what information I could on plants of the Sierra Nevada and make it available here. Therefore, I first acknowledge those that came before me, who in a sense had to learn by trial and error which plants were useful and which were not. Additionally, I would like to thank the University of Nevada Press for the opportunity to make this book a reality. There were many reviewers who provided thoughtful and constructive criticisms that greatly improved its content and presentation. To all of you, a very sincere thank-you. However, I accept responsibility for any errors.

Edna Rey-Vizgirdas

My interest in the environment began early in childhood. When we first visited the Sierra on a camping trip over thirty-five years ago, I was enthralled. The view of the majestic Minarets took my breath away, and I promised myself I would someday move to the mountains, which I did as soon as I graduated from high school. I went on to live in June Lake, Lake Tahoe, and Sequoia National Park working as a park ranger, researcher, and ski instructor. Spending time outdoors continues to provide me with inspiration, enjoyment, and fulfillment. For me, it is an ongoing practice of meditation—being aware of my surroundings in every moment, with each step and each breath, whether I'm in a forest, sun-drenched meadow, or snowstorm—and realizing that life has unlimited possibilities. It is in this spirit that I dedicate this book to all those who find hope and beauty and peace in the wilderness.

Introduction

The greatest service which can be rendered to any country
is to add a useful plant to its culture.
—Thomas Jefferson (1790), on introducing upland rice to America

The Sierra Nevada

The Sierra Nevada is one of the most magnificent mountain ranges in the world. This snowy and sawtooth range is high in the East, low in the West, and was born of convulsions beneath the earth. Since its birth, the range has been finely molded by wind, water, fire, ice, and time.

In Spanish, *Sierra Nevada* means "snowy range." It was in 1776 that Padre Pedro Font on the second Juan Bautista de Anza expedition gave that name to the mountains that were seen in the distance to the east of San Francisco. Another commonly used nickname is the Range of Light, which was first used by John Muir in 1894 in his book *The Mountains of California:*

> Looking eastward from the summit of Pacheco Pass one shining morning, a landscape was displayed that after all my wanderings still appears as the most beautiful I have ever beheld. At my feet lay the Great Central Valley of California, level and flowery, like a lake of pure sunshine, forty or fifty miles wide, five hundred miles long, one rich furred garden of yellow Compositae. And from the eastern boundary of this vast golden flower-bed rose the mighty Sierra, miles in height, and so gloriously colored and so radiant, it seemed not clothed with light but wholly composed of it, like the wall of some celestial city. . . . Then it seemed to me that the Sierra should be called, not the Nevada or Snowy Range, but the Range of Light. And after ten years of wandering and wondering in the heart of it, rejoicing in its glorious floods of light, the white beams of the morning streaming through the passes, the noonday radiance on the crystal rocks, the flush of the alpenglow, and the irised spray of countless waterfalls, it still seems above all others the Range of Light. (1)

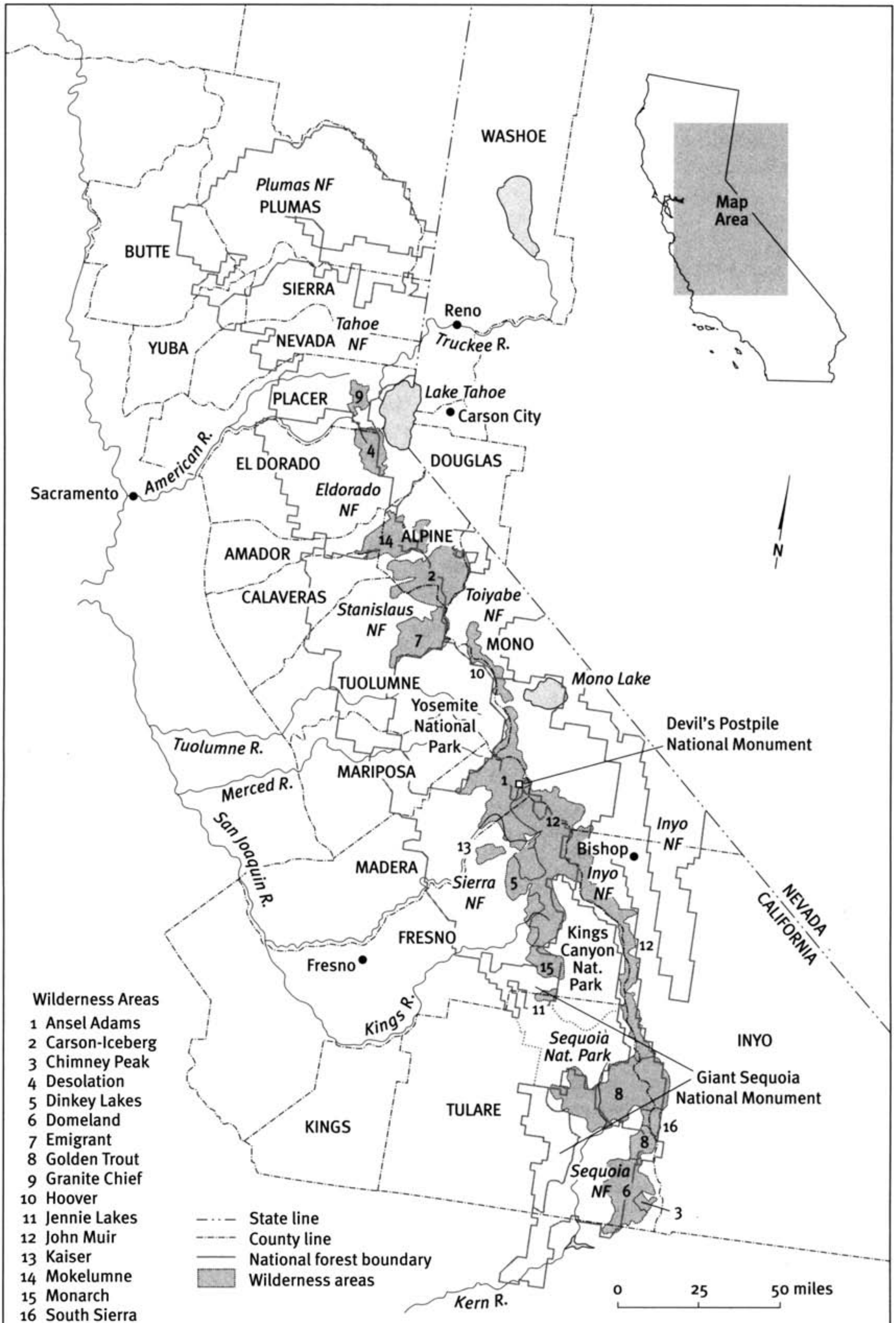
Today, millions of different people come to these mountains. There are skiers who seek the speed of snow-covered slopes, backpackers and hikers who kick up dust as they advance to some distant lake or peak, and naturalist types who take the time to count the number of petals and stamens of wildflowers in meadows and who watch for familiar and new species of birds, butterflies, and mammals. There are also wilderness connoisseurs who search for nothing more than the peace, quiet, and solitude these mountains have to offer. However, to the Native people of the past, these mountains meant something more.

The Sierra Nevada is the largest continuous mountain range in the United States and lies almost entirely within the state of California, extending into Nevada only on the eastern side near Lake Tahoe (page 2). The range is more than four hundred miles long and between sixty and eighty miles wide, and it extends in a southeasterly direction from about Lake Almanor in the North to approx-

Thoreau versus Muir in the High Sierra

In examining the lives of Henry David Thoreau and John Muir, there are those who believe that Thoreau might not have made it in the high county of the Sierra Nevada. Consider the following: he could not have built a cabin for twenty-eight dollars, grown vegetables, taken odd jobs, and gone for ramblings and contemplative walks in the woods. To survive in the High Sierra requires considerable effort.

