

Jug Handle State Natural Reserve
The Ecological Staircase
Information for the Self-Guided 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**.

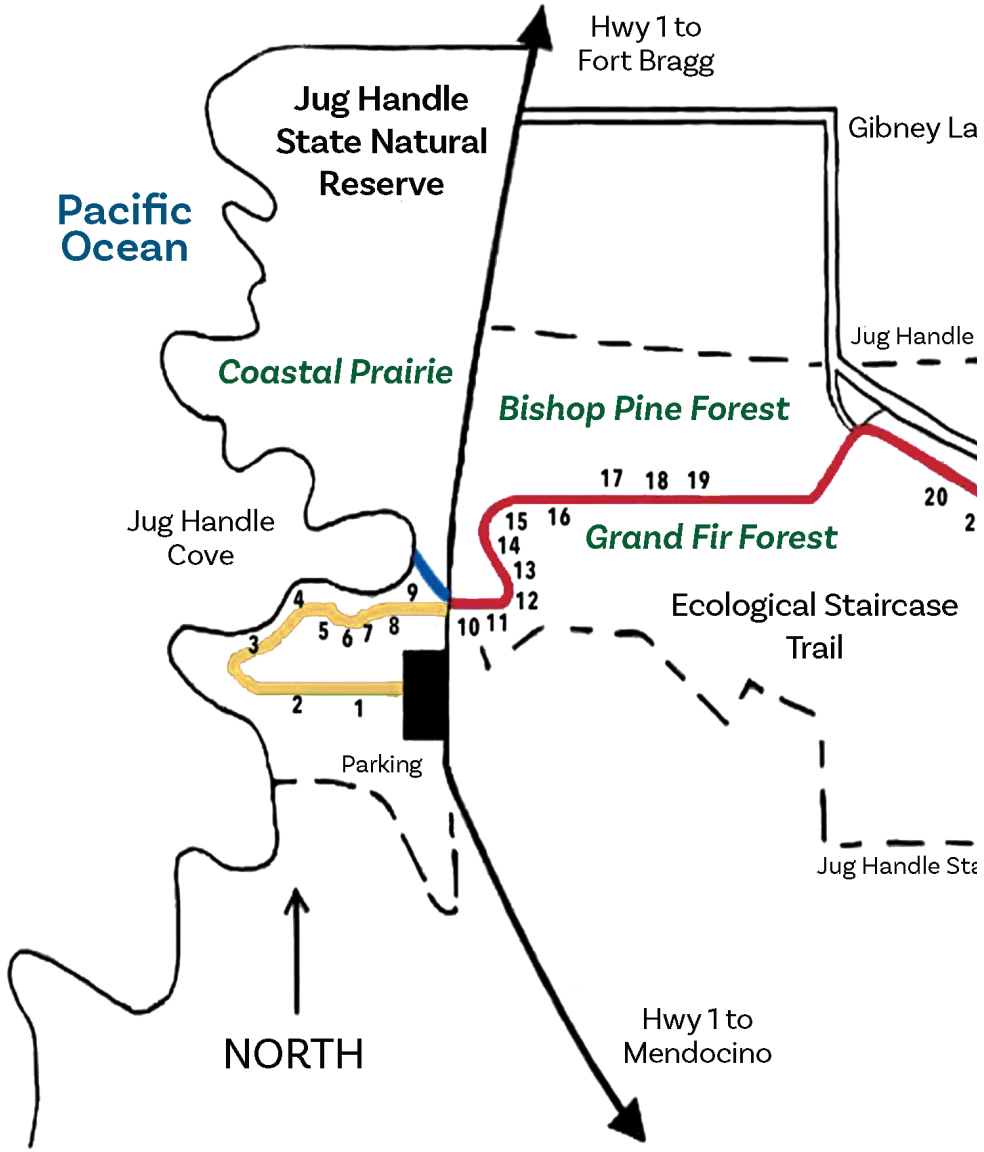
The numbers in this brochure correspond to numbered posts you will find along the trail. The trail is about 2.5 miles long and returns along the same route. Round trip is more than 5 miles and takes approximately three hours to complete. (See map inside pages.)

There is no drinking water along the trail.

