**California Wildlife Habitat Relationships System**
**California Department of Fish and Game**
**California Interagency Wildlife Task Group**

# Cropland

David C. Zeiner

## Vegetation

**Structure**—Vegetation in this habitat includes a variety of sizes, shapes, and growing patterns. Field corn can reach ten feet while strawberries are only a few inches high. Although most crops are planted in rows, alfalfa hay and small grains (rice, barley, and wheat) form dense stands with up to 100 percent canopy closure. Most croplands support annuals, planted in spring and harvested during summer or fall. In many areas, second crops are commonly planted after harvesting the first. Wheat is planted in fall and harvested in late spring or early summer. Overwintering of sugar beets occurs in the Sacramento Valley, with harvesting in spring after the soil dries.

**Composition**—The 1982 crop report (California Department of Food and Agriculture 1983) recognized 200 crops in California that include 25 classified as orchard or vineyard for Wildlife Habitat Relationships (WHR) purposes. Cropland vegetation is grown as a monoculture, using tillage or herbicides to eliminate unwanted vegetation.

**Other Classifications**—Most vegetation classification systems include cropland in more general categories, such as Agriculture (California Department of Fish and Game 1966) or Urban/Agriculture (Parker and Matyas 1981).

## Habitat Stages

**Vegetation Changes**—Cropland habitats do not conform to normal habitat stages. Instead, cropland is regulated by the crop cycle in California. These habitats can either be annual or perennial, vary according to location in the state, and germinate at various times of the year. Crops such as milo, cotton, rice and lettuce are common annual plants, whereas alfalfa, asparagus, artichokes and strawberries are perennials. In addition, the crop rotation system is used extensively. The system rotates crop types (usually between annual and perennials) to conserve soil nutrients, thus maintaining soil productivity.

Duration of Stages—Most cropland types in California are annuals and are managed in a crop rotation system. Generally, the crop rotation system employs a combination of annual and perennial crops on a 5-7 year rotation. For example in the San Joaquin Valley, cotton will be planted and maintained for 3 years, following by 3 years of alfalfa and 1 year of grain. In Imperial and Ventura Counties crops are cultivated year-round. Double and triple cropping is a common practice in some areas. After the first crop is harvested, a second and sometimes a third crop is planted and harvested depending on species and

climate. For example, in Ventura County on the Oxnard plain, cool weather crops such as lettuce and cabbage are grown in the fall and winter followed by tomatoes, corn, and peppers in the spring and summer. Planting time frames vary as well with the majority of cropland habitats being planted in spring and harvested late summer and early fall. However, exceptions do exist (e.g. sugar beets) where crops are planted in the summer and harvested the following spring.

## Biological Setting

**Habitat**— Croplands occur in association with Orchard-Vineyard, Pasture (Irrigated), Residential-Park, and wildlife habitats such as riparian, chaparral, wetlands, desert, and herbaceous types.

**Wildlife Considerations**— Croplands are established on the State's most fertile soils, which historically supported an abundance of wildlife unequalled in other sites. Croplands have greatly reduced the wildlife richness and diversity of California. Many species of rodents and birds have adapted to croplands and are controlled by fencing, trapping, and poisoning to prevent excessive crop losses (California Department of Food and Agriculture 1975). Prior to establishing State and Federal wildlife refuges, waterfowl depredation of crops was extensive. That problem has been essentially eliminated; however, some species of waterfowl depend on waste rice and corn that remain in the fields after harvesting (California Department of Fish & Game 1983). Deer, elk, antelope, and wild pigs forage in alfalfa and grain fields and can cause depredation problems. Pheasants introduced to the cropland habitat have experienced recent population declines owing to changes in crop patterns and cultural practices for growing small grains. Changes include clean farming, double cropping, and chemical control of rice diseases and pests rather than leaving land fallow in alternate years. Except for insectivores, raptors, doves, and pheasants, avian wildlife that becomes numerous and uses crops before they are harvested are generally not welcome by growers. Wildlife such as waterfowl, sandhill cranes, and other species that use waste grains after harvest are usually not discouraged. Croplands flooded for weed control, leaching, irrigation, or waterfowl hunting serve as freshwater wetlands for a variety of associated wetland wildlife, including shorebirds, wading birds, and gulls.

## Physical Setting

Croplands are located on flat to gently rolling terrain. When flat terrain is put into crop production, it usually is leveled to facilitate irrigation. Rolling terrain is either dry farmed or irrigated by sprinklers. Soils often dictate the crops grown. Corn requires better soils than barley, which can grow on poor quality soils, and rice does well on clay soils not suitable for other crops. Leaching can remove contaminants in areas of high salt or alkali levels, making the soils highly productive. This has occurred extensively in the San Joaquin and Imperial Valleys. Climate also influences the type of crops grown. Only hardy crops such as potatoes, barley, and wheat do well in the short growing season in Klamath Basin; whereas, in the Imperial Valley, a variety of crops grow over an eleven

month, frost-free growing season.

## Distribution

There were over 5,768,100 acres of commercial cropland in California in 1983, located in every county but San Francisco (California Department of Food and Agriculture 1983). Hay was grown in nearly every county on more acreage than any other crop—1,480,000 acres. Cotton was second with 950,000 acres in the San Joaquin and Imperial Valleys. Wheat was third with 720,000 acres in all areas of the State except the north coast, 72 percent being produced in the Sacramento and San Joaquin Valleys (University of California 1983).

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# Rice

Ronald F. Schultze

## Vegetation

**Structure--** Rice and wild rice are flood irrigated crops that are seed producing annual grasses. Commercial rice generally is only a couple of feet tall, whereas, commercially grown wild rice may be six feet tall or taller. They are usually grown in leveed fields that are flooded much of the growing period, and dried out to mature and to facilitate harvesting. They usually produce 100 percent canopy closure as they mature. They are usually planted in spring and harvested in fall.

**Composition--** The California Agriculture - Statistical Review 1990 (California Department of Food and Agriculture, 1991) reported that 385,000 acres of rice was grown in California in 1990. Wild rice was not reported by the Department of Food and Agriculture for 1990.

**Other Classifications--** Most vegetation classification systems include rice in more general categories, such as, Agriculture (California Department of Fish and Game, 1966), Urban/Agriculture (Parker and Matayas, 1981).

## Habitat Stages

**Vegetation Changes--** Rice does not conform to normal habitat stages, however it is similar to seasonally flooded wetlands. Rice is an annual. Crop rotation systems are common with rice in California. They may be planted in rotation with other irrigated crops and especially winter wheat or barley. Winter wheat or barley may be planted in the fall, dry farmed, and then harvested the following spring. This is often done for weed control, drying of the soil and to control rice root diseases. Some acres may be fallowed or placed in set-aside programs for a year or more; sometimes planted to legumes such as vetches which fix nitrogen in the soil.

**Duration of Stages--** Rice is an annual, usually planted in the spring and harvested in the fall.

## Biological Setting

**Habitat--** Rice occurs in association with other croplands in the Central Valley of California and other wildlife habitats such as riparian, and wetlands. Wild rice is grown similarly in the Central Valley, but also is grown in northern California where it may occur near annual grassland, riparian, wetland, and brushland habitat types.

**Wildlife Considerations--** Rice is grown usually in heavier clayey soils that hold water well. Many of these soils once supported natural wetlands which historically supported an abundance of wildlife, especially waterfowl and shorebirds. Although other croplands have greatly reduced the wildlife richness and diversity of California, rice has been more compatable. Many species of wildlife and especially waterfowl, shorebirds and wading birds have adapted to rice. Prior to establishing State and Federal wildlife refuges, waterfowl depredation of rice was extensive. That problem has been reduced; however, some species of waterfowl depend on waste rice that remains in the fields after harvesting. Pheasants have also benefited from rice, but pheasants have experienced recent population declines owing to changes in crop patterns and cultural practices for growing small grains. Changes include clean farming, double cropping, lazer leveling and straight or "squared" levees as apposed to contour levees, and chemical control of rice diseases and pests rather than leaving land fallow in alternate years are examples of problems. Wildlife such as waterfowl, sandhill cranes, and other species that use waste grains after harvest are usually not discouraged. Rice fields flooded after harvest with waste grain and for waterfowl hunting serve as freshwater wetlands for a variety of associated wetland wildlife, including shorebirds, wading birds, and gulls.

## Physical Setting

Rice is usually located on flat terrain. When flat terrain is put into rice production, it usually is leveled to facilitate irrigation. Rice can grow on poor quality soils, and rice and barley can do well on clay soils not suitable for other crops. Leaching or flushing can remove contaminants in areas of high salt or alkali levels, making the soils more productive. This has occurred in both the San Joaquin and Sacramento valleys.