John Muir, on the other hand, was the quintessence of adaptation to the range. For food, he took a loaf of bread and sometimes tea. To sleep, he used no blankets but kept the campfires burning throughout the night. He drank simply from the streams or sucked on snow, and for shelter he did what most of the denizens of the mountains did: he crawled under the lower branches of a pine. Without anything to slow him down, he went where he pleased, and survival was no problem.



Sierra Nevada

imately Tehachapi Pass, located southeast of Bakersfield. To the early settlers and travelers, the Sierra Nevada was an impediment to communication and progress and was of little interest until the discovery of gold in the foothills in 1848. Today, there are three national parks (Yosemite, Sequoia, and Kings Canyon), one national monument (Devil's Postpile), nine national forests, and numerous state parks (Whitney 1979; Barbour et al. 1993).

At its foundation, the Sierra Nevada is an enormous deposit of granitic rock whose exposed slopes are readily visible at the crest of the range. The gradual west slope rising from the expansive Central Valley to the Sierra crest is dissected by deep, west-trending river canyons. At the eastern edge of the uplift, the high peaks dominate the uppermost elevations, forming rolling highlands in the North—with elevations mostly less than 9,000 feet—and expansive, highly dissected mountains in the broad southern alpine zones, where Mount Whitney (the highest peak in the contiguous forty-eight states) rises to 14,495 feet. The range ends abruptly at the eastern escarpment, dropping with a shallow gradient in the North but in the South plunging more than 10,000 feet from the Sierran crest to the floor of the Great Basin. In all, there are about eleven peaks that top 14,000 feet and an additional five hundred peaks above 12,000 feet. Some sixty glaciers can also be found.

With so much topographic relief, the Sierra Nevada possesses a high diversity of plant species, and many species are endemic (restricted) to the range. In fact, because the range represents about 20 percent of the California land base, it also contains more than 50 percent of the state's flora. Of this, approximately 405 plant taxa are endemic to the Sierra Nevada, and 218 taxa are considered rare by conservation organizations, state and federal agencies, or both (Hickman 1993).

Plants as Food and Medicine

A Word about Ethnobotany

As this book explores the uses of Sierra Nevada plants, we provide a brief overview to the science of ethnobotany. In the 1800s, there were a number of scientists actively studying all forms of the plant world that the primitive or aboriginal people used for medicine, food, and textile fabrics. As early as 1874, this was referred to as "aboriginal botany," and this term persisted for a number of years. Then in 1895, a professor of biology, John W. Harshberger, initiated the fashion of using the prefix *ethno* to indicate the study of local people's natural history (Powers 1874; Harshberger 1896). Therefore, ethnobotany is the study of "plants used by primitive and aboriginal people" (Harshberger 1896, 146). Other definitions for ethnobotany include "the study of the interrelationships of primitive man and plants" and "the study of plants in their relations to human culture." In a real sense, ethnobotany is a science born in the United States. The following list shows how the meaning of ethnobotany has changed from the mid-1800s to the present.

Interpretations of Ethnobotany

DATE	THE INTERPRETATION OF ETHNOBOTANY
1873	*Aboriginal Botany*—the study of all forms of vegetation that aboriginal people used for commodities such as medicine, food, textiles, and ornaments (Powers 1874)
1895	*Ethnobotany*—the use of plants by aboriginal peoples (Harshberger 1896)
1916	Not just a record of plant use, but the traditional impressions of the total environment as revealed through custom and ritual (Castetter 1944)

1932	Not only tribal economic botany but also the whole range of traditional knowledge of plants and plant life (Gilmore 1932)
1941	The study of relations that exist between humans and their ambient vegetation (Castetter 1944)
1941	The study of the interrelations between "primitive" humans and plants (Castetter 1944)
1981	The study of direct relationships between humans and plants (Ford 1978)
1990	The study of useful plants prior to commercialization and eventual domestication (Wickens 1990)
1993	The recording and evaluation of environmental knowledge that different cultures have accumulated throughout millennia (FEB 1993)
1994	All studies (concerning plants) that describe local people's interaction with the actual environment (G. J. Martin 1995)

Adapted from Cotton 1996

Before the term *ethnobotany* arose in 1895, the study of traditional botanical knowledge centered on the applications and economic potential of plants used by Native peoples. However, during the first part of the 1900s, anthropological and ecological aspects became more important, and later, as ethnobotanical studies intensified in the 1980s, a whole spectrum of interpretations appeared as many other disciplines become involved in "ethnobotany," ending with a reinterpretation in 1995 (adapted from Cotton 1996).

An ethnobotanist, in turn, explores how plants are used as food, shelter, medicine, and clothing; in hunting; and in religious ceremonies. The roots of ethnobotany lie within botany, and botany originated, in part, from an interest in finding plants to help fight illness. Until very recently, medicine and botany were always studied together, and many of the drugs we have today were derived from plants. Because ethnobotany is a multidisciplinary science, to become an ethnobotanist, a person's interest in botany and ecology is supplemented by such disciplines as linguistics, anthropology, chemistry, sociology, and pharmacology. The following list highlights some of the various fields of study in ethnobotany today.

Some Areas of Modern Ethnobotanical Studies

FIELD	MAIN AREAS OF STUDY
Ethnoecology	Traditional knowledge of plant phenology, adaptations, and interactions with other organisms. Natural and environmental impact of traditional vegetation management.
Traditional Agriculture	Traditional knowledge of crop varieties and agricultural resources. Natural and environmental impact of crop selection and crop management.
Cognitive Ethnobotany	Traditional perceptions of the natural world (through the analysis of symbolism in ritual and myth) and their ecological consequences. Organization of knowledge systems (through ethnotaxonomic study).
Material Culture	Traditional knowledge and use of plants and plant products in art and technology.
Traditional Phytochemistry	Traditional knowledge and use of plants for plant chemicals (for example, pest control and traditional medicine).
Paleoethnobotany	Past interactions of human populations and plants based on the interpretation of archaeobotanical remains.

Ethnobotany is a diverse field of study that examines all aspects of the relationships between plants and traditional peoples. As such, it is interdisciplinary and draws from a wide range of subject areas (adapted from Cotton 1996).

For most of the one to two million years that humans have existed, they lived in much closer association with the natural world than now. In fact, day-to-day survival required an entirely different set of skills and knowledge than we have today, which included detailed knowledge of plants, animals, location of water, and other natural resources. Then, over the years (and many generations) and through trial and error, humans maintained a repertoire of edible, useful, and medicinal plants. It is because of these experiments that we have information on the uses of many plants. Unfortunately, today most people are unaware of these riches and have become dependent on only a few "domesticated" species of plants. Those who seek out wild plants find a continual source of stimulation and enjoyment, particularly as it relates to the survival of one's spirit.

Today, we still interact with many plants, but in more indirect ways. However, there are still cultures that maintain strong connections with their local plants, and there are still people involved in recording this knowledge for the benefit of those who have preserved the information as well as for the benefit of all humanity. The plant kingdom continues to provide treatments for illnesses in the world. For example, a number of species have been useful in the treatment of certain types of cancer: taxol is the active compound from *Taxus brevifolia* used in the treatment of ovarian cancer, and colchicine from crocus is used in chemotherapy. Other plants such as periwinkle (*Catharanthus roseus*) are being used for Hodgkin's disease and leukemia, milk thistle (*Silybum marianum*) for liver disease, and foxglove (*Digitalis*) for heart disease (Lewis and Elvin-Lewis 1977; Duke 1992a). In some cases, the curative substance is available only from the plant, and the demand for the substance can be satisfied only by collecting it in the wild or by growing the plants as crops.

FARMING
Farming has often been blamed for materialism in human society because it gave people something worth hoarding and squabbling about—food. It also allowed the start of commerce, with some people living by providing goods and services, and others by growing food.

