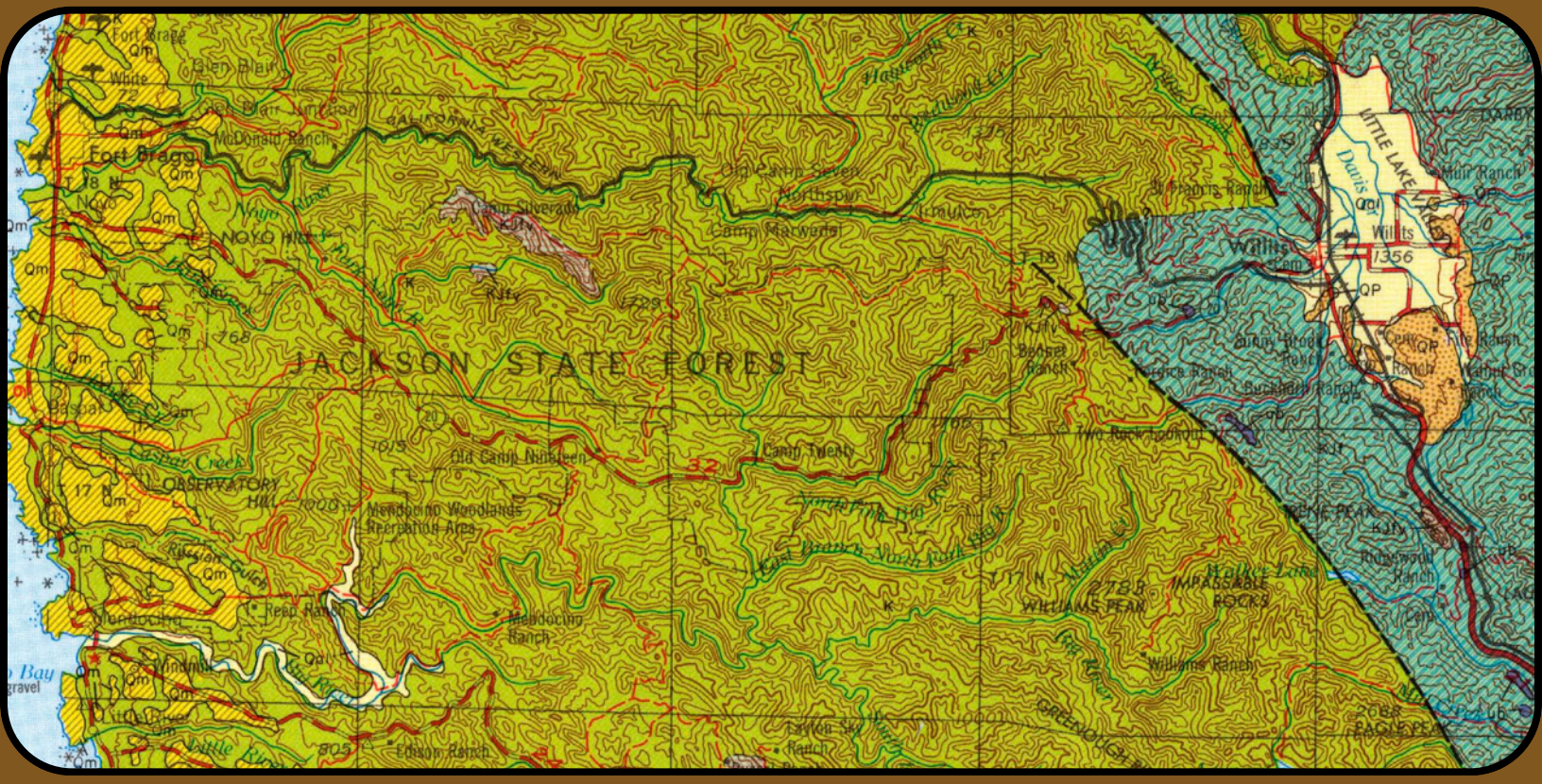
Professional Soil Scientists Association of California in Collaboration with California Forest Soils Council

Annual Meeting and Field Tour Guide Book



Soils, Climate, and Prescribed Fire from Coast to Inland in Mendocino County

June 5-8, 2025

Professional Soil Scientists Association of California Annual Meeting & Field Tour in Collaboration with California Forest Soils Council Present

Soils, Climate, and Prescribed Fire from Coast to Inland in Mendocino County

June 5-8, 2025

Guide Book

Meagan Hynes, David Smith, & Chris D'Aiuto Eds.

