NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WILDLIFE UPLAND HABITAT MANAGEMENT

(acre)

CODE 645

DEFINITION

Creating, restoring, maintaining or enhancing areas for food, cover, and water for upland wildlife and species which use upland habitat for a portion of their life cycle.

PURPOSES

Provide a variety of foods for the desired kinds of wildlife species.

Provide a variety of cover types for the desired kinds of wildlife species, examples include nesting, fawning, loafing, resting, escape, travel lanes, and thermal.

Provide drinking water for the desired kinds of wildlife species.

Arrange habitat elements in proper amounts and locations to benefit desired species.

Manage the wildlife habitat to achieve a viable wildlife population within the species home range.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies on all landscapes that are suitable for the kinds of wildlife habitat that are needed within the range of the desired species or the natural community under consideration.

CRITERIA

General Criteria Applicable to all Purposes

Habitat development and management necessary, to achieve the purpose(s), shall be based on a wildlife habitat appraisal or suitable habitat evaluation. The appraisal or evaluation procedure shall be used to determine a habitat suitability for either individual fields, home range areas, habitat type or natural community as well as to provide an overall evaluation for the entire property or operating unit.

Habitat Appraisal or Habitat Evaluation

The evaluation will result in a quality rating or habitat suitability index (hsi). This will consider the type, amount, and distribution of habitat elements required. The quality rating or hsi will be compared to the quality criteria in Section III of the FOTG.

If the evaluation indicates a level below the acceptable quality, alternatives will be recommended that will result in the necessary changes in habitat elements or their management to bring the rating up to the minimal acceptable or above.

If the evaluation is at the minimum or above, alternatives will be recommended that will result in the necessary management to preserve, maintain or improve the existing habitat in its present state or toward optimum conditions.

California Habitats

The following upland habitat types will be considered when assessing wildlife habitat. For the purpose here some California habitats have been lumped together where similar management activities occur (refer to "A Guide to Wildlife Habitats of California" or the following web site: www.dfg.ca.gov/whdab/cwhr/whrintro.html

I. **Agricultural Habitats** - Annual food plots, dryland grain crops, irrigated hayfield, irrigated grain crops, irrigated row and field crops, rice, irrigated hayfield, pasture, vineyard, deciduous orchard, and evergreen orchard.

II. **Grassland Habitats** - Annual grassland and perennial grassland.

III. **Shrub-Dominated Habitats** - Low sage, sagebrush, bitterbrush, alpine dwarf-shrub, montane chaparral, mixed chaparral, chamise-redshank chaparral, and coastal scrub.

IV. **Desert Habitats** - Alkali desert scrub, desert scrub, desert succulent shrub, desert wash, palm oasis, and joshua tree.

V. **Woodland Habitats** - Coastal oak woodland, blue oak woodland, blue oak-foothill pine, and valley oak woodland.

VI. **Forest Habitats** - Eastside pine, Jeffrey pine, lodgepole pine, subalpine conifer, red fir, white fir, Sierran mixed-conifer, ponderosa pine, montane hardwood-conifer, montane hardwood, aspen, Klamath mixed-conifer, closed-cone pine-cypress, redwood, Douglas-fir, pinyon-juniper, and juniper.

VII**. Riparian Habitats** - Valley foothill riparian, montane riparian and desert riparian.

VIII. **Urban Habitats**

Habitat Elements

The following habitat elements will be considered when assessing wildlife habitat. Not all may apply to every habitat type.

I. Food

A. Type

1. Vegetative diet elements such as fungi, lichens, moss, ferns, algae, graminoids, forbs, shrubs, tree leaves, roots, seeds, acorns, grain, berries, fruits, nuts, cones, flowers, and nectar.
2. Animal diet elements - invertebrates, insects, fish, amphibians, reptiles, birds, mammals, carrion, and eggs.

B. Amount

C. Season of availability and need.

II. Cover

A. Type
B. Amount
C. Season

III. Water

A. Quality
B. Quantity
C. Accessibility
D. Seasonal availability

IV. Interspersion and Distance to

A. Crops
B. Grasses and or legumes
C. Shrubs
D. Trees
E. Water
F. Openings

V. Migration

A. Routes
B. Season of use
C. Corridors

Development and Management of Wildlife Habitat

As indicated by the wildlife habitat evaluation, certain habitat elements may be weak or missing. For the desired species, identify the types, amount, and distribution of habitat elements and management actions necessary to achieve the management objectives.

The amount and kinds of habitat elements planned, their location and management shall be identified in a management plan.

The use of native plant materials shall be encouraged.

Vegetative manipulations to restore plant and/or animal diversity can be accomplished by prescribed burning or mechanical, biological or chemical methods, or a combination of any of these.

Livestock grazing or haying, if used, shall be conducted to maintain or improve vegetation structure and composition so as to improve or maintain the desired wildlife habitat.

Management measures shall be provided to control invasive species and noxious weeds. Spraying or other control of noxious weeds shall be done on a "spot treatment" basis to protect forbs and legumes that benefit native pollinators and other wildlife and provide insect food sources for grassland nesting birds.

Ecological Site Descriptions can be a useful source of information in determining potential plant community and other habitat components.

Wildlife habitat management is typically concerned with two major objectives: (1) maintaining quality habitat as it exists in a natural ecosystem and (2) restoring quality habitat where it has deteriorated or where a specific habitat element is lacking, such as, water, food, or cover. The following basic principles should be included in planning and implementing habitat manipulation practices (Wildlife Conservation Principles and Practices, 1979):

I. Projects must be justified according to biological needs based on investigation and evaluation.

II. Proposed practices must be evaluated for their effect on other natural resources and land uses.

III. Projects must be economically practical and should specify if the objective is to maintain, improve, or completely alter the existing habitat character.

IV. Improvements must simulate natural conditions. Generally native flora and fauna should be perpetuated.

V. Manipulation projects must be designed to follow natural topographical features rather than geometrical squares or strips.

VI. Projects must be monitored and evaluated to determine if the objectives have been accomplished. If not, adjustments or modifications may be needed to achieve the objectives, unless they are modified for some reason.

WILDLIFE SPECIES CRITERIA

Two approaches can be utilized for Upland Wildlife Habitat Management: either by species or by habitat. The first approach to wildlife habitat development and management presented here is by desired species. Refer to "California's Wildlife - Amphibians and Reptiles, Birds, Mammals". Following is criteria by a few selected species:

Pheasant Habitat

Ring-necked pheasant is a common to uncommon introduced, permanent resident. They occur in scattered locations throughout California, but are centered in the Central Valley. They depend upon cropland, especially grain crops, with adjacent herbaceous and woody cover. They also occur in perennial grasslands with sufficient cover.

I. Food - Ring-necked pheasant forages mostly on the ground, but also from plants. It gleans, scratches, and grazes. It eats waste grain, other seeds, and other plant parts. Insects and other arthropods are important in spring and summer, especially for chicks.

II. Cover - Tall, rank herbage, shrubs, and woodland are required for cover, especially near feeding areas. Insufficient cover is a major habitat problem. Dense herbage is required for nesting, especially at shrub/herb edge.

III. Water - Most suitable pheasant habitat provides sufficient water from dew, insects, and succulent vegetation. However, the highest densities occur where open water is available.

IV. Interspersion - Requires a mixture of croplands with abundant cover.

Quail Habitat

Three species of quail are most common in California: California quail - Common, permanent resident of low and middle elevations the length of California. It is found in shrub, scrub, and brush, open stages of conifer and deciduous habitats, and margins of grasslands and croplands. Gambel's quail - A common resident of Colorado and Mojave Desert regions of southeastern California. Preferred habitats include desert riparian, and a wide variety

of other desert habitats, especially near streams, springs, and water holes. Mountain quail - It is common to uncommon as a resident found in most major montane habitats. It is found seasonally in open, brushy stands of conifer and deciduous forest and woodland, and chaparral. The following criteria applies primarily to California quail:

I. Food - Forages on the ground and low vegetation. Scratches, gleans, grazes, and browses, often jumps to pick seeds, blossoms, and fruits. Seldom ventures more than 50-100 feet from cover to feed. Chicks eat large amounts of arthropods.

II. Cover - Brush and trees provide cover for feeding, escape, movement, and roosting. Brush piles can provide beneficial habitat element. Nests in a small depression in ground, lined with grasses and forbs; nest hidden in herbage, often under shrubs.

III. Water - In cool weather, probably can meet water needs from succulent plants, arthropods, and dew. In hot weather, requires free water daily. Has ability to drink mildly salty water.

IV. Interspersion - Requires a mosaic of low, brushy vegetation, with grass/forb openings, taller shrubs, and trees, interspersed with water.

Mourning Dove Habitat

Mourning dove are common in several habitat types throughout the state, including cropland, orchards, pastures, grasslands, open chaparral, Great Basin and desert habitats, open hardwood, hardwood-conifer, riparian, and low-elevation conifer. They generally move from the northern and colder parts of the state into warmer areas in the fall and winter.

I. Food - Mourning doves feed mostly on seeds of cereal grains, forbs, and grasses. In spring they occasionally feed on snails and they feed some on insects. Turkey mullein, red maids, wild sunflower, buckthorn, and lambsquarters are common plant seeds eaten. Wheat, barley, safflower and milo are also important in their diet.

II. Cover - Trees and shrubs provide important cover in woodland, forest and riparian stands. Orchards are also important. Mourning doves nest is often a loose platform of twigs on a horizontal limb or crotch of tree. They rarely nest on the ground.