Nutrition and Seasonality of Plants

Wild plants are a good source of vitamins and minerals. In fact, much of the medicinal value originally associated with many wild plants was due simply to their high vitamin and mineral contents. Wild plants can also provide proteins, carbohydrates, fats, vitamins, and minerals that are needed for good mental and physical condition (C. E. Smith 1973; Elias and Dykeman 1982). Certain amino acids, however, can be obtained only from animal products (for example, meats, milk, cheese, and eggs). The following summarizes some of the important vitamins and minerals that are needed for good health.

Some Important Vitamins and Minerals for Health

Vitamins

These are organic compounds that are necessary in small quantities to prevent disease and help regulate the body's biochemical processes. Prolonged excessive doses of vitamins A, D, and K can have toxic effects. In addition to the vitamins listed below, biotin, choline, folic acid, and pantothenic acid are also essential nutrients.

Niacin (Nicotinic Acid) A vitamin of the B complex, niacin occurs in both plant and animal tissues in various forms. In the body, niacin from plants is changed to niacinamide for use. Niacin takes part in enzyme reactions involved in the production of body energy and tissue respiration. Pellagra is a niacin-deficiency disease. Niacin is water soluble and is not sensitive to heat, acids, or alkali.

Vitamin A Vitamin A is not found in plants but rather is manufactured by animals from pigments called carotenes that are common in plants. Vitamin A is essential for night vision and promotes healthy skin and mucous membranes. It is also important for bones and teeth, proper digestion, and the production of red and white blood cells. It is fat soluble and sensitive to oxygen.

Vitamin B_1 (Thiamine) Found in both plant and animal tissues, thiamine is important for the body's production of energy through the breakdown of carbohydrates. It appears to be important for normal functioning of the nervous system and is involved in the action of the heart. Vitamin B_1 is water soluble and sensitive to heat. Most plants contain trace amounts.

Vitamin B_2 (Riboflavin) Riboflavin usually occurs in the same foods as vitamin B_1. It is essential for cell growth and enzymatic reactions by which the body metabolizes proteins, fats, and carbohydrates. Vitamin B_2 is water soluble and sensitive to light.

Vitamin B_6 (Pyridoxine) B_6 is still a relatively little-known vitamin. It participates in many enzymatic reactions and is particularly important for brain and nervous system function. Vitamin B_6 is water soluble and sensitive to oxygen and ultraviolet light.

Vitamin B_{12} (Cyanocobalamin) Little or no B_{12} is found in plants. Strict vegetarians sometimes suffer from pernicious anemia, a disease associated with B_{12} deficiency. Vitamin B_{12} is necessary for proper functioning of cells, especially in the nervous system, bone marrow, and gastrointestinal tract. It is involved in the metabolism of fats, proteins, and carbohydrates. Vitamin B_{12} is water soluble and sensitive to light, acids, and alkalis.

Vitamin C (Ascorbic Acid) Vitamin C occurs in almost all plants to some degree. Because our bodies cannot make or store vitamin C, a continuous supply must be present in the food we eat. Body cells require vitamin C for proper functioning, as does the formation of healthy collagen (the basic protein of connective tissue), bones, teeth, cartilage, skin, and blood vessels. Vitamin C also promotes the body's effective use of other nutrients such as iron, B vitamins, vitamins A and E, calcium, and certain amino acids. By promoting the formation of healthy connective tissue, vitamin C helps to heal wounds and burns. Stress, fever, and infection tend to increase the body's need for vitamin C. A deficiency of vitamin C is called scurvy. Vitamin C is water soluble and is sensitive to air, heat, light, alkalis, and copper ware.

Vitamin D Vitamin D does not occur in plants. However, some plants contain compounds called sterols, which when irradiated with ultraviolet light make Vitamin D. Vitamin D is necessary for healthy bones and teeth, for proper assimilation of calcium and phosphorus, and in preventing rickets. It is a fat-soluble vitamin that is not sensitive to heat, light, or oxygen.

Vitamin E (Tocopherol) Vitamin E is found in both plant and animal tissues. It is an antioxidant, acting to protect red blood cells, vitamin A, and unsaturated fatty acids from oxidation damage. It also helps maintain healthy membrane tissue. In laboratory experiments, it was found to be necessary for fertility in rats. Vitamin E is fat soluble and is sensitive to oxygen, alkali, and ultraviolet light.

Vitamin K Though vitamin K occurs primarily in plants, it is also synthesized by bacteria found in the small intestine. It is necessary for the liver's synthesis of the blood-clotting enzyme prothrombin. Vitamin K is fat soluble and is sensitive to light, oxygen, strong acids, and alcoholic alkalis.

Minerals

These are chemical elements necessary for proper functioning of the body. Most are obtained from the foods we eat. There are two groups of minerals: *macrominerals* and *microminerals*. Macrominerals are found in relatively large amounts in the body, whereas microminerals are found in smaller amounts. Following is a list of minerals known to be necessary in human nutrition. There are other minerals, but their functions are not clearly understood.

MACROMINERALS	
Calcium	Calcium is the most abundant mineral in the body. It occurs in plants, dairy products, and seafood. Calcium is necessary for healthy bones and teeth, clotting of blood, the functioning of nerve tissue and muscles (including the heart), enzymatic processes, and controlling movement of fluids through cell walls.
Chlorine	As a gas chlorine is poisonous, but in the form of chloride compounds, it is an essential mineral. It acts with sodium to maintain the balance between fluids inside and outside the cells. Gastric juices in the stomach contain hydrochloric acid, the production of which requires chloride. Table salt (NaCl) is our main source.
Magnesium	Found in both plant and animal tissues, magnesium is essential as an enzyme activator and is probably involved in the formation and maintenance of body protein.
Phosphorus	Occurring in plant and animal tissues, phosphorus takes part in the production of energy for the body and is second only to calcium as a constituent of bones and teeth. Phosphorus is necessary for metabolic functions relating to the brain and nerves, as well as for muscle action and enzyme formation.
Potassium	Potassium is abundant in plant and animal tissues. It promotes certain enzyme reactions in the body and acts with sodium to maintain normal pH levels and balance between fluids inside and outside the cells.
Sodium	A common mineral in plants and animals, sodium regulates the volume of body fluids, and when balanced with potassium, it helps maintain cell-fluid equilibrium. It is also necessary for nerve and muscle functioning. The ideal amount can be obtained through a diet of vegetables such as dandelion greens, spinach, mustard greens, watercress, and carrots.
Sulfur	Sulfur supply comes from sulfur-containing amino acids and from the B vitamins thiamine and biotin. Its main sources are dairy products, meats, legumes, nuts, and grains. Sulfur is involved in bone growth, blood clotting, and muscle metabolism. It also helps to counteract toxic substances in the body by combining with them to form harmless compounds.
MICROMINERALS	
Copper	Copper is found in plant and animal tissues and is essential (with iron) for formation of hemoglobin in red blood cells. Copper is also important for protein and enzyme formation, as well as for the nervous and reproductive systems, bones, hair, and pigmentation.
Iodine	Iodine's only dependable sources are seafood and seaweeds. Other plants will contain iodine if grown in iodine-rich soils. It is necessary for normal physical and mental growth and development, as well as for lactation and reproduction. An iodine deficiency is called goiter.
Iron	Iron occurs in plant and animal tissues. The body retains iron very well, and only trace amounts are needed in the diet. Iron is essential to form the oxygen-carrying hemoglobin in red blood cells and is involved in muscle function.
Manganese	Plants are the best source for manganese. Trace amounts are necessary for healthy bones and for enzyme reactions involved in energy production.
Zinc	Zinc is found primarily in animals but also occurs in plants growing in good soil. It is important for various enzyme reactions, the reproductive system, and for the manufacture of body protein.

