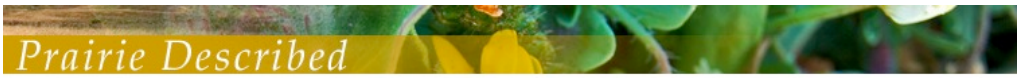
A PROJECT OF THE SONOMA-MARIN COASTAL PRAIRIE WORKING GROUP



ANIMALS

Coastal prairies are home to many grassland-dependent mammals, birds, insects, and reptiles including elk, badgers, pocket gophers, grasshopper sparrows, savannah sparrows, meadowlarks, red-tail hawks, white-tail kites, golden eagles, western fence lizards, skinks, rare butterflies and moths, and a variety of other insects.

There are number of wonderful on-line resources for finding out more about these species. On these pages, we do not try to duplicate the efforts of other species database, but rather to summarize information about each species that is helpful for understanding how each species relies on grasslands for their reproduction and survival. In addition, we also provide some "Fun Facts" that will enhance appreciation of these amazing species.

MAMMALS

TULE ELK (*CERVUS CANADENSIS ANNODES*) – NATIVE

Deer Family (Cervidae)

- Tule Elk is the smallest subspecies of North American elk (*Cervus canadensis*)(Linse 1998)

TULE ELK:

- Is found only in California.
- Historically occurred in the Central Valley and coastal regions of central California (Linse 1998).

Male tule elk at California State Tule Elk Reserve near Tupan, CA. 2008-02-12 Photo by David Jordan. Wikipedia Commons.

- Occurs only in grasslands and marshlands (Linse 2998).

TULE ELK ECOLOGY

- Grazing:

- Tule Elk graze on grasses and forbs, then move to browse (shrubs and trees) as herbaceous plants dry out (Jameson Jr. and Peeters 1988).
- Elk tend to consume a greater amount of forbs than grasses or browse during the year and are unique among other ungulates in their consumption of lichens (Findholt et al. 2004).
- While significant dietary overlap occurs with other local ungulates, Elk favor forbs (with a lower proportion of grass and browse); cattle favor grasses (with a lower proportion of forbs and very little browse), and black-tailed deer favor forbs and browse in roughly equal proportion with a lower proportion of grasses contribution to their diet (Findholt et al. 2004)
- Although grasses are the primary component of their fall diets, Tule Elk eat very little non-native annual bromes, such as Soft Chess (*Bromus hordaceus*) and Ripgut Brome (*Bromus diandrus*) (Gogan and Barret 1995 cited in Howard 1998).

More Fun Facts About Tule Elk

- Male elk shed and grow a new set of antlers each year that can weigh up to 40 pounds. The antlers are made out of bone and as they grow in the spring they are covered with a system of nourishing blood vessels that looks like velvet (National Park Service 2009).

Tule Elk, Lake Pillsbury near Hull Mountain, Mendocino National Forest, Lake County, California. 2010. Crabtree13. http://commons.wikimedia.org/wiki/File:TuleElkPillsbury1.jpg

- The three subspecies of California elk are unique from other North American deer in that they have an upper canine tooth. This tooth was used as the traditional pendant of the Elk's Club (Jameson Jr. and Peeters 1988).
- Tule elk were thought to be a subspecies of the European or Western red deer (*Cervus elaphus*) but mitochondrial DNA indicates the North American elk are more closely related to the Eastern red deer (*Cervus canadensis*) and that the three "subspecies" of elk in California (tule elk, Roosevelt elk, and Rocky Mountain elk) may be races rather than subspecies (Ludt, et al. 2004).
- It is estimated that over 500,000 elk once roamed California. Their numbers plummeted through intensive hunting after the gold rush.
- The state awarded elk complete protection in 1873, 13 years after they went extinct in Marin County and 3 years after they were thought to be extinct statewide (National Park Service 2009).
- The California Department of Fish & Game reintroduced tule elk to Tomales Point, Point Reyes National Seashore In 1978. The Point Reyes herd is now one of the largest populations in California with over 400 counted during the 2009 census (National Park Service 2009).

Black-tailed deer (*Odocoileus hemionus columbianus*) – Native

Deer Family (Cervidae)

Black-tailed Deer is the coast range form of the mule deer (*Odocoileus hemionus*).

Columbian Black-tailed Deer, Coast deer male. Walter Siegmund. http://commons.wikimedia.org/wiki/File:Odocoileus_hemionus_5447.JPG

Black-tailed Deer Ecology

- Grazing:
    - Black-tailed Deer grazes on grasses and forbs and browses on the leaves and shoots of shrubs and small trees (Jameson Jr. and Peeters 1988).
    - While significant dietary overlap occurs with other local ungulates, Elk favor forbs (with a lower proportion of grass and browse); cattle favor grasses (with a lower proportion of forbs and very little browse), and black-tailed deer favor forbs and browse in roughly equal proportion with a lower proportion of grasses contribution to their diet (Findholt et al. 2004).

Botta's Pocket Gophers (*Thomomys bottae*) - Native

Gopher Family (Geomyidae)

Botta's Pocket Gopher has a missile-shaped body, large head, robust claws, and loose skin. The coloration of its fur is highly variable and is correlated with color of the surrounding soil.

Botta's Pocket Gopher (*Thomomys bottae*) at Ano Nuevo State Park, California. 29 January 2011. Leonard Weiss. Wikimedia Commons: http://commons.wikimedia.org/wiki/File:Pocket-Gopher_Ano-Nuevo-SP.jpg

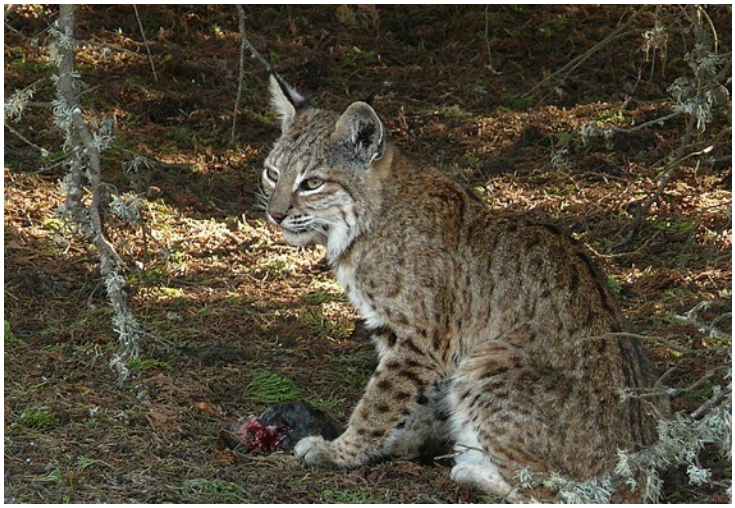
Botta's Pocket Gopher:

- Is native to western North America. It is also known in some sources as valley pocket gopher, particularly in California. (Wikipedia)
- Is one of five species of pocket gophers (*Thomomys* spp.) in California (Salmon and Gorenzel 2002).
- occurs in valleys, desert ranges, and mountain slopes to above timberline, and Is the most common species of gopher in California grasslands.

Pocket Gopher Ecology

- Species Interactions:

- Gopher mounds cover plants surrounding the openings of gopher burrows. At some sites, the area covered by gopher mounds resulting in a loss of herbaceous coverage can be as much as 25-30% of the plant coverage ((Koide et al. 1987).
- Soil deposited by gophers at the surface is generally free of seeds, and the differential ability of plants to colonize the areas determines the composition of the resulting community on these patches (Douglas 1969; Hobbs and Hobbs 1987; Hobbs and Mooney 1985; Koide et al.1987). Because non-native species tend to excellent colonizers, gopher mounds can enhance the growth of non-native species. Some land managers have taken advantage of the "new" soil deposited in gopher mounds as target sites for seeding native grasses (Brock Dolman, Occidental Arts and Ecology Center, pers. comm.)
- Many grassland predators eat pocket gophers. Weasels and snakes including gopher and rattlesnakes) pursue the gopher in their burrows. Badgers, and historically grizzly bears (Mattison 2004), are adept at digging out gophers. Many more prey on gophers when they are aboveground feeding, dispersing, or constructing mounds. These include coyotes, domestic dogs, foxes, house cats, striped skunks, bobcats, raptors, owls and herons (Case 2008).
- Re-use of gopher burrows can be a significant cost savings for other grassland species. Tunneling underground is a tremendously demanding activity estimated to require 360 to 3,400 times the energy of moving across the surface. Most amphibians and lizards are ignored by gophers. Ground squirrels, kangaroo rats, and smaller rodents use gopher burrows but tend leave the tunnel if it is occupied by a gopher (Case 2008).



