Pygmy Cypress

Canada. Its clustered leaves resemble its near relative the azalea. The head of small flowers can be seen in late summer. The leaves are toxic to livestock and humans.

Fort Bragg Manzanita
Arctostaphylos nummularia

37. This low growing manzanita grows most abundantly in the Pygmy Forest but ranges as far south as San Francisco on poor soils. It has small round dark green leaves and red peeling bark. Pink urn shaped flowers produce small apple-like fruit in the fall.

38. Notice the difference between this rhododendron in the Pygmy Forest and the one you looked at in the Redwood Forest. This plant, when growing in the Pygmy Forest, has very small curled leaves and a height of about 3 feet; in the better soils of the redwood forest it can grow to about 20 feet with broad, flat, much larger leaves.

39. **Reindeer Lichen,** *Cladonia portentosa* ssp. *pacifica.* This species of lichen is rare in our area except in the Pygmy Forest. When well developed and untrammeled it forms dense soil mats several feet across and approximately 4 inches tall. Soil lichens play an important role in the ecosystem by preventing erosion and runoff. In the arctic this species is important browse for mammals.

Reindeer Lichen
Cladonia portentosa ssp .pacifica

40. Across the gully you can see where the water has cut away the soil leaving the horizons visible. The top dark organic layer is very thin, under that is the deeper light colored leached area. This horizon is named "podzol" from the Russian word for ash, referring to the ash colored layer. It is light colored from hundreds of thousands of years of rainfall leaching the minerals down though the soil. Below the podzol layer and about 18" from the surface of the soil lies the iron hardpan. This is composed of tiny iron concreted rock-like particles that inhibit root growth. A clay horizon makes up the lowest horizon beneath the iron hardpan.

You have reached the end of the trail, follow the arrows until you come back to the gravel path. Proceed back down the same trail to the Jughandle parking lot.

First printed by the State of California in 1998. For more information about the Pygmy Forest contact the Mendocino Sector Headquarters at (707) 937-5804, or come by the office on Hwy 1, across from the entrance to Russian Gulch State Park, Monday-Friday, 8:00- 4:30.

Jug Handle State Natural Reserve

the Ecological Staircase

A Self-guided Nature Trail

Welcome to Jug Handle State Natural Reserve. You are standing on one of the most interesting geological areas in the northern hemisphere. Here, time, geological forces and climate have all interacted to form a staircase of distinct plant communities and associated soils, culminating in the unique Pygmy Forest.

The numbers in this brochure correspond to numbered posts that you will find along the trail. The trail is about 2.5 miles long and returns along the same route (round trip 5+ miles), and takes approximately 3 hours to complete. (See map inside pages.) There is no drinking water along the trail.

This brochure, new interpretive panels, and many improvements along the Ecological Staircase Trail were made possible through a generous grant to the California State Park System from a group of anonymous donors in 1995.

A Pygmy Forest at Van Damme State Park (3 miles south of Mendocino) is accessible by auto. The Pygmy Forest portion of that trail is also accessible to wheelchair visitors.

CALIFORNIA STATE PARKS SINCE 1864 ®

Posts #1 - #7 can be walked as a short headlands loop trail.

1. Along this portion of the Mendocino Coast the land has been uplifted into a series of flat terraces. In most locations along the California coast the land was raised and tilted by geologic forces forming what we know as the Coast Ranges. Each terrace is approximately 100,000 years older than the lower terrace. Here at Jughandle all 5 terraces form what is known as the Ecological Staircase.

Here on the first terrace, known locally as the headlands, three plant communities exist; the North Coast Bluff Scrub, the Coastal Prairie and the Bishop or Closed-Cone Pine Forest. This entire terrace was formed at the same time; the three vegetation types reflect differences in the physical environment.

2. You are standing on the first terrace, formed underneath the sea and uplifted by tectonic forces. Look out at the Coastal Prairie dominated by grasses, wildflowers and blackberries. Most of the common grasses that dominate this prairie are introduced species like sweet vernal grass and velvet grass. These non-native grasses have dominated the landscape due to past history of plowing and grazing livestock by early settlers. The fibrous roots of grasses have created a rich soil by adding humus through the annual cycle of root growth and death. During the spring and summer months colorful displays of native wildflowers dot the landscape. Among the most common species are: the orange and yellow California poppies, pink sea thrift, white yarrow and baby blue eyes.