Adapted from Lust 1987

There are nine categories of plant foods discussed in this book. They include root vegetables; green vegetables; fleshy fruits; seeds, nuts, and grains; inner bark; and flowers. Plant food categories in the following list show the approximate number of species providing food within each category in the Sierra Nevada. Many plants have multiple food uses.

PLANT FOOD CATEGORY	APPROXIMATE NUMBER OF SPECIES
Roots (roots, bulbs, corms, rhizomes, and tubers)	247
Greens (stems, leaves, shoots, and buds)	676
Fleshy Fruits	387
Seeds, Nuts, and Grains	349
Inner Bark, Cambium, and Sap	246
Flowers	137
Sweetening Agents	69
Beverages (tea and juice)	92
Miscellaneous (flavoring, casually edible, and gum)	147
TOTAL	2,350

Root vegetables (that is, tubers, corms, bulbs, rhizomes, and true roots) include plants such as wild onions, blue camas, spring beauty, lilies, bitterroot, and balsamroot. Roots are the storage organs high in carbohydrates. The greatest amount of energy from roots is available at the end of the growing season. These carbohydrates come in a variety of forms and flavors and are not always readily digestible by humans. One type of carbohydrate found in some roots is inulin, which becomes sweet after cooking due to its conversion to fructose. If the skin of a plant's root is consumed, it can provide minerals and a small amount of vitamins.

Green vegetables include leaves, stems, shoots, and buds. Examples are fireweed (shoot and stem), lamb's-quarters, nettles, and mustards (leaf). Many green vegetables are most palatable and digestible when they are young. Green vegetables are high in moisture and often contain carotene, vitamin C, folic acid, and various minerals (for example, iron, calcium, and magnesium).

Fleshy fruits include serviceberry, gooseberries, currants, huckleberries, wild plums, cherries, and rose hips. Fleshy fruits are a good source of ascorbic acid and contain high amounts of other nutrients such as calcium, vitamin A, and folic acid.

Seeds, nuts, and grains are good sources of protein, fat, carbohydrates, vitamins, and minerals. Oils can also be rendered from these foods. Nuts are especially good sources of B vitamins, amino acids, and iron (Doebley 1984).

CARBOHYDRATES, FATS, AND PROTEINS
The body's primary source of energy is glucose, a carbohydrate. Fats produce more energy for each gram consumed than carbohydrates. Fats and carbohydrates are the best sources of energy. Protein is the least-preferred source of energy because it has to be extensively metabolized by the body to make glucose.

The cambium or inner bark of coniferous and deciduous trees and shrubs is another category of plant foods. The inner bark may be scraped off trees in the spring. Many species have a high sap content. For example, maple sap is high in carbohydrate- or sugar-energy value for an inner bark food (Gottesfeld 1992).

The final category of plant foods are the flowers. Rose petals, fireweed flowers, and mariposa lily buds are high in moisture. Flowers are low in proteins and fats, but some are rich in vitamin A (carotene) or vitamin C. There is little published information on the mineral content of flowers.

The nutritional value of plants changes with the seasons. During spring and summer, many plants are tender and rich in vitamins. Roots and tubers are high in carbohydrates and other nutrients. But as summer progresses, roots become less desirable because the stored energy is shifted to the aboveground parts. Fall is a time of nuts and berries, which provide a good source of protein. Roots again begin to store carbohydrates. Winter, however, can be bleak. The aboveground edibles may be limited to berries that have persisted into winter, bark and pine needles for teas, and inner bark. Teas can be restorative and do provide some food value. Teas can be upgraded into stews by adding insect larvae, birds, or mammals to make them more nutritious and sustaining.

The nutritional value of plants also depends on preparation methods. For example, cooking greens in two changes of water makes them more palatable but can reduce the nutritional value. Generally, the preferred order of preparation for plants foods is: raw, quick-cook or steamed, baked, then boiled. Frying is the least desirable cooking method because it destroys many useful vitamins and minerals.

Active Principles of Medicinal Plants

The medicinal value of plants is due to the presence in the plant tissue of a chemical substance—an active principle—producing a physiological effect. Many of the active principles are highly complex, and their precise chemical nature is still unknown. However, some have been isolated, purified, and even synthesized or simulated. Active principles commonly fall into one of six categories: alkaloids, glycosides, essential oils, gums and resins, fatty oils, and antibiotic substances (Hocking 1949; Lewis and Elvin-Lewis 1977; Duke 1992b; Chatfield 1997).

Alkaloids are a diverse group of alkaline compounds with marked physiological activity and always contain nitrogen. Alkaloids include morphine, cocaine, nicotine, quinine, plus more than five thousand others. The plant families richest in alkaloids include the Solanaceae, Fabaceae, Rubiaceae, Liliaceae, and above all Apocynaceae.

Glycosides are compounds that, when hydrolyzed, produce a component of one or several sugars (that is, glycone) and a nonsugar component (aglycone). The various types of glycosides are classified by their aglycone part. Among the most important glycosides in modern medicine are the cardiac glycosides that are found in the dogbane (Apocynaceae), milkweed (Asclepiadaceae), lily (Liliaceae), buttercup (Ranunculaceae), and figwort (Scrophulariaceae) families. Digitalis is a widely prescribed drug of plant origin and owes its activity to cardiac glycosides. Additionally, cyanogenic glycoside yields hydrocyanic acid and is reported from some two thousand species of flowering plants.

Essential oils usually have various chemical constituents, oftentimes terpene derivatives or aromatic compounds. They rarely consist of a single constituent but often contain alcohols, ketones, aldehydes, phenols, ethers, esters, and other compounds, as well as sometimes nitrogen and sulfur. Many are highly germicidal, a property owing to their ability to penetrate into protoplasm. However, they are usually too insoluble in water to be important in medicine as antiseptics. They are valuable as carminatives in cough drops, mouthwashes, gargles, sprays, and healing ointments.

Gums are polymers of various rarer sugars, and *resins* are oxidation products of essential oils. Both are used as purgatives and in ointments. *Fatty oils* (lipids) are used in emulsions and as purgatives. *Antibiotic substances* are various complex organic compounds, usually from molds, actinomycetes, and bacteria that are capable in small amounts of inhibiting life processes of microorganisms.

Doctrine of Signatures
In ancient times, it was thought that if a plant part was shaped like, or in some other way resembled, a human organ or disease characteristic, then that plant was useful for that particular organ or ailment. This concept has no scientific basis, though sometimes uses conceived centuries ago have persisted and may even have been corroborated by scientific evidence of their efficacy.

A couple of examples of this doctrine would be that kidney beans were good for the kidneys, and the leaves of Arrowhead (*Sagittaria* spp.) would be useful for wounds caused by arrows.

The Natural History and Ecology of Sierra Nevada Plants

Sierra Nevada Forests and Plant Communities

To better facilitate the learning of useful plants, it is helpful to know something about plant communities and plant distribution. For example, if you found yourself in a forest dominated by ponderosa pine (*Pinus ponderosa*), then you will also know that there are often a great many other plant species associated with this forest type. Each species has its specific distribution based on a variety of requirements. Appendix 1 provides a list of the habitats within the Sierra Nevada and associated useful plant species.

Life-Zone Concept

One of the earliest attempts to explain the distribution of plants (and animals) was introduced by C. Hart Merriam, chief of the U.S. Biological Survey. He attempted to correlate climatic conditions, more specifically temperature, as the most important factor in fixing the limits beyond which a particular species of plant or animal cannot go. Merriam's life-zone system, or life zones as they are commonly referred to, found great favor with biologists in the early years of the nineteenth century and was widely used. It is not uncommon to still see some field guides today using the terminology developed by Merriam. However, the limitations to this scheme were quite evident.