## Distribution

There were over 385,000 acres of rice grown in California in 1990. Wild rice is grown in the central valley along with other commercial rice. Wild rice is also grown in northern California, such as in Fall River Valley, where it is to cold for other commercial rice production.

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# Lacustrine

William E. Grenfell Jr.

## General Description

**Structure--** Lacustrine habitats are inland depressions or dammed riverine channels containing standing water (Cowardin 1979). They may vary from small ponds less than one hectare to large areas covering several square kilometers. Depth can vary from a few centimeters to hundreds of meters. Typical lacustrine habitats include permanently flooded lakes and reservoirs (e.g., Lake Tahoe and Shasta Lake), intermittent lakes (e.g., playa lakes) and ponds (including vernal pools) so shallow that rooted plants can grow over the bottom. Most permanent lacustrine systems support fish life; intermittent types usually do not.

## Aquatic Environment

Suspended organisms such as plankton are found in the open water of lacustrine habitats. Dominant are the phytoplankton, including diatoms, desmids and filamentous green algae. Because these tiny plants alone carry on photosynthesis in open water, they are the base upon which the rest of limnetic life depends. Suspended with the phytoplankton are animal or zooplankton organisms which graze upon the minute plants. Most characteristic are rotifers, copepods and cladocerans (Smith 1974).

The plants and animals found in the littoral zone vary with water depth, and a distant zonation of life exists from deeper water to shore. A blanket of duckweed may cover the surface of shallow water. Desmids and diatoms, protozoans and minute crustaceans, hyrdras and snails live on the under-surface of the blanket; mosquitoes and collembolans live on top. Submerged plants such as algae and pondweeds serve as supports for smaller algae and as cover for swarms of minute aquatic animals. As sedimentation and accumulation of organic matter increases toward the shore, floating rooted aquatics such as water lillies and smartweeds often appear. Floating plants offer food and support for numerous herbiverous animals that feed both on phytoplankton and the floating plants (Smith 1974).

**Other Classifications--** Other names of lacustrine habitats include Lacustrine (Cowardin et al. 1979), Lakes - 10.41, Manmade Reservoirs - 10.42 and Ponds -10.43 (Cheatham and Haller 1975). The U.S. Fish and Wildlife Service summarizes several lacustrine habitats according to their occurrence in certain terrestrial habitats (Proctor et at. 1980).

## Aquatic Zones and Substrates

The lacustrine habitat may exist in any of the structural classes 1:2 4:O~B. The limnetic or open water zone extends from the deepest part to the depth of effective light penetration. The submerged (littoral) zone is shallow enough to permit light penetration and occurs at the edges of lakes and throughout most ponds. Periodically flooded lacustrine habitats should be evaluated only when water is present. This stage usually cannot support fish populations, and therefore will not attract fish predators. To qualify as shoreline, there must be a water border and less than 2 percent vegetation. Shoreline vegetation exceeding 2 percent would fall into the riparian category.

Lakes and ponds are more or less temporary features of the landscape because of a slow siltation process. The time it takes depends on size, rate of sedimentation and the increase of organic matter.

## Biological Setting

**Habitat--** Lacustrine habitats may occur in association with any terrestrial habitats, Riverine (RIV) and Fresh Emergent Wetlands (FEW).

**Wildlife Considerations--** Lacustrine habitats are used by 18 mammals, 101 birds, 9 reptiles and 22 amphibians for reproduction, food, water and cover. This represents about 23 percent of the species in the Wildlife Habitat Relationships data base. The endangered Santa Cruz long-toed salamander and rare black toad require ponds for breeding. The endangered bald eagle feeds on fish and some birds taken from lakes.

## Physical Setting

The relatively calm waters of lakes and ponds offer environmental conditions that contrast sharply with those of running water. Light penetration is dependent on turbidity. Temperatures vary seasonally and with depth. Because only a small proportion of the water is in direct contact with the air and because decomposition is taking place on the bottom, the oxygen content of lake water is relatively low compared to that of running water. In some lakes, oxygen may decrease with depth, but there are many exceptions. These gradations of oxygen, light and temperature along with the currents and seiches, profoundly influence the vertical distribution of lake organisms (Smith 1974).

## Distribution

Lacustrine habitats are found throughout California at virtually all elevations, but are less abundant in arid regions.

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# Riverine

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## General Description

**Structure--** Intermittent or continually running water distinguishes rivers and streams. A stream originates at some elevated source, such as a spring or lake, and flows downward at a rate relative to slope or gradient and the volume of surface runoff or discharge. Velocity generally declines at progressively lower altitudes, and the volume of water increases until the enlarged stream finally becomes sluggish. Over this transition from a rapid, surging stream to a slow, sluggish river, water temperature and turbidity will tend to increase, dissolved oxygen will decrease and the bottom will change from rocky to muddy (McNaughton and Wolf 1973).

## Aquatic Environment

**Composition--** The majority of fast stream inhabitants live in riffles, on the underside of rubble and gravel, sheltered from the current. Characteristic of the riffle insects are the nymphs of mayflies, caddisflies, alderflies, stoneflies; and the larva and pupae of true flies. In pools, the dominant insects are burrowing mayfly nymphs, dragonflies, damselflies and water striders. Water moss and heavily branched filamentous algae are held to rocks by strong holdfasts and align with the current. Other algae grow in spheric, or cushionlike colonies with smooth, gelatinous surfaces. Algae growth in streams often exhibits zonation on rocks, which is influenced by depth and current.

With increasing temperatures, decreasing velocities and accumulating bottom sediment, organisms of the fast water are replaced by organisms adapted to slower moving water. Mollusks and crustaceans replace the rubble-dwelling insect larvae. Backswimmers, water boatmen and diving beetles inhabit sluggish stretches and backwaters. Emergent vegetation grows along river banks, and duckweed floats on the surface. Abundant decaying matter on the river bottom promotes the growth of plankton populations that are not usually found in fast water.

**Other Classifications--** Other classification systems of rivers and streams are: Riverine (Cowardin et al. 1979); Streams-10.2, Rivers-10.3 (Cheatham and Haller 1975) and Proctor et al. (1980).

## Aquatic Zones and Substrates

The riverine habitat exists in structural classes 1;24:0-B. Open water (1) is defined as greater than 2 meters in depth and/or beyond the depth of floating rooted plants, and does not involve substrate. Small rivers and streams may not have an open water zone. The submerged zone (2) is between open water and shore. The shore (4) is seldom flooded (except for wave wash or fluctuations in flow) and is less than 10 percent canopy cover. For shorelines with 10 percent canopy cover or more, use a terrestrial habitat designation.

The rate at which a stream erodes its channel is determined by the nature of the substrate, composition of the water, climate and the gradient. The greater the slope, the greater the capacity to transport abrasive materials through increased velocity (Reid 196)

Most natural riverine systems are relatively stable over long periods of time as long as there is no human interference. The building of dams and the dredging and straightening of stream channels are in the most important factors controlling the duration of stream and river types.

## Biological Setting

**Habitat--** Riverine habitats can occur in association with many terrestrial habitats. Riparian habitats are found adjacent to many rivers and streams. Riverine habitats are also found contiguous to lacustrine and fresh emergent wetland habitats.

**Wildlife Considerations--** The open water zones of large rivers provide resting and escape cover for many species of waterfowl. Gulls, terns, osprey and bald eagle hunt in open water. Near-shore waters provide food for waterfowl, herons, shorebirds, belted-kingfisher and American dipper. Many species of insectivorous birds (swallows, swifts, flycatchers) hawk their prey over water. Some of the more common mammals found in riverine habitats include river otter, mink, muskrat and beaver.

## Physical Setting

Streams begin as outlets of ponds or lakes (lacustrine), or rise from spring or seepage areas. All streams at some time experience very low flow and nearly dry up. Some streams, except for occasional pools, dry up seasonally every year.

The temperature of the riverine habitat is not constant. In general, small, shallow streams tend to follow, but lag behind air temperatures, warming and cooling with the seasons. Rivers and streams with large areas exposed to direct sunlight are warmer than those shaded by trees, shrubs and high, steep banks.

The constant swirling and churning of high-velocity water over riffles and falls result in greater contact with the atmosphere-and thus have a high oxygen content. In polluted waters, deep holes or low velocity flows, dissolved oxygen is lower (Smith 1974).

## Distribution

Rivers and streams occur statewide, mostly between sea level and 2438 meters (8000 fl).