III. Water - Mourning doves drink water once or twice daily.

Wild Turkey Habitat

Wild turkey is an uncommon permanent resident of California. It was introduced in 1877. It's range is expanding as introductions continue. Wild turkey occur in local, scattered populations north to Humboldt and Siskiyou counties, and south to Santa Barbara, Riverside, and San Diego counties. It is found mostly in deciduous riparian, oak, and conifer-oak woodlands. It prefers large-tree stages with low to intermediate canopy, interspersed with numerous grass/forb openings, near water. Rugged, hilly terrain may be needed, to allow escape from predators.

I. Food - Turkey eat seeds, leaves, fruits, buds, acorns, pine nuts, other nuts, and arthropods. It scratches and gleans from ground, plucks, and picks and strips seeds from low plants. It also searches and plucks arthropods from ground and low plants.

II. Cover - Turkey roost high in tree groves near water. They frequently use mature trees, often ponderosa, Jeffrey or digger pine in valley foothill hardwood and valley foothill hardwood-conifer, in sheltered locations, in uneven stands. Turkey nest on ground in a slight depression, well concealed in thick, low vegetation in, or near a forest clearing. Nest is usually near permanent water.

III. Water - They require free water once or twice daily. They seldom roost or nest more than 1-2 miles from permanent water.

IV. Interspersion - Wild turkey require a diverse mosaic of conifer and deciduous stands of different ages, with scattered openings and water. Greater mobility allows turkey to use larger areas than other upland game birds. Suitable undisturbed roosting trees are critical.

Mule Deer Habitat

Mule deer are common to abundant, yearlong residents or elevational migrants in much of California, except in deserts and intensively farmed areas without cover. They occur most commonly in early to intermediate successional stages of most forest, woodland, and brush habitats. They prefer a mosaic of various-aged vegetation that provides woody cover, meadow or grassland and shrubby

openings, and free water. Deer populations can respond to habitat management. Populations can decline in response to fragmentation, degradation, or destruction of habitat caused by urban expansion, incompatible use of the land resources (e.g., timber, water, and rangeland), and disturbances by humans. Mule deer can compete for food with domestic livestock, wild horses, wild pigs, and black bears. Six subspecies occur in California: Columbian black-tailed deer, California mule deer, Rocky Mountain mule deer, southern mule deer, Inyo mule deer, and burro mule deer.

I. Food - Mule deer browse and graze. They prefer tender new growth of shrubs, especially buckbrush and other ceonothus species, mountain mahogany, and bitterbrush. They also feed on many forb species and some grasses. Mule deer feed from ground surface into shrubs and trees as high as they can reach. They dig out and feed on subterranean mushrooms. Food preferences are seasonal, depending on forage quality and availability. Forbs and grasses are important in spring. They feed heavily on acorns where available, mostly in autumn. Various shrubs are critical in summer and winter. They utilize salt or mineral licks.

II. Cover - Brushy areas and tree thickets provide escape cover. Vegetative cover is critical in winter and summer. They use south facing slopes more in cold weather and north facing slopes in hot summer weather. Fawning takes place in moderately dense shrublands and forests, dense herbaceous cover, and high elevation riparian and mountain shrub habitats, with available water and abundant forage. Suitable habitat is comprised of a mosaic of vegetation types that provide an interspersion of herbaceous openings, dense brush or tree thickets, riparian habitat, and abundant edge

III. Water - Mule deer require about 3 quarts of water/day/100 lb. of body weight.

Pronghorn Habitat

Pronghorn are fairly common in northeastern California and some locations in Mono County. Since 1982 pronghorn have been translocated into northeastern Kern, San Luis Obispo, and Monterey counties. Pronghorn are found in sagebrush, low sage, bitterbrush, grassland, pinyon-juniper, riparian, and alkali desert scrub habitats. Pronghorns compete with domestic sheep, feral burros, and wild horses. Excessive use by these other species will reduce carrying capacity of range for pronghorns. Fences, and other barriers associated with human activities, not designed to allow them to pass, are detrimental to pronghorns.

I. Food - Forbs are the most important forage during summer. Browse is important in all seasons and critical in winter. Several species of sagebrush are important browse, followed by bitterbrush and other shrubs. Grass is used to a lesser extent than forbs and browse, but may be important spring forage. Alfalfa and other cultivated crops may be important in some areas.

II. Cover - Pronghorns prefer low, rolling terrain in open grassland and sagebrush communities. Optimal habitat is 40-60% grass, 10-30% forbs, and 5-20% shrubs. Low vegetation up to 15 inches is preferred. They rely on speed, and ability to detect moving predators at long distances, to escape in open habitats. They also use shrubs and rolling topography for cover.

III. Water - Free water is important. The amount of water consumed varies; less is needed where succulent green vegetation is available. Pronghorn consume about one-third quart/day in May and about 5 quarts/day in August.

Elk Habitat

Scattered resident populations of elk are found in several areas of California. Three subspecies are found in the state: Rocky Mountain elk, Roosevelt elk and tule elk. Rocky Mountain and Roosevelt elk breed in open, brushy stands of many deciduous and conifer habitats with abundant water. They feed in riparian areas, grasslands, meadows, and herbaceous and brush stages of forest habitats. Several introductions, and reintroduction's, of tule elk have been made in recent years. Tule elk introduced into the Owens Valley, Inyo County, use brush, scrub, and herbaceous habitats throughout the year. Tule elk have also done well in the Corrizo Plains of San Luis Obispo County and in Monterey County; some associated with dense grass and herbaceous cover on Conservation Reserve Program lands in the area.

I. Food - Elk are herbivores that graze and browse. Their diet varies greatly in different parts of the state. They eat grasses, forbs, tender twigs and leaves of shrubs and trees, fungi, some acorns, and aquatic vegetation. In the Owens Valley, tule elk

consumed substantial amounts of alfalfa in summer. At Prairie Creek, Humboldt County, grasses made up 56-76%, and browse 21-34%, of the forage consumed. They forage on ground and in shrubs, and up to 6 feet in trees.

II. Cover - Roosevelt and Rocky Mountain elk require mature stands of deciduous and conifer forest habitats. Dense brush understory is used for escape and thermal cover. These habitats are particularly important on south-facing slopes for cover in winter. In the Owens Valley, tule elk inhabit bottomlands with herbaceous vegetation, and low slopes and alluvial fans supporting predominantly brushy habitats. Calving occurs in areas with available water and brushy vegetation that provide dense cover near openings, and seclusion from human impacts.

III. Water - The distance between open water sources should be no greater than 2 miles.

Wild Pig Habitat

Feral and introduced wild pigs are permanent residents found at low and middle elevations in scattered locations in cismontane California. They inhabit riparian areas, oak woodlands, annual grasslands, mature conifer and hardwood forests with moderate to high-canopy closure, and in chaparral and other brush areas. Adjacent agricultural lands often enhance habitat.

I. Food - Wild pigs are omnivores. Mast crops, especially acorns are important. They also eat wild oats and other green grasses, forbs, berries, roots, bulbs, insects, and carrion. They forage on the ground surface, root beneath ground surface, and forage up to 2 feet above ground. Will root under logs, rocks, other surface cover, and litter.

II. Cover - Wild pigs require dense brush, or rock crevices and caves, for escape and resting cover and shade. Dense brush areas, or rock crevices and caves are required for farrowing (raising litter of piglets). Farrowing sites may be dug in earth and lined with vegetation.

III. Water - Wild pigs require drinking water at least every 2 days when feeding on dry forage. Water consumption varies with age, ambient temperature and humidity, and moisture content of food.

WILDLIFE HABITAT CRITERIA

The second approach to Upland Wildlife Habitat Management is by habitat types. Habitats are as described in "A Guide to Wildlife Habitats of California". They have been treated in groups of habitats in this practice standard.

Agricultural Habitats

Agricultural habitats consist of pasture, cropland (dryland grain, irrigated hayfield, irrigated grain crops, irrigated row and field crops, rice), vineyards and orchards (vineyards, deciduous orchards, evergreen orchards) and annual food plots.

I. Pasture - Pasture vegetation is usually a mix of perennial grasses and legumes that normally provide 100 percent canopy closure. Old or poorly managed pastures may have patches of weeds. The mix of grasses and legumes varies according to management practices such as species planted, fertilization, soil type, irrigation, weed control, and type, stocking rate of livestock and duration of grazing.

Pastures are used by a variety of wildlife depending upon geographic area and types of adjacent habitats. Ground-nesting birds, including waterfowl, pheasant, and sandhill crane, nest in pastures if adequate residual vegetation is present at the beginning of nesting season. Flood irrigation of pastures provides feeding and roosting sites for many wetland-associated birds, including shorebirds, wading birds, gulls, waterfowl, and raptors. Antelope, deer and elk also graze pastures when they provide adequate, adjacent escape cover. The endangered Aleutian goose in Del Norte County and Sacramento and San Joaquin valleys requires pastures that are sufficiently grazed to keep them low and open. In the Grasslands Resource Conservation District of Merced County, cultural methods are commonly modified so that pastures can be flooded in fall and winter for waterfowl hunting and grazed in summer by livestock.

II. Cropland - Many types of crops are grown in California. Most croplands support annuals, planted in spring and harvested during summer or fall. In many areas, second or even third crops are planted after the harvest of the first crop. 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.

Croplands are established on some of the most fertile soils, which historically supported an abundance of wildlife unequalled in other sites. Many species of rodents and birds have adapted to croplands and may become pests. They are controlled by fencing, trapping and poisoning to prevent excessive crop losses. Some species of waterfowl depend on waste rice and corn that remain in fields after harvest. Deer, elk, antelope, and wild pigs forage in alfalfa and grain fields and can cause depredation problems. Pheasants introduced to cropland habitats have experienced recent population declines because of 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.