Climate of the Sierra Nevada

The present-day climate of the Sierra Nevada is dominated by a Mediterranean pattern of a cool, wet winter followed by a long dry period in summer. Temperature and precipitation help in determining to a great extent the kinds of plants and animals that live at different elevations within the Sierra Nevada. In general, temperature decreases about one degree Fahrenheit for each three hundred–foot rise in elevation, and as it cools the air drops its moisture as rain or snow. Annual precipitation tends to increase by approximately one inch for every one hundred–foot rise in elevation, reaching a maximum at about fifty-five hundred feet on the central western slope of the range. Most precipitation falls in the form of snow at the higher elevations and may persist in areas well into the summer months. The elevation at which maximum precipitation is higher in the southern portion of the Sierra Nevada is at about six thousand feet, whereas in the northern Sierra it is at about four thousand feet. What is generally seen with an increase of one thousand feet in elevation are changes similar to if one was moving three hundred miles northward. Because more precipitation occurs on the western slope of the range, the eastern slope is drier and is often referred to as being in the *rain shadow* of the Sierra Nevada (Whitney 1979).

Plant Communities

Patterns of plant distribution are controlled not only by changes in elevation but also by factors such as the availability of moisture during the growing season and the amount of snow accumulation during winter. Plant communities of warm south-facing slopes can differ markedly from cooler north-facing slopes that lie just across a valley. Soil type also affects plant distribution. For example, soils that have developed on glacial till, as an example, often harbor different species than soils formed from decomposed granite (Whitney 1979; Barbour et al. 1993).

In the late 1940s, two botanists, P. A. Munz and D. D. Keck, were developing a new flora for California and desired a more precise classification to describe the distribution of plants than that provided by Merriam. In 1949 they published "California Plant Communities," which divided the state into five biotic provinces that were further divided into eleven vegetation types. Within the eleven vegetation types, they recognized twenty-four plant communities, including valley grassland, foothill woodlands, chaparral, montane coniferous forests, alpine, sagebrush, and pinyon-juniper woodland. More recently, *The Jepson Manual: Higher Plants of California* took a slightly different and more convenient approach to dividing the state. The area covered by this book is primarily the Sierra Nevada and east of the Sierra Nevada (in part) (Hickman 1993).

Trek across the Sierra

As is already evident, mountains have a major influence on climate. In general, they force moisture-laden air from the prevailing winds upward along their steep slopes. As the air rises, it cools, and the moisture condenses into rain or snow. Thus, the western Sierra Nevada slopes are cool and wet, whereas the eastern slopes are relatively dry. Due to changes in elevation and the rain-shadow effect, mountains provide habitat for considerably more kinds of plants (and animals) than the surrounding lowlands. Although there are many more plant communities and species to be encountered on the western slope of the Sierra Nevada, this book does provide information for as many species as possible on both sides of the range.

For a closer look at the plant communities within the range, we will climb up and over—first up the western slope through the foothill woodlands with its gray pine and oaks and through the thickets of the chaparral. Once we breach this nearly impenetrable rampart, we will be in the midmountain forests of ponderosa (*Pinus ponderosa*) and sugar pine (*P. lambertiana*) and groves of giant sequoias (*Sequoiadendron giganteum*), then higher still through the red firs (*Abies magnifica*) and lodgepole pines (*P. contorta*) until we reach the subalpine world of gnarled trees. Proceeding even higher yet, we will go beyond the timberline and into the alpine world. Once we reach the crest of the High Sierra, we will start down the steep east side into a land totally different from the one where we began. The following discussion summarizes the works of M. G. Barbour and J. Major (1988), S. Whitney (1979), M. G. Barbour et al. (1993), and V. R. Johnston (1994).

The Foothills

Our trek begins on the west side of the Sierra where we first encounter the foothills. The foothills form a belt about ten to thirty miles wide and five hundred to five thousand feet in elevation above the Central Valley floor. The zone is defined by a distinctive vegetation mosaic comprising grassland, woodland, and chaparral (at its upper limits). The four major plant communities recognized include valley grassland, foothill woodland, riparian woodland, and chaparral.

Valley grassland covers the gentle rolling hills and extends upward in elevation as an understory beneath the foothill woodland. Like the chaparral and foothill woodland, valley grassland is a widespread and characteristic element in the foothill landscape but is now dominated by alien plant species. At one time, the grassland was dominated by perennial bunchgrasses such as purple needlegrass (*Stipa pulchra*) and foothill bluegrass (*Poa scabrella*). The Sierra grasslands are most beautiful in the spring when grasses are brilliant green and decorated with great swaths of native wildflowers. Appendix 1 provides an additional list of useful plants to be found in the valley grassland.

Foothill woodland occurs on fairly deep, well-developed soils and is dominated by blue oak (*Quercus douglasii*) and gray pines (*P. sabiniana*). These two species are more or less constant associates throughout their geographic ranges.

The foothill-woodland community occupies a variety of habitats between three hundred and five thousand feet, depending on latitude and other factors. A number of different woodland phases and types have been described and include the valley oak phase, blue oak phase, live oak phase, and north slope phase. Each has its own species components. Appendix 1 provides an additional list of useful plants to be found in the foothill woodland.

Snaking through the dry landscape, foothill streams with their characteristic willows (*Salix* spp.), cottonwoods (*Populus* spp.), and other moisture-loving species are the *riparian areas.* Because these species lack the adaptations to heat and drought, their existence is dependent on the assurance of water during the hot summer. As one moves upslope through the foothills, the stream channels become increasingly narrow and steep sided. The steeper canyon walls tend to drain water rapidly, and the riparian woodland is reduced to a thin margin of vegetation along the stream bank, often losing its identity as a community. Appendix 1 provides an additional list of useful plants to be found in the riparian habitat.

On steep slopes or other areas underlain by thin, rocky, or otherwise inhospitable soils, the foothill woodland is replaced by *chaparral.* This is a dense, fire-adapted shrub community dominated by chamise (*Adenostoma fasciculatum*) and several species of manzanita (*Arctostaphylos* spp.). In most areas, chaparral usually forms extensive cover on steep south-facing slopes but occurs on other aspects as well. In mature chaparral, grasses and wildflowers are rare, as are seedlings of the dominant shrubs. However, these grasses and wildflowers are quite abundant in recently burned areas. In contrast to mature chaparral, young chaparral stands exhibit greater species diversity. Appendix 1 provides an additional list of useful plants to be found in the chaparral.

Common Yellow Pines
The two common yellow pines are ponderosa and Jeffrey. They are so closely related that at one time they were considered to be varieties of the same species. However, the differing chemistry of their resins and the size and structure of their cones separate them. In Jeffrey pine, the cones are larger and less prickly than the ponderosa. On the ponderosa, the needles are greener against the Jeffrey's grayer ones. Finally, the Jeffrey pine gives out the fragrant aroma of vanilla or butterscotch from cracks in its bark on warm days.

The Montane Forest Belt

Above the elevations of two thousand feet in the northern Sierra Nevada and five thousand feet in the southern Sierra Nevada, foothill woodland gives way to montane coniferous forest. This broad vegetation belt spans three life zones: lower montane, upper montane, and subalpine. Within these zones are four distinct coniferous communities—mixed coniferous forest, red fir forest, lodgepole pine forest, and subalpine forest—as well as montane chaparral and meadows. In the northern Sierra Nevada, the coniferous belt extends to about eight thousand feet, whereas in the southern Sierra Nevada, the trees occur as high as eleven thousand feet. Although these four communities are more or less arrayed by elevation, their shared boundaries are seldom distinct. As a general rule, the communities tend to range higher on south-facing slopes and ridge tops and lower on northern exposures and in canyon bottoms.

Slope and Aspect
In mountains, aspect can have nearly as great an influence on habitat as elevation. Aspect is the direction a slope faces. This determines the amount of sunlight, frost, wind, and snowpack to which it is exposed, and in turn it affects the types of plants that grow there. North- and south-facing slopes may be dominated by completely different plant species. Aspect helps create a mosaic of habitat types, enhancing biological diversity of an area. Finally, aspect been shown to be important in determining land use. North-facing slopes can be about six degrees Fahrenheit colder than south-facing slopes, so humans have opted to settle south-facing slopes first, building villages, clearing cropland, and planting orchards.