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# Orchard-Vineyard

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## Vegetation

**Structure**—Orchards in California are typically open single species tree dominated habitats. Depending on the tree type and pruning methods they are usually low, bushy trees with an open understory to facilitate harvest. Trees such as citrus, avocados, and olives are evergreen, others are deciduous. May tree species range in height at maturity from 5 to 10 m (15 to 30 ft) but may be 3 m (10 ft) or less in pomegranates and some dwarf varieties, or 18 m (60 ft) or more in walnuts and date palms (Sunset 1972). Crowns often do not touch, and are usually in a linear pattern. Spacing between trees is uniform depending on desired spread of mature trees. The understory is usually composed of low-growing grasses and other herbaceous plants, but may be managed to prevent understory growth totally or partially, such as along tree rows.

Similarly, vineyards are composed of single species planted in rows, usually supported on wood and wire trellises. Vines are normally intertwined in the rows but open between rows. Rows under the vines are usually sprayed with herbicides to prevent growth of herbaceous plants. Between rows of vines, grasses and other herbaceous plants may be planted or allowed to grow as a cover crop to control erosion.

**Composition**— The 1982 Crop Report (California Department of Food and Agriculture 1983) indicated production of 20 orchard crops and five vine crops. It was also reported that 1, 177,100 acres of orchards and 615,800 acres of vineyards were in production. Of the producing orchards about 263,000 acres were citrus (oranges, lemons, grapefruit and tangerines), 534,000 acres were nuts (almonds, walnuts and pistachios) and about 380,000 acres were in other fruit trees (apples, apricots, avocados, cherries, dates, figs, nectarines, olives, peaches, pears, plums, pomegranates and prunes). Producing vineyards were primarily grapes (611,300 acres) with kiwi fruit, boysenberries, olalliberries and raspberries making up the remainder. The Bureau of Census (1984) reported there were 2,158,437 acres of bearing and non-bearing orchard and vineyards in California in 1982.

The understory in both orchards and vineyards usually consists of bare soil (controlled by tillage and/or herbicides) or a cover crop of herbaceous plants. The cover crop can be composed of either natural or planted domesticated herbaceous plants. Natural herbaceous plants commonly consist of perennial grasses such as Bermuda; or annual grasses such as soft chess, annual ryegrass, johnsongrass, wild oats, red brome, red fescue, barnyard grass, and others or forbs such as wild mustard, fiddleneck, or filigree, depending on seed sources in the area. Numerous grasses and legumes are planted as

cover crops in orchards and vineyards either as single species or in mixes. Cover crops of domesticated grasses and legumes generally fall into four categories (Finch and Sharp, 1981):

1) Annually seeded winter growing grasses and legumes, such as cereal rye, barley, annual ryegrass and purple vetch;

2) Reseeding winter annual grasses and legumes, such as Blando brome, zorro annual fescue, Wimmera-62 ryegrass, annual bluegrass, lana woolypod vetch, orse clover, crimson clover, bur clover, subclover, and black medic;

3) Summer annuals such as Sudan grass, grain, sorghums, and California blackeye bean; and

4) Perennial grasses and legumes such as tall fescue, creeping red fescue, orchardgrass, perennial ryegrass, narrowleaf trefoil, Salina strawberry clover, and ladino clover.

**Other Classifications**— Most vegetation classification systems include orchards and vineyards in more general categories, such as Agriculture (California Department of Fish & Game, 1966), and Urban/Agriculture (Parker and Matyas 1981).

## Habitat Stages

**Vegetation Changes**— Orchards are planted in uniform patterns and intensively managed. They are usually established as sapling trees (2), and most are managed to grow to small tree (4) size. However, trees such as walnuts grow to size class medium/large (5). Canopy closure classes range from sparse (S) to dense (D). As trees become old or in some way damaged or diseased they are usually replaced. In some cases however, entire orchards may be replaced with young trees. A few orchards have been abandoned, especially in the gold rush country of the Sierra Nevada Mountains. They are eventually invaded by native or naturalized herbaceous plants followed by shrubs and trees.

Similarly, vineyards are usually composed of young (2) or mature (3) shrub size classes and have sparse (S) or open (O) canopy closure classes. Both orchards and vineyards usually have some growth of herbaceous plants in the understory.

**Duration of Stages**— Duration of orchards and vineyards vary depending on species, however both are long lived. Generally grapes will persist for over 40 years and will be replaced usually because of disease. Fruit and nut trees are also long lived, however most are replaced at approximately 35-40 years old. Replacement of such orchards is usually a result of product price fluctuations or a decline in productivity.

## Biological Setting

**Habitat**— Orchards and vineyards are typically associated with other agricultural types such as cropland (CRP) and pasture (PAS), and some are near urban types They are frequently associated with Valley-Foothill Riparian (VRI) areas, shrub habitats (Mixed chaparral (MCH)), herbaceous types such as Annual Grasslands (AGS), a few tree types such as Valley-Foothill Hardwood (VFH), Valley-Foothill Hardwood-Conifer (VHC) and Ponderosa Pine (PPN).

**Wildlife Considerations**— Orchards and vineyards have been planted on deep fertile soils which once supported productive and diverse natural habitats. Larger and more diverse populations of wildlife were also supported by these native habitats. However, some species of birds and mammals have adapted to the orchard and vineyard habitats. Many have become "agricultural pests" which has resulted in intensive efforts to reduce crop losses through fencing, sound guns, or other management techniques.

Wildlife such as deer and rabbits browse on the trees or vines; other wildlife such as squirrels and numerous birds feed on fruit or nuts. Some wildlife (e.g., morning dove, California quail) are more passive in their use of the habitat for cover and nesting sites. Evergreen orchards can be especially beneficial to wildlife during inclement weather in winter or in hot summer periods. Water and shade can also be beneficial in irrigated orchards. Many wildlife species act as biological control agents by feeding on weed seeds or insect pests. The literature is generally lacking on wildlife associated with these habitats except as it relates to pests and pest control. Martin et al. (1951) give an overview of wildlife use of plants for food. Examples of wildlife reported to commonly feed on nuts (almonds and walnuts) include northern flicker, scrub jay, American crow, plain titmouse, Brewer's blackbird, house finch, and California ground squirrel. Some other orchard crops such as apples, cherries, figs, pears and prunes are also eaten by these same species plus others such as band-tailed pigeon, yellow-billed magpie, western bluebird, American robin, varied thrush, northern mockingbird, cedar waxwing, yellow-rumped warbler, black-headed grosbeak, Bullock's oriole, desert cottontail, western gray squirrel, coyote, black bear, raccoon, and mule deer.

## Physical Setting

Orchards and vineyards can be found on flat alluvial soils in the valley floors, in rolling foothill areas, or on relatively steep slopes. Though some orchards are non-irrigated, most are irrigated. Some flat soils are flood irrigated, but most orchards and vineyards are sprinkler irrigated. Large numbers of orchards and vineyards are irrigated by drip or trickle irrigation systems. Most orchards and vineyards are in valley or foothill areas, with a few up to 3000 feet elevation. Many are not very tolerant of frost.

## Distribution

In 1985 there were nearly 2,160,000 acres of orchards and vineyards in California. Commerical orchard and vineyard crops are grown in every county except Alpine,

Lassen, Modoc, Mono, Plumas, San Francisco, and Trinity counties.

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# Fresh Emergent Wetland

Gary Kramer

## Vegetation

**Structure--** Fresh Emergent Wetlands are characterized by erect, rooted herbaceous hydrophytes. Dominant vegetation is generally perennial monocots to 2 m (6.6 ft) tall (Cheatham and Haller 1975, Cowardin et al. 1979). All emergent wetlands are flooded frequently, enough so that the roots of the vegetation prosper in an anaerobic environment (Gosselink and Turner 1978). The vegetation may vary in size from small clumps to vast areas covering several kilometers. The acreage of Fresh Emergent Wetlands in California has decreased dramatically since the turn of the century due to drainage and conversion to other uses, primarily agriculture (Gilmer et al. 1982).

**Composition--** On the upper margins of Fresh Emergent Wetlands, saturated or periodically flooded soils support several moist soil plant species including big leaf sedge, baltic rush, redroot nutgrass and on more alkali sites, saltgrass. On wetter sites, common cattail, tule bulrush, river bulrush, and arrowhead are potential dominant species (Cheatham and Haller 1975, U.S. Army Corps of Engineers 1978, Wentz 1981).

**Other Classifications--** Other names for Fresh Emergent Wetland habitats include riverine, lacustrine and palustrine emergent wetland (Cowardin et al. 1979); alkali marsh - 5.23 and fresh water marsh - 5.24 (Cheatham and Haller 1975); tule marsh - 37 (Küchler 1977) and cattail-sedge (Parker and Matyas 1981). The U.S. Fish and Wildlife Service summarizes several Fresh Emergent Wetland classifications according to their occurrence in certain terrestrial habitats (Proctor et al. 1980).