III. Vineyards and Orchards - Vineyards and orchards are typically single species vine or tree habitats. Spacing between vines or trees is uniform depending on desired spread of mature plants. 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 vine or tree rows.

Orchards and vineyards have usually been planted on deep fertile soils that once supported productive and diverse natural habitats. Some species of birds and mammals have adapted to these 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 rabbit browse on the trees or vines, other wildlife such as squirrel 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 or nest 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. Examples of wildlife that 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.

IV. Annual food plots - Food crops are most commonly grown to provide food for wildlife, especially during winter months. It is usually better to establish or promote natural food plants that reseed or maintain themselves naturally. Domestic food plants commonly grown and managed for wildlife include wheat, barley, corn, grain sorghum, milo millet, and sunflowers. These plants usually need to be planted annually and may require extra management, such as, irrigation. Plantings shall be seeded at proper time to ensure maturity of food plants at the appropriate time. For the propagation of domestic food plants see the appropriate plant reference sheet.

The minimum size of a grain food plot is one-quarter acre (about 12,000 sq. ft.). Grain food plots over 4 contiguous acres are generally not needed. Plots should be 30 feet wide. As a rule, one-grain plot for every 40 acres of farmland should suffice.

Each year one-half of the grain food plot should be planted with the other half allowed to grow natural annual plants. Rotate this sequence the following year.

Food plots should be located on the least erosive areas of a field. Soil loss must be within tolerable limit (T). Adequate vegetative cover must be developed and maintained to provide both wildlife and erosion control benefits. If food plots are relocated or discontinued, the site should be re-seeded if needed to establish erosion control cover and to establish desired wildlife habitat. Plots may

be located on slopes greater than 5 percent provided soil losses do not exceed tolerable limits (T).

The plot should be adequately fertilized. Weed control is not required as the presence of some plants may actually benefit wildlife by providing higher protein and greater number of seeds than domestic grains.

Food plots will be protected from livestock grazing.

III. Wildlife Considerations - Following are some farming practices that can benefit wildlife (Wildlife Habitat Management of Forestlands, Rangelands, and Farmlands, 1998):

A. Conservation tillage is primarily designed to leave protective residue on the soil surface to reduce erosion. Tillage varies from reduced-till where about 20% of the previous year's residue is left, to no-till where at least 90% of the previous year's residue is left on the soil surface. The greater the residue the higher the value for cover and food for wildlife. Also, nest destruction and abandonment can be reduced if fewer passes are made by farm equipment across a field. Research shows greater songbird and upland bird richness and higher nest densities with no-tillage than with conventional tillage. Small mammal abundance also increases with no-tillage.

B. Crop diversity with good interspersion, high contrast of vertical structure, small field size, high crop diversity (>4 crops), and non-cultivated areas (25% of area in permanent cover) will benefit wildlife. Fallow fields also have wildlife benefits.

C. Field borders - Planting or leaving narrow strips of permanent cover, such as perennial grass, legumes, shrubs, and a few trees between fields and around the perimeter creates horizontal and vertical diversity in a cropland area. Field borders should be at least 15 feet wide. Added benefits to providing wildlife habitat include reduced erosion, reduced planting costs, reduced weed and pest insect control, and improved water quality.

D. Odd areas - Odd areas include eroded areas in crop fields, gullies, rock piles, rock outcrops, borrow pits, gravel pits, and areas of good land cut off from the rest of the field by stream, drainage ditch, gully, or center-pivot irrigation. If food or cover plants are lacking, they can be planted.

Grassland Habitats

Grassland habitats consist of annual grassland and perennial grassland (refer to "A Guide to Wildlife Habitats of California"). These habitats are also referred to as prairies.

I. Annual grassland habitats are typically open grasslands composed primarily of annual plant species. Structure and species composition in annual grassland depends largely on weather patterns and livestock grazing. Introduced annual grasses are typically the dominant plant species. These include wild oats, soft chess, ripgut brome, red brome, wild barley, and foxtail fescue. Common forbs include filaree, turkey mullein, clovers, bur clover, popcorn flower, and California poppy. Many of the annual grassland communities with restrictive soil layers support vernal pools. Vernal pools are seasonal wetlands that support unique plant and animal communities.

II. Perennial grassland habitats generally occur in two forms in California: coastal prairie, found in areas of northern California under maritime influence, and relics in the valley grasslands now dominated by annual grasses and forbs. Perennial grasslands are dominated by perennial grass species such as California oatgrass, Pacific hairgrass, sweet veltgrass and purple needlegrass.

The native grasslands likely consisted of climax stands of perennial bunchgrasses, such as purple needlegrass, on wetter sites and annual species comprising climax communities on drier alluvial plains. In annual grasslands today, plant succession does not occur in the classical sense. Species composition is greatly influenced by seasonal and annual fluctuations in weather patterns. Annual plants germinate with the first fall rains, growing slowly during winter and more rapidly in the spring. Livestock grazing favors the growth of low-stature, spring-maturing forbs, such as filaree, and summer annuals, such as turkey mullein. Because these are important food plants for many wildlife species, proper levels of livestock grazing are generally beneficial in annual grassland habitats. In the absence of livestock grazing, annual grassland habitats are often dominated by tall, dense stands of grasses such as ripgut brome, wild oats, medusa head, and annual ryegrass.

Historically, factors that have affected perennial grassland habitats on the north coast include the

introduction of non-native annual plant species, increased grazing pressure, elimination of frequent fires, and cultivation. Heavily grazed perennial grassland dominated by annual grasses returns to perennial species under reduction in grazing fairly readily.

III. 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. Typical reptiles found in annual grasslands include western fence lizard, common garter snake, and western rattlesnake. Mammals include black-tailed jackrabbit, California ground squirrel, Botta's pocket gopher, western harvest mouse, California vole, badger, coyote and San Joaquin kit fox. Common birds known to breed in annual grassland include burrowing owl, short-eared owl, horned lark, and western meadowlark. This habitat also provides important foraging habitat for turkey vulture, northern harrier, American kestrel, black-shouldered kite, and prairie falcon. Perennial grassland similarly provides habitat for many of these same species and others, most notably in the north coast, Roosevelt elk.

Shrub Dominated Habitats

Shrub dominated habitats include alpine dwarf-shrub, montane chaparral, low sage, sagebrush, bitterbrush, mixed chaparral, Chamise-redshank chaparral, and coastal scrub (refer to "A Guide to Wildlife Habitats of California").

I. Alpine dwarf-shrub, montane chaparral - These shrub habitats generally occur in higher elevation areas, above 3,000 feet. Alpine dwarf-shrub habitats are low graminoid and forb communities with an admixture of dwarf shrubs. The perennial herbs or dwarf shrubs are usually less than 18 inches tall. Birds common in this habitat include blue grouse, rufous hummingbird, mountain bluebird and gray-crowned rosy finch. Mammals in this habitat include the Mount Lyell shrew, broad-footed mole, pika, white-tailed jackrabbit, yellow-bellied marmot, Belding's ground squirrel, northern pocket gopher or mountain pocket gopher.

Montane chaparral varies markedly throughout California. Species composition changes with elevational and geographical range, soil type, and aspect. Species charcterizing this habitat include whitethorn ceanothus, snowbrush ceanothus, greenleaf manzanita, pinemat manzanita, hoary manzanita, bitter cherry, huckleberry oak, sierra chinkapin, juneberry, fremont silktassel, Greene goldenweed, mountain mahogany, toyon, sumac and California buckthorn. Montane chaparral provides habitat for a wide variety of wildlife. Numerous rodents inhabit chaparral. 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. 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. 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. 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.

III. Low sage, sagebrush, bitterbrush - These shrub habitats generally occur in eastern and northeastern California. Low sagebrush communities are generally restricted to elevated arid plains along the eastern flanks of the Sierra Nevada, from Inyo County northward through Modoc and Siskiyou Counties. The subalpine stage dominated by black sagebrush is especially well developed in the White and Inyo Mountains. Stands dominated by low sagebrush are perhaps best developed in forest openings on the Modoc Plateau. Excluding species dependent on ponds, lakes, marshes, and cliffs commonly found in northeastern California, 28 species of terrestrial vertebrates have been reported that find conditions optimum for breeding in typical stands of low sage, including chukar, burrowing owl, rock wren, and pronghorn. An additional 37 species find this habitat suitable for breeding in low sage including sage grouse, mourning dove, and kit fox. In addition, several species of raptors find ideal hunting grounds in stands of low sagebrush. These stands tend to lose their snow cover earlier in spring than surrounding habitats; thus they provide an especially important source of new, green forage for pronghorn and mule deer.

Sagebrush stands are typically large, open, discontinuous stands of big sagebrush of fairly uniform height. The sagebrush habitat is a discontinuous strip along the east and northeast edge of California. The sagebrush habitat is very important to wildlife. It is a major winter-range type for migratory mule deer, and many herds summer in sagebrush-ponderosa pine complexes at middle and high elevations. The sagebrush and its included low sagebrush and bunchgrass types are the principal habitats for pronghorns. The sage grouse is dependent on various successional stages of the type all year. It is also occupied by jackrabbits, cottontail rabbits, ground squirrels, least chipmunk, kangaroo rats, wood rats, pocket mice, deer mice, grasshopper mice, sagebrush vole, and the California bighorn sheep. Birds of the sagebrush type include chukar, black-billed magpie, gray flycatcher, pinyon jay, sage thrasher, and several sparrows, and hawks. Maintenance of this habitat is essential for many of these species. Some can benefit from the increased diversity and forage created by careful use of fire, mechanical brush management, seeding, or grazing.