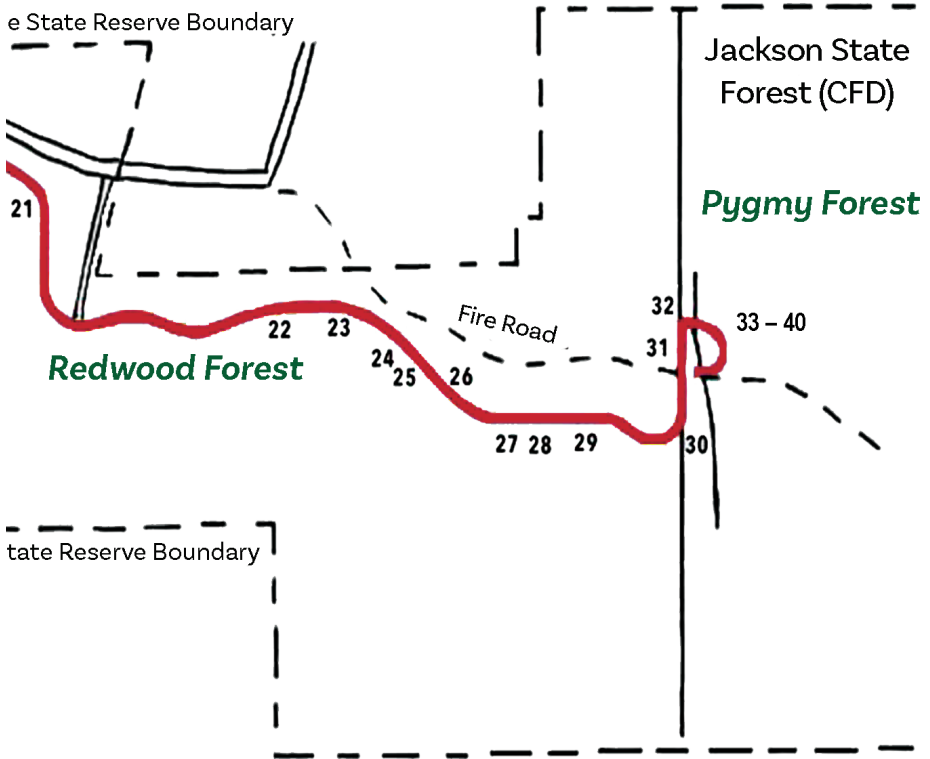
A **Pygmy Forest at Van Damme State Park** (3 miles south of Mendocino) is accessible by vehicle. The Pygmy Forest portion of the trail is also wheelchair accessible.

Jug Handle State Natural Reserve

Map to the Interpretive Posts Along the Ecological Staircase Trail



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

1. Plant Communities

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 Jug Handle, all five 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. Coastal Prairie

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. Terrace Formation

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, and 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 underwater. 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. Plant Adaptations

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.

5. Sitka Spruce *Picea sitchensis*



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 mousetail-like bract. Sitka spruce is a fairly rare tree this far south. It is found in the Pacific Northwest from Alaska 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. 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 somatal 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.

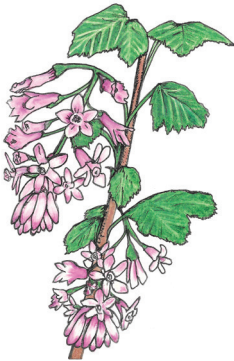
6. Continued...

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 County to southern British Columbia, eastward to Montana and Idaho. The wood is used for general construction and pulpwood.

7. Pacific Reed Grass *Calamagrostis*

This large bunch grass is called Pacific Reed Grass. Before plowing and grazing of the coastal headlands, it was once abundant. 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.

8. Pink Flowering Currant *Ribes var. glutinosum*



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.

9. Bishop Pine *Pinus muricata*



You are standing in a forest type not common in California, the North Coast Bishop Pine forest. Unlike most conifers, Bishop Pine or (*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 lives 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 County. 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.



The 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.

10. Floodplain

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.

12. Willow *Salix*



Willows are one of the most common riparian plants in temperate regions worldwide. Willows are all deciduous with long alternate leaves. This species can be a shrub or tree to 40 feet tall.

11. Cascara Sagrada *Frangula purshiana*

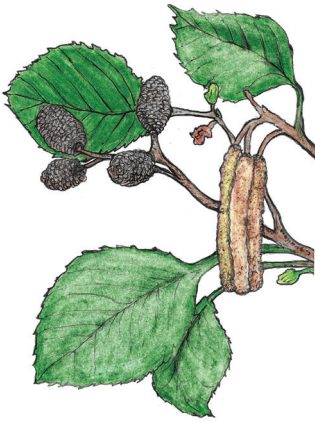
In the past trees were harvested for their bark in the Fort Bragg area. A laxative called “cascara sagrada” is derived from the bark.