3. Across the cove you can see the soil layers exposed at the cliff's edge. Resting on the bedrock of Graywacke sandstone is a brownish colored layer of old beach material 6 to 20 feet thick, on top of that lies the dark layer of grassland soil. On this youngest terrace, the soil is barely developed into soil layers or horizons, compared to the older terraces further up the trail. Soil microorganisms and coastal prairie plants form the soil from the bedrock, Graywacke Sandstone. Directly below a new terrace is being formed under water. As the coastline continues to rise, it will become a new step in the "staircase." The light turquoise colored seawater, contrasting with the deeper dark colored water, shows the area of the new underwater terrace being formed.

4. The North Coast Bluff Scrub community found along the edge of the cliff is made up of perennial low growing shrubs like purple and yellow seaside daisy (*Erigeron glaucus*), the yellow flowered sticky gum plant (*Grindelia stricta*), and nitrogen fixing bluff lupine (*Lupinus littoralis*). These plants are adapted to strong winds and ocean salt spray by growing low to the ground. They lose less water to the drying winds by being covered with many tiny hairs. The grassland or prairie grows along the margin of the bluff community.

Sitka Spruce
Picea sitchensis

5. At the edge of the bluff stands a grove of small Sitka spruce. The bluish needles of the young foliage stand out against the green foliage of surrounding forest trees. At close glance this species is easy to identify with its flat sharply pointed needles growing from a small sturdy peg or wooden petiole. Find a branch without needles so you can feel the bumpy pegs. Only spruces have these wooden pegs. Its cones are similar to Douglas fir without the "mouse tail" like bract. Sitka spruce is a fairly rare tree this far south. It is found in the Pacific northwest from Alaska down to Mendocino county.

6. **Grand Fir**, *Abies grandis.* This oddly shaped Grand fir is lying on its side, its upright branches killed by the drying effect of the salt laden winds.

32. You are at the beginning of the boardwalk. The ecological staircase ends at the climax community, the Pygmy Forest. The only place in the world that the Pygmy Forest occurs is in a few isolated patches here in northern California. The trees and shrubs are stunted by an extremely nutrient poor, highly acidic soil underlain by an iron hardpan. 100 year-old trees only reach the height of a few feet . The ground and trees are covered by many species of lichens due to the availability of light and the suitably moist climate and clean air. The soil lichens help prevent erosion by water movement.

The Pygmy Forest is essentially a bog in that the soil never dries out beneath the surface. Plants must tolerate low oxygen levels in the soil because when the soil is wet, water replaces oxygen in the soil pore spaces. Since roots take in oxygen and give off carbon dioxide, most plants can't live in soils that are too wet.

Rhododendron, huckleberry and salal are common in both the Redwood Forest and Pygmy Forest. These species grow poorly in pygmy soil and in the richer soils they grow larger. Bishop pine grows in more infertile soils through out the coastal area. The pygmy cypress, Bolander pine and Fort Bragg manzanita tend to be more restricted to the Pygmy Forest due to their inability to compete well with other species.

Bolander Pine
Pinus contorta
ssp. *bolanderi*

33. In the sphagnum bogs scattered throughout the Pygmy Forest, Bolander pine can grow to 75 feet but in the rest of the pygmy forest they only reach a few feet tall, some of these are 100 years old! Bolander pine has 2 needles to a bundle and closed cones like the Bishop pine.

34. **Red Usnea,** *Usnea rubicunda*
Look for the red thread-like lichen on the branches of the pygmy cypress. Lichens are a combination of a fungus and a photosynthetic green or blue-green alga. The lichens do not hurt the tree, they are just taking advantage of an "empty space" to attach and photosynthesize. Please do not pick the lichens because it takes decades for even this small quantity of lichens to grow. There are many species of *Usnea* in the Pygmy Forest. All *Usneas* have a central elastic persistent cord in the middle of their body. They are common on trees in mature forests.

PYGMY FOREST INTERPRETIVE PANEL:

This rare plant community occurs only in a few sites where sea-cut terraces and their soil surfaces have remained flat during half a million years of geological uplift. The soils here are 1000 times more acidic than soil found in the redwood forest. Heavy winter rains have leached iron and other soil nutrients from the surface of the ground and washed them down to the subsoil. The iron, soluble under acidic conditions, combines with eroding bedrock (subsoil) to form an iron-concreted hardpan eighteen inches beneath your feet. Extremely acidic conditions and poor soil fertility, coupled with shallow hardpan formation, contribute to the stunted, sparse growth of the Pygmy Forest.