## Habitat Stages

**Vegetation Change--** 1;2:S-D. It is commonly thought that as depressions or shoreline areas that support Fresh Emergent Wetlands (FEW) accumulate silt, marsh communities are replaced by upland communities. This process is slow unless erosion, either natural or man caused, is accelerated (U.S. Army Corps of Engineers 1978). Fresh emergent wetland habitats may exist in any of the structural classes 1-2:S-D. In areas with relatively stable climatic conditions, fresh emergent wetlands maintain the same appearance year to year (Cowardin et al. 1979); however, where extreme climatic fluctuations occur, they may revert to an open water phase in some years (Stewart and Kantrund 1971).

**Duration of Stages--** Fresh Emergent Wetlands are relatively stable successionally (U.S. Army Corps of Engineers 1978) but are transitory in a geological time frame (Odum 1971). Fire, flooding, and draining, maintain shallow basins where Fresh Emergent Wetlands prosper (Odum 1971); but conversion to uplands, which may take from decades to centuries, is the climax. The time this process takes depends on wetland size, rate of sedimentation, frequency of flooding and drainage, and the rate of increase in organic matter. Few studies estimate the time frame of long term wetland succession, but a wetland studied by McAndrews et al. (1976) had a history of 11,000 years and was still present.

## Biological Setting

**Habitat--** Fresh emergent wetland habitats may occur in association with terrestrial habitats or aquatic habitats including Riverine (RIV), Lacustrine (LAC) and Wet Meadows (WTM). The up\and limit of Fresh Emergent Wetlands is the boundary between land with predominantly hydrophytic cover and land with primarily mesophytic or xerophytic cover or the boundary between hydric and non hydric soils (Cowardin et al. 1979). The boundary between fresh emergent wetlands and deep water habitats (e.g., Lacustrine or Riverine) is the deep water edge of the emergent vegetation. It is generally accepted that this demarcation is at or above the 2 m (6.6 ft) depth (Cowardin et al. 1979, Zoltai et al. 1975). The 2 m (6.6 ft) lower limit for emergent wetlands was selected because it represents the maximum depth to which emergent plants normally grow (Welch 1952, Sculthorpe 1967).

**Wildlife Considerations--** Fresh emergent wetlands are among the most productive wildlife habitats in California. They provide food, cover, and water for more than 160 species of birds (U.S. Comptroller General 1979), and numerous mammals, reptiles, and amphibians. Many species rely on Fresh Emergent Wetlands for their entire life cycle. The endangered Santa Cruz long toed salamander and rare black toad require pond water for breeding, while the rare giant garter snake use these wetlands as its primary habitat. The endangered Aleutian Canada goose, bald eagle, and peregrine falcon use Fresh Emergent Wetlands as feeding areas and roost sites (Calif. Dept. Fish Game 1980).

## Physical Setting

**Physical Setting--** Fresh emergent wetland habitats occur on virtually all exposures and slopes, provided a basin or depression is saturated or at least periodically flooded. However, they are most common on level to gently rolling topography. They are found in various landscape depressions or at the edge of rivers or lakes (Wentz 1981). Fresh emergent wetland vegetation zones characteristically occur as a series of concentric rings which follow basin contours and reflect the relative depth and duration of flooding. If the bottom of the wetland is very uneven, vegetation zones may be present in a patchy configuration rather than the classic concentric ring pattern (Millar 1976). Soils are predominantly silt and clay, although coarser sediments and organic material may be intermixed (Cowardin et al. 1979). In some areas organic soils (peat) may constitute the

primary growth medium (U.S. Army Corps of Engineers 1978). Climatic conditions are highly variable and range from the extreme summer heat of Imperial County to the Great Basin climate of Modoc County where winter temperatures often are well below freezing (Cheatham and Haller 1975).

## Distribution

Fresh emergent wetlands are found throughout California at virtually all elevations but are most prevalent below 2270 meters (7500 ft) (Cheatham and Haller 1975). The largest acreage of fresh emergent wetlands occur in the Klamath Basin, Sacramento Valley, San Joaquin Valley, Sacramento-San Joaquin Delta and Imperial Valley-Salton Sea.

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# Blue Oak-Foothill Pine

Jared Verner

## Vegetation

**Structure--** This habitat is typically diverse in structure both vertically and horizontally, with a mix of hardwoods, conifers, and shrubs. The shrub component is typically composed of several species that tend to be clumped, with interspersed patches of Annual Grassland. Woodlands of this type generally have small accumulations of dead and downed woody material and relatively few snags, compared with other tree habitats in California. Most existing stands of this type are in mature stages, with canopy cover ranging from 10 to 59 percent, and dbh ranging from 2.5 to 30 cm (1 to 12 in). Size class 6 depends on a sparse overstory of foothill pine above a lower canopy of oaks, as canopies of blue oak seldom exceed 15 m (50 ft) in height. Individual trees seldom exceed 125 cm (49 in) dbh, and exceptionally may reach 30 m (100 ft) in height.

**Composition**-- Blue oak and foothill pine typically comprise the overstory of this habitat, with blue oak usually most abundant. Stands dominated by foothill pine tend to lose their blue oak, which is intolerant of shade (P. M. McDonald, pers. comm.). In the foothills of the Sierra Nevada, tree species typically associated with this habitat are interior live oak and California buckeye. In the Coast Range, associated species are the coast live oak, valley oak, and California buckeye (Griffin 1977). Interior live oak sometimes dominates the overstory, especially in rocky areas and on north-facing slopes at higher elevations (Neal 1980).

At lower elevations, where blue oaks make up most of the canopy, the understory tends to be primarily annual grasses and forbs. At higher elevations where foothill pines and even interior live oaks sometimes comprise the canopy, the understory usually includes patches of shrubs in addition to the annual grasses and forbs. Shrub species include Ceanothus spp. Mariposa manzanita, whiteleaf manzanita, Parry manzanita redberry, California coffeeberry, poison-oak, silver lupine, blue elder, California yerba-santa, rock gooseberry, and California redbud.

**Other Classifications**-- This type is referred to as Blue Oak-Foothill Pine by the Society of American Foresters (Eyre 1980) and Parker and Matyas (1981), and as Blue Oak-Foothill Pine Forest by Küchler (1977). Neal (1980) gives an excellent, short description of the type, and a more complete description can be gleaned from Griffin (1977) in his discussion of California's oak woodlands.

## Habitat Stages

**Vegetation Changes**-- 2-5:S-D;6. Succession presumably proceeds from annual grasslands directly to tree stages at lower elevations, where a shrub layer is usually sparse or absent. At higher elevations, shrubs and trees regenerate together.

**Duration of Stages--** Secondary succession beginning with disturbed soil is rapid during early stages, with annual grasslands giving way to shrubs within 2 to 5 years. However, stands of mature shrubs adequate to provide habitat for those wildlife species requiring them take longer to develop approximately 10 to 15 years. The conifers grow more rapidly than the hardwoods, maturing into relatively large trees even within 30 to 40 years, judging from the photo series taken at the San Joaquin Experimental Range in Madera County (Woolfolk and Reppert 1963). Most of the meager information on growth rates of blue oaks comes from sites in northern and central California. They generally grow slowly at all ages. Blue oaks in Nevada, Shasta, and Placer Counties showed little or no growth in height after they reached 65 cm (26 in) dbh (McDonald 1985)(No McDonald 1985 in Habitat Lit Cite.). The age at which they normally begin producing acorn crops is unknown (M. McClaran, pers. comm.), but it likely takes several decades. Concern has been expressed for the long-term existence of this habitat (Holland 1976), because "little regeneration has occurred since the late 1800s, as livestock, deer, birds, insects, and rodents consume nearly the entire acorn crop each year. Of the few seedlings that become established a large proportion are eaten by deer" (Neal 1980:126). Furthermore, the absence of grazing livestock does not generally result in regeneration (White 1966), because many other animals eat acorns and seedling oaks. Moreover, introduced grasses are subject to burning, may compete directly with seedling oaks for light and nutrients, and may be allelopathic to the oaks. The general absence of secondary successional stages of these woodlands has precluded detailed study of their composition or rates of change.

## Biological Setting

**Habitat**-- As Griffin (1977:386) points out, "oak woodland seldom forms a continuous cover over large areas. It is a major item in a mosaic including valley grassland...and chaparral...with strips of riparian forest." This mosaic is reflected in the character of the understory in stands of BOP woodlands. At lower elevations, these woodlands merge with Annual Grasslands, Blue Oak Woodlands, and Valley Oak Woodlands. The Annual Grasslands actually extend into the woodlands as a ground cover where not shaded by shrubs. The Blue Oak Woodlands differ from the BOP type in lacking a conifer component and usually in lacking a shrub component.