Bobcat (*Lynx rufus*) eating gopher, California, USA. 3 November 2009. Linda Tanner. Wikimedia Commons: http://commons.wikimedia.org/wiki/File:Bobcat_With_A_Gopher_Lunch.jpg

- Grazing:
  - Pocket gophers are strict herbivores and feed on forbs, grasses, shrubs, and trees in three ways: (1) they feed on roots that they encounter when digging; (2) they may go to the surface, venturing only a body length or so from their tunnel opening to feed on aboveground vegetation and seeds, such as acorns; and (3) they pull vegetation into their tunnel from below (Case 2008). Grasses are often consumed entirely (Gettinger 1984b).

- Proportions of plants consumed vary seasonally. Gophers eat a greater amount of aboveground vegetation (shoots, leaves) during the growing season when the vegetation is green and succulent. Year-round, however, roots are the major food source, and they eat a variety of fleshy underground storage structures, such as bulbs, rhizomes, corms and tubers (Case 2008). Dandelions are a preferred food. (Case 2008).
- Gophers can consume significant amounts of grassland plants. At a density of 23 per acre, Botta's pocket gophers decreased the forage yield by 25% in annual-dominated rangelands in the California foothills. Similar consumption rates were measured in western Nebraska rangeland, where plains pocket gophers reduced forage yield 21% to 49% Case 2008).

- Soil Disturbance:
  - Pocket gopher burrows consist of a main burrow with lateral burrow, generally 4 to 18 inches (10 to 46 cm) below the surface of the ground that are either plugged or mounded at the soil surface. Deeper branches can reach down to 5 or 6 feet (1.5 to 1.8 m) are used for nesting caching food. A single burrow system may contain up to 200 yards of tunnels (Case 2008).

Botta's Pocket Gopher (*Thomomys bottae*) with fresh mound. 22 February 2008. Dominic Sherony. http://commons.wikimedia.org/wiki/File: Botta%27s_pocket_gopher.jpg

  - Gopher burrowing activity brings large amounts of soil to the surface. The number of soil mounds on the surface of the ground can reach 300 per animal in a year (1 to 3 per day and 70 mounds per month) resulting in as much as 2 1/4 tons of earth moved per gopher each year, or 46 3/4 tons per acre for a population of 50 pocket gophers (Case 2008).
  - Potential benefits of pocket gopher soil disturbance are: (1) increased soil fertility by adding organic matter such as buried vegetation and fecal wastes; (2) increased soil aeration and decreased soil compaction; (3) increased water infiltration and thus decreased runoff; and (4) increased rate of soil formation by bringing subsoil material to the surface of the ground, subjecting it to weathering (Case 2008).

More Fun Facts About Pocket Gophers

- Pocket gophers are named for the two fur-lined pouches, one on the outside of each cheek, in which they transport collected food to underground storage chambers. The pouches can be turned inside out (Case and Jasch 2005).

- Pocket gopher fossils have been found from Rancholabrean deposits in California, and the oldest fossil is 103,000 years old near Long Beach California (Jones and Baxter 2004).
- As with all rodents, the incisors of pocket gophers grow continuously and gophers must gnaw to keep their teeth ground to an appropriate length. Gophers exert tremendous pressure with their bite, up to 18,000 pounds per square inch (1,265 kg/cm2) (Case 2008).

California Vole, Meadow Vole, Meadow Mouse (*Microtus californicus*) - Native

Vole and Hamster Family (Cricetidae)

California Meadow Voles (*Microtus californicus*) are burrowing mouse-like rodents with short tails. There are six species of voles or meadow mice in California and the California Meadow Vole is the most widespread in the state.

***Microtus californicus*, at the Piedras Blancas Lighthouse, San Luis Obispo County, California. 23 May 2010, Jerry Kirkhart, Wikimedia Commons**

California Meadow Vole:

- Is found in a variety of habitats where grasses occur.

California Meadow Vole Ecology

- Grazing:
  - California voles can be detected by their characteristic system of runways visible in the grass that connect their burrow openings (Salmon and Gorenzel 2010).
  - California voles feed on grass stems and leaves during the wet season and switch to grass seeds during the summer (Batzli 1986). The preferred food plants appear to be *Avena* and *Lolium* (Batzli and Pitelka 1970). *M. californicus* also relies on sedges, fruits and forbs in certain areas. In the winter, the vole eats mostly roots and underground plant parts (Burt and Grossenheider, 1980; Ingles, 1965 cited in Peronne 2002).
  - Vole survival and reproduction is better in vegetation dominated by the native perennial grass *Elymus triticoides,* most likely because it provides cover during the summer, leading to higher survival (Cockburn and Lidicker 1983).
  - Heavy grazing by *M. californicus* can alter floristic richness (Cockburn and Lidicker 1983).
- Life History:
  - A successful lifespan for a vole is up to a year, but the average lifespan is only a few months. (Wilson and Ruff, 1999 cited in Peronne 2002)

- Reproduction begins near the time of the first rains, and ends when the hot summer dries out the vegetation. In coastal populations, where the grasses stay green all year, and temperatures are mild, breeding can occur throughout the year (Peronne 2002)
- California voles seem mostly monogamous when populations aren't too dense. Dense populations or populations with unbalanced sex ratios will display polygynous traits. In these populations, males defend territories where grass is the staple diet, and females defend areas where fruits and forbs are the primary food source (Peronne 2002).

- Species Interactions:
  - There are fewer voles in grazed grasslands than in those that are not grazed by domestic livestock. Grazing reduces vole populations and subsequently there are fewer raptors, such as White-tailed Kites, in grazed grasslands (Johnson and Horn 2008).
  - Vole predators are numerous and include coyotes, kestrels, hawks, weasles, kits, owls, snakes, herons, egrets, and ferrel cats. Voles are the primary food source for grassland raptors and mammal carnivores. In many cases, the abundance of voles will determine the abundance of predator populations (Peronne 2002).

Coyote munching on meadow vole at Tilden Regional Park in the East Bay. Photo by Elaine Bond 2011.

More Fun Facts About California Voles

- 1.2 million year old fossils of *Microtus* species are known from California, although it is unclear the specimens are *M. californicus* or related, possibly extinct, species (Bell and Bever 2006 cited in Wikipedia 2011.
- During peak population times, numbers of voles are said to exceed to hundreds per acre, and up to a thousand per hectare, causing crop problems in areas where farms coincide with vole habitat (Peronne 2002), including cultivated artichoke fields (*Cynara scolymus*) in California (Koehler, et al. 1989).

BLACK-TAILED JACKRABBIT (*LEPUS CALIFORNICUS*) - NATIVE

Rabbit Family (Leporidae)

Black-tailed Jackrabbits are large, long-eared rabbits of the open grasslands.

Black-tailed Jackrabbit eating berries. Basin State Park, Utah. 28 June 2006, James Marvin Phelps, Wikimedia Commons

BLACK-TAILED JACKRABBIT:

- Is the most widely distributed jackrabbit in North America.
- Are found from central Washington south to Baja California and east to Missouri (Howard 1995).
- Require a shrub-grassland mosaic (Howard 1995).

BLACK-TAILED JACKRABBIT ECOLOGY

- Grazing:
    - They hide and nest under shrubs during the day and move into grasslands at night to feed on grasses, forbs and small shrubs (Howard 1995).
    - Hares consume 1/2 to 1 pound (1.1 to 2.2 kg) of green vegetation each day. Rangeland overbrowsing and overgrazing can occur any time jackrabbit numbers are high. Eight jackrabbits are estimated to eat as much as one sheep, and 41 jackrabbits as much as one cow. Estimates of jackrabbit populations run as high as 400 jackrabbits per square mile (154/km 2) extending over several hundred square miles. Range damage can be severe in such situations, especially where vegetation productivity is low (Knight 1994).
    - Black-tailed jackrabbits can consume many plants that are unpalatable or even poisonous to cattle (Howard 1995).
- Fire: Black-tailed jackrabbits can escape from fires and return after the fire has passed.
- Species Interactions: They are important prey species for grassland carnivores, including raptors, coyotes, foxes, and badgers.