12. Continued...

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 their 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.

13.

Red Alder *Alnus rubra*



Red Alder reaches up to 130 feet tall. It has alternate, doubly serrated deciduous leaves with distinct veins. Turn over the leaf and look at the rolled-under leaf margin. This feature distinguishes 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

because of the nitrogen-fixing bacterium, Frankia, living within its roots. The bacterium provides the nitrogen used to create amino acids and proteins. These nutrients then filter through the riparian food web. Red Alder also harbors the bacterium *Streptomyces* in their roots that 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.

14.

Red Elderberry *Sambucus racemosa*

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 are 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* from 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.

15. Wax Myrtle
Morella californica



This white-barked, small evergreen tree can grow to approximately 30 feet. 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 this is used for candles, but it's a favorite fruit for many birds. Its roots also host the important nitrogen fixing bacterium, Frankia.

16. Invasive Plants

For the next few hundred yards until you reach post 17, you will be walking through an area dominated by non-native plants: pine, 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.

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 throughout California.

18. Pacific Northwest Forest

You have now reached the second terrace dominated by the Sitka spruce and Grand Fir. This plant community is part of the

18. Continued...

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. Sitka Spruce

Look at the scaly bark of the Sitka. Notice how it compares to the flatter bark of the 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.

20. Douglas Fir *Pseudotsuga menziesii*

Douglas Fir can reach 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 to 1,200 years. Douglas Fir is the most important timber tree in the 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.

21. Manzanita *Arctostaphylos*

Feel the bark on this manzanita. Last year's bark is sparse and peeling away, this year's 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 forests along the coast from sea level to 2,500 feet, from northern California to British Columbia.

22.

Rhododendron
Ericaceae



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

23.

Tanbark Oak
Notholithocarpus densiflorus



The evergreen tanbark oak can grow over 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 flooring, furniture and fuel. It is an extremely vigorous stump sprouted after it is cut.

24. Redwoods *Sequoia sempervirens*



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 as in a soccer ball instead of overlapping like in the cones of pines, firs and spruces. The heartwood, especially 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 2000 years. It is one of the

only conifers that stump sprouts, forming rings of trees after one is cut. The tallest known redwood measures 280 feet, the height of a 37-story building.

25. Seasonal Stream

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 fibriatum*) 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 red berries. All huckleberries are edible. The leaves are thin and 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 feet. They range along the coast from San Francisco to Alaska and throughout the Sierra Nevada.

27. Bog

A few hundred feet off to your left is a large bog. Here pygmy cypresses grow to over a 100 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 flowering many times the height that they normally grow.

28. Western Hemlock *Tsuga heterophylla*



The nodding top of young hemlock trees look quite different from the erect tops of other conifers. Its light green needles are of different lengths, with its branches drooping, giving the tree an 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, which 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 blueberries are edible but not quite as tasty as huckleberry. Salal grows below 3,000 feet in the coastal mountains from the San Francisco Bay to Alaska.

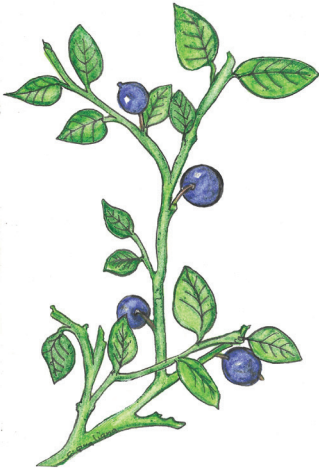
30. Soil Leaching

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

30. Continued...

of nutrients. As you walk, stay on the gravel path and boardwalk to preserve the fragile lichen crust that remains only in this undisturbed Pygmy forest. The section of forest that you will walk through at first is undergoing restoration.

31. Blue Huckleberry *Vaccinium ovatum*



This evergreen shrub has small serrate leaves and delicious blueberries. 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-shaped flowers hang from the branches. It is abundant from sea level to 3,000 feet in coastal mountains from the Transverse Range of southern California to British Columbia.

32. Pygmy Forest

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. One hundred year old trees only reach the height of a few feet.

The ground and trees are covered by many species of lichens because of the availability of light and the suitability of the 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 throughout the coastal area. The Pygmy Cypress, Bolander

pine and Fort Bragg manzanita tend to be more restricted to the Pygmy forest because of their inability to compete well with other species.