Bitterbrush is found on flats and slopes with deep, well-drained, rapidly permeable soils having a slightly acid reaction (pH 6.0 to 7.0). For antelope bitterbrush the summers are warm and the winters very cold. For desert bitterbrush the summers are hot and the winters somewhat milder. Bitterbrush is highly digestible and contains desirable levels of moisture, calcium, phosphorus, and fat. It tolerates considerable browsing. Mule deer, pronghorn, cattle, sheep, and horses favor its leaves and twigs. The minimum level of crude protein required in mule deer diets is 6 to 7 percent. Antelope bitterbrush exceeds that level, even in winter when it is especially important in the deer diet. It exceeds 17 percent crude protein during the period of rapid growth in early June. Many species of birds, rodents, and insects use seeds. Birds also eat the loopers and tent caterpillars that feed on the vegetative parts of bitterbrush. Some of the more characteristic wildlife species found in bitterbrush habitat include the western fence lizard, gray flycatcher, Brewer's blackbird, green-tailed towhee, jackrabbits, least chipmunk, Belding's ground squirrel, kangaroo rats, and badger.

III. Mixed chaparral, Chamise-redshank chaparral, and coastal scrub - These shrub habitats generally occur from the Cascades and western slopes of the Sierra Nevadas to the coast. Wildlife species found in chamise-redshank chaparral are also found in mixed chaparral, montane chaparral, or coastal scrub and in shrubs beneath several woodland and forest types. The primary land management consideration is selection of alternative fire management treatments. Long-term fire suppression can lead to stand senescence and declines in deer, small mammals, birds, and reptiles. Most animal populations reach peak densities in the first two or three decades, frequently 1 to 15 years, after a fire. Repeated fires at short intervals could favor crown-sprouting shrubs over obligate seed sprouters. Either management extreme could have long-term impacts on wildlife through changes in nutrient availability, soil quality or vegetation composition, structure, and recovery time. Prescribed burning can be an effective management tool, but the effects vary with season of burn. Post-fire herbs may be important in immobilizing nitrogen within the chaparral system. Protecting these herbs from grazing may be important for effective long-term habitat maintenance. Populations of most small vertebrates decline sharply or are eliminated when chaparral is converted to grassland. Active and passive chaparral management programs must tailor management prescriptions to specific site characteristics and project goals.

IV. Wildlife Considerations - California chaparral refers to dense stands of shrubby plants dominated by broadleaf and narrowleaf nondeciduous species. Most are sprouters. Regenerative characteristics include prolific seed production, rhizomes, and sprouting from crowns following top-kill, as from fire. Of all the habitat management techniques used on brushlands today, only two occurred as natural components in ecosystem development: herbivory and fire. Cultural practices used include mechanical tree and shrub removal or manipulation, herbicides, prescribed burning, seeding, and fertilizing. Their relative value as habitat management techniques varies with vegetation type. Integrative management, i.e., using a variety of techniques (grazing, prescribed burning, mowing, herbicides) in sequential or spatial pattern or design to accomplish habitat objectives, is beyond this standard. Such detailed planning is intimately site-specific, extremely complex, and requires creativity and a thorough understanding of the potential plant responses to each technique.

Following is a discussion of rangeland practices and their potential as tools for wildlife habitat

management (Wildlife Habitat Management of Forestlands, Rangelands, and Farmlands, 1998):

A. Strategic grazing (livestock are used as a manipulative tool to create specific habitat conditions) - This is suitable technique for chaparral and mountain shrub habitats.

B. Environmental protective grazing (livestock are cautiously managed and strictly controlled to protect fragile environments and prevent overuse of wildlife habitats) - This is suitable technique for chaparral and mountain shrub habitats.

C. Fire (prescribed burning) - has good potential in chaparral but only moderate potential for mountain shrub habitats.

D. Woody plant control (mechanical, herbicide) - Mechanical has good potential for both chaparral and mountain shrubs, special care must be taken to protect against erosion. Herbicide use has only moderate potential for shrub habitat management.

E. Disking - Disking is of moderate use for chaparral and low potential for mountain shrub.

F. Reseeding - Is of moderate use for chaparral and good potential for mountain shrub habitats.

G. Fertilizing - Fertilizing has low potential for management in chaparral and mountain shrub habitats.

Desert Habitats

Desert habitats include desert succulent scrub, desert scrub, alkali desert scrub, and desert wash (refer to "A Guide to Wildlife Habitats of California"). Desert riparian is discussed under Riparian Habitats.

I. Desert succulent shrub - Desert succulent shrub habitats typically are low, open shrublands which include succulents such as ocotillo, Mojave yucca, desert agave, buckhorn cholla, teddybear cholla, branched pencil cholla, beavertail pricklypear, grizzlybear pricklypear, hedgehog barrel cactus, barrel cactus, fishhook cactus, hedgehog cactus, and saguaro. Desert succulent shrub habitats have greater flora diversity and structural complexity than most surrounding areas. These characteristics result in greater animal densities and more wildlife species than in adjacent habitats.

II. Desert scrub - Desert scrub is the most widespread habitat in the California deserts. They are found throughout the Mojave and Sonoran Deserts. Desert scrub habitats are open, scattered assemblages of broad-leaved evergreen or deciduous microphyll shrubs. Canopy cover is generally less than 50 percent, usually much less. Bare ground is often found between plants. Creosotebush is often a dominant. Desert scrub habitats generally have low species diversity, however many plant species are found in the habitat. Desert scrub habitats support a variety of wildlife species. Presence of standing water in winter and growth of herbaceous plants in spring, provide foraging areas and food for species in these seasons. Primary resident wildlife species are reptiles or rodents, however other animals are represented. Typical species include Couch's spadefoot toad, desert tortoise, a variety of lizards and snakes including desert iguana, and common kingsnake, black-throated sparrow, various pocket mice and kangaroo rats, kit fox, coyote and bobcat.

III. Alkali desert scrub - Alkali desert scrub habitats occur in California throughout the Mojave Desert, parts of the Colorado Desert, parts of northeastern California within the Great Basin, and in the southern San Joaquin Valley. Examples of the halophytic phase of alkali scrub are common in California deserts, but are scattered and usually associated with dry lakes and flood plains of rivers such as the Mojave, Colorado, and Amargosa. Alkali scrub plant assemblages (primarily chenopods) are generally subdivided into two phases: xerophytic and halophytic. Some of the primary perennial shrub and subshrub species of the halophytic phase of alkali scrub include arrow-weed, black greasewood, alkali goldenbush, species of kochia, iodinebush, alkali rubber rabbitbrush, species of seablite and species of saltbush and saltcedar. Plant species of the xerophytic phase include various species of shrubby saltbushes, especially allscale, desert holly, fourwing saltbush, Nuttall saltbush, big saltbush, Parry saltbush, shadscale, Torrey salt bush, and western Mojave saltbush. Characteristic wildlife species of the shadscale (xerphytic) phase of alkali scrub include the pallid kangaroo mouse, chisel-toothed kangaroo rat, zebra-tailed lizard, and the San Emigdio blue butterfly, whose host plant is fourwing saltbush. Characteristic species of other aspects of alkali scrub habitat are the Mojave ground squirrel, zebra-tailed lizard, and long-nosed leopard lizard.

IV. Desert wash - Desert wash habitats are characterized by the presence of arborescent, often spiny, shrubs generally associated with intermittent streams (washes) or drier bajadas (alluvial deposits adjacent to washes). Plants comprising desert wash habitats generally are taller and denser than those of surrounding desert habitats. The composition of desert wash plant communities depends on variables such as latitude, elevation, and precipitation. Desert wash habitats are generally found in the Mojave and Sonoran Deserts in southern California. Canopy species typically found in washes include blue paloverde, littleleaf paloverde, desert ironwood, smoketree, catclaw acacia, mesquite, and screwbean mesquite. Desert wash habitats, such as, paloverde and desert ironwood associations, are important to wildlife populations. Such habitats support more bird species at higher densities than other desert habitats with the exception of riparian. The dense shrubbery also provides food and cover for other wildlife forms, such as the desert tortoise.

V. Wildlife Considerations - All hot deserts are fragile in their response to overgrazing or fire. Hot deserts did not evolve with grazing pressure by large herbivores, except for scattered populations of mule deer, pronghorns, or bighorn sheep. Fuel loads are relatively low, so fire frequently was low.

Woodland Habitats

Woodland habitats include valley oak woodland, blue oak woodland, blue oak-foothill pine, coastal oak woodland, montane hardwood, aspen and eucalyptus (refer to "A Guide to Wildlife Habitats of California").

I. Valley oak woodland - This habitat varies from savanna-like to forest-like stands with partially closed canopies, comprised mostly of winter-deciduous, broad-leaved species, primarily valley oak. 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. Stands of valley oaks are found on deep sills on broad ridgetops in the southern Coast Range. Where this type occurs near the coast, it is usually found away from the main fog zone. These woodlands provide food and cover for many species of wildlife.

II. Blue oak woodlands - Blue oak woodlands occur along the western foothills of the Sierra Nevada-Cascade Ranges, the Tehachapi Mountains, and in the eastern foothills of the Coast Range, forming a nearly continuous ring around the Central Valley. The habitat is discontinuous in the valleys and on lower slopes of the interior and western foothills of the Coast Range from Mendocino County to Ventura County. Research on wildlife use in blue oak woodlands of the western Sierra Nevada indicates that 29 species of amphibians and reptiles, 57 species of birds, and 10 species of mammals find mature stages of this type suitable or optimum for breeding, assuming that other special habitat requirements are met. Acorns buried by scrub jays, yellow-billed magpies, western gray squirrels and California ground squirrels are more likely to germinate because they root better and are less likely to be eaten.