35. **Pygmy Cypress,** *Hesperocyparis pygmaea*
This is a mature pygmy cypress, perhaps a hundred years old. It has small scale-like needles and round cones that open in heat or after a fire. It can grow close to 150 feet tall in better soils, and is generally restricted in range to the Pygmy Forest or sphagnum bogs in the Pygmy Forest. (see illustration next page)

36. **Labrador Tea,** *Rhododendron columbianum*

This evergreen shrub grows in the Pygmy Forest and in bogs and wet meadows, sea level to 10,000 feet throughout the Sierra Nevada and coast ranges to

red berries. All huckleberries are edible. The leaves are thin smooth to serrate. The urn shaped, greenish to pink flowers are shaped like the flowers of its cousins the manzanita and madrone. You will often find red huckleberry growing on top of old stumps in moist shaded woods, between sea level and 4,500'. They range along the coast from San Francisco to Alaska and throughout the Sierra Nevada.

27. A few hundred feet off to your left is a large bog. Here pygmy cypresses grow to over a hundred feet tall with an understory of labrador tea. Because of the bowl shaped topography, a bog developed with many of the typical Pygmy Forest species growing many times the height that they normally grow.

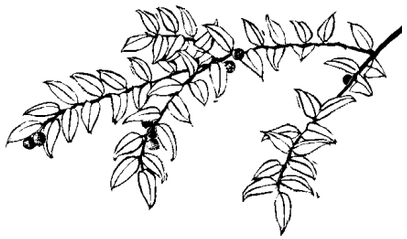
Western Hemlock
Tsuga heterophylla

28. The nodding top of this young hemlock is quite different from the erect tops of the other conifers. Its light green needles are of different lengths, its branches drooping giving the tree and overall lacy or pendulous appearance. The bark is thin, and the sapwood and heartwood are white to yellow. Hemlock cones are round and about an inch in diameter. You will see this tree germinating on old rotten logs and in moist shady sites. The trees live up to 500 years and can grow to over 200 feet tall. Western hemlock can have more than a hundred different fungi attached to its roots in a mycorrhizal association that helps the tree to grow by extending its root mass for water and mineral absorption. The tree provides sugar to the fungus from photosynthesis. An important pulp tree in the Pacific northwest, western hemlock grows from the northern California coast to Alaska. Commercially, it is mixed with Grand Fir and sold as "Hem-Fir", an inferior construction grade wood.

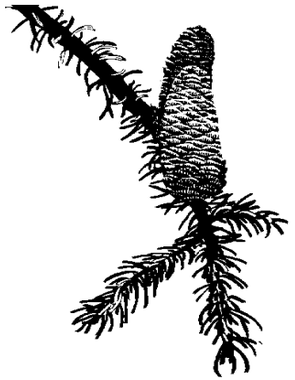
29. Salal, *Gaultheria shallon*
This low growing evergreen shrub with its glossy leaves is often used in the florist trade as "lemon leaf". Its beautiful pink flowers are shaped like its relatives the manzanita and huckleberry. The large blue berries are edible but not quite as tasty as huckleberry. Salal grows below 3,000'in the coastal mountains from the San Francisco Bay to Alaska.

30. You have arrived at the third terrace, the beginning of the Pygmy Forest community. In front of you is a stunted redwood. The soil is so low in nutrients here that redwood needles turn yellow. Look at the color of the soil; hundreds of thousands of years of leaching have produced a white soil leached of nutrients. As you walk, stay on the gravel path and boardwalk in order to preserve the fragile lichen crust that remains only in undisturbed Pygmy Forest. The section of forest that you will walk through at first is undergoing restoration. It has had years of abuse from vehicular, foot and horse traffic.

Blue Huckleberry
Vaccinium ovatum



31. This evergreen shrub has small serrate leaves and delicious blue berries. The fruits are gathered and sold commercially. The leaves are used in fresh flower arrangements and are important food for deer and other mammals. White to pink urn shape flowers hang from the branches. It is abundant from sea level to 3,000' in coastal mountains from the Transverse Range of southern California to British Columbia .



Grand Fir *Abies grandis*

Growing to about 200 feet, its thin bark is often covered with patches of white crustose lichens and sap pockets. The needle tips are shaped in an "m", with two white stomatal lines on the back of each needle. All true firs have erect deciduous cones, shattering on the tree, spreading their seeds in the winds. Thus mature cones are seldom seen on the ground. Occasionally immature cones partially eaten by a Gray or Douglas squirrel may be seen along the trail. Seedlings germinate well in shady sites. The heartwood and sapwood is white and like the foliage is quite aromatic. These trees are common near the coast, where they tolerate the salty winds, but more rare inland to about 10 miles. They grow from northern Sonoma Co. to southern British Columbia eastward to Montana and Idaho. The wood is used for general construction and pulpwood. They live up to 200 years.