MORE FUN FACTS ABOUT JACKRABBITS

- The name “jackrabbit” came from early settlers in the Southwest who called it “jackass rabbit” referring to its long ears (Ballenger 1999).

Jackrabbits prefer well-grazed grasslands. Howard (1995) cites a study that suggests that jackrabbit populations can be controlled by keeping rangelands in excellent condition (i.e., with adequate grass growth). Daniel et al (1993) found that jackrabbit populations were significantly higher on rangeland in fair condition than on rangelands in excellent condition.

Grassland Carnivores

Grassland carnivores, mammals and raptors alike, are supported by the abundant rodents such as meadow voles, pocket gophers, shrews, and rabbits that occupy coastal prairie habitat. In the past, now extinct megafaunal browsers and grazers once supported (as prey) a different set of megafaunal carnivores in coastal prairies.

- Coyote (*Canus latrans*)
- Gray fox (*Urocyon cinereoargneteus*)
- Red fox (*Vulpes vulpes*)
- Ringtail (*Vassariscus astutus*)
- Mountain lion (*Felis consolor*)
- Bobcat (*Lynx rufus*)
- Feral house cat (*Felis catus*), introduced

Coyote closeup. Christopher Bruno. http://commons.wikimedia.org/wiki/File:Coyote_closeup.jpg

Black bear (*Ursus americanus*) – Native

Bear Family (Ursidae)

Black Bear:

- Is native to much of North America

Fun Facts About Black Bear

- Black bears were found on Point Reyes until about 1863 (Kawahara 1970).
- Considered extinct from the area by 1901, there was a confirmed presence in 1971 and in September and October 2010, there were five reports of black bear tracks and scat (droppings) along the Tomales Bay side of the park (National Park Service 2010a).

A brown American Black Bear cub seen west of Boulder, Colorado, USA dining on bunch grass. Hustvedt. http://commons.wikimedia.org/wiki/File:Ursus_americanus_boulder_colorado.jpg

- Although a problem in other areas, black bear attacks are so rare in California that there are more reports of Bigfoot sightings (Stienstra 2000).

California Grizzly Bear (*Ursus arctos horribilis*) - Native, extirpated

Bear Family (Ursidae)

Grizzly Bear:

- Is native to California's coastal prairie and scrub from the northernmost boundary of California through the Central Coast and from the San Francisco Bay Area up into the Central Valley grasslands and foothills and the foothills near Los Angeles (Stienstra 2000).

"Monarch" the last California grizzly bear in captivity is the mascot of the bear flag republic on display at the California Academy of Sciences. Photo by Payton Chung (Wikipedia).

Grizzly Bear Ecology

- Life History: Eat both plant and animal foods. Plant foods included clover, berries, tule roots, bulbs, grapes, wild oats and other grasses (Stienstra 2000). Prey animals included lizards, deer, gophers, mice, grubs, and yellow jacket nests (Stienstra 2000).
- Grazing: Grizzly bears are known to eat California brome (*Bromus carinatus*), a coastal prairie grass (Tollefson 2006).
- Soil Disturbance: Digging by grizzly bears once had big effects on plant distributions by digging for bulbs and roots with their 5-6 inch long claws.

The only grizzly bear left in California is on the state flag.

More Fun Facts about Grizzly Bears

- A grizzly bear was purportedly roped on the sand dunes of Tomales Bay in 1850 (Kawahara 1970).
- California's state symbol has been extinct in California since 1922 when the last grizzly was killed in Fresno County (Noss and Peters 1995; Stienstra 2000).
- Grizzly bears were driven to extinction by population growth and habitat loss in the San Francisco Bay Area, Sacramento and Los

Angeles. According to Stienstra (2000), the ferocious grizzly lost its advantage when the rifle was brought to the state in the 1840s. Grizzlies were hunted for their meat and for sport and killed by sheep and cattle ranchers protecting their herds.

Natural range of the grizzly bear in California. Adapted from Stienstra 2000.

BADGERS (*TAXIDEA TAXUS*) - NATIVE

Weasel Family (Mustelidae)

BADGER:

- Is distributed throughout California
- Are more abundant in grasslands where small burrowing rodents are abundant (Stienstra 2000).

BADGER ECOLOGY

- Life History: Badgers are largely carnivores that prey mainly on small mammals including pocket gophers, kangaroo rats, moles, mice and other rodents (Sullivan 1996).
- Soil Disturbance:
    - Badgers use their long claws to dig their prey out of the ground and to dig dens.
    - Badger dens are up to 30 feet long and 10 feet deep with large mounds of soil built up at the entrance. Badgers move to new dens sometimes as often as every day (Sullivan 1996).

Badger (*Taxidea taxus*) with pocket gopher in coastal grasslands. Photo courtesy of Ryan DiGaudio

MORE FUN FACTS ABOUT BADGERS

- Badgers have been present in Sonoma, Marin, and San Francisco Bay area grasslands since the Pleistocene when their excavations probably served as readily available mud wallows for herds of prehistoric bison and mammoths (Parkman 2006).
- higher on rangeland in fair condition than on rangelands in excellent condition.

INTRODUCTION TO GRASSLAND BIRDS

- Grassland birds are the most threatened group of birds in the United States. Most grassland birds are ground nesters and/or foragers. Grassland bird populations diminish with habitat fragmentation (Rao, et al. 2008).
- **Species Interactions:**
  - Birds, such as the grasshopper sparrow and savannah sparrow, need the open spaces between bunch grasses to forage and build their nests. Grassland with 100% cover (i.e., no gaps among grasses) is poor habitat for grassland birds, whether dominated by introduced annual grasses or restored native grasslands.
  - Wildflowers that grow among grasses are an essential food source along with the insects that the plants attract.
  - Poorly managed grazing can destroy nests by trampling and reducing protective cover (Unitt 2008).

Much of the information below on grassland birds and raptors is from The Birds of North America On-line (Cornell Lab of Ornithology 2010).

GRASSHOPPER SPARROW (*AMMODRAMUS SAVANNARUM*) - NATIVE

Sparrow Family (Emberizidae)

The grasshopper sparrow is a small, stocky, flat-headed sparrow with a short tail and unstreaked breast.

GRASSHOPPER SPARROWS:

- Is distributed across North America (Slater 2004)
- Breeds only in grasslands

GRASSHOPPER SPARROW ECOLOGY:

- Life History:
  - Grasshopper sparrows nest in small depressions in the ground. The nests are small

Grasshopper Sparrow (Ammodramus savannarum). 29 May 2005(2005-05-29), dominic sherony, Wikimedia Commons.

Grasshopper Sparrow on a nest. Chester A. Reed, "The Bird Book", 1915. http://commons.wikimedia.org /wiki/File:Reed-grasshopper-sparrow.png.

cups woven from grass and lined with plant fibers, fur, and roots. The nest is usually concealed by a canopy of bent grass. (Slater 2004).

- If you happen upon a nesting female grasshopper sparrow, she will escape by quietly running away through the grass rather than flying (Slater 2004).
- Grasshopper sparrows forage for seeds and insects on the ground and on low plants. (Slater 2004).

MORE FUN FACTS ABOUT GRASSHOPPER SPARROWS

- Although grasshopper sparrows may indeed sometimes eat grasshoppers, these small birds are named instead for their song which sounds like a grasshopper buzzing (Fix and Bezener 2000).
- Threatened primarily by urbanization, the grasshopper sparrow is considered a Bird Species of Special Concern by the California Department of Fish & Game (Unitt 2008). Populations have declined over 60% in the last 25 years (Slater 2004).

BRYANT'S SAVANNAH SPARROW (*PASSERCULUS SANDWICHENSIS ALAUDINUS*) – NATIVE

Sparrow Family (Emberizidae)

Bryant's Savannah Sparrows are a small streak-breasted species with a yellow dot on its brow.

BRYANT'S SAVANNAH SPARROW:

- A subspecies of Savannah Sparrow (*Passerculus sandwichensis*), Bryant's Savannah Sparrow is endemic to California
- Occurs only in the narrow coastal strip from Humboldt Bay in the

Passerculus sandwichensis - Savannah Sparrow, Bolsa Chica Ecological Reserve, Huntington Beach, California. December 2006, Elaine R. Wilson, Wikimedia Commons.

north to the Morro Bay area in the south with its center of abundance in the San Francisco Bay area (Fitton 2008).