At upper elevations, BOP habitats merge with extensive stands of Mixed Chaparral in most localities, although in some places the Ponderosa Pine type grows at an elevation low enough to form a mixed ecotone with Mixed Chaparral and BOP.

**Wildlife Considerations--** BOP woodlands provide breeding habitats for a

large variety of wildlife species, although no species is totally dependent on them for breeding, feeding, or cover. In the western Sierra Nevada, for example, 29 species of amphibians and reptiles, 79 species of birds, and 22 species of mammals find mature stages of this type suitable or optimum for breeding, assuming that other special habitat requirements are met (Verner and Boss 1980).

Most species breed during late winter and early spring a factor to consider when planning management activities. Snags are less common, and hence less critical to wildlife, in this than in other forest types. Most species of cavity-nesting birds, for example, use living oaks. The cavities are often in scars where limbs have broken from the trunk or a main branch and have developed a level of decay that makes them more easily excavated by primary cavity nesters.

According to Olson (1974), blue oaks produce an abundant seed crop every 2 to 3 years and bumper crops every 5 to 8 years; however, McClaran (pers. comm.) questions that such a clear cycle of acorn production has been confirmed. In any case, acorns are an important food resource for many species of birds (Verner 1980a.) and mammals (Barrett 1980).

## Physical Setting

The habitat occurs in a typically Mediterranean climate hot, dry summers and cool, wet winters. Most precipitation falls as rain from November through April, averaging from 51 to 102 cm (20 to 40 in) within the primary range of blue oak (McDonald 1985). The frost-free growing season ranges from 150 to 300 days, with January minima averaging 1 C (30 F) and July maxima averaging 32 C (90 F) (McDonald 1985). Soils are from a variety of generally well-drained parent materials, ranging from gravelly loam through stony clay loam. Soils rich in rock fragments are typical (McDonald 1985).

## Distribution

The range of this habitat (well described by Neal, 1980) generally rings the foothills of the Central Valley, between 150 and 915 m (500 and 3000 ft) in elevation. The Pit River drainage in the Cascade Range and the foothills of the Klamath Mountains mark the approximate northern limit. The habitat is nearly continuous in the western foothills of the Sierra Nevada, except for a gap of 96 km (60 mi) between the Kings and Kern Rivers, where foothill pine is missing. The distribution extends south into the Liebre Mountains of northern Los Angeles County and the drainages of Piru Creek and Santa Clara River in Ventura County. It is discontinuous in the Coast Range west of the Central Valley from Ventura to Mendocino Counties. And it extends westward to within 16 km (10 mi) of the coast in a few places (Griffin 1977, Neal 1980).

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# Annual Grassland

John G. Kie
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## Vegetation

**Structure**. Annual Grassland habitats are open grasslands composed primarily of annual plant species. Many of these species also occur as understory plants in Valley Oak Woodland (VOW) and other habitats. Structure in Annual Grassland depends largely on weather patterns and livestock grazing. Dramatic differences in physiognomy, both between seasons and between years, are characteristic of this habitat. Fall rains cause germination of annual plant seeds. Plants grow slowly during the cool winter months, remaining low in stature until spring, when temperatures increase and stimulate more rapid growth. Large amounts of standing dead plant material can be found during summer in years of abundant rainfall and light to moderate grazing pressure. Heavy spring grazing favors the growth of summer-annual forbs, such as tarweed and turkey mullein, and reduces the amount of standing dead material. On good sites, herbage yield may be as high as 4900 kg/ha (4400 lb/ac) (Garrison et al. 1977).

**Composition**. Introduced annual grasses are the dominant plant species in this habitat. These include wild oats, soft chess, ripgut brome, red brome, wild barley, and foxtail fescue. Common forbs include broadleaf filaree, redstem filaree, turkey mullein, true clovers, bur clover, popcorn flower, and many others. California poppy, the State flower, is found in this habitat. Perennial grasses, found in moist, lightly grazed, or relic prairie areas, include purple needlegrass and Idaho fescue. Vernal pools, found in small depressions with a hardpan soil layer, support downingia, meadowfoam, and other species (Parker and Matyas 1981). Species composition is also related to precipitation (Bartolome et al. 1980). Perennial grasses are more common on northern sites with mean annual rainfall greater than 150 cm (60 in). Soft chess and broadleaf filaree are common in areas with 65-100 cm (25-40 in) of rainfall, and red brome and redstem filaree are common on southern sites with less than 25 cm (10 in) of precipitation (Bartolome et al. 1980).

**Other Classifications**. Annual Grassland habitat has been described as Valley Grassland (Munz and Keck 1959, Heady 1977), Valley and Foothill Grassland (Cheatham and Haller 1975), California Prairie (Küchler 1977), Annual Grasslands Ecosystem (Garrison et al. 1977), Brome grass, Fescue, Needlegrass, and Wild Oats series (Paysen et al. 1980), and Annual Grass-Forb series (Parker and Matyas 1981).

## Habitat Stages

**Vegetation Changes** 1-2:S-D. Annual Grassland habitats occupy what was once a pristine native grassland. The native grassland likely consisted of climax stands of perennial bunchgrasses, such as purple needlegrass, on wetter sites (Bartolome 1981, Bartolome and Gemmill 1981), with annual species existing as climax communities on drier alluvial plains (Webster 1981). Today, plant succession in the classical sense does not occur in Annual Grassland habitats. However, species composition is greatly influenced by seasonal and annual fluctuations in weather patterns. Annual plants germinate with the first fall rains that exceed about 15 mm (0.6 in), growing slowly during winter and more rapidly in spring (Heady 1977). Botanical composition changes throughout the growing season because of differences in plant phenology (Heady 1958). Most annuals mature between April and June (Heady 1977), although some species, such as tarweed and turkey mullein, continue to grow into summer. Fall rains that encourage germination, followed by an extended dry period, favor the growth of deep-rooted forbs (Duncan and Woodmansee 1975), but continuing rainfall favors rapidly growing grasses (Pitt and Heady 1978). Livestock grazing favors the growth of low-stature, spring-maturing forbs, such as filaree (Freckman et al. 1979), and summer annuals, such as turkey mullein (Duncan 1976). Because these are important food plants for many wildlife species, proper levels of livestock grazing are generally beneficial in this habitat. In the absence of livestock, Annual Grassland habitats are often dominated by tall, dense stands of grasses such as ripgut brome (Freckman et al. 1979) and wild oats.

**Duration of Stages--** Although Annual Grassland habitats consist largely of non-native annuals, these effectively prevent the reestablishment of native perennials over large areas and now comprise climax communities (Heady 1977). Introduced annuals should be considered naturalized plant species and so managed, rather than as invading species characteristic of poor range sites.

## Biological Setting

**Habitat**. Annual Grassland habitat is found just above or surroundingValley Foothill Riparian (VRI), Alkali Desert Scrub (ASC), Fresh Emergent Wetland (FEW), Pasture (PAS) and all agricultural habitat types, and below Valley Oak Woodland (VOW), Blue Oak Woodland (BOW), Blue Oak-Foothill Pine (BOP), Chamise-Redshank (CRC), and Mixed Chaparral (MCH) habitats. Annual Grassland habitat also borders Coast Oak Woodland (COW), Closed Cone-Pine-Cypress (CPC), Coastal Scrub (CSC), and Eucalyptus (EUC) habitats.

**Wildlife Considerations**. Many wildlife species use Annual Grasslands for foraging, but some require special habitat features such as cliffs, caves, ponds, or habitats with woody plants for breeding, resting, and escape cover. Characteristic reptiles that breed in Annual Grassland habitats include the western fence lizard, common garter snake, and western rattlesnake (Basey and Sinclear 1980). Mammals typically found in this habitat

include the black-tailed jackrabbit, California ground squirrel, Botta's pocket gopher, western harvest mouse, California vole, badger, and coyote (White et al.1980). The endangered San Joaquin kit fox is also found in and adjacent to this habitat (U.S. Fish and Wildlife Service 1983). Common birds known to breed in Annual Grasslands include the burrowing owl, short-eared owl, horned lark, and western meadowlark (Verner et al. 1980). This habitat also provides important foraging habitat for the turkey vulture, northern harrier, American kestrel, black-shouldered kite, and prairie falcon.