The *mixed coniferous forest* ranges from two thousand to six thousand feet in the northern Sierra and between four thousand and eight thousand feet in the southern Sierra. Three subtypes (ponderosa pine forest, white fir forest, and Jeffrey pine forest) have been identified within this forest.

The first subtype, the *ponderosa pine forest,* occurs from two thousand to six thousand feet in the northern Sierra and four thousand to seven thousand feet in the southern Sierra. It is replaced in the North above five thousand feet and above six thousand in the South by Jeffrey pine (*P. jeffreyi*). This species is able to tolerate lower air temperatures and deeper snows than the ponderosa pine. Additionally, Jeffrey pine also replaces ponderosa pine on the east side of the Sierra from Carson Pass south.

The second subtype is the *white fir forest.* It is dominant on cool, mesic sites from four thousand to seven thousand feet on the west slope, and common associates include sugar pine, incense cedar (*Calocedrus decurrens*), and Douglas-fir (*Pseudotsuga menziesii*). On drier sites, it is found with ponderosa or Jeffrey pine. The giant sequoia is also a member of the community and is found growing on moist, unglaciated flats in the central and southern Sierra between forty-five hundred and eighty-four hundred feet. Giant sequoias are only found on the west side of the Sierra Nevada in about seventy-five scattered groves from Placer County to southern Tulare County.

The third subtype is the *Jeffrey pine forest.* This species is the cold-weather version of ponderosa pine, replacing it on the east side of the Sierra and above five thousand to seven thousand feet on the west slope. Common associates on the west slope include incense cedar, black oak (*Quercus kelloggii*), white fir (*Abies concolor*), and sugar pine on drier, rockier slopes. Appendix 1 provides an additional list of useful plants to be found in the mixed coniferous forest.

The *red fir forest* occupies deep, well-drained soils between five thousand and eight thousand feet in the northern Sierra and between seven thousand and nine thousand feet in the South. This forest is primarily dominated by red fir (*Abies magnifica*), and mature stands often contain no other conifer because of the dense canopy that shades out competitors. What understory vegetation that does exist in this forest is largely confined to forest openings; otherwise, the forest is a realm of deep shade. The red fir forest is also called the "snow forest" of the Sierra because it occupies the zone with the greatest reported snowfall. In general, soil moisture is the primary factor governing the upper and lower elevational limits of the red fir forest. Few species of plants are able to tolerate dense shade and deep litter in mature red fir forests. Appendix 1 provides an additional list of useful plants to be found in the red fir forest.

Above the red fir forest is the *lodgepole pine forest.* This forest is typical of the glacial basins encountered in the lower subalpine and forms rather open stands at elevations between six thousand and eight thousand feet in the North and eight thousand and eleven thousand feet in the southern Sierra. In general, lodgepole pine is the dominant conifer of the glacially scoured ridges, valleys, and basins. Understory is sparse or absent in this forest. However, what does occur as understory is usually confined to sunny openings or moist soils near lakes and streams. Lodgepole forests have little in terms of understory, and as such these forests are sometimes called biological deserts (V. R. Johnston 1994). Appendix 1 provides an additional list of useful plants to be found in the lodgepole pine forest.

The *subalpine forest* consists of scattered stands and individuals trees (dwarf or shrubby) in the rocky slopes above eight thousand to ten thousand feet in the northern Sierra and ninety-five hundred to twelve thousand feet in the South. The community is poorly represented north of Lake Tahoe and occurs only in isolated stands on a few of the higher peaks. Subalpine forest is dominated by whitebark pine (*P. albicaulis*), mountain hemlock (*Tsuga mertensiana*), and in the southern Sierra Nevada by foxtail pine (*P. balfouriana*). Subalpine soils are rather rudimentary, consisting largely of disintegrated granite with little humus and minimal horizon development (lithosols). Appendix 1 provides an additional list of useful plants to be found in the subalpine forest.

The *mountain meadows* that occur in the Sierra Nevada range in size from a few acres to large open flats covering many square miles. Although these meadows range from dry to wet types, as a group they occur only where moisture is abundant in the upper few inches of soil at least during part of the growing season. It is this factor that accounts for the persistence of meadows that would otherwise be covered by forest (Whitney 1979).

Meadows are numerous and extensive in the subalpine zone, but they also occur downslope in the red fir and mixed conifer forests as well. Their lower limit in the northern Sierra is about four thousand feet, whereas in the southern Sierra it is about six thousand feet. This elevational limit more or less coincides with reliable winter snow cover. Farther downslope, the precipitation (snowfall) is irregular and melts quickly (Whitney 1979). Appendix 1 provides an additional list of useful plants to be found in the mountain meadows.

The Alpine Environment

The mountains are fountains of men as well as of rivers, of glaciers, of fertile soil. The great poets, philosophers, prophets, able men whose thought and deeds have moved the world, have come down from the mountains—mountain-dwellers who have grown strong there with the forest trees in Nature's workshops.
—John Muir, *John of the Mountains*

The alpine environment extends from the tree line to the summit of the high peaks, usually above 9,900 feet near Lake Tahoe, 10,500 feet in the Yosemite region, and 11,000 feet in the southern Sierra. The region is devoid of trees and is dominated by large expanses of bare or sparsely vegetated rock. What vegetation does exist is usually sparse and consists entirely of dwarf perennial herbs growing close to the ground where the winds are gentler and rock faces are warmed by the sun. The two broad categories of plant associations found in the alpine zone are the *alpine meadows* (dominated by sod-forming sedges and grasses) and *alpine rock communities* (dominated by widely spaced bunchgrasses and cushion plants). Appendix 1 provides an additional list of useful plants to be found in the alpine habitats.

The East Side of the Sierra

Now, our trek takes us onto the desert face of the range. The winter storms that move up the west face of the Sierra Nevada are nearly wrung dry by the time they reach the crest, and so the east flank receives significantly less precipitation. Below seven thousand feet on the east slope, the vegetation is dominated by two communities—pinyon-juniper woodland and sagebrush shrubland (together called the pinyon-sagebrush zone). The east slope forests and meadows are comparable to those on the west slope but are less extensive and represented by fewer species.

The *pinyon-juniper woodland* community ranges from four thousand to fifty-five hundred feet in the northern Sierra and from five thousand to eight thousand feet in the southern. Sagebrush usually forms the understory in this woodland that is dominated by single-leaf pinyon pine (*Pinus monophylla*). The woodland occurs sparsely but more or less continuously from Alpine County south to Kern County. Interestingly, throughout most of the Great Basin, Utah juniper (*Juniperus osteosperma*) is a constant associate with single-leaf pinyon, but for some unknown reason it is missing from the woodland on the east slope of the Sierra (Whitney 1979).

The treeless community of the *sagebrush shrubland* occurs on coarse, dry, well-drained soils below six thousand feet (seven thousand feet in the South). rubs are widely spaced, with grasses and forbs forming a sparse but characteristic understory between the larger plants. The overwhelming dominant species in most stands is sagebrush (*Artemisia tridentata*). Appendix 1 provides an additional list of useful plants to be found in the pinyon pine and sagebrush habitats of the eastern Sierra Nevada.

Scientific and Common Names

In the discussion of useful plants, plant families are arranged alphabetically within each of the four major groups of higher plants (ferns and their allies, gymnosperms, and flowering-plant dicots and monocots). Although this arrangement may seem awkward to professional botanists, it has been adopted with the realization that this arrangement of families (and genera within families, species within genera) will be more easily consulted by readers in nonbotanical fields who may have occasion to use this book. The following list identifies the number of species that occur within each of the four basic categories of vascular plants.