- Is a year-round resident of California's coastal prairies and marshes

BRYANT'S SAVANNAH SPARROW ECOLOGY:

- Life History:
  - Savannah Sparrows avoid areas with unusually tall grasses.
  - Birds nest on the ground in open-cup nests that are near grass bunches or under matted plants. The nests are hidden under the grass canopy. Females and males distract predators by erecting their crests and/or quivering wings (California Partners in Flight 2000).
  - Birds forage around the bases of plants mostly for seeds and fruit, and occasionally insects and other small animals such as slugs and sow bugs during the breeding season.

FUN FACTS ABOUT BYANT'S SAVANNAH SPARROW

- Considered a species of special concern by the California Department of Fish & Game, the major threats are loss or alteration of habitat and habitat fragmentation (Fitton 2008).

WESTERN MEADOWLARK (*STURNELLA NEGLECTA*) - NATIVE

Blackbird Family (Icteridae)

WESTERN MEADOWLARK:

- Is a year-round residents of California grasslands

WESTERN MEADOWLARKS ECOLOGY

- Life History:
  - Western meadowlarks nest on the ground. They build cup-like nests in dry depressions hidden in the vegetation. The nests are usually covered by a grassy dome woven from the surrounding vegetation.
  - They feed on insects (beetles, crickets, grasshoppers, caterpillars, ants, bees, wasps) and seeds and probe in the soil for grubs and worms.

Western meadowlark (Sturnella neglecta). Photo by Kevin Cole 2008, from http://commons.wikimedia.org/wiki/File:Western_Meadowlark.jpg.

More Fun Facts About Western Meadowlark

- Still abundant but declining throughout its range in North America, the western meadowlark is listed as a species of concern by Point Reyes Conservation Science (California Partners in Flight 2000).
- Thought to be the same species as the eastern meadowlark (*Sturnella magna*), this species was overlooked by the Lewis and Clark expedition and therefore earned its species name, *neglecta* (Fix and Bezener 2000). The two species are almost identical with black v-shaped marking on bright yellow breasts, but the western meadowlark is distinguished by its musical flutelike song.

Raptors: Birds of Prey

- The raptors described below are year-round residents of coastal prairies who prey mainly on abundant meadow voles that scurry through a maze of grassy tunnels they create on the grassland floor (California Partners in Flight 2000) and other small mammals, such as gophers.
- Sustaining healthy populations of raptors requires maintaining prey habitat in foraging areas. The density of these birds is highly correlated to the density of prey animals in grasslands (California Partners in Flight 2000).
- The grasslands of California's Central Valley are the largest overwintering location for raptors in North America

Red-shouldered Hawk (*Buteo lineatus*) in the Cloisters City Park in Morro Bay, CA. 12 September 2007. Michael Baird. http://commons.wikimedia.org/wiki/File:Red-shouldered-hawk_3.jpg

NORTHERN HARRIER (*CIRCUS CYANEUS*) – NATIVE

Eagle and Hawk Family (Accipitridae)

Formerly known as the marsh hawk, the northern harrier can be identified by its low flying habit and its owl-like face. The males are grey and the females are brown.

NORTHERN HARRIER ECOLOGY

- Life History: Unlike the other raptors listed here, northern harriers nest on the ground where they build open nests surrounded by erect annual or perennial grasses and forbs (California Partners in Flight 2000).
- Species Interactions: They prey small rodents, birds, amphibians, and reptiles.

Female Northern Harrier, 7 December 2008. Andreas Trepte. www.photo-natur.de

MORE FUN FACTS ABOUT NORTHERN HARRIERS

- The northern harrier is considered a California Species of Special Concern by the California Department of Fish and Game (California Partners in Flight 2000).
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RED-TAIL HAWK (*BUTEO JAMAICENSIS*) - NATIVE

Eagle and Hawk Family (Accipitridae)

RED-TAIL HAWK:

- Hunts in meadows and grasslands

RED-TAIL HAWK ECOLOGY

- Life History:
  - Red-tailed hawks nest in tall trees and hunt in nearby meadows and grasslands where they prey on meadow voles, pocket gophers, rabbits, and other small animals.

Juvenile red-tailed hawk (Buteo jamaicensis) eating a California meadow vole (Microtus californicus). Photo by Steve Jurvetson, Flickr.

- Small rodents make up 85-90% of their diet with an occasional bird, snake, and other small reptile (Stienstra 2000).
- They often perch on fence posts and power lines.

WHITE-TAIL KITE (*ELANUS LEUCURUS*) - NATIVE

Eagle and Hawk Family (Accipitridae)

Juvenile White-tailed Kite (Elanus leucurus).1 November 2007, Len Blumin, Wikimedia Commons

WHITE-TAIL KITE

- Hunts in grasslands. They hover in air before parachuting feet first with white wings held high upon the spotted prey.

WHITE-TAIL KITE ECOLOGY

- Life History:
  - Kites nest in tall bushes or trees near their foraging areas and rarely perch on man-made objects (Fix and Bezener 2000).
  - During the non-breeding season, they roost communally in groups of from 10 to 40 individuals. A roost of greater than 100 birds was reported in Sonoma County in 1965 (Bolander and Arnold 1965)
- Species Interactions:
  - Like red-tail hawks, white-tail kites prey heavily on meadow voles and small rodents sometimes eating small birds, snakes, lizards, and large insects.
  - White-tail kites use ungrazed areas much more than grazed lands, presumably due to higher abundance of prey species, especially voles, and white-tail kite populations increased 10 times after grazing was stopped in grasslands purchased by the California Department of Fish and Game purchased for white-tail kite conservation (Dunk 1995).

MORE FUN FACTS ABOUT WHITE-TAILED KITES

- Populations were severely reduced in California in the early 1900s because of habitat loss, shooting, and egg collecting. In the 1930s, the species was predicted to go extinct, but from the 1940s to the 1980x, the California population increased dramatically (Dunk 1995).

Golden Eagle (*Aquila chrysaetos*) - Native

Eagle and Hawk Family (Accipitridae)

Golden Eagles:

- Nest on the edges of cliffs or in tall trees that overlook open grassland hunting grounds (Fix and Bezener 2000).

Golden Eagle Ecology:

- Life History: The nest, built of sticks, branches and roots, can measure up to 10 feet across.
- Species Interactions: Golden eagles prey on small mammals, birds, and less often lizards, snakes and some larger mammals, such as wild pig and foxes. They also eat carrion.

*A portrait of a Golden Eagle (*Aquila chrysaetos*). 2 July 2007. Rocky. http://commons.wikimedia.org/wiki/File:Aquila_chrysaetos_portrait.jpg*

California Condor (*Gymnogyps californianus*) - Native

New World Vulture Family (Cathartidae)

California Condor:

Once ranged to Florida and Washington State, the last remaining wild bird was captured on April 19, 1987 (Fix and Bezener 2000).

California Condor Ecology

Species Interactions: Carrion is the main food of the California condor. These large scavengers once thrived on the carcasses of elk, pronghorn, and other large animals that roamed California's grasslands.

More Fun Facts About California Condor

- The last of the wild condors were taken into captivity and today, there are only a few small introduced populations in California and Arizona (Chamberlain, et al. 2005).

Close view of a California condor (*Gymnogyps californianus*) Spring 2000. Frier/ Nikon, Scott. U.S. Fish and Wildlife Service Digital Library System.

- The United States Fish & Wildlife Service announced in October 2010 that there are over 100 free-flying condors in California as a result of recovery efforts begun in a 1982 captive breeding program when the wild population was just 22 individuals (Woodbridge 2010).
- During the Pleistocene, Merriam's terratorn (*Terratornis merriami*), a large condor-like raptor, ranged over the entire United States feeding on marine mammals as well as now extinct megafauna.
- Tom Smith, Bodega Miwok, told Isabel Kelly in 1932 that the condor "did not stay in this country much; he came around here once. He flies here in summer time, he doesn't want to get wet" (Kelly 1996).

A California condor protects its chick inside a cave on the side of a cliff near Hopper Mountain National Wildlife Refuge. (USFWS Journal).

Lizards in Grasslands

Most lizards prefer open habitats which provide microhabitats for basking and feeding. For this reason, moderate grazing can enhance habitat for lizards. Western fence lizard, western skink, and western whiptail lizards were three times more abundant in grazed areas than non grazed areas of grasslands in the East Bay Region of San Francisco Bay (Riensche 2008).