## Physical Setting

Annual Grassland habitat occurs mostly on flat plains to gently rolling foothills. Common soil orders include Entisols and Alfisols (Garrison et al.1977). Entisols are often found at lower elevations on flood plains and swales that receive periodic deposits of alluvium (U.S. Soil Conservation Service1975), and are characterized by little or no pedogenic horizon development. Alfisols occur at higher elevations above the valley floor (Garrison et al.1977). Some Annual Grassland habitats can be found in the drier portion of the southern San Joaquin Valley on Aridisols (Garrison et al. 1977). Climatic conditions are typically Mediterranean, with cool, wet winters and dry, hot summers. The length of the frost free season averages 250 to 300 days (18 to 21 fortnights) (Garrison et al. 1977). Annual precipitation is highest in the north (Redding, 960 mm (38 in) ) and north coast (Ukiah, 909 mm (36 in)), decreasing to the south (Sacramento, 430 mm (17 in); Stockton, 339 mm (13 in); Fresno, 259 mm (10 in)), and reaching a minimum in the southern San Joaquin Valley (Bakersfield, 150 mm (6 in) ) (Major 1977).

## Distribution

Annual Grassland habitat occurs in patches of various sizes throughout the state

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# Montane Chaparral

Roland J. Risser and Michael E. Fry

## Vegetation

**Structure--** The growth form of montane chaparral species can vary from treelike (up to 3 meters) to prostrate. When mature, it is often impenetrable to large mammals. Its structure is affected by site quality, history of disturbance (e.g., fire, erosion, logging) and the influence of browsing animals. For example, on shallow granitic soils in the Sierra Nevada, low dense growths of pinemat manzanita and huckleberry oak characterize an edaphic climax community, associated with scattered conifers and much exposed granite. Following fire in the mixed conifer forest habitat type, whitethorn ceanothus-dominated chaparral may persist as a subclimax community for many years. Montane chaparral is characterized by evergreen species; however, deciduous or partially deciduous species may also be present. Understory vegetation in the mature chaparral is largely absent. Conifer and oak trees may occur in sparse stands or as scattered individuals within the chaparral type.

**Composition--** Montane chaparral varies markedly throughout California. Species composition changes with elevational and geographical range, soil type, and aspect. One or more of the following species usually characterize montane chaparral communities: whitethorn ceanothus, snowbrush ceanothus, greenleaf manzanita, pinemat manzanita, hoary manzanita, bitter cherry, huckleberry oak, sierra chinquapin, juneberry, fremont silktassel, Greene goldenweed, mountain mahogany, toyon, sumac and California buckthorn. As one or more of these species become dominant under various environmental regimes, further subclassification of the montane chaparral series is possible (Krebs 1972, McNaughton 1968).

**Other Classifications--** Montane chaparral has been broadly described as chaparral (Munz and Keck 1973, (Küchler 1977) or mountain shrub (USDA 1977). Subclassifications based upon predominant species composition have also been described as montane mixed shrub series, huckleberry oak/pinemat manzanita series, bush chinquapin series, greenleaf manzanita series, tobacco brush series, mountain whitethorn series (Parker and Matyas 1981); upper montane chaparral, lower montane chaparral (Cheatham and Haller 1975).

## Habitat Stages

**Vegetation Changes--** 1;2-4:S-D. Montane chaparral in California occurs in

gradations between two characteristic successional sequences: The first sequence is associated with poorer, typically shallow soils (in early stages of development), often overlying fractured bedrock. Here, chaparral species may predominate to form an edaphic climax community.

In the second sequence, chaparral is a secondary succession following disturbance on deeper forest soils. After disturbance (logging, fire, erosion) chaparral proliferates and may exclude conifers and other vegetation for many years. However, chaparral may facilitate the germination of red fir seedlings (Barbour 1984) and other shade tolerant conifers by providing a protective cover, moderating microclimate, and improving soil conditions. Chaparral shrubs may be an essential link in forest succession by building up soil nutrient levels, especially nitrogen, to the point where trees can survive (Zavitovski and Newton 1968). In mature timber stands, chaparral species may senesce due to insufficient light through the canopy and are only present as a sparse understory. Thus, silvicultural practices have a strong influence on the structure of montane chaparral.

Most montane chaparral species are fire adapted. Mature plants sprout back from the root crown. Some species require scarification of the seed for germination and may produce numerous seedlings after a fire (Gratkowski 1961). However, if fires are too frequent, these species may be eliminated (Biswell 1969) changing the subsequent structure of the community. Deer and livestock foraging on sprouting chaparral may also have a significant effect on its rate of development, structure, and ultimate species composition (Biswell and Gilman 1961, Davis 1967). The forage yields of most sprouting shrubs are reduced for the first few years after a fire, but rapidly regain their original status. Burned areas commonly produce new shrub growth high in protein and are a preferred food source for herbivores (Einarsen 1946, Swank 1956).

**Duration of Stages--** Following fire, herbaceous plants may dominate for up to 5 years. Usually within 7 to 9 years the brush overstory is fully developed (Sweeney 1956, Sampson 1944). Chaparral may persist for up to 50 years or longer before conifer development begins to significantly reduce the shrub growth through shading (Lyon 1969, Sweeney 1968). Where chaparral types occur as an edaphic climax (i.e., on poor, rocky soils, fractured bedrock or lava caps), growth rates may be rather slow, growth form is usually small and stunted, and individuals may be quite old. Development of montane chaparral at high elevations is often slowed by cold temperatures, snow cover and a short growing season (Barbour and Major 1977). However, at lower elevations, burned or logged areas may sprout new growth by the next growing season.

## Biological Setting

**Habitat--** Montane chaparral adjoins a variety of other wildlife habitats, including montane riparian (MRI), mixed chaparral (MCH), and perennial grassland (PGS). It becomes established in disturbed coniferous habits such as ponderosa pine (PPN), mixed conifer (SMC), Jeffrey pine (JPN), red fir (RFR) and lodgepole pine (LPN). At high elevations in the southern Sierra, it may occur with a sparse juniper overstory. At the lower extent of its elevational range, montane chaparral may intergrade with mixed

chaparral, a very similar habitat type.

**Wildlife Considerations--** Montane chaparral provides habitat for a wide variety of wildlife. Numerous rodents inhabit chaparral (Wirtz 1974). Deer and other herbivores often make extensive use of chaparral. Throughout the west slope of the Sierra and south through the Transverse Range, deer are strongly associated with chaparral communities. Montane chaparral provides critical summer range foraging areas, escape cover and fawning habitat. In the Sierra, fawning areas are frequently found where the chaparral lies adjacent to or contains an interspersion of perennial grass or meadow-riparian habitat (Ashcraft 1975, Dasmann, 1971, Ashcraft 1976, Pacific Gas and Electric 1981). Some small herbivores use chaparral species in fall and winter when grasses are not in abundance. Rabbits and hares eat twigs, evergreen leaves and bark from chaparral. Shrubs are important to many mammals as shade during hot weather, and moderate temperature and wind velocity in the winter (Loveless 1967). Many birds find a variety of habitat needs in the montane chaparral. It provides seeds, fruits, insects, protection from predators and climate, as well as singing, roosting and nesting sites (Verner and Boss 1980), Storer and Usinger 1970).

## Physical Setting

Montane chaparral can be found on shallow to deep soils, on all exposures, and from gentle to relatively steep slopes. It may dominate on more xeric sites, but occurs locally throughout the coniferous forest zone. Generally, climate is like that associated with the coniferous forest zone, cold winter temperatures with substantial precipitation. Summers are typically hot and dry (Barbour and Major 1977). In the northern portion of the state, montane chaparral is found between 914 to 2743 m (3000-9000 ft). In southern California this type occurs above 2134 m (7000 ft).

## Distribution

Montane chaparral is associated with mountainous terrain from mid to high elevation at 914 to 3047 m (3000-10,000 ft). It occurs in southern California above 2134 m (7000 ft) in the Transverse Range of Los Angeles, and in San Bernardino, Riverside and San Diego counties; from Siskiyou to Kern counties in the Cascade and Sierra Nevada mountains; as a minor type from Tehama to Lake counties; and in Del Norte, Siskiyou, Trinity, and Shasta counties in the North Coast Ranges and Klamath mountains (Barbour and Major 1977). As a successional stage following disturbance, its distribution coincides with the ponderosa pine and mixed coniferous forest habitat types (Barbour and Major 1977).

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# Valley Foothill Riparian

William E. Grenfell Jr.

## Vegetation

**Structure**-- Canopy height is approximately 30 m (98 ft) in a mature riparian forest, with a canopy cover of 20 to 80 percent. Most trees are winter deciduous. There is a subcanopy tree layer and an understory shrub layer. Lianas (usually wild grape) frequently provide 30 to 50 percent of the ground cover and festoon trees to heights of 20 to 30 m (65 to 98 ft). Herbaceous vegetation constitutes about one percent of the cover, except in openings where tall forbs and shade-tolerant grasses occur (Conard et al. 1977). Generally, the understory is impenetrable and includes fallen limbs and other debris.