33. Bolander Pine
Pinus contorta ssp. bolanderi



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 small trees 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 algae. 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.

35. Pygmy Cypress
Hesperocyparis pygmaea

This is a mature pygmy cypress, perhaps a 100 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.



36. Labrador Tea
Rhododendron columbianum

This evergreen shrub grows in the Pygmy forest and in bogs and wet meadows, from sea level to 10,000 feet throughout the Sierra Nevada and Coast Ranges to Canada. Its clustered leaves resemble its near relative, the azalea.

37.

Fort Bragg Manzanita *Arctostaphylos nummularia*



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 apply-like fruit in the fall.

38.

Dwarf Rhododendron

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

untrammled, 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 an important browse for mammals.



40.

Soil Horizons

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 leach area. This horizon is named “podzol” from the Russian word for ask, referring to the ash-colored layer. It is light colored from hundreds of thousands of years of rainfall leaching the minerals down through 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, concrete, rock-like particles that inhibit root growth. A clay horizon makes up the lowest horizon beneath the iron hardpan.

You are walking on sacred land. Cultural Lifeways at Jug Handle/Tca'dam (Northern Pomo)



Oat-wheat

Our People from Northern and Coastal Pomo Tribes have thrived on this coast since the beginning of time. We will always

have a presence and profound connection to this place. While we speak different languages, we share a mutual respect as caretakers

of the environment. We use this area for subsistence living, passing our traditional ecological knowledge onto our youth. We live in reciprocity with nature, giving thanks to our relatives from that land and sea as we gather medicines, basket materials, seaweed, and fish.



Lucy Cooper & Susie Campbell

Courtesy of the Campbell/Cooper Family



Sherwood Valley Band of Pomo Indians Big Time Gathering

Courtesy of Sherwood Valley Band of Pomo Indians

From Shelter Cove to the Navarro River, we continue to care for the land, the water, the plants, and the animals, always using sustainable, traditional methods. These methods not only reflect our culture but also our spiritual

Tan oak

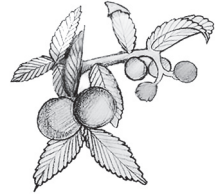




Mountain balm

practices and beliefs, exemplifying our duty of care for our home. We understand our everyday lives are a part of our ceremony. To keep both ourselves and our land balanced, we must care for the natural world around us.

Our people continue to suffer from the impacts of colonization. State and federal government-sanctioned genocide, forced land removal, outlawing of traditional practices, and ecocide impact the environment and our access to our homelands. We are the descendants whose grandparents stood against genocide, mass slayings, boarding schools, colonization, and inhumane laws that promised to exterminate them. Through it all, we remain and are here to tell our story.



Huckleberries (black)

We continue our traditions to restore the balance.



Redwood huts

Courtesy of the Campbell/Cooper Family

Our People have subsisted off the Mendocino Coast for millennia and are not the source of resource depletion, ocean acidification, pollution, or climate change. We continue to commune in the same places, seeking sustenance from the Earth's bounty. We monitor the

health of seaweed, shellfish, and other sea life. We tend to the plants on the bluffs and forested slopes. The same families return year after year to the same places, and we have a fundamental interest in wanting to keep our sacred landscapes healthy and clean.



Sedge root

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Redwood

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 8-4:30.

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 Jug Handle parking lot.

Field Notes: _____



Milkweed



**Blue
elderberry**

This educational brochure is provided by the Mendocino Area Parks Association (MendoParks.org) thanks to support from the Community Foundation of Mendocino County's **Environmental Education and Conservation Endowment Fund** and **Fund for Trails and Open Space**, with additional funding from **California State Parks Foundation**.

Suggested donation: \$5

Your gift helps with reprinting costs for the trail guide!

*This publication is available in alternate formats by contacting **MendoParks: 707-937-4700. 711, TTY relay service.***



Photo: [Mark Scheffer](#)



**COMMUNITY
FOUNDATION**
OF MENDOCINO COUNTY



MendoParks is the 501c3 nonprofit organization that supports state parks in Mendocino County with educational activities, park improvements, and visitor services. We receive no government funding or tax dollars for our operations, and all the money we raise stays right here in our state parks in Mendocino County.

Join us in keeping parks safe, accessible and thriving!

Become a MendoParks Member, make a heartfelt Donation or Volunteer.

Visit MendoParks.org to learn more.