Contributors:
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Patrick Brand
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Joel Butterworth
Meagan Hynes
Michael Jones
Lis Kraycik
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Teresa Sholars
David Smith

Thanks you to the following individuals who helped organize and assist with this meeting and field tour:

Claire Ashby Rees, PSSAC
Lynn Webb (retired CalFire)
Chris D'Aiuto
John Francis Brune
Lia Webb
Sara Ahlich

PSSAC
Professional Soil Scientists Association of California

California Forest Soils Council
Since 1981

Cover image from Geologic Map of California, Department of Natural Resources, Division of Mines, Ukiah Sheet, Olaf P. Jenkins Ed. 1960

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Meeting Agenda

Thursday, June 5, 2025

3:00 pm - 9:00 pm *Arrival*
Participants arrive at Mendocino Woodlands Camp 3, Check-in with PSSAC/CFSC registration. Set up campsites/cabins. Dinner on your own using the campsite kitchen or dinner on your own in town.

Friday, June 6, 2025

7:15 am *Welcome Talk*
Meet at the main area of Camp 3 and pick carpool buddies for the day. **Bring your own lunch.** Snacks will be provided.

7:30 am *Leave for Stop #1*

8:00 am *Stop #1*
First stop in Jughandle State Natural Preserve - Hans Jenny and Soil Pits: Geology, Soils, and Vegetation - David Longstreth, Patrick Brand, Kevin Doherty (CA Dept. of Conservation), Susan Marshall (Cal Poly Humboldt), Teresa Sholars (Mendocino College)

9:45 am *Leave for Stop #2*

10:15 am *Stop #2*
Jackson Demonstration Forest - Jenny Pits Part 2, Lynn Webb (Retired CalFIRE), and Pygmy Forest Rx Burn Study, Mike Jones (UCANR)

11:45 am *Leave for Stop #3 and LUNCH*

12:10 - 1:00 pm *LUNCH at Stop #3*

1:00 pm *Stop #3*
Fire Mitigation Study - Mike Jones (UCANR)

2:30 pm *Leave for Stop #4*

2:45 pm *Stop #4*
Caspar Sap Flow Study and Turbidity in Watersheds Study

4:15 pm *Leave for Mendocino Woodlands Camp 3*

5:00 pm *Business Meetings*
Separate PSSAC and CFSC

6:00 pm *Annual Banquet*
Dinner Provided by PSSAC and CFSC

Saturday, June 7, 2025

7:30 am *Travel to Willits*
Load up vehicles and travel to the first stop in Willits. **Bring your own lunch**. Snacks will be provided.

8:30-8:45 am Meet at Willits Bypass Mitigation Rendezvous Spot
We will travel from here to Stops 1 and 2. Introduction and grazing - Chris Bartow (MCRCD), Reveg and Hydrology study - Geri Hulse-Stevens (consultant).

9:00 am *Willits Bypass Mitigation Project Stop 1 -* *This stop is behind a locked gate, so you must travel with the group.* Reconstructed wetlands - Geology/Geomorphology and Soils - Jeff "JP" Peters and Joel Butterworth

10:30 am *Willits Bypass Mitigation Project Stop 2 -* *This stop is behind a locked gate, so you must travel with the group.* More Constructed Wetlands and soil discussion - Jeff "JP" Peters and Joel Butterworth

12:00 pm *LUNCH*
At Recreation Grove Park across from Willits Library and Mendocino County Museum. Bring your own lunch.

1:00 pm *Soil Climosequence Introduction*
Introduction - David Smith (NRCS retired)

1:20 pm *Leave for Stop A*

1:45 pm *Soil Climosequence Stop A*
Gabriel Madrigal Bench - David Smith (NRCS retired)

2:10 pm *Leave for Stop B*

2:45 pm *Soil Climosequence Stop B*
Camp 20 - David Smith (NRCS retired)

3:15 pm *Leave for Stop C*

3:45 pm *Soil Climosequence Stop C*
Pygmy Forest in Jackson Demonstration Forest/Hwy 20 - David Smith (NRCS retired)

4:10 pm *Leave for Stop D*

4:30 pm *Soil Climosequence Stop D*
Noyo Headlands Park - David Smith (NRCS retired)

6:00 pm *DINNER*
CFSC is putting on a BBQ back at camp for donation.

Sunday, June 8, 2025

11:00 am Cleanup & Pack Up!
Everyone must be packed up and leave Mendocino Woodlands by this time.

2025 PSSAC/CFSC Annual Meeting Speaker Bios

Chris Bartow

Chris joined Mendocino County Resource Conservation District (MCRCD) in September 2014. Chris has twenty years of experience in agriculture working on ranches in Nevada and California, ten of which have been here in Mendocino County. Chris has managed livestock on private and public ground and has extensive experience working at the interface of private livestock grazing and public agency regulations and requirements. In Willits, Chris has been involved in the conservation and management of Baker's Meadowfoam, an endangered species. He has also been involved in researching the relationship between grazing animals and grassland ecosystems. Chris lives and ranches with his family in Willits.

Patrick K. Brand

CA Professional Geologist GEO 8693 - CA Certified Engineering Geologist EG 2542

I have served as an Engineering Geologist for the California Geological Survey since 2013. I am stationed at a CAL FIRE facility in Santa Rosa, CA, and my primary role includes review of CEQA-compliant Timber Harvest Plans (THP) in the Northern California coastal region to assess geologic conditions relative to proposed operations with respect to protection of public safety and minimization of the potential for adverse environmental impacts, including frequent reviews and field inspections across Mendocino County. As well, I prepare consulting engineering geologic reports for THPs and perform research and geologic mapping in Jackson Demonstration State Forest in Mendocino County. I have also participated as an engineering geologist on several California State Watershed Emergency Response Teams (WERT) (2014, 2015, 2016, 2017, 2018, 2020) that are formed to assess the impacts of wildfire regarding risk to life, property, and habitat due to landsliding, mudflows, and erosion that may occur during post fire winter rains. I am currently working to complete an updated map of landslides, geomorphology, and geology of the Mendocino 7.5' quadrangle which includes the marine terraces in the field trip vicinity. Prior to working for the State of California, I worked for eight years in private industry in Northern California providing geological consultation on a variety of civil engineering projects. I received an M.S. in Geological Sciences from Arizona State University, Tempe, AZ. My B.S. in General Geology with honors, was from University of Kansas, Lawrence, KS.

Mairead Brogan

Mairead Brogan is a second year PhD student at Northern Arizona University. She earned a degree in Ecology and Evolutionary Biology from the University of Colorado, Boulder, where she researched the impacts of nuisance algal blooms on aquatic communities. Her current research investigates ecohydrological processes in a managed second-growth coast redwood forest, focusing on water movement, use, and stress under varying canopy cover conditions.

Joel Butterworth

Joel is a retired environmental consultant with a BA in Geography from UC Santa Barbara and an MS in Geography with a minor in Soil Science from Oregon State University. He held certifications as a Professional Wetland Scientist and in erosion and sediment control and stormwater pollution control up until the time that he (mostly) retired in 2022. He worked for a variety of environmental consulting firms during his 35-year career, the last 12 years of which with ICF Jones & Stokes. His work involved wetland delineations, soil evaluations in support of habitat restoration projects, stormwater pollution prevention plans, and environmental impact

assessments. Joel worked on the Willits Bypass Project from 2009 through 2013, conducting wetland delineations, describing soil profiles and installing shallow groundwater monitoring wells.

Kevin Doherty, CEG

CA Professional Geologist GEO 7824 - CA Certified Engineering Geologist EG 2666

I received a BS in Geology from San Francisco State University in 1997. I have been an engineering geologist with the California Geological Survey's Forest and Watershed Group since 2013. Much of my time is spent with Cal Fire reviewing proposed timber harvest plans. Work product generated from timber harvest reviews are completed within mandated deadlines pursuant to California's Forest Practice Rules (FPR). My duties also include evaluation of post-