**Composition--** Dominant species in the canopy layer are cottonwood, California sycamore and valley oak. Subcanopy trees are white alder, boxelder and Oregon ash. Typical understory shrub layer plants include wild grape, wild rose, California blackberry, blue elderberry, poison oak, buttonbrush, and willows. The herbaceous layer consists of sedges, rushes, grasses, miner's lettuce, Douglas sagewort, poison-hemlock, and hoary nettle.

**Other Classifications**-- Other classification schemes that describe VRI habitats are Cottonwood and California Sycamore (Parker and Matyas 1981), Central Valley Bottomland Woodland 6.11, Southern Alluvial Woodland - 6.31 (Cheatham and Haller 1975), Wild Rose Alder, Cottonwood, Sycamore, Willow (Paysen et al. 1980), Riparian Forest - 28 (Küchler 1977) and Forested Wetland -61 (Anderson et al. 1976).

## Habitat Stages

**Vegetation Changes--** 1;2-5:S-D. Cottonwoods grow rapidly and can reach WHR size/age class 5 in about 20 to 25 years. One specimen measuring 92 cm (36 in) (inside the bark) showed an age of 29 years (Sudworth 1908). This secondary succession to climax could occur as rapidly as 25 to 30 years in VRI habitats dominated by cottonwood. One valley oak tree 54 cm (21 in) in diameter (WHR size/age class 4) showed an age of 57 years. Valley oak dominated riparian systems would probably take 75+ years to reach climax/maturity. Some VRI types consisting of only a shrub layer (VRI 1;2: S-D) (willows, wild rose, blackberry) may persist indefinitely.

**Duration of Stages--** Shrubby riparian willow thickets may last 15-20 years before being overtopped and shaded out by cottonwoods. Cottonwood or willow tree

habitats close to river channels that receive a good silt infusion, without major disruptive flows, tend to be self perpetuating (R. Holland pers. comm.).

## Biological Setting

**Habitat--** Transition to adjacent non-riparian vegetation is usually abrupt, especially near agriculture (Cheatham and Haller 1975). The Valley-Foothill Riparian habitat is found in association with Riverine (RIV), Grassland (AGS, PGS), Oak Woodland (VFH) and Agriculture (PAS, CRP). It may intergrade upstream with Montane Riparian.

**Wildlife Considerations**-- Valley-foothill riparian habitats provide food, water, migration and dispersal corridors, and escape, nesting, and thermal cover for an abundance of wildlife. At least 50 amphibians and reptiles occur in lowland riparian systems. Many are permanent residents, others are transient or temporal visitors (Brode and Bury 1985). In one study conducted on the Sacramento River, 147 bird species were recorded as nesters or winter visitants (Laymon 1985). Additionally, 55 species of mammals are known to use California's Central Valley riparian communities (Trapp et al. 1985).(No 1985 cites for Brode and Bury, Laymon, and Trapp et al. in habitat Lit Cite. I used 1984 cites for all 3 in Lit Cite at end.)

## Physical Setting

Valley-foothill riparian habitats are found in valleys bordered by sloping alluvial fans, slightly dissected terraces, lower foothills, and coastal plains. They are generally associated with low velocity flows, flood plains, and gentle topography. Valleys provide deep alluvial soils and a high water table. The substrate is coarse, gravelly or rocky soils more or less permanently moist, but probably well aerated (Cheatham and Haller 1975). Average precipitation ranges from 15 to 76 cm (6-30 in), with little or no snow. The growing season is 7 to 11 months. Frost and short periods of freezing occur in winter (200 to 350 frost-free days). Mean summer maximum temperatures are 24 to 39 C (75 to 102 F), mean winter minima are 2 to 7 C (29 to 44 F) (Munz and Keck 1973). VRI habitats are characterized by hot, dry summers, mild and wet winters. Coastal areas have a more moderate climate than the interior and receive some summer moisture from fog (Bailey 1980). Potential evaporation during the warmest months is often greater than precipitation. Low rainfall and streamflow result in water scarcity in many parts of the area.

## Distribution

Valley-foothill riparian habitats occur in the Central Valley and the lower foothills of the Cascade, Sierra Nevada and Coast ranges. They are also found in lower slopes at the bases of the Peninsular and Transverse ranges. A few lower elevation

locations are on the desert side of the southern California mountains. VRI habitats range from sea level to 1000 m (3000 ft), fingering upward to 1550 m (5000 ft) on south-facing slopes.

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# Valley Oak Woodland

Lyman V. Ritter

## Vegetation

**Structure**-- This habitat varies from savanna-like to forest-like stands with partially closed canopies, comprised mostly of winter-deciduous, broad-leaved species. Denser stands typically grow in valley soils along natural drainages. Tree density decreases with the transition from lowlands to the less fertile soils of drier uplands. Exceptions to this pattern are known, especially in the central coastal counties (N. H. Pillsbury, pers. comm.). Similarly, the shrub layer is best developed along natural drainages, becoming insignificant in the uplands with more open stands of oaks. Valley oak stands with little or no grazing tend to develop a partial shrub layer of bird-disseminated species, such as poison-oak, toyon, and coffeeberry (J. R. Griffin, pers. comm.). Ground cover consists of a well-developed carpet of annual grasses and forbs. Mature valley oaks with weil-developed crowns range in height from 15 to 35 m (49 to 115 ft) (Cheatham and Haller 1975, Conard et al. 1977).

**Composition**-- Canopies of these woodlands are dominated almost exclusively by valley oaks (Conard et al. 1977). Tree associates in the Central Valley include California sycamore, Hinds black walnut, interior live oak, boxelder, and blue oak. The shrub understory consists of poison-oak, blue elder, California wild grape, toyon, California coffeeberry, and California blackberry. Various sorts of wild oats, brome, barley, ryegrass, and needlegrass dominate the ground cover. Foothill pine and coast live oak are associated with VOWs along the Coast Range (Parker and Matyas 1979). Griffin (1976) reported that Coulter pine and canyon live oak are found in a montane Savannah of valley oak in the Santa Lucia Range, Monterey County.

**Other Classifications**-- This type is referred to as the Foothill Woodland by Munz and Keck (1959), Valley Oak Savanna (33) by Küchler (1977), the Valley Oak Phase of the Foothill Woodland by Griffin (1977), Valley Oak Series by Paysen et al. (1980), and Valley Oak Community by Parker and Matyas (1979). Conard et al. (1977) and others include VOWs in the Central Valley riparian zone, a vegetative division in the physiographic gradient extending from river edges to higher terraces. Cheatham and Haller (1975) included part of the VOW habitat in their Central Valley Bottomland Woodland (6.11), and Küchler (1977) included parts in his Riparian Forest (28) designation.

## Habitat Stages

**Vegetation Change**-- 1;2-5:S-D. In most remaining VOW, little recruitment of young oaks occurs to replace the veteran oaks dying of natural causes or being destroyed by urban and agricultural development (White 1966, Griffin 1973, 1976, 1977). The lack of oak recruitment seems to be related to animal damage of acorns and seedlings (Griffin 1980a, b). The successful combination of circumstances for valley oak establishment is speculative. The future of this habitat in valley locations seems to be fewer valley oaks and more open grassland (Griffin 1976). However, Griffin (1976) found that the current absence of ground fire encourages the invasion of evergreen oaks, Coulter pine, or both, in upland sites in the Santa Lucia Mountains. Presently, most valley oak stands are in mature stages 5:S-D, but structural classes 1-5:S-D are presumably possible. Canopy development and plant density are variable. Only a few localized studies give quantitative data on the structure of VOW (see Griffin 1976, Conard et al. 1977).

**Duration of Stages**-- Secondary succession of VOWs under natural conditions has not been studied and little opportunity exists for its study. Most surviving stands appear to be between 100 and 300 years old, and individual valley oaks may live as long as 400 years (Stern 1977). Valley oaks seem to be tolerant of flooding (Harris et al. 1980), and young trees will sprout when fire damaged (Griffin 1976). Given natural perturbations such as fire and flooding, and assuming successful regeneration of valley oaks, VOW would probably remain the climax community.

## Biological Setting

**Habitat**-- VOWs in the Great Valley usually merge with Annual Grasslands or border agricultural land. Where these woodlands extend to the foothills surrounding the valley, they intergrade with Blue Oak Woodlands or Blue Oak-Foothill Pine habitats. Near major stream courses this community intergrades with Valley-Foothill Riparian vegetation. West of the Coast Range, VOWs sometimes associate with Coastal Oak Woodlands and, to a limited extent, Montane Hardwood and Coastal Scrub.