KRUMMHOLZ INTERPRETIVE PANEL:

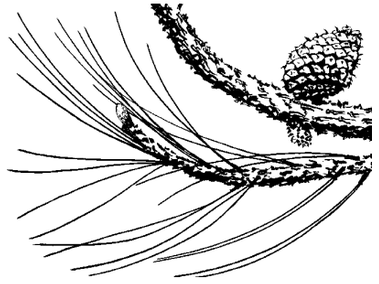
Notice that most of the trees before you are sculpted by salt-laden north winds that dry and kill the tips of the branches. The bent and twisted quality of this tiny grove is called **krummholz**, from the German word meaning "bent wood." These trees, also found along the rest of the Ecological Staircase Trail, usually grow tall and straight. This grove creates a sheltered environment for many local species of birds, mammals and insects that otherwise could not live on this windswept bluff.

7. Pacific Reed Grass, *Calamagrostis nutkaensis*
This large bunch grass is called Pacific reed grass. Once, before plowing and grazing of the Coastal Prairies, this large tufted grass covered much of the headlands. Now it is only common in isolated patches in the Closed-Cone Pine Forest and in the Coastal Prairie where occasionally it can compete with the introduced grasses.

Pink Flowering Currant
Ribes sanguineum var. *glutinosum*

8. This deciduous shrub has pink flowers in the spring and purple currants in the fall that provide food for wildlife. The alternate leaves are veined and lobed like a maple leaf. Its flowers and leaves have a distinctive smell. This species is often used in ornamental landscapes and occurs in riparian and moist sites from Washington to central California.

Bishop Pine
Pinus muricata



9. You are standing in a forest type that is not common in California, the North Coast Bishop Pine Forest. Unlike most conifers, Bishop pine, *Pinus muricata,* does not open its cones and distribute its seeds when they are mature. They release their seeds only when the cones are exposed to intense heat. This adaptation to fire discharges seeds into a bed of fertile ash. Bishop pine grows to less than a hundred feet and is fairly short lived to

approximately 80 years. It has deeply furrowed bark and two needles to a bundle. It grows on sandy soils here on the first terrace near the ocean, on old dunes in patches in the Redwood Forests and in older soils in the Pygmy Forest. It ranges from coastal northern Baja California to Humboldt Co. Look up at the tall pines and notice that the mature trees are round-headed instead of the typical cone shape of most conifers. This lends quite a different look to the mature Closed-Cone Pine Forests.

10. From here you can see the small floodplain of Jughandle Creek. All life here is adapted to the constant surge and flow of floods, distributing fertile silt along the edges of the creek. Flooding is a natural and necessary part of the ecology of riparian systems. Plant roots constantly grow toward the surface to survive being buried by silt again and again. Look up the slope at how the darker green evergreen coniferous forest contrasts with the lighter green creekside community dominated by broadleaf deciduous trees and shrubs. These riparian communities abound with wildlife.

Cascara Sagrada
Frangula purshiana

11. During World War II these deciduous trees were harvested for their bark in the Fort Bragg area. A laxative called "cascara sagrada" is derived from the bark. This species grows up to 50 feet tall, with alternate glossy leaves, distinct veins and leaf margins that can be smooth to serrate. Black round fruits provide food for birds and small mammals. Cascara sagrada grows in riparian areas and other moist sites from British Columbia to Baja California.

Shining Willow
Salix lasiandra

12. Willows are one of the most common riparian plants in temperate regions world wide. Willows are all deciduous with long alternate leaves. This species can be a shrub or tree to 40 feet tall. At the base of its finely serrate, darker green leaves is a leaf-like structure called a stipule. Willow bark has long been known as a pain reliever. Chemists copied natural molecules from this plant to make the synthetic drug aspirin. Shining willow is common in wet meadows, along rivers and seashores to 6,000 feet throughout California north to Alaska.