Western Whiptail, Cnemidophorus tigris multiscutatus. Chris Brown. 4 October 2006. http://commons.wikimedia.org/wiki/File: Cnemidophorus_tigris_multiscutatus.jpg

Western fence or blue-belly lizard (*Sceloporus occidentalis*) - Native

North American Spiny Lizards (Phrynosomatidae)

Adults can be black, gray or brown with blue marking on the sides of the belly and throat and yellow or orange marking on the limbs.

Western Fence Lizard:

- Is one of the most common western lizards and occupies a wide variety of habitats (Stebbins 1966).
- Prefers open (grazed) grasslands (Riensche 2008).

Western Fence Lizard Ecology

- Species Interactions: Cattle grazing can increase the abundance of western fence lizard populations (Riensche 2008).
- Fire: Western fence lizards move from unburned to burned areas in southern California chaparral where they can be found basking on the blackened leafless branches of shrubs (Lillywhite and North 1974).

Western fence lizard. US Forest Service Pacific Southwest Research Station http://www.fs.fed.us /psw/topics/wildlife/herp/mattole.shtml.

More Fun Facts About Western Fence Lizards

- Sonoma, Marin and other areas of California have low rates of Lyme disease. This is because a protein in the blood of the western fence lizard kills the bacterium carried by the western black-legged tick (*Ixodes scapularis*), that causes Lyme disease).
- Males often display their blue throat markings when intimidated by flattening their sides and raising the skin on their throats; when courting they do the same while bobbing up and down to impress their prospective mates (Storer and Usinger 1963).

WESTERN SKINK (*EUMECES SKILTONIANUSON*) - NATIVE

Skink Family (Scincidae)

The western skink can be easily identified by the broad brown stripe edged with black bordered with a white stripe on either side. the blue tail occurs only in juveniles (Stebbins 1966).

WESTERN SKINK:

- Is more common in grazed grasslands than ungrazed grasslands (Riensche 2008).
- Occupies a variety of habitats with leaf litter.

WESTERN SKINK ECOLOGY

- Species Interactions:
  - Cattle grazing can increase the abundance of western skinks in grasslands (Riensche 2008).
  - Western Skinks forage through surface litter looking for insects (adults, eggs, larvae), spiders, beetles. caterpillars, moths, grasshoppers, crickets, insect larvae, ants, centipedes, and sow bugs (California Department of Fish and Game 2010).

Eumeces skiltonianus *from northern California. 11 March 2006. Marshal Hedin. Wikimedia Commons: http://commons.wikimedia.or /wiki/File:Eumeces_skiltonianus_ (Marshal_Hedin).jpg*

SOUTHERN ALLIGATOR LIZARD (*ELGARIA MULTICARINATA*) - NATIVE

Anguidae (Alligator Lizards and Allies)

SOUTHERN ALLIGATOR LIZARD ECOLOGY:

- Species Interactions: Southern alligator lizards are voracious eaters and prey on insects, arthropods, and other lizards (California Department of Fish and Game 2010).

Southern Alligator Lizard ('Elgaria multicarinata' subsp. "webbii"), 21 May 2009 BetacommandBot. Wikimedia Commons: http://commons.wikimedia.org/wiki/File:Elgaria_multicarinata_08416.JPG

WESTERN RING-NECKED SNAKE (*DIADOPHIS PUNCTATUS AMABILIS*) - NATIVE

Typical Snake Family (Colubridae)

The western ring-necked snake is named for the pale yellow or reddish collar at its neck. It is small, reaching only about 15 inches long and about as thick as a pencil (Storer and Usinger 1963).

WESTERN RING-NECKED SNAKE:

- Occurs throughout the United States, central Mexico, and south eastern Canada.
- In California is found along the south-central California coast from Ventura County north to southern Santa Cruz County, and inland through the coast ranges.

Photographer: LA Dawson Animal courtesy of Austin Reptile Service. 2006-03-15. Wikimedia Commons: http://commons.wikimedia.org/wiki/File:Diadophis_punctatus.jpg

- Is found in a wide variety of habitats with southern populations occurring primarily within riparian, meadows and other moist environments.

Western Ring-Necked Snake Ecology

- Species Interactions: These snakes feed on salamanders, lizards, small snakes, slugs, worms, and insects (Californiaherps.com 2010).

More Fun Facts About Western Ring-Necked Snakes

- The subspecies *D. p. amabilis* is endemic to California and occurs from Sonoma County to Monterey County (Californiaherps.com 2010).
- Mildly venomous, perhaps to subdue prey, it is not considered dangerous to humans (Californiaherps.com 2010).
- When disturbed, it will coil its tail exposing the bright red underneath (Californiaherps.com 2010).

Pacific gopher snake (*Pituophis catenifer catenifer*) – Native

Colubridae (Colubrid "Snake" Family)

Gopher Snake Ecology

- Life History: Pacific gopher snakes are non-venomous snakes that kill their prey by constricting their body in coils around the prey or by pressing the prey against side of their burrows (Californiaherps.com 2010).
- Species Interactions: Pacific gopher snakes feed on pocket gophers, other small mammals, birds and their eggs, lizards and insects (Californiaherps.com 2010).

A closely related subspecies of Gopher snake (Pituophis catenifer sayi). 6 April 2007. Freeparking. Wikimedia Commons: http://commons.wikimedia.org/wiki/File:Pituophis_catenifer_sayi_(2).jpg

More Fun Facts About Pacific Gopher Snakes

- Pacific gopher snakes are often mistaken for rattlesnakes because of their similar diamond-shaped markings and because they often mimic rattlesnake behavior (Stebbins 1966). When cornered they will coil up, draw back and spread their heads and vibrate their tail before they lunge and hiss at the intruder (Storer and Usinger 1963).

WESTERN YELLOW-BELLIED RACER (*COLUBER CONSTRICTOR MORMON*) – NATIVE

Colubridae (Colubrid "Snake" Family)

Yellow-bellied racers are typically under 3 feet long, slender with large eyes, a broad head and slender neck. Their bodies can be brown, blue grey or olive green above with off-white or yellow below (Sonoma County Reptile Rescue n.d.).

Western Racer (Coluber constrictor mormon). 30 May 2011. Jrtayloriv. Wikimedia Commons: http://commons.wikimedia.org/wiki/File:Coluber_constrictor_mormon_--_closeup_of_face,_side.jpg

WESTERN YELLOW-BELLIED RACER:

- Prefers open areas with sunny exposure - meadows, grassland, sagebrush flats, brushy chaparral, woodlands, riparian areas such as pond edges, and forest openings (www.Californiaherps.com).
- Is found throughout most of California north and west of the Sierras, and south along the coast to the Baja California border (Californiaherpts.com)

WESTERN YELLOW-BELLIED RACER ECOLOGY

- Species Interactions: Despite its name it does not constrict prey but actively hunts for lizards, small mammals, birds (also bird eggs), snakes, and large insects, by moving quickly with head held high and captures and crushes the prey with its jaws or by trapping the prey with its body (Californiaherps.com 2010).

MORE FUN FACTS ABOUT YELLOW-BELLIED RACERS

Yellow-bellied racers are one of the few snake species in the world whose juvenile coloration differs significantly from the adults.

NORTH PACIFIC RATTLESNAKE (*CROTALUS OREGANUS*) - NATIVE

Viperidae (Viper Family)

Young north Pacific rattlesnakes have bright yellow tails with a silent undeveloped "button"-like rattle (Californiaherps.com 2010; Stebbins 1966).

Rattlesnake from northern California. 2 August 2007. Marshal Hedin. Wikimedia Commons: http://commons.wikimedia.org/wiki/File: Rattlesnake_(Marshal_Hedin).jpg

NORTHERN PACIFIC RATTLESNAKE:

- Although they rare along the coast, Northern Pacific Rattlesnakes have been observed in coastal prairie in Marin County (CPEFS Mapping Crew, personal communication 2010).

NORTH PACIFIC RATTLESNAKE ECOLOGY

Species Interactions: Rattlesnakes often use a sit-and-wait approach to hunting and feed primarily on small rodents (including gophers) , small rabbits, some birds, and lizards that are unlucky enough to pass nearby (Storer and Usinger 1963).

MORE FUN FACTS ABOUT NORTHERN PACIFIC RATTLESNAKE

- Both adults and juveniles are dangerous to humans and should be avoided.
- This rattlesnake is the only poisonous reptile in California (Storer and Usinger 1963).