FOUR BASIC CATEGORIES OF USEFUL MOUNTAIN PLANTS IN THE SIERRA NEVADA

CATEGORY (PLANT GROUP)	APPROXIMATE NUMBER OF SPECIES
Ferns and Fern Allies	>47
Gymnosperms	>23
Flowering Plants—Dicots	>1,126
Flowering Plants—Monocots	>175
TOTAL	

The scientific and common names are given for each species. A brief description of the plant stressing key features is provided. Plant nomenclature (scientific and common names) used in this book follows that of *The Jepson Manual: Higher Plants of California* (Hickman 1993). Common names for plants can be misleading and do not always distinguish among the species. Additionally, a species known by a common name in one region may have another common name elsewhere, leading to further confusion. However, common names have been retained because they are generally of more interest, and more likely to be known, by the public. You are encouraged to learn to identify plants by both their scientific and their common names.

Finally, the dichotomous keys (called "Quick Keys") found in this book are provided for those who are familiar with their use. These keys are associated with only those groups of plants that the beginning or experienced botanist might consider to be "safe" and easy to recognize. The various keys are adapted from several sources, including N. F. Weedon (1996), Hickman (1993), and P. A. Munz and D. D. Keck (1973). No attempts have been made to develop concise keys for all the species that may occur in the Sierra Nevada.

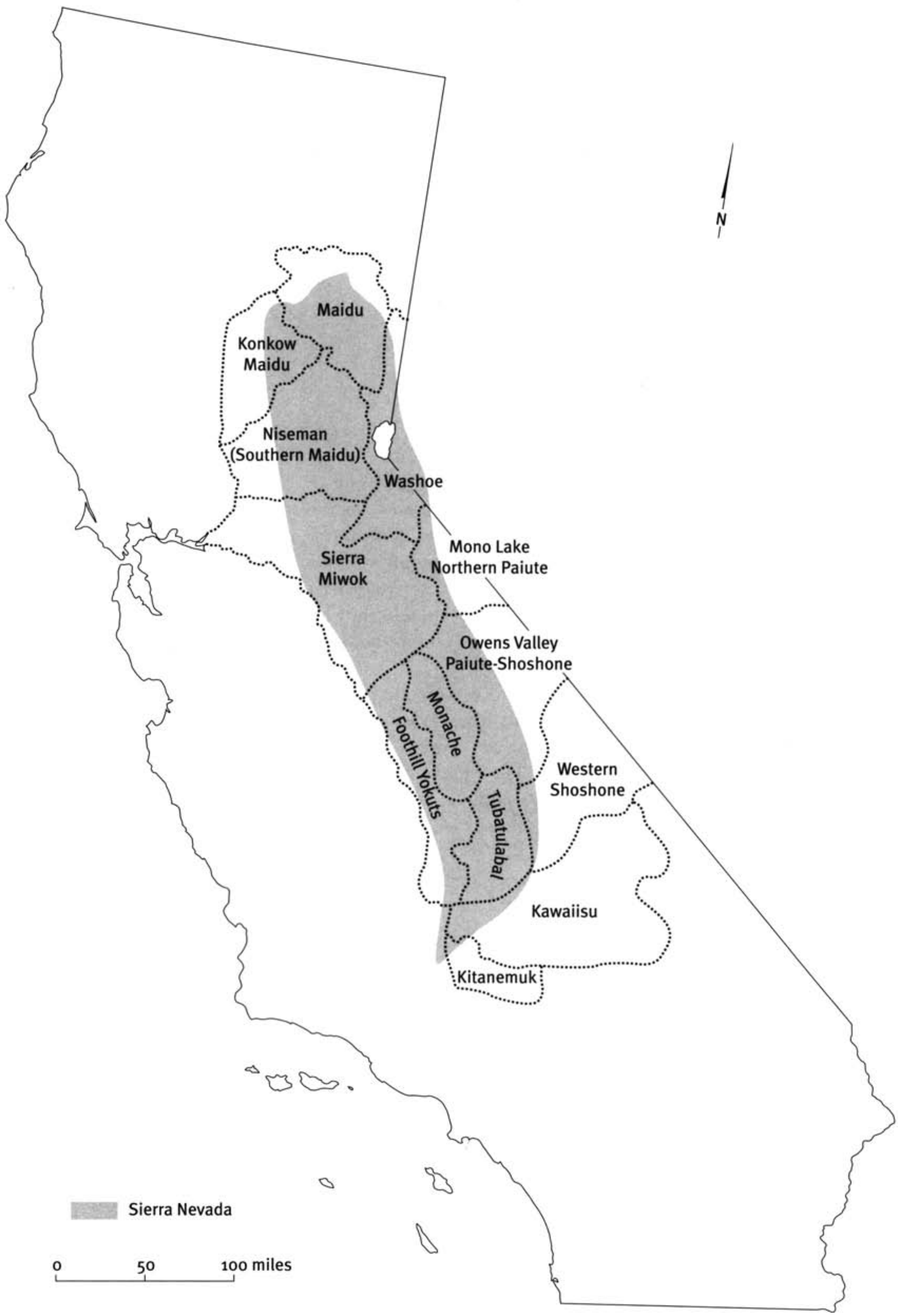
Rare and Protected Plants

The Native Americans and other aboriginal peoples were dependent upon nature for all of their needs and had an extensive knowledge of which plants (and animals) were edible or useful. Because of this dependence, they shared a strong conservation ethic based on the sanctity of life. Today, with increasing human population and our demands upon natural resources, many species are becoming rare due to habitat destruction, competition with nonnative species, or other means. As previously mentioned, the Sierra Nevada is rich in vascular plant diversity, with more than 3,500 native species of plants (Hickman 1993). Of this total, about 400 plant species occur only in the Sierra Nevada, including 3 trees, 20 shrub species, and several hundred herbaceous plants. Appendix 2 lists some of the threatened, endangered, and sensitive species of plants that are known to occur in the range.

Mountain ecosystems have evolved in the absence of human activities and have no ready response to some kinds of disturbance. Though appearing rugged, mountain environments are fragile, are highly susceptible to disturbance, and at

WILLIS LINN JEPSON
Willis Linn Jepson (1867–1946) is often referred to as the father of California botany and was one of the first people to receive a Ph.D. in botany from the University of California, in 1898. While he was a professor of botany at the University of California, he is best known for writing *The Jepson Manual: Higher Plants of California.* Mount Jepson (13,390 feet), located in the Palisades on the border of Inyo and Fresno Counties, is named in his honor. The 1993 revision of the Jepson manual is currently the standard reference for the identification of wild vascular plants in California.

Of recent years there has come into man's life a new joy. This joy is the acquaintanceship with plants. Nature has long been ready to reveal her secrets, but only to those prepared to hear and see. Gradually a new understanding has arisen between Nature and mankind, and as a result we obtain from such a revelation a joy undreamed of a few years ago. . . . Plants no longer are lifeless things labeled and grouped under ponderous Latin titles; they are highly developed organisms, which . . . walk, swim, run, fly, jump, skip, hop, roll, tumble, set traps, and catch fish; decorate themselves that they may attract attention; powder their faces; imitate birds, animals, serpents, stones; play hide and seek; blossom underground; protect their children, and send them forth into the world prepared to care for themselves.
—Royal A. Dixon



Native Americans of the Sierra Nevada

times have a low ability to rebound and heal themselves after damage. The degree to which this is true is variable, but the vulnerability of mountain environments to disturbance is well documented (Zwinger and Willard 1972; Price 1981). The flora and fauna of mountain ecosystems are composed of species that are well adapted to cope with environmental extremes, low productivity, and fluctuations within the system. Because of climatic extremes, a brief growing season, lack of nutrients at higher elevations, low biological activity and productivity, their islandlike character, steepness of slopes, and the basic conservatism of the dominant life forms all make for the rate of restoration to original conditions after disturbance in mountain environments to be rather slow (Price 1981).