Red Alder
Alnus rubra

13. Red alder reaches up to 130' tall. It has alternate, doubly serrate deciduous leaves with distinct veins. Turn over the leaf and look at the rolled under leaf margin. This feature distinguishing it from the inland white alder that has flat leaf margins. Alder fruits resemble small cones, distributing the seeds by gusts of wind. Red alder is a very important tree due to the nitrogen-fixing bacterium, *Frankia*, living within its roots. The bacterium provides the nitrogen that is used to create amino acids and protein. These nutrients then filter though the riparian food web. Red alder also harbors the bacterium *Streptomyces* in their roots that can inhibit root rot pathogens. This bacteria genus produces many of our antibiotics like streptomycin, tetracycline and erythromycin. Red alder occurs along stream beds and moist sites along the coast from Alaska to southern California.

acidic soils in moist coniferous forest in coastal mountains from San Francisco to British Columbia.

REDWOOD INTERPRETIVE PANEL:

Redwood trees grow the tallest, live the longest and are among the most fire resistant and flood tolerant of the trees found along coastal California. They grow on slopes, flood plains and level sea-cut terraces, away from the drying effects of ocean breezes.

Redwood trees create their own environment. Their specially formed needles collect moisture from summer fog and drip it to their roots. Tall groves, especially of old-growth trees, create deep shade where few species of plants can survive. Some birds, insects, mammals and amphibians live high up in the canopy, where they can find the most light and food. In addition, certain lichens found in the canopy fix nitrogen essential for the food web of the Redwood Forest ecosystem.

Tanbark Oak
Notholithocarpus densiflorus

23. The leaning moss covered tree near you is a tanbark oak. This evergreen tree can grow over a 100 feet tall. Its stiff, leathery sharply serrate leaves have distinctive veins, with thick hair covering the underside. In the spring new leaves emerge pink and then turn green. Its acorns are highly sought after by squirrels and birds and the bark was harvested in the past for tanning leather. Today tanbark oak is used for fax paper, flooring, furniture and fuel. It's an extremely vigorous stump sprouter after it is cut.

Redwood
Sequoia sempervirens

24. Now that we are away from the salt laden breezes of the ocean the forest changes and is now dominated by redwoods. Redwoods have a limited distribution, occurring only along the coast, between southern Oregon and central California where summer fog and moderate temperatures prevail.

The bark is thick, red, fibrous and fire resistant. Look on the ground and you can see that the needles fall in branchlets instead of singly like in other conifers. The heartwood is red, and the sapwood is pink. The small oval cone is about 1 inch in diameter with its scales touching like in a soccer ball instead of overlapping like in the cones of pines, firs and spruces. The heartwood, especially in old growth, is rot resistant. The timber is highly valued for use as siding, paneling, fencing, decking, garden landscaping and building foundations. This tree can live to about 2,000 years. It is one of the only conifers that stump sprouts, forming rings of trees after one is cut. The tallest redwood measures 368' tall and 12'6" in diameter.

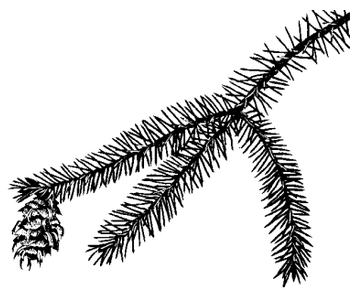
25. You are standing by one of the many small tributaries that make up the watershed of Jughandle Creek. To your left is a line of corn lilies *(Veratrum fimbriatum*) with their large pleated leaves. In the winter a stream runs here and in the summer these moisture loving plants are the only indication of that stream.

26. **Red Huckleberry**, *Vaccinium parvifolium*
A large hemlock with exposed roots shades the red huckleberry and deer fern (Blechnum spicant). The red huckleberry differs from its relative the blue huckleberry by its strongly angled, green twigs and

18. You have now reached the second terrace dominated by Sitka spruce and Grand fir. This plant community is part of the great Pacific northwest forest that ranges close to the coast from southern Alaska south to Mendocino county. Other species that commonly occur in this forest type are western hemlock, Douglas fir, salal, sword fern and blue huckleberry.

19. Look at the scaly bark of this Sitka spruce, notice how it compares to the flatter bark of the nearby Grand fir. At your feet you may find the small cones of the spruce. It grows up to about 200 feet and lives to about 850 years. It tolerates moist soils by growing its roots along the forest floor often forming a buttressed base. Sitka spruce is used for lumber for light construction, siding and pulpwood.