INSECTS

- Although coastal prairies are known for their high diversity of wildflowers, they may support an even higher diversity of insects.
- California's remaining coastal prairies act as refuges for the many insect species with greatly reduced populations; however, some are already extinct (California Native Plant Society 2001).
- Insects serve many ecological roles, but perhaps the most important is pollination. Pollinating insects, such as native bees, bumblebees, beetles, butterflies, moths, and flies are needed by 90% of flowering plants and over one third of our food crops for their reproduction (Pollinator Partnership 2010).

OHLONE TIGER BEETLE (*CICINDELA OHLONE*) - NATIVE

Ground Beetle Family (Carabidae)

OHLONE TIGER BEETLE:

- Is known only from 5 locations in Santa Cruz County; because it was recently discovered, the original range and extent of the populations is unknown.
- Occurs only on coastal terraces in Santa Cruz County with California oatgrass (*Danthonia californica*) and purple needlegrass (*Nassella pulchra*, *Stipa pulchra*) (Freitag, et al. 1993; Santa Cruz Public Library 2009).

Ohlone tiger beetle. Photo courtesy of US Fish & Wildlife Service. http://www.fws.gov/pacific/news/2001/ohlonetigerbeetle.jpg.

Ohlone Tiger Beetle Ecology

Life History:

- The beetles are active from late January to April and tend to be found in areas of low and sparse vegetation where there are patches of bare ground (Freitag, et al. 1993).
- The larvae live in small burrows (4-6mm diameter) the burrow openings are flat with no surrounding excavated soil mounds apparent (Jones 2001). Adults move among plants to find mates and hunt for prey (Jones 2001).

Species Interactions:

- Both the adult beetles and the larvae are predatory on insects. The larvae grab passing insects and other invertebrates from their burrows, and adults hunt prey on foot (Jones 2001).
- Ohlone beetle populations are threatened by rooting wild pigs that destroy the smooth surfaces the beetles need to hunt and mate (Phelan 2002).
- Ironically, the beetles need paths, once created and maintained by now extinct megafauna, elk, and deer and now, by hikers and mountain bikers. However, Ohlone tiger beetles are often crushed by mountain bike tires (during the beetles' active period from January to April) and impeded by the ruts and rills on paths destroyed by erosion from improper use (Phelan 2002).

More Fun Facts About the Ohlone Tiger Beetle

- The Ohlone tiger beetle is named for its fierce predatory behavior and for the Ohlone village site that is now Marshall Field in which it was first discovered (Phelan 2002).
- This species was first described in 1987 from a specimen collected northwest of the city of Santa Cruz, the Ohlone tiger beetle is known only from five remnant native grasslands. The Ohlone tiger beetle was federally listed as endangered by the federal government in 2001 (Jones 2001).

Introduction to Butterflies and Moths

- Adult butterflies and moths can look very similar:
  - Butterflies usually have a club or swelling at the end of their antennae while moths can have simple to feather shaped antennae, but do not have clubs at the tip.
  - Butterflies are usually more colorful while moths are plainer and sometimes quite hairy.
  - Butterflies are active during the daylight hours (diurnal) while moths are active at evening (crepuscular) and at night (nocturnal) (Opler, et al. 2010).

Butterfly and moth caterpillars are even harder to tell apart.

- The Big Sky Institute in Montana has a great website called "Butterflies and Moths of North America" where you can search for butterflies and moths that occur in Sonoma and Marin Counties or in any county in the United States (Opler, et al. 2010).

UMBER SKIPPER (*POANES MELANE*) - NATIVE

Skipper Butterfly Family (Hesperiidae)

Skippers are stocky butterflies that resemble moths.

UMBER SKIPPER ECOLOGY:

- Life History: Males perch on grasses and wait for passing receptive females (Opler, et al. 2010)
- Species Interactions:
    - Coastal prairie plants that act as host plants for the umber skipper are tufted hairgrass (*Deschampsia caespitosa*) and California brome (*Bromus carinatus*). The caterpillars feed on the leaves and live in shelters of rolled or tied leaves. The adults survive on flower nectar (presumably from wildflowers) (Opler, et al. 2010).

Umber skipper (Poanes melane). Photo courtesy of Eugene Zelenko. 7 Feb 2010. Wikimedia commons.

ENDANGERED BUTTERFLIES

- Habitat loss and degradation of coastal prairie habitat has led to the decline of prairie-dependent butterflies. Among those most threatened are species that depend on only a few plant species, called host plants, for their reproduction. When habitat is fragmented or invaded by weeds, host plants often decline, and, even when present, can also be overlooked or not used by butterflies when surrounded by and overtopped by non-native species (Severns 2008)
- Butterflies often have two kinds of host plants:
    - Mature butterflies lay their eggs on the host plant and once the eggs have hatched serve as larval food-plants.The butterflies described below lay their eggs on specific plants upon which the larvae or caterpillars feed during their growth stages called instars.
    - Once they metamorphose, butterflies feed on nectar from the same or other species of plants.

MISSION BLUE BUTTERFLY (*PLEBEJUS ICARIODES MISSIONENSIS*) - NATIVE

Blues and Hairstreak Family (Lycaenidae)

The mission blue butterfly is a subspecies of Boiduval's blue butterfly with a wingspan of 1 to 1.5 inches. The males' wings are a colorful iridescent blue on top; the females' wings are dark brown with blue at the bases.

A male mission blue alights on a grass blade during its 3 week flight season. Golden Gate National Parks Conservancy. Photo courtesy of the National Park Service.

THE MISSION BLUE:

- Is found only in Marin County and the San Francisco Bay area.
- May have been more widespread, but the original distribution is unknown (Arnold 1983: 25, as *Plebejus icariodes missionensis)*.

MISSION BLUE ECOLOGY

- Life History: Mission blue butterflies have a one-year life-cycle:
    - The adult butterflies live for only about a week from March to July. The female butterflies lay single eggs on the top surfaces of leaves and sometimes on the stems and seedpods and flowers of perennial lupines.
    - When the eggs hatch the caterpillars feed for several weeks on the inner leaf tissue and flowers and then migrate down the stem into the leaf litter at the base of the plant and lie dormant.
    - The following spring they ascend to feed on plant tissue, descend to pupate in the leaf litter, and finally ascend again to metamorphose into butterflies.
- Species Interactions:
    - Adults mate and feed on flower nectar, primarily of coast buckwheat (*Eriogonum latifolium*), but also feed on nectar from golden aster (*Heterotheca sessiflora*), blue dicks (*Dichelostemma capitatum* ssp. *capitatum*), and Ithuriels's spear (*Triteleia laxa*).
    - The female butterflies lay single eggs on, and larvae feed only on three perennial lupines: silver lupine (*Lupinus albifrons*), summer lupine (*Lupinus formosus*), and varied lupine (*Lupinus variicolor*). The annual, sky lupine (*Lupinus nanus*), may be a fourth larval host species (Wang n.d.).

- The later stages or instars of the larvae of the mission blue butterfly are tended by ants, primarily the small honey ant (*Prenolepis impairs*) and *Formica lasioides* (Arnold 1983). The larvae secrete honeydew that the ants eat, and the ants presumably help protect the larvae from parasitoids and predators

Mission Blue larva with small honey ants (Prenolepis impairs) that protect the larva and harvest secreted honeydew. Photo courtesy of Thomas Y. Wang, http://www.missionblueproject.com/contact.htm.

MORE FUN FACTS ABOUT MISSION BLUE BUTTERFLIES

- The species was first described in 1937 by Hovanitz from a specimen collected on Twin Peaks in the Mission District of San Francisco and collected in the 1960s at Fort Baker, Marin County, the original distribution is unknown (Arnold 1983: 25, as *Plebejus icariodes missionensis)*.
- The mission blue butterfly was listed by the United States Government as an endangered species in 1976. Residential and industrial development has greatly reduced the extent of its coastal grassland habitat. (U. S. Fish & Wildlife Service 2010).
- A second subspecies of this butterfly, Fenders blue butterfly (*Icaricia icariodes fender*), is endangered in Oregon prairies where it depends on two lupine species, one that is also endangered.