Therefore, the plants you encounter will vary in their ability to withstand harvesting. For example, collecting berries may not directly kill a plant but may affect its ability to survive. Additionally, because digging up the roots of a plant will destroy it, you must select your specimens carefully. And remember, many species of wildlife rely on plants for survival, whereas most hikers and nature enthusiasts collect plants for pleasure, not necessity.

It is strongly recommended that you obtain a list of threatened, endangered, or sensitive plant species before you start collecting. Currently, about 218 species are considered rare or threatened by the California Native Plant Society, California Department of Fish and Game, and the U.S. Fish and Wildlife Service. By avoiding rare species and using common sense, you should be able to enjoy wild plants without appreciably affecting either their population or their surroundings. You should also check in with the local land-management agency (that is, the Bureau of Land Management or the Forest Service) for its policy on collecting native plants.

THREE IMPORTANT RULES BEFORE CONSIDERING ANY PLANT AS A SOURCE OF FOOD:
1. If you cannot positively identify a plant, do not consider it as a food source.
2. There is no such thing as a safe "plant edibility test."
3. Just because you see an animal eating a particular plant does not mean that we are able to eat it. We have seen squirrels eat the deadly amanita mushrooms and bears eat death camas (*Zigadenus*).

ECOLOGICAL REASONS NOT TO PICK WILDFLOWERS
1. Flowers are more than beautiful structures that appeal to humans: they exist so the plant can reproduce itself. Many of the most spectacular blossoms are specially designed to attract certain pollinating animals. The number of flowers pollinated combined with their arrangement on the stem can make a difference between reproductive success or failure for the entire year.
2. Removing wildflowers from annuals (plants that bloom for only one year and then die) means the seeds the plant would have made will not be there for next year's wildflower season.
3. Many species of wildflowers have already suffered great reductions in numbers over the past one hundred years because of increasing alterations of their habitat.
4. It is often difficult to distinguish between common and rare or endangered species of wildflowers. Species that are in danger of extinction may look abundant to the casual observer who is possibly looking at one of only a few remaining areas where the plant is found.

California Native Groups

To most California Natives, it is said that their ancestors were created tens of thousands of years ago in the place where their group lived. That is, they did not migrate here, but rather they were created here.

Most California Natives thought of themselves as the "People" and often did not have a specific "name" for themselves. The names depicted on the map were given to the California Natives by nonnatives or are the names currently used by the California Natives. The areas outlined are approximate to provide the reader of this book with a reference to their general location (see page 16).

Guidelines for Gathering

There will undoubtedly be people who may be curious in sampling the wild plant foods. If you are one of those people, please keep in mind that there are no general rules for distinguishing an edible plant from an unsavory or poisonous species, and one must identify a plant correctly before attempting to use it. There are some books that suggest if you do not know a plant, you can eat a small quantity and wait to see if it has any adverse effects. This is a potentially serious mistake (Kingsbury 1964; Kinghorn 1979; Vizgirdas 1999a). For instance, if the unknown plant happens to be death camas (*Zigadenus*), not only would it cause much discomfort (such as a burning sensation in the mouth), but it could even kill you. Additionally, anyone who intentionally plans to search out and consume edible plants should exercise extreme caution. Correct identification of plants is necessary to avoid similar species or parts that may be unpalatable or poisonous. One of the best ways to learn about plants is to consult a knowledgeable botanist or qualified individual.

If you do decide to harvest plants, it is important to harvest them with wisdom and respect. The uncontrolled harvesting of mountain plants could severely damage delicate plant communities. In addition, it is illegal to injure or uproot a living plant in some areas covered by this book (for example, national parks and monuments and state parks). If a plant is rare or endangered, look for other plants. If you are not in an emergency survival situation, you should be even more frugal and thoughtful.

Also, be mindful of your own safety when dealing with edible and useful plants. In California and elsewhere, state and federal agencies often spray chemicals to control noxious weeds, especially in areas where logging, mining, and grazing activities occur or in developed campgrounds. Although such chemicals may be considered "safe," there are no guarantees. You should avoid collecting in areas affected by pollutants such as along roads or in drainages affected by mining activities.

In *Stalking the Wild Asparagus,* Euell Gibbons (1962) described the taste for wild edible plants as an acquired one, ranging from awful to barely palatable. Although we have sampled many wild plants that fall into those two categories, we have also found wonderful delicacies that make supermarket food seem pale by comparison. If you have a positive outlook in your endeavor, it may someday help you if you are ever in a survival situation. Otherwise, it is a wonderful excuse to explore the western mountains.

A final thought:

> Where you find a people who believe that man and nature are indivisible, and that survival and health are contingent upon an understanding of nature and her processes, these societies will be very different from ours, as will their towns, cities and landscapes.

—Ian McHarg, *Design with Nature*

Ferns and Fern Allies

On the mountains there is freedom!
The world is perfect everywhere, save where man comes with his torment.
—Johann Christoph Friedrich von Schiller, *The Bride of Messina*

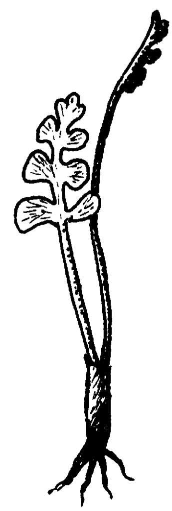
Fern and fern allies include the clubmosses, horsetails, and ferns. They are herbaceous plants that reproduce by spores, which develop inside structures called sporangia.

Adder's-Tongue Family (Ophioglossaceae)

The herbaceous plants have fleshy rhizomes with numerous fibrous, often fleshy roots. The leaves (fronds) consist of two parts, a sterile simple or compound, sessile or stalked blade, and a stalked spore-bearing spike or panicle, sterile or fertile parts borne on an erect common stalk. There are three genera and seventy-plus species of this family. Two genera are found in the United States, but only moonwort (*Botrychium*) may be found in the Sierra Nevada. None of the members of this family are of economic importance.

Moonwort (*Botrychium*)

Description: Worldwide, there are about forty species of moonwort, of which eight occur in California and five in the Sierra Nevada. This is a difficult genus to study and requires fully developed specimens for identification. The spore sacs, technically termed the sporangia, are borne in grapelike clusters on a naked stalk, not on leaves as in the true ferns. The genus name is from the Greek *botrys,* meaning a cluster, referring to the grapelike arrangement of the sporangia.


Moonwort
(*Botrychium* spp.)

1. Scalloped Moonwort (*B. crenulatum*)—This is a rare species found in marshes and meadows throughout the Sierra Nevada between 4,000 and 8,000 feet.
2. Common Moonwort (*B. lunaria*)—Look for common moonwort in open, dry places, meadows, slopes, and banks below 8,000 feet in the central Sierra Nevada.
3. Mingan Moonwort (*B. miganense*)—This is a rare species occurring in forests along streams below 6,000 feet in the southern Sierra Nevada.
4. Leathery Grape Fern (*B. multifidum*)—This species grows in moist, open habitats between 3,000 and 10,000 feet throughout the Sierra Nevada.
5. Yosemite Moonwort (*B. simplex*)—This species is found in open places, grassy meadows, and damp places from 5,000 to 11,000 feet throughout the Sierra Nevada.

Interesting Facts: Early records appear to indicate that juice extracts from common moonwort were used to stop bleeding and vomiting, and also for the treatment of bruises. They may have been used to concoct balsams for healing internal wounds (Grillos 1966).

Additionally, a root poultice or lotion made from *B. virginianum* (rattlesnake fern) was used for snakebites, bruises, cuts, or sores. In folk medicine, the root tea was used as an emetic (Foster and Duke 1990).