Douglas Fir
Pseudotsuga menziesii



20. This is a young tree, at maturity it can grow well over 300 feet. Douglas fir is easy to identify with its uniform length needles on branches that end in a red pointed bud. The sapwood is white and the heartwood pink. Old bark is deeply furrowed, when cut you can see alternating layers of red phloem and yellow cork. The cones resemble Sitka spruce cones except that it has a 3-lobed bract sticking out from each scale. This is a very widely distributed tree growing in the mountains and coastal regions from central California to British Columbia and from mountains in Mexico north through the Rocky Mountains to Canada. Depending on local conditions it can live from 500 to1,200 years. Douglas fir is the most important timber tree in U.S. because its wood is very strong and hard. Most framing lumber is made from this wood. It is also the leading species for plywood veneer. The bark is used as a potting soil amendment and as a source of tannins, waxes and food preservatives. Important nitrogen fixing lichens live in the canopy of old growth Douglas fir and contribute to the minerals cycle that is needed for forest health. This tree provides food for the Douglas squirrel and other animals of the forest.

21. **Hairy Manzanita,** *Arctostaphylos columbiana.* Feel the bark on this manzanita. Last years bark is sparse and peeling away, this years bark is red, hard and smooth. Hairy manzanita can grow as a shrub or a small tree depending on light availability. It has white flowers, blooming in January and February when there are few other flowers in bloom, providing an important source of food for bumblebees. It is similar to one of its relatives, the madrone tree, which has orange peeling bark and larger leaves. Madrones are rare this close to the coast. Manzanita berries are mealy but edible, resembling little apples, hence its spanish name "manzanita". Hairy manzanita grows in coniferous forest along the coast from sea level to 2,500', from northern California to British Columbia.

Rhododendron,
Rhododendron macrophyllum

22. There are over a thousand species of rhododendron in the north temperate region and Australia. The word rhododendron means "tree rose" in Greek. The leaves are considered poisonous to livestock. This species is an evergreen shrub or small tree with beautiful pink flowers and leaves that cluster at the ends of branches. It grows in

RIPARIAN INTERPRETIVE PANEL:

This habitat is called Riparian, which means "by the river." The trees and shrubs that grow here require much more summer moisture than plants growing far from the stream. These trees shade the stream in summer. Because most of them lose their leaves in late fall, they let in light and warmth in winter. This keeps the water temperature at levels that provide optimal conditions for fish such as our local Steelhead and Coho Salmon.

Red Alders are vital to the food cycle of forest life. Thousands of bacteria nodules cling to their roots and convert atmospheric nitrogen, useless to most organisms, into a form of nitrogen which all life uses to make protein. In autumn, alder leaves fall into the stream and decompose, providing food for the aquatic larva of mayflies, midges and stoneflies. Fish, lizards, salamanders, birds and bats eat the flies. Their droppings, rich in useful nitrogen, provide nutrients for plants and other animals, which then continue the recycling of nitrogen throughout the ecosystem.

Red Elderberry
Sambucus racemosa

14. Notice the opposite, leaves on this deciduous tree. Each leaf is made up of 5 to 7 leaflets. The white flowers produce red fruits that are toxic to humans, but important to birds. The blue fruited species found inland do have edible berries though the leaves of all elderberries are toxic. Red elderberry grows along the coast from British Columbia to southern California. The word *Sambucus* for the genus of all elderberries is derived from the musical instrument the Sambuke because this tree was the source of its wood. The pith used in botany laboratories is derived from this tree.

Wax Myrtle
Morella californica

15. This white barked small evergreen tree can grow to approximately 30'. The fruit of its eastern relative, the bayberry, is widely known for its use in making bayberry candles. Wax myrtle only has a small amount of wax on its fruit, occasionally used for candles, but is a favorite fruit for many birds. Its roots also host the important nitrogen fixing bacterium *Frankia.*

16. For the next few hundred yards, until you reach post #17, you will be walking through an area dominated by non-native plants such as Monterey pine, and yellow flowering, spiny gorse, French and Scotch broom and the ever-present non-native sweet vernal and velvet grasses. The Monterey pines were planted here by early landowners but are native only to the Monterey peninsula. Gorse and the brooms were originally brought to the west coast as ornamentals for their abundant yellow flowers. They have invaded the natural environment where the land has been disturbed by grazing, logging and development. This area is in the process of having all of the non-native Monterey pines taken out.

17. **Monterey Pine,** *Pinus radiata*
Look and see if you can tell the difference between the greener 3-needled Monterey pine and the native 2-needled grayer Bishop pine. Monterey pine is planted as a timber tree in South America, Australia and New Zealand; it is also an important ornamental tree through out California.

Jug Handle State Natural Reserve:
Map to the Interpretive Posts along the Ecological Staircase Trail