SAN BRUNO ELFIN BUTTERFLY (*CALLOPHRYS MOSSII BAYENSIS*) - NATIVE

Blues and Hairstreaks Family (Lycaenidae)

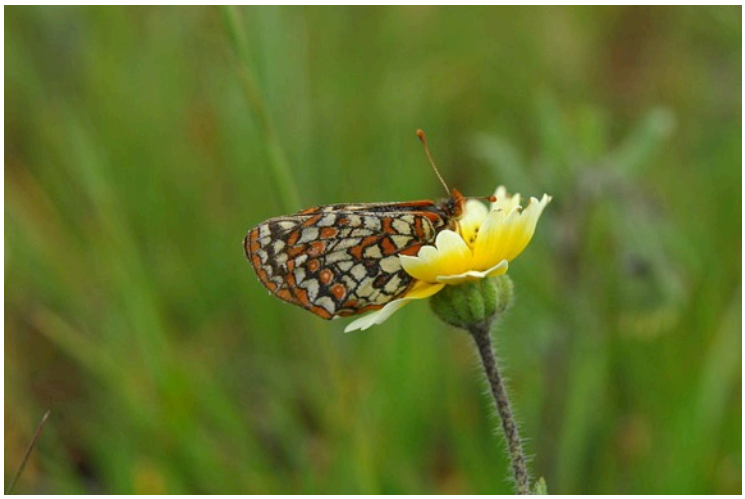
SAN BRUNO ELFIN BUTTERFLY:

- Species Interactions:
  - The larval host plant is stonecrop (*Sedum spathulifolium*; Crassulaceae), which tends to occur in rocky outcrops and has a widespread distribution in California.
  - Several species of ants tend the young larvae and protect them from predators. The larvae secrete honeydew that the ants eat, and the ants presumably help protect the larvae from parasitoids and predators (National Park Service 2010b). There are at least nine species of native ants involved and each species seems to attend a different color morph. (U. S. Fish & Wildlife Service 1984).

Host plant of the San Burno Elfin butterfly, broadlead stonecrop, Sedum spathulifolium. 2 July 2008. Walter Siegmund. http://commons.wikimedia.org/wiki/File:Sedum_spathulifolium_4832.JPG

BAY CHECKERSPOT BUTTERFLY (*EUPHYDRYAS EDITHA BAYENSIS*) - NATIVE

Admiral and Brush-footed Butterfly Family (Nymphalidae)



Bay Checkerspot butterfly (Euphydryas editha bayensis). 13 May 2010. SACRAMENTO FISH AND WILDLIFE OFFICE; U.S. Fish and Wildlife Service. Wikimedia Commons: http://commons .wikimedia.org/wiki/File:Euphydryas_editha _bayensis.jpg

BAY CHECKERSPOT BUTTERFLY:

- Occurs only in serpentine outcrops in the San Francisco watershed
- May have been the most abundant and widespread butterfly species in the central Coast Range of California 200 years ago (Murphy and Weiss 1988).

BAY CHECKERSPOT BUTTERFLY ECOLOGY

- Species Interactions:
    - The larval host plants of the Bay Checkerspot Butterfly are dwarf plantain (*Plantago erecta*) and two species of Indian paintbrush, *Castilleja densiflorus* and *C. exserta* (National Park Service 2010b). Females lay their eggs on dwarf plantain early in the season. When this small plant begins to dry up, butterflies then lay their eggs on *Castilleja* and immature larvae disperse to the *Castilleja* to finish their development (Ehrlich, et al. 1975; Murphy and Weiss 1988). Checkerspot butterfly reproductive success is highest in areas with serpentine soils, since *Castilleja* species used by the butterflies occurs on this soil type (Ehrlich, et al. 1975).
    - Adult nectar sources include *Lomatium* spp., California goldfields (*Lasthenia californica*), coastal tidytips (*Layia platyglossa*), and scytheleaf onion (*Allium falcifolium*). Of these species, the scytheleaf onion is most often found growing in serpentine.
    - When cattle grazing was removed from grasslands growing on serpentine soils in San Jose, several populations of Bay checkerspot butterfly nearly went extinct because the

Bay Checkerspot host plant, Owl's Clover (Castilleja densiflora), Briones Regional Park, Contra Costa County, CA. 6 April 2003. Franco Folino. http://commons.wikimedia. org/wiki/File:Castilleja_densiflora.jpg

areas were rapidly invaded by introduced grasses that took advantage of the increased nitrogen available from automobile pollution (Weiss 1999).

MORE FUN FACTS ABOUT BAY CHECKERSPOT BUTTERFLIES

- The causes of Bay Checkerspot declines and local extinctions are urbanization, freeway construction, invasion of non-native plants, fire, a combination of drought and overgrazing, and surprisingly, a lack of grazing or undergrazing when combined with the nutrient enrichment effects of nitrogen pollution from automobiles on busy Highway 101 (Murphy and Weiss 1988). Serpentine soils are generally dominated by native plants that are more adapted to the lack of nutrients and the presence of heavy metals. Nitrogen deposition from automobile pollution facilitates the invasion of introduced grasses into the nutrient-poor soils (Weiss 1999).

MYRTLE'S SILVERSPOT BUTTERFLY (*SPEYERIA ZERENE MYRTLEAE*) – NATIVE

Admiral and Brush-footed Butterfly Family (Nymphalidae)

MYRTLE'S SILVERSPOT BUTTERFLY:

- Once ranged from San Mateo County to the mouth of the Russian River in Sonoma County in coastal prairie, coastal scrub and dune habitat.
- Is now known only from four populations in northwestern Marin County and southwestern Sonoma County (two at Point Reyes National Seashore)

Myrtle's silverspot butterfly at Point Reyes National Seashore. (NPS http://www.nps.gov/pore/parkmgmt/upload/rps_myrtlessilverspot_070816.pdf).

MYRTLE'S SILVERSPOT BUTTERFLY ECOLOGY

Species Interactions:

There is only one larval host plant, the western dog violet (*Viola adunca*).

The adults primarily feed on flower nectar from the curly-leaved monardella (*Monardell*a *undulata*), a rare native plant, but also gather nectar from a variety of native plants including hairy gum plant (*Grindelia hirsutula*), bull thistle (*Cirsium vulgare*), coastal sand verbena (*Abronia latifolia*), seaside fleabane (*Erigeron glaucus*), and false dandelion (*Hypochaeris radicata*) (Adams 2007; Black and Vaughan 2005).

Adult food plant, Monardella undulata, of the Checkerspot butterfly. 18 June 2007. JKirkhart35. http://commons.wikimedia.org/wiki/File: Monardellaundulata.jpg

Call for Action: Myrtle's Silverspot Butterfly

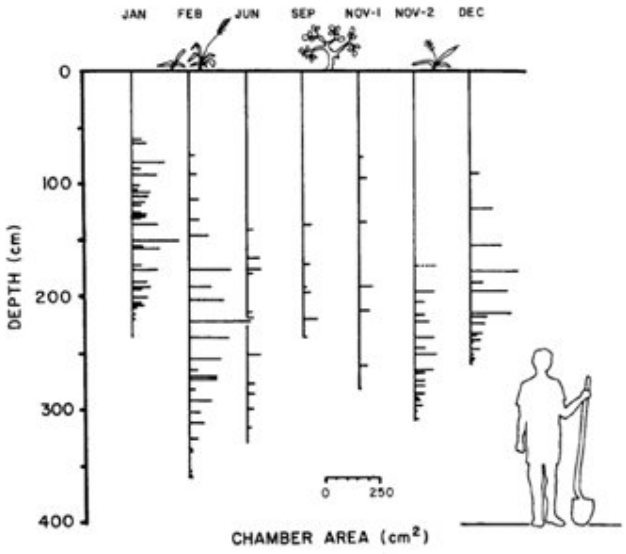
"This butterfly is in serious need of action on its behalf by the public, including working with private landowners on whose land most of the populations survive. It is likely that given the specific habitat requirements of this subspecies and the history of environmental change brought on by human activities, that simply setting aside land for this butterfly will not ensure its future. Active management, whether by selective grazing or some other method, of Myrtle's silverspot habitat will be necessary" (Black and Vaughan 2005)

GRASSHOPPERS

Nearly 200 species of grasshoppers occur in California and more that 50% are endemics (Stromberg et al. 2007).

- **Grazing:**
  - Grasshoppers feed on grasses and forbs. Few adult grasshoppers are present during the early rainy season when winter annual plants begin to germinate and grow. However, small seedlings eaten during this time may suffer greater damage because they are more vulnerable.
  - The plants with the potential for highest risk from grasshopper herbivory are perennials or late-season annuals that are growing from June to October when grasshoppers are adults and are the most active (Joern 1989).
  - Grasshopper damage has been reported during outbreaks in 1957 and 1958 (Stroheckers et al. 1969 cited in Stromberg et al. 2007) and was reported historically from established California missions, but Cronise 1986 (cited in Stromberg et al. 2007) reported that their effects were not extensive.
  - In Montana grasshopper herbivory influences rates of nitrogen cycling by changing the quality of leaf litter and rates of decomposition
- **Species Interactions:** Many predators eat grasshoppers including western meadowlark, grasshopper sparrows, and kingbirds (Stromberg et al. 2007).