III. Coastal oak woodland - Coastal oak woodlands are common to mesic coastal foothills of California. They are extremely variable. The overstory consists of deciduous and evergreen hardwoods, mostly oaks 15 to 70 ft tall, sometimes mixed with scattered conifers. In mesic sites, the trees are dense and form a closed canopy. In drier sites, the trees are widely spaced, forming an open woodland or savanna. The understory is equally variable. In some instances, it is composed of shrubs from adjacent chaparral or coastal scrub, which forms a dense, almost impenetrable understory. More commonly, shrubs are scattered under and between trees. Where trees form a closed canopy, the understory varies from a lush cover of shade-tolerant shrubs, ferns, and herbs to sparse cover with a thick carpet of litter. When trees are scattered and form open woodland, the understory is grassland, sometimes with scattered shrubs. The interrelationships of slope, soil, precipitation, moisture availability, and air temperature cause variations in structure of coastal oak woodlands. These factors vary along the latitudinal, longitudinal and elevational gradients over which coastal oak woodlands are found. Coastal oak woodlands provide habitat for a variety of wildlife species. At least 60 species of mammals may use oaks in some way. Over 110 bird species have been observed during breeding season in California habitats where oaks form a significant part of the canopy or subcanopy. Quail, wild turkey, squirrels, and deer may be so dependent on acorns in fall and early winter that a poor acorn year can result in significant declines in their populations. Therefore,

many wildlife managers are concerned over the continuing loss of coastal oak woodland habitats.

IV. Montane hardwood - A typical montane hardwood habitat is composed of a pronounced hardwood tree layer, with an infrequent and poorly developed shrub stratum, and a sparse herbaceous layer. Bird and other animal species characteristic of the Montane Hardwood habitat include disseminators of acorns (scrub and Steller's jays, acorn woodpecker, and western gray squirrel) plus those that utilize acorns as a major food source - wild turkey, mountain quail, band-tailed pigeon, California ground squirrel, dusky-footed woodrat, black bear, and mule deer. Deer also use the foliage of several hardwoods to a moderate extent. Many amphibians and reptiles are found on the forest floor. Among them are Mount Lyell salamander, ensatina, relictual slender salamander, western fence lizard, and sagebrush lizard. Snakes include rubber boa, western rattlesnake, California kingsnake, and sharp-tailed snake.

V. Wildlife considerations - The following recommendations can benefit wildlife in oak woodlands (Proceedings of the Symposium on the Ecology, Management, and Utilization of California Oaks, 1980).

A. Concentrate on the feeding and nesting requirements of breeding birds, as adequate provision for them will likely satisfy the other needs of birds in oak woodlands, including those of migrants and winter residents.

B. Maintain mixed-species, uneven-aged stands, especially allowing for live oak retention.

C. Provide a continuing supply of large, old trees, especially those with a good record of high acorn production.

D. Manage for a mean annual production of at least 100 lbs. of acorns per acre.

E. Provide an ample shrub layer where one occurs in existing oak stands, and consider the possibility of establishing shrubs in stands from which they were removed in the past.

F. Consider needs of oak-using species from different, adjacent habitat types.

G. Maintain a 25 to 50 percent canopy cover in oaks.

H. Maintain a basal area of 200 to 2000 ft^2 per each 40 acres.

I. Maintain a mixture of age classes including older, more prolific seeders.

J. Disperse oaks in 0.5 to 5 acre aggregations.

VI. Aspen - Mature stands of quaking aspen usually have relatively open canopies, often shared with other deciduous trees and a few conifer species, typically pines. The open nature of the stands results in substantial light penetration to the ground. Therefore all stands have a herbaceous understory with about half maintaining a tall shrub layer. Although no wildlife species is totally dependent on habitats dominated by aspen, this cover type adds significantly to the richness of the wildlife in areas where aspen occurs. The habitat typically has a shrubby ecotone with adjacent meadows. This and the shrub understory within stands provide nesting cover for several species that might otherwise be scarce or absent. The mesic sites that permit aspen to establish also result in higher insect production compared to adjacent forests or shrublands. Such insect production, together with a high rate of fungal infection of trees, is thought to account for the greater variety and abundance of birds in aspen habitats than in adjacent forests and shrublands. Aspen stands are habitats favored by a variety of cavity-nesting birds, such as bluebirds, sapsuckers, downy woodpeckers, and chickadees. Snags are important to cavity nesters in these stands, but live aspens are easily and therefore commonly drilled by excavating species. On the eastern slopes of the Sierra Nevada, aspen stands adjoining sagebrush and other shrub habitats apart from forested sites often provide nesting cover for northern goshawks.

VII. Eucalyptus - Eucalyptus habitats range from single-species thickets with little or no shrubby understory to scattered trees over well-developed herbaceous and shrubby understory. In most cases, eucalyptus forms a dense stand with a closed canopy. Stand structure for this habitat may vary considerably because most eucalyptus have been planted into either rows for wind protection or dense groves for hardwood production and harvesting. Eucalyptus is often found in monotypic stands. Characteristic wildlife species of this

habitat include crow, raven, barn owl, and red-tailed and red-shouldered hawks. Eucalyptuses are important as roosts, perches, and nest sites for a number of bird species, particularly raptors. Those eucalyptus with stringy bark or a tendency for rapid deposition of litter, create micro habitats for a number of small vertebrate species, including alligator lizard, gopher snake, and woodrat.

Forest Habitats

Forest habitats consist of conifers or evergreen needle-leaved trees including redwood, Klamath mixed conifer, Douglas-fir, subalpine conifer, red fir, lodgepole pine, Sierran mixed conifer, white fir, ponderosa pine, Jeffrey pine, closed-cone pine-cypress, montane hardwood-conifer, pinyon-juniper, and juniper (refer to "A Guide to Wildlife Habitats of California").

I. Redwood - Redwood habitats are distributed along the coast of California ranging from the California-Oregon border to San Luis Obispo County. It is a composite name for a variety or mix of conifer species that grow within the coastal influence zone <31 miles from the coast. In the north coast region of California, within 2.5 miles from the coast, the redwood habitat consists of redwood, Sitka spruce, grand fir, red alder, and Douglas-fir. Western redcedar and western hemlock are also associates but seldom comprise the major portion of a stand. Redwood becomes dominant along coastal areas approximately 2 to 10 miles from the ocean where Douglas-fir, red alder, and grand fir are its major associates. Further inland, Douglas-fir becomes dominant with tan oak and madrone as the major associates.

Redwood habitats provide food, cover, or special habitat elements (for at least one season) for 193 wildlife species. This total is comprised of 18 amphibians, 12 reptiles, 109 birds, and 54 mammals. Of these species, 18 are considered harvest species. A variety of sensitive species are found in the habitat. species such as the red-legged frog, ensatina, osprey, ringtail, fisher, and marbled murelet show a relatively high preference for various redwood habitat phases and stages. To a minor extent, sensitive species such as the peregrine falcon, pileated woodpecker, spotted owl, and northern flying squirrel can be found, but are usually vagrants in the habitat. The bald eagle can also be found in the habitat, but is usually not a common visitor.

II. Subalpine conifer, red fir, lodgepole pine, Douglas-fir, Klamath mixed-conifer, Sierran mixed-conifer, white fir, ponderosa pine, Jeffrey pine, closed-cone pine-cypress, montane hardwood-conifer - Several habitats are included in this group of coniferous forest habitat types (refer to "A Guide to Wildlife Habitats of California"). They are complex and commonly commercial timber harvest is a primary or significant use off these habitats. Timber Harvest Plans are required before harvest and specific practices are required, including wildlife habitat management or mitigation elements. Ponderosa pine habitat will be discussed here as an example. Wildlife considerations will be consolidated for all the habitats at the end of the Forest habitats section.

Ponderosa pine habitat is found on suitable mountain and foothill sites in much of California, except in the immediate area of San Francisco Bay, in the north coast, south of Kern County in the Sierra Nevada and east of the Sierra Nevada crest. The ponderosa pine habitat is replaced by Jeffrey pine on the Mojave Desert slopes of the Transverse Range and often on the eastern side of the Peninsular and Coast Ranges. The ponderosa pine habitat includes pure stands of ponderosa pine as well as stands of mixed species in which at least 50% of the canopy area is ponderosa pine. Associated species vary depending on location in the state and site conditions. Typical tree associates include white fir, incense-cedar, Coulter-pine, Jeffrey pine, sugar pine, Douglas-fir, bigcone Douglas-fir, canyon live oak, California black oak, Oregon white oak, Pacific madrone and tanoak. Associated shrubs include manzanita, ceanothus, mountain-missery, Pacific dogwood, hairy yerba-santa, yellowleaf silktassel, bitter cherry, California buckthorn, poison-oak, and Sierra gooseberry. Grasses and forbs include slimleaf brome, Orcutt brome, carex, smallflower melicgrass, bluegrass, bottlebrush squirreltail, bedstraw, brackenfern, bush morning-glory, rhomboid clarkia, Child's blue-eyed mary, shrubby eriastrum, splendid gilia, Sierra iris, whisker-brush, Inyo bush lupine, summer lupine, purple nightshade, streptanthus, gooseroot violet, and wildiris.

Ponerosa pine sometimes is a transitional or migratory habitat for deer and can be extremely important to deer nutrition in migration holding areas. A mixture of early and late successional stages closely interspersed probably will provide good general wildlife habitat, but riparian zones,

deer migratory routes and holding areas require special consideration during management planning. The Sierra red fox, Siskiyou mountain salamander and Shasta salamander are found in the habitat.

III. Pinyon-juniper, juniper - Juniper habitats in California are roughly described by the range of western juniper in northeastern California south to where pinyon pine becomes an important associate. This area includes northeastern California south and east to northern Inyo County. The pinyon-juniper habitat is found in the Sierra Nevadas, Mojave Desert, and in the San Jacinto and Santa Rosa Mountains. Juniper habitats are characterized as woodlands of open to dense aggregations of junipers (California, Utah or western) in the form of arborescent shrubs or small trees. Pinyon-juniper habitat typically is an open woodland of low, round crowned, bushy trees that are needle-leaved, evergreen, and depending on site suitability, range from less than 30 ft in height. Juniper berries are an important food source for wintering birds. Juniper foliage is also consumed by several mammals and may be an important food source for some of these animals especially during harsh winters. Characteristic species of the pinyon-juniper habitat include pinyon mouse, bushy-tailed woodrat, pinyon jay, plain titmouse, and bushtit. Both pinyon nuts and juniper berries are important food sources and many wildlife species serve as dispersal agents for these plants.

IV. Wildlife Considerations - Managing forestlands for wildlife primarily involves maintaining or creating forest environments that satisfy the habitat requirements of the species under consideration (Research and Management Techniques for Wildlife and Habitats, 1994) . Factors that affect the abundance and distribution of forest animals include the age, size, shape, plant composition, and internal structure of forest stands, and the distribution of forest stands across the landscape. Wildlife management in forest ecosystems, therefore, requires an understanding of species-specific habitat requirements, and control of human activities and some of the environmental factors (biological and physical) that modify forest vegetation. It also requires an understanding of the effects and periodicity of environmental factors that cannot be controlled. Decisions about how to use natural resources on forestlands often are influenced greatly by laws, politics, social pressures, and the philosophy of the agency or individual controlling the land. Thus, managing forestlands for wildlife is an activity that frequently involves meshing technical knowledge and skills with societal demands and interests. Silvicultural practices implemented to provide a sustained yield of wood products largely determine the structure and composition of vegetation in most managed forests. Following are some management techniques or considerations for wildlife habitat improvement:

A. Mechanical site preparation - Slash remaining after a clearcut harvest frequently is chopped to promote the development of a new crop of seedling trees or to reduce fire hazard. Bulldozers with a sharp blade on the front (a K_G blade) sometimes are used to push over residual trees with no commercial value. The layer of organic matter (i.e., leaves, twigs, and other plant remains) sometimes is mixed with the mineral soil by some mechanical action to prepare the soil for planting or improve the seedbed for natural regeneration. This process is called scarification. Typically, intensive mechanical site preparation reduces overall floral diversity by killing the rootstock of some plant species. Mechanized crushers also have been used to prepare sites for planting. Reduction of woody debris by this method can stimulate resprouting of palatable shrubs, which may increase the quantity and quality of food for big-game animals. Removal of coarse woody debris from cutting units does not benefit all animals. Dead wood (snags and logs) and partially dead trees provide habitat elements for numerous birds and mammals. The role and management of dead wood and defective trees in forest systems are discussed later.

B. Prescribed burning - Fire played an important role in altering the structure, composition, and growth of vegetation in many forest ecosystems in the past. Prescribed burning with light fires applied under specific conditions reduce surface fuel loads (i.e., amounts of combustible woody debris) and thereby reduce the chance of wild fires or simply eliminate slash resulting from harvest. Surface fires also prepare the soil for germination of pine seeds, thin pine thickets, and control brush and hardwood shrubs. Because of these effects, prescribed fire has gained popularity as a method for preparing a site for planting or natural regeneration (either after a clearcut or before a selection cut) and for meeting a variety of silvicultural objectives during the growth of a stand. Changes in forest vegetation caused by prescribed fires are beneficial to some species of wildlife. Burning after clearcutting in the western and southern United States often improves the

quality of the site for big-game animals by reducing the depth of slash (recommended to be <0.5 meters) and by stimulating the growth of palatable forage plants. The inlfuences of prescribed fires are not always positive. Prescribed fires can reduce the density of snags and defective trees and thus potentially reduce the abundance of cavity-nesting birds, although this effect is likely transitory because some trees are killed by prescribed fires. Reduction of understory shrubs, a goal of some prescribed burns, has a negative influence on species associated with this kind of vegetation. Also, if prescribed burns are to frequent or intense, production of forage and browse plants, usually high after burning, can be reduced.

C. Thinning - Most thinning operations temporarily open the canopy, thereby enhancing the growth of understory plants. Thus, thinnings can increase forage for forest ungulates, but not as effective as clearcuts or selective cuts. Thinning to provide understory forage plants may be especially important in dense, even-aged stands where understory plants often are suppressed for long periods. Changes in understory vegetation and tree density brought about by thinning also can affect the abundance and composition of forest birds. In general, bird species that use open forests or edges thrive in thinned stands, whereas species that inhabit dense forest generally avoid thinned stands, at least until the canopy closes.

D. Mast-producing trees - Production of mast is critical for many species of wildlife. For example, black bears heavily use mast produced by oaks as a source for food. Oaks usually make up a relatively small percentage of the trees in the area and should be protected and favored during silivicultural operations. Oaks must be of a sufficient diameter and age to maximize acorn production. Thus, if oaks are harvested under an even-aged management system, rotation lengths must be at least 70-100 years to ensure mast production for a period of years. Timber single-tree selection cuts should be avoided if oaks are to be retained over time because other, more shade-tolerant species, if present, will tend to replace oaks after several cutting cycles. Also, retaining oaks in both the "white oak" and "black oak" groups is important to increase the likelihood of acorn production each year. White oaks produce seeds each year, whereas, black oaks require 2 years to develop acorns.

E. Dead wood in forest ecosystems - Dead wood in forest ecosystems frequently is an important element of the habitat of many animals. For example, standing dead trees, often called snags, and live trees with dead tops or branches are important to many species of animals because they provide sites for nesting, roosting, foraging, and other activities. In some forests, birds that nest in cavities in snags and in cavities in living trees make up as much as 30-45% of the total birds in the area. The degree of dependence of animals on cavities varies among species but can be high. In forests of Oregon and Washington, for example, "snags are used by nearly 100 species of wildlife of which at least 53 (39 birds and 14 mammals) are cavity-dependent".

1. Snags - Snags are the most important substrate for cavity-nesting animals in western coniferous forests, although trees with dead tops also are important in some areas. The number and characteristics of snags vary as the stand matures and are the product of the interaction of tree mortality and snag deterioration. The pattern of snag abundance in Douglas-fir forests in the Pacific Northwest probably typifies many western coniferous forests. Young (35 years old) stands of Douglas-fir produce many small (<19 cm dbh) snags, whereas older stands produce fewer but larger snags (>/=48 cm dbh). Large snags remain standing longer than small snags because they deteriorate more slowly. The size of snags used most frequently by animals varies among forest types, but snags >38 cm dbh usually are preferred as nest sites. Snags of all sizes show some evidence of use by foraging woodpeckers, although large snags (>38 cm dbh) are used more frequently. Snags in all stages of decay are used by animals. Three general rules can be applied to snags:

a. Leave all hard snags (i.e., those in the early stages of decay), damaged and dying trees, and defective (cull) trees, except those considered safety hazards. Hard snags or cull trees should be left for recruitment of future soft snags.

b. Select snags and defective (cull) trees for retention that meet or exceed the minimum size requirements for nesting (usually woodpeckers). Place emphasis on larger diameter trees because the larger trees remain standing longer, retain bark longer, and support a larger variety of wildlife.

c. If tradeoff must be made, retain hard snags instead of soft snags, large diameter (>38 cm dbh) snags instead of small diameter snags, tall (>18 m) snags instead of short snags, and snags with greater bark cover instead of snags with little bark cover.

2. Logs - Dead woody materials on the ground, especially large logs, store energy and some nutrients, serve as sites for nitrogen fixation, provide favorable moisture condition for the growth of young trees, and protect the soil from surface erosion. Large logs are important to many species of forest animals. Woodpeckers eat insects that inhabit logs, and numerous species of mammals use logs as sites for reproduction, foraging, and cover. Forest-dwelling amphibians also often are found in association with decaying logs on the forest floor. It is important to retain logs >30 cm in diameter at the large end and >6m long, and at least five large, uncharred logs per hectare for wildlife.

F. Den trees - Management for cavity-using animals should focus on the retention of live trees with cavities, sometimes called "den trees", in forests where snags do not provide adequate habitat. Snags are not as important to cavity-nesting animals in many deciduous forests as they are in western coniferous forests, because many cavities in deciduous forests are excavated or occur naturally in live trees, or dead portions of live trees.

G. Nest boxes - Placing nest boxes in forest stands can satisfy the nest hole requirements of some secondary cavity-nesting animals. Some species of birds and mammals actually use nest boxes more frequently than natural cavities when boxes are available. Nest boxes can be used, therefore in intensive management of one or a few species (e.g., American kestrels, eastern bluebirds, wood ducks). Nest boxes do not, however, substitute for snags in all ways (e.g., providing habitat for the same kinds of insects and arthropods). Also, erecting and maintaining nest boxes on large areas is impractical.

H. Forest fragmentation - Tracts of the oldest age classes of timber in western coniferous forests and elsewhere are being reduced and fragmented by timber management. Fragmentation of forestlands into small patches changes the quality of the forest environment for wildlife in both obvious and subtle ways. Fragmentation reduces the size of forest patches, changes the types and quality of food and cover, alters temperature and moisture regimes, and potentially exposes animals to increased predation, competition, parasitism, and exploitation by humans. Because of these changes, small and isolated patches of forest generally support fewer animal species than do large forest tracts. Species that can inhabit small forest tracts may not survive for long periods because small and isolated populations are at greater risk of local extinction from catastrophes, demographic variability, or genetic deterioration. Forest patches of appropriate size, stage of development, and distribution must be maintained on a landscape scale if the full complement of native animal species is to survive in a given region or forest type. Specific guidelines for managing fragmented forests for wildlife are difficult to develop, and they likely would differ among forest types and regions. Some general guidelines are possible, however, and several recommendations have been proposed:

1. Maintain or plan for the largest contiguous blocks of forest possible. The number of bird species that occupy forest patches is positively correlated with patch size. Ideally, the area maintained should be large enough so that adequate forestland remains for wildlife after natural disturbances (e.g., fires, storms, floods).

2. Minimize distances among patches of forest in the landscape to facilitate movement of animals among patches. The animals that recolonize forest islands must come from within the island or from other forest patches. For this reason, small patches are likely to be more valuable as habitat for forest animals if they are close to a large patch.

3. Provide corridors to facilitate movement of animals among patches when patches are separated by considerable distances. Corridors could operate at several different scales and could link, for example, national forests and national parks within a geographic province, relatively large patches of a particular type of forest environment within a national forest, or relatively small patches of forest that collectively constitute the habitat needs of a single animal or pair of animals.

4. Retain or manage for patches that maximize the ratio of forest interior to forest edge. The portions of a forest patch that are most useful to animals that depend on forest interior might be >300m from an edge. Long, narrow patches (e.g., <600 m wide) might provide no habitat for these species.

I. Old growth - Efforts to retain old-growth stands in managed forests must begin with a definition of old growth. Definitions should be specific to a particular forest type and include a. composition of plant and animal species, b. vegetative structure, including sizes (ages) and densities of living and dead trees (standing and fallen), and the number and nature of canopy layers, and c. minimum stand size (area) as related to specific ecological functions, particularly those concerning wildlife and fish habitat. Decisions about how much old growth to retain, and the size and spatial arrangement of old-growth stands, should be based in part on the needs of animals that depend on old-growth stands for survival.

J. Riparian zones - Riparian zones are areas immediately adjacent to streams, rivers, ponds, lakes, and wetlands. Many forest animals use riparian vegetation as an important feature, and some animals, such as the beaver, profoundly influence the nature of streams and nearby vegetation. Even animals that do not depend on riparian zones for survival might use them secondarily, or as travel corridors. Recommendations for managing riparian zones are relatively simple. First, construction of landings, roads, campgrounds, and other facilities in riparian vegetation should be avoided. Second, logging, grazing, or other activities in the riparian zone that would disrupt the integrity of the riparian vegetation and the aquatic system should not occur. Third, erosion within the upland areas should be controlled. It is important to consider protecting forests adjacent to all parts of streams and forested environments around other potentially important aquatic environments (e.g., ponds, seeps, springs). For more specific recommendations for management of riparian areas look under the next section on Riparian Habitat.

Riparian Habitats

Riparian habitats include valley-foothill riparian, desert riparian and montane riparian (refer to "A Guide to Wildlife Habitats of California").

I. 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. 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, buttonbush, and willows. The herbaceous layer may consist of sedges, rushes, grasses, miner's lettuce, Douglas sagewort, poison hemlock, and hoary nettle.

II. Desert riparian - Desert riparian habitats are typically dense groves of low, shrublike trees or tall shrubs to woodlands of small to medium-sized trees. They are usually found adjacent to permanent surface water (e.g., streams, and springs) or in naturally subirrigated areas. Usually there is an abrupt transition between desert riparian and adjacent shorter and more open desert habitats. The vegetation height depends on constituent plant species; willow thickets range from 3-10 feet in height, whereas Fremont cottonwood may exceed 80 feet tall. Dominant canopy species vary. Overstory species include tamarisk, salt cedar, velvet ash, mesquite, screwbean mesquite, Fremont cottonwood, and willows such as Gooding, Hinds, and arroyo. The understory includes smaller plants of the dominant canopy species as well as quailbush, Mojave seablight, desert lavender, seep willow, and arrowhead.

III. Montane riparian areas are found associated with mountain lakes, ponds, seeps, bogs, meadows, rivers, streams and springs. In northwest California along streams west of the Klamath Mountains, black cottonwood is a dominant hardwood. In some areas, it is codominant with bigleaf maple. In either case, black cottonwood can occur in association with dogwood and boxelder. At high elevations, black cottonwood occurs with quaking aspen and white alder. In northeastern California, black cottonwood, white alder and thinleaf alder dominate the montane riparian zone. Oregon ash, willow and a high diversity of forbs are common associates. In the Sierra Nevada, characteristic species include thinleaf alder, aspen, black cottonwood, dogwood, wild azalea, willows and water birch. In the southern Coast Range as well as Transverse and Peninsular ranges, bigleaf maple and California bay are typical dominants of montane riparian habitat. Fremont cottonwood is the most important cottonwood in the Sierra below 1524 m (5000 ft), much of the Coast Ranges and the Transverse and Peninsular ranges.

IV. Wildlife Considerations - Riparian habitats provide food, water, migration and dispersal corridors, and escape, nesting, and thermal cover for an abundance of wildlife, including many species of amphibians, reptiles, birds and mammals. Riparian areas also provide benefits to fish and other aquatic species.

V. Riparian habitat considerations - Floodplains along unconstrained stream channels typically are vegetated with a mosaic of plant communities, the composition of which varies in response to available surface and ground water, differential patterns of flooding, fire, and predominant winds, sediment deposition, and opportunities for establishing vegetation. Riparian zones are so different from one another that generalized animal-to-habitat relationships are difficult to develop for riparian habitats. To do a good planning job with riparian areas, the planner must derive a specific set of relationships for each particular case. Riparian managers should consult both fishery and wildlife biologists when management activites are planned within the riparian zone. The following considerations can be helpful:

A. Species and age composition of vegetation structure can be extremely important. Simple vegetative structure, such as a herbaceous layer without woody overstory or old woody riparian trees without smaller size classes, creates fewer niches for wildlife. The fewer niches there are, the fewer species there are. The quality and vigor of the vegetation can affect the productivity of fruits, seeds, shoots, roots, and other vegetative material, which provide food for wildlife.

B. Increasing the patch size (area) of a streamside vegetation type, increasing the number of woody riparian tree size classes, and increasing the number of species and growth forms (herb, shrub, tree) of native riparian-dependent vegetation can increase species richness and biomass (numbers). Restoration techniques can change the above factors.

C. Plant species are adapted to certain zones along streams or other water bodies, from wettest to driest, and depend on season, frequency, and duration of flooding. For example, in wettest areas species such as cattails, tules, and willows, above that, buttonbush, blue elderberry, mule fat, alder, cottonwood, California sycamore, and black walnut, and at higher floodplain level, coyote brush, valley oak or Oregon white oak.

D. Corridor width - The following considerations may help determine corridor widths (Stream Corridor Restoration: Principles, Processes, and Practices, 1998):

1. Seepage areas and 1st Order Streams -
a. Sponge effect for hydrologic flows, minimizing downstream flooding.
b. Control of dissolved-substance inputs from upland.

2. 2nd to 4th Order stream -
a. Conduit for upland interior species; both sides of stream so species readily crossing floodplain have alternate routes.
b. Control of dissolved-substance inputs from upland.
c. Minimize hillslope and streambank erosion.
d. Sponge effect for hydrologic flows, minimizing downstream flooding.
e. Friction effect, minimizing downstream sedimentation.
f. Protect high habitat diversity and species richness of floodplain.
g. Provide interior habitat for species conduit, as migrating open stream intersects hillslopes causing them to be open habitat.

3. 5th to 10th Order River -
a. Conduit for upland interior species, on both sides of river so species that rarely can cross the floodplain have a route on each side.
b. Provide interior habitat for species conduit, as migrating open river intersects hillslopes causing them to be open habitat.
c. Minimize hillslope and streambank erosion.
d. Shade and logs provide fish habitat where river is adjacent to hillslope.
e. Source of soil organic matter, an important base of the river food chain. f. Shade and logs provide fish habitat where ever river is as it migrates across the floodplain. Incorporate Large Woody Debris (LWD). g. Genetic benefit to upland species that can use habitat continuity to infrequently cross floodplain. h. Sponge effect for hydrologic flows, minimizing downstream flooding. i. Friction effect minimizing downstream sedimentation.
j. Protect high habitat diversity and species richness of floodplain.

k. Conduit for semi-aquatic and other organisms dependent on river channel resources.

E. Another way of determining recommended minimum widths of riparian areas is by the formula: stream width times 5 ft (S_w X 5 ft = Rip) with a minimum width of 25 ft. For sloping lands the buffer area (riparian area plus upland) in forested lands: Buffer width = % slope times 5 ft (%S X 5 ft = buffer) with a minimum of 50 ft and maximum of 150 ft., although under appropriate conditions can be larger.

F. Road construction in riparian zones will lessen the effectiveness of the area as habitat for many wildlife species. This results from both the alteration in the vegetation and in the increased disturbance from traffic along the road. Increased sedimentation from road construction may be detrimental to water quality and hence to aquatic life. Many streams are already paralleled by roads. Road construction probably has a more critical and long-lasting impact on riparian zones than many other management activities.

G. Improper livestock grazing practices in riparian areas can reduce water quality, eliminate streamside shrubs, small trees, and herbaceous cover, cause soil compaction, accelerate erosion, and breakdown streambanks. Proper grazing management should insure welfare of the riparian areas. The heavier and more prolonged the grazing period the more severe will be the impacts. The season or timing of grazing is important, for example, some perennial vegetation needs to grow and store energy before going dormant for the winter months, therefore, grazing earlier in the season may be most beneficial. However, early spring habitat is critical for nesting birds, so it is important to maintain good early season cover for nesting sites.

H. Fencing riparian areas to exclude or manage livestock can enhance wildlife benefits. Livestock grazing may be a useful management tool for maintaining good quality habitat in some situations.

I. Necessary livestock water can be piped outside the riparian zone into troughs to provide water for livestock and reduce impact to riparian areas.

J. Grazing, mowing and burning are common land management practices that can significantly affect the understory. Options for managing these activities include the following:

1. Manage grazing intensity or location to ensure riparian deciduous shrubs are not high-lined.

2. Manage grazing intensity or location to ensure recruitment of young riparian shrubs and trees and to ensure sufficient understory volume for low- and ground-nesting birds.

3. Manage grazing intensity and timing to ensure that direct impacts on ground/low-nesting birds do not occur during breeding season.

4. Mow and burn the groundcover in riparian habitats after the end of breeding season.

K. Control and eradicate, when possible, infestations of invasive non-native plants. Such control is best planned and implemented on a watershed scale, which helps insure against reinvasion.

Urban Habitats

Urban vegetation varies significantly, to some degree depending on location and size of the community or city (refer to "A Guide to Wildlife Habitats of California"). Five types of vegetative structure have been defined: tree grove, street strip, shade tree/lawn, lawn, and shrub cover. Tree groves, common in city parks, green belts, and cemeteries, vary in height, tree spacing, crown shape, and understory conditions, depending on species planted, planting design, and maintenance. Ground cover in these groves ranges from 0 to 90 percent. Street tree strips show variation in spacing of trees, depending on species and design. Both continuous and discontinuous canopies are observed. Most street tree strips are planted in grass, but other ground covers are not uncommon. Shade trees and lawns are typical of residential areas and reminiscent of natural savannas. Lawns are structurally the most uniform vegetative units of urban habitat. A variety of grass species are used, which are maintained at a uniform height and continuous ground cover. Shrub cover is more limited in distribution than the other structural types. Hedges represent a variation of the urban shrub cover type. Species, planting design, and maintenance control the structural characteristics of this type. The juxtaposition of urban vegetation types within cities produces a rich mosaic with considerable edge areas. The overall mosaic may be more valuable as wildlife habitat than the individual units in that mosaic.

Three urban categories relevant to wildlife are distinguished: downtown, urban residential, and suburbia. The heavily developed downtown is usually at the center, followed by concentric zones of urban residential and suburbs. There is a progression outward of decreasing development and increasing vegetative cover. Species richness and diversity is extremely low in the inner city. Rock dove (pigeon), house sparrow, and starling comprise 90 percent of all avian density and biomass. The urban residential zone is characterized by denser and more varied mosaic of vegetation - shade trees, lawns, hedges and planted gardens. This area is inhabited by a variety of birds including scrub jay, mockingbird, and house finch. Mammals may include raccoon, opossum, striped skunk, and fox squirrel. Small creeks have significant impacts on species composition depending on type of riparian vegetation incorporated. Suburban areas with mature vegetation more closely approximate the natural environment. In addition to landscaped gardens and lawns, relatively large tracts of adjacent natural vegetation such as chaparral, grasslands, and oak woodland abound. Wildlife diversity increases while species density decreases and proportionately greater numbers of native species occur. Bird species include wrentits, bushtits, plain titmouse, chestnut-backed chickadee, and California quail. Mammals include black-tailed deer, ringtail cat, black-tailed jackrabbit and fox squirrel. Gopher snake, western fence lizard, and alligator lizard also occur in this zone.

A distinguishing feature of urban wildlife habitat is the mixture of native and exotic plant species. Both native and exotic species are valuable, with exotic species often providing a good source of additional food in the form of fruits and berries.

I. Wildlife Considerations (Research and Management Techniques for Wildlife and Habitats, 1994) - The following are recommendations to enhance wildlife habitat in the urban environment:

A. Try to reduce habitat loss, degradation, and fragmentation.

B. Maintain larger units of wetland habitats and forested stands, and natural heritage or sensitive species areas.

C. Emphasize the unique cover types of larger parcels; otherwise try to increase diversity of ample-sized habitat types and avoid monocultures.

D. Protect and improve units along edges of streams and lakes.

E. Use "planned neglect" and natural succession whenever possible, favor some tangled thickets with snags.

F. Protect or create standing and flowing water with naturalistic edges.

G. Manage the intensity of human usage of public open space, providing a range of areas from large urban wild areas to downtown parks.

CONSIDERATIONS

Wildlife population control (hunting to reduce numbers) which is the responsibility of state and federal wildlife agencies and the landowner may be necessary to protect and maintain certain habitats.

Consider that manipulations of habitat may impact more than the desired kinds of wildlife. These possible effects shall be evaluated and taken into consideration during the planning process.

Consider the problems of habitat fragmentation when using this practice; create large blocks of habitat verses increased edge, which leads to predation and parasitism by some species such as cowbirds.

Consider habitat linkages and habitat corridors when developing upland wildlife habitat.

This practice may be used to promote the conservation of declining species, including threatened and endangered species.

Endangered Species Considerations

Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in

adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

PLANS AND SPECIFICATIONS

Plans and specifications for this practice shall be prepared for each site. Plans and specifications shall be recorded using approved specification sheets, job sheets, technical notes, or narrative documentation in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The purpose of operation, maintenance, and management is to insure that the practice functions as intended over time.

A plan for operation and maintenance of upland wildlife habitat at a minimum shall include monitoring and management of structural and vegetative measures.

Timing of haying and livestock grazing will avoid periods when upland wildlife are nesting, fawning, etc. and will allow the establishment, development, and management of upland vegetation for the intended purpose.

Biological control of undesirable plant species and pests (e.g., using predator or parasitic species) shall be implemented where available and feasible.

REFERENCES

Cited References

A Guide to Wildlife Habitats of California, Kenneth E. Mayer and William F. Laudenslayer, Jr. Editors, California Department of Forestry and Fire Protection, Sacramento, CA 1988 (For updated version of habitats refer to CDFG web site: http://www.dfg.ca.gov/whdab/cwhr/whrintro.html)

Proceedings of the Symposium on the Ecology, Management, and Utilization of California Oaks, General Technical Report PSW-44, USDA, Forest Service, 1980.

Research and Management Techniques for Wildlife and Habitats, Fifth ed., T.A. Bookout, Editor, The Wildlife Society, Bethesda, MD, 1994.

Stream Corridor Restoration: Principles, Processes, and Practices, National Engineering Handbook, Part 653, USDA, Natural Resources Conservation Service, 1998.

Wildlife Conservation Principles and Practices, Richard D. Teague and Eugene Decker, The Wildlife Society, Washington, D.C., 1979.

Wildlife Habitat Management of Forestlands, Rangelands, and Farmlands, Neil F. Payne and Fred C. Bryant, Krieger Publishing Co., Malabar, FL, 1998.

Other References

Establishing Woody Plants for Upland Game Habitat in California, California Dept. of Fish and Game and SCS, Wildlife Habitat Leaflet No. 6, 1977.

Making Farms Attractive for Pheasants, California Dept. of Fish and Game, Game Management Leaflet 3.

Improving Chamise Brushlands for Deer and Other Game, California Dept. of Fish and Game, Game Management Leaflet No. 4.

Water Developments for Upland Game Birds, California Dept. of Fish and Game, Game Management Leaflet 5.

Improving Land for California Valley Quail, California Dept. of Fish and Game, Game Management Leaflet 8.

Atriplex - A Cover Plant for Wildlife, California Dept. of Fish and Game, Game Management Leaflet 11.

Improving Land for Cottontails, California Dept. of Fish and Game, Game Management Leaflet 13.

Raptors of California, 1976, California Dept. of Fish and Game.

Principles of Wildlife Management, Cooperative Extension, Leaflet 2218.

California Big Game and Its Management, Cooperative Extension, Leaflet 2223.

California Upland Game and Its Management, Cooperative Extension, Leaflet 2720.

California Furbearers and Their Management, Cooperative Extension, Leaflet 2721.

California Birds and How to Improve Their Habitat, Cooperative Extension, Leaflet 2707.

Food Habits of California Upland Game Birds, W.E. Grenfell, B.M. Browning, Walter E. Stienecker, Wildlife Management Branch, Administrative Report No. 80-1, April, 1980.

Other Key Practices

Brush Management
Early Successional Habitat Development and Management
Fencing
Field Border
Hedgerow Planting
Pond
Prescribed Burning
Restoration and Management of Declining Habitats
Wetland Wildlife Habitat Management
Wildlife Watering Facility

Job Sheets

Conservation Management of Land for California Valley Quail, CAL-7-N-14000-104.

How to Use Multiflora Rose for Living Fences and Wildlife Cover, 7-L-14000-18.

Kestral (Sparrow Hawk) House Plans and Specifications, CA-499.

Bluebird House Plans and Instructions, CA-500.

Barn Owl Nest Box Plans and Instructions, CA-501

Artificial Perches for Raptors Plans and Instructions, CA-502

Plant and Animal Reference Sheets

Management and Uses of California Blackberry, CA 7-L-20000-461.

Management and Uses of Bladderpod, CA 7-L-20000-409.

Management and Uses of Quailbush, CA 7-L-20000-408.

Management and Uses of Fourwing Saltbush, CA 7-L-20000-485.

Management and Uses of California Sycamore, CA 7-l-20000-487.

Leaflets

Several Plant Reference Sheets have been developed by NRCS and CDFG which may be useful for developing wildlife habitat, such as, "Casa" Quailbush, "Dorado" Bladderpod, and "Marana" Fourwing Saltbush