**Wildlife Considerations**-- These woodlands provide food and cover for many species of wildlife. Oaks have long been considered important to some birds and mammals as a food resource (i.e., acorns and browse). Verner (1980a) reported that 30 bird species known to use oak habitats in California include acorns in their diet. An average of 24 species of breeding birds were recorded on a study plot at Ancil Hoffman Park, near Carmichael, in Sacramento County from 1971 to 1973 (Gaines 1977). The study plot was dominated by valley oaks but included some cottonwood in the canopy. Probably the most significant breeding bird species recorded was red-shouldered hawk. In decreasing order, the most common species were European starling, California quail, plain titmouse, scrub jay, rufous-sided towhee, Bewick's wren, bushtit, and acorn woodpecker. Barrett (1980) indicates that the ranges of about 80 species of mammals in California show substantial overlap with the distribution of valley oaks, and several, such as fox and western gray squirrels and mule deer, have been documented using valley oaks for food and shelter.

## Physical Setting

This habitat occurs in a wide range of physiographic settings but is best developed on deep, well-drained alluvial soils, usually in valley bottoms. Most large, healthy valley oaks are probably rooted down to permanent water supplies (Griffin 1973). Stands of valley oaks are found in deep sills on broad ridge-tops in the southern Coast Range. Where this type occurs near the coast, it is usually found away from the main fog zone (Griffin 1976). The climate is Mediterranean, with mild, wet winters and hot, dry summers.

## Distribution

Remnant patches of this habitat are found in the Sacramento Valley from Redding south, in the San Joaquin Valley to the Sierra Nevada foothills, in the Tehachapi Mountains, and in valleys of the Coast Range from Lake County to western Los Angeles County. Usually it occurs below 610 m (2000 ft), although Griffin (1976) reported a ridge-top stand at 1525 m (5000 ft) in the Santa Lucia Mountains.

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# IRRIGATED HAYFIELD

E. Lee Fitzhugh and Ronald F. Schultze

## Vegetation

**Structure--** Except for 2 to 6 months initial growing period, depending on climate, and soil, this habitat is dense, with nearly 100 percent cover. Average height is about 0.46 m. (1.5 feet) tall. Planted fields generally are monocultures ( the same species or mixtures or a few species with similar structural properties). Structure changes to a lower stature following each harvest, grows up again and reverts to bare ground following plowing or discing. Plowing may occur annually, but is usually less often. Layering generally does not occur in this habitat. Unplanted "native" hay fields may contain short and tall patches. If not harvested for a year, they may develop a dense thatch of dead leaves between the canopy and the ground.

**Composition--** This habitat includes alfalfa fields and grass hayfields. (Cereal grain fields, whether harvested for hay, grain or straw, should be classified as IGR or DGR.) Alfalfa usually exists unplowed for approximately 3 years or more, followed by a cereal grain crop, vegetables, potatoes or tomatoes for 1-4 years before being planted to alfalfa again. Most hay fields in the warmer parts of California are monocultures of alfalfa. In cooler areas, both alfalfa and introduced grass hay are common and are regularly irrigated. Occasionally, "native" hay fields are irrigated to enhance their productivity. Native hay fields may include introduced grasses and forbs, but they are managed less intensively and contain a variety of naturally-occurring graminoids and forbs as well. Alfalfa fields generally will be monocultures except for weeds and small inclusions of roads and ditches. Roads will be mostly barren, while ditchbanks, if vegetated, will support plants similar to those found in FEW. The mixture of grasses and forbs (mostly legumes) varies according to the region of the state (climate, soils), seed mixture used, tillage, irrigation, years since initial planting, and weed control.

**Similar Habitats--** Designation of a grassy hayfield as IRH depends more on management of the site than on plant composition. Hayfields are irrigated, intensively mowed and managed, whereas the same vegetation, allowed to grow in a more natural state might be a sedge, wet meadow, or perennial grassland habitat. Similar CWHR habitats are FEW, PAS, PGR, and WTM. The primary difference is that IRH is irrigated and occasionally plowed, mowed, and planted. PAS may also have these characteristics, but is more intensively grazed than IRH. Montane "native hay" pastures that are irrigated, mowed, and grazed belong in IRH if they are allowed to regrow so that by the end of the growing season and through the winter they have a substantial height of vegetation. Otherwise, they belong in the PAS type.

**Other Classifications--** Except in the case of "native hay," agricultural habitats are included only in the U.S. (UNESCO) Vegetation Cover Classification System (USVCCS). IRH would include at least three USVCCS formations corresponding to close-grown herbaceous crops in annual and perennial temperate grassland or forb vegetation categories. IRH could include 10 of the sedge and meadow series of Sawyer and Keeler-Wolf (1995). Most rushes (Cyperus spp.) are included by Sawyer and Keeler-Wolf (1995) in their sedge types. Spikerush (Eleocharis spp.), which they treat separately, is more typically a FEW species, but may occur as inclusions in a larger "native hay" IRH stand.

## Habitat Stages

**Vegetation Changes--** In warmer areas and on better soils, alfalfa is part of a regular 7-8-year crop rotation. In this setting, alfalfa renews soil nitrogen, improves tilth, and can reduce disease and weeds in the vegetable and grain parts of the rotation. Alfalfa is present for 4 years and is not plowed or disked during this time. Alfalfa also is grown where climate or soil is less adaptable to other crops. An Alfalfa-grain or Alfalfa-potato rotation is common in the Great Basin areas. Alfalfa fields may be plowed every 3-6 years, removing some weedy growth, and replanted to alfalfa. In both alfalfa and grass-hay, tall and short stages are dictated by management more than by plant growth. Grass hayfields vary from annually-planted introduced grasses in warm climates to naturally-occurring perennial grasses and sedges in colder climates. Mixtures of annual and perennial, native and introduced species are common. In some "native" hay fields there can be relatively long periods of continuous inundation, on the order of one or more months, usually in winter or spring. Cattails or bulrushes may invade, but they are controlled by management. Vegetation changes are possible given management direction.

**Duration of Stages--** Growth begins during February in Cental Valley alfalfa fields. Alfalfa harvesting occurs 3-4 times per season in intermountain areas, 6-8 times in the Central Valley, and 8-9 times in the Imperial Valley. In the Imperial Valley and the Central Valley, harvesting occurs about monthly during most of the season. At high elevations native hay usually is harvested in June, but later harvesting occurs where owners or managers are concerned about bird nesting. Plowing or discing is infrequent.

## Biological Setting

**Habitat--** In most areas, rotational field crops, vineyards, or orchards will grow on adjacent areas. Natural plant communities that may occur adjacent to IRH include many flat-land, deep-soil communities from sagebrush and annual grassland to desert grassland, alkali desert scrub or creosote desert scrub, depending on the location. At higher elevations, IRH may be adjacent to coniferous forest types. This habitat sometimes exists where soil, water, or climatic conditions limit growth of other crops. If abandoned, alfalfa fields will be replaced naturally by invasive exotic plants, which may be different

from those that occupied the site before tilling. Imperial Valley and Central Valley fields occupying alkaline soils, if abandoned, could revert to patchy saltgrass, salt-tolerant shrubs, and unvegetated alkaline flats. Abandoned intermountain alfalfa fields may revert to cheatgrass and Russian thistle, while native hay fields will develop a dense thatch and decadent plants.

**Wildlife considerations**-- This habitat provides a high quality seasonal resource for blackbirds, deer, doves, egrets, elk, foxes, garter snakes, gophers, gopher snakes, hawks, king snakes, owls, pronghorn, sandhill cranes, voles, waterfowl, and others. However, where harvesting is constant, reproduction values for ground-nesting species are reduced to zero. If rotational cropland is adjacent, this habitat can provide cover during seasonal discing and planting on the rotated fields.

## Physical Setting

This habitat occurs in variable climates, from hot and dry to cool and wet to cold and snowy. IRH requires relatively flat topography that allows irrigation or water-spreading. Soils are highly variable but usually more than 1 meter (3.3 feet) deep and often of alluvial origin.

## Distribution

This habitat is found throughout California from below sea level to about 2100 m.(7,000 feet). Typical examples are found in Imperial Valley and Modoc County, representing different extremes, and in San Joaquin County, representing a more central form. Agricultural databases that could be used to represent abundance and distribution do not define IRH as we do, and can provide misleading estimates. However, our best estimate, based on a Natural Resources Conservation Service (NRCS 1997) tabulation of Agricultural Commissioners' crop reports for 1996 is that California supports more than 405,000 ha.(1,000,000 acres) of hayfields.

## Literature Cited

NRCS. Unpublished. Crop residue management survey: worksheet for 1997, based on Agricultural Commissioners' Agricultural Crop Reports for 1996. USDA, Natural Resources Conservation Service, Davis, CA.