Devastating Grasshopper, Melanoplus devastator, a massing species of California grasslands. 30 September 2007. Eugene Zelenko. http://commons.wikimedia.org/wiki/File:Melanoplus_devastator-Female-1.jpg



Depth of honey ant (Prenolepsis imparis) nests as measured in Tallahassee Florida during winter months. The figure of a 5 1/2 foot man is for comparison (Tschinkel 1987).

Introduction to Native Ants

There are approximately 281species of ants in California, 255 of those are native, 100 are are native to the San Francisco Bay Area alone (Mahir and Ameet 2010), and 63 (25%) are found only in California (Ward 2005a).

- **Soil Disturbance**: Ants can have large effects above and below ground. Ants carry aboveground matter into the soil enriching it with nutrients and their belowground tunneling and chamber-building disturbs and aerates the soil.
- **Species Interactions**:
  - Ant activities tend to increase the presence soil biota, such as bacteria, fungi, and nematodes (Boulton, et al. 2003).
  - Although not as effective pollinators as bees, ants can carry pollen from flower to flower and may be important pollinators of some rare plants. A study of the San Fernando Valley spineflower (*Chorizanthe paryi* var. *fernandina*; Polygonaceae) in southern California revealed that native ants are important pollinators that substantially increased seed production of this rare and endangered plant that was once thought to be extinct (Jones, et al. 2010).

SMALL HONEY ANT (*PRENOLEPIS IMPARIS*) - NATIVE

Ant Family (Formicidae)

Prenolepis imparis. ***Photo by April Nobile. Copyright AntWeb.org, 2000-2009.***

This ant can be recognized by the strong constriction in the mesonotum that divides the slender thorax into two parts (Texas A & M University 2008.

SMALL HONEY ANT:

- Is native from Canada to Nebraska, south to Texas and Florida, and also occurs in New Mexico, California, Oregon and Washington (Texas A & M University 2008).

- Occupies a variety of woodland habitats and can invades structures and potted plants (Texas A & M University 2008).

SMALL HONEY ANT ECOLOGY

- Species Interactions: The small honey ant is one of two ant species that tend the endangered mission blue butterfly larvae (Arnold 1983).

MORE FUN FACTS ABOUT HONEY ANTS

- They are also called the winter ant, because they can forage in temperatures when most ants are inactive.
- Their nests can extend as much as 12 feet deep and each vertical nest contains many lateral rooms for food storage and for rearing larvae (Tschinkel 1987).

  Tschinkel (1987) reported that some of the ant colonies housed from 9,000 to 10,000 workers and were from 7 to 9 years old.

Plaster cast of a* Prenolepis imparis *nest made by Dr. Walter Tschinkel at Florida State University. Photo by Charles F. Badland, with permission of Walter R. Tschinkel. Researchers can replicate the size and complex structure of underground ants nests by making casts with plaster, molten aluminum, molten zinc, and paraffin (Tschinkel 2010).

HARVESTER ANT (*MESSOR*) - NATIVE

*Head view of harvestor ant (*Messor andrei*) specimen CASENT0005728 collected by P.S. Ward. Copyright AntWEb.org, 2000-2009.*

Ant Family (Formicidae)

The nests of harvester ants can be identified by the seed chaff that litters the entrances (Ward 2005a).

HARVESTER ANTS (ANTS IN THE GENUS MESSOR):

Occupy open, dry habitats.

HARVESTER ANT ECOLOGY

- Species Interactions:
  - Ants in the genus *Messor* are granivorous or seed eating ants.
  - Harvester ants can affect the distribution of plants by removing and/or dispersing seeds.

MORE FUN FACTS ABOUT HARVESTER ANTS

- *Messor andrei* is endemic to California and Baja California (California Academy of Sciences 2002-2010).

FUNNEL ANT (*APHAENOGASTER OCCIDENTALIS*) - NATIVE

Profile ant Aphaenogaster occidentalis specimen casent0005725. © AntWeb.org / CC-BY-SA-3.0. http://www.antweb.org/description.do?name=occidentalis&genus=aphaenogaster&rank=species&project=calants.

Ant Family (Formicidae)

FUNNEL ANT:

- Is widespread in moister habitats in California.
- Is a ground nesting omnivore or generalized scavenger.
- Has been documented at Bodega Marine Reserve (Ward 2003; Ward 2005b), Salt Point State Park and at Mount Tamalpais State Park (CDFA 2010).

WESTERN BLACK-LEGGED TICK (*IXODES SCAPULARIS*) - NATIVE

Hard Tick Family (Ixoididae)

Larvae have six legs and both nymph and adult have eight legs.

WESTERN BLACK-LEGGED TICK:

Black-legged tick,* Ixodes scapularis. *18 June 2004. Jim Gathany. http://commons. wiki media.org/wiki/File:Ixodes_ scapularis.jpg

- Occurs in the western U.S. and British Columbia
- Are present in many habitats in all but two counties in California; they can also found in coastal prairies.

WESTERN BLACK-LEGGED TICK ECOLOGY

- Life History: Western black-legged ticks are "three-host ticks" meaning that they find a new host to feed on for each of their three life stages: larval, nymph, and adult (Vredevoe 1997a). Each stage typically lasts a year and ends with a dormant period (CDCP 2010).
- Species Interactions:
  - The larvae and nymphs feed on lizards and small rodents (Vredevoe 1997b).
  - Adults feed on large mammals and humans; only one blood-meal is taken at each stage (Vredevoe 1997b).

OTHER FUN FACTS ABOUT WESTERN BLACK-LEGGED TICKS

- Ticks find their hosts by "questing" (Vredevoe 1997a). They crawl up grass stems or perch on leaves, typically along the edges of trails, and wait for a passing animal to brush by. Ticks do

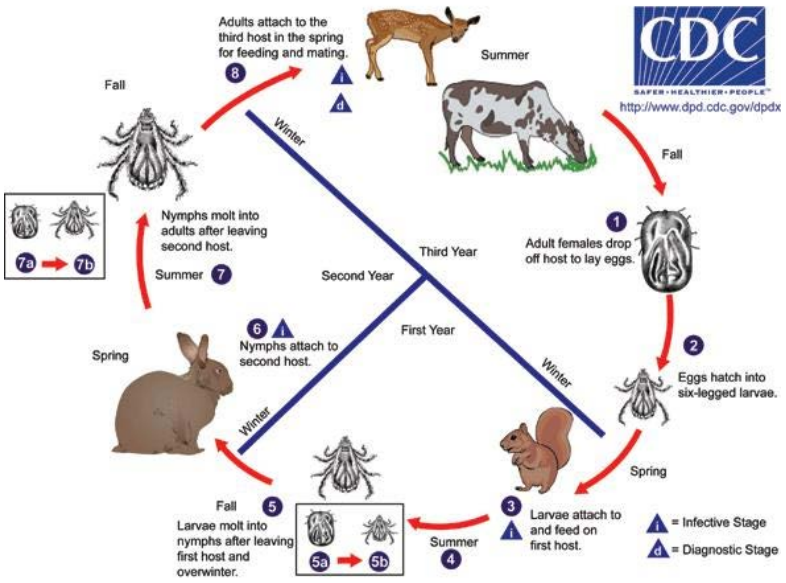


Figure 60. Life cycle of the three-host tick. Courtesy of DPDx website, Center for Disease Control. http://www.dpd.cdc.gov/dpdx/HTML/ Ticks.htm.

not jump or leap, but grasp with their front legs.

- Western black-legged ticks carry the Lyme disease spirochete (a corkscrew shaped bacteria) and the equine granulocytic ehrlichiosis rickettsia in California (Vredevoe 1997b).
- They acquire Lyme disease spirochetes by sucking them up as they feed on an animal carrying the disease; the spirochetes multiply inside the tick and they can then transfer them to the next animal they feed on (CALDA n.d.).
- Ticks that carry Lyme disease are found in all but two counties in California. There have been no collections in four counties, however, since 1985. (California Department of Health Services, accessed Feb. 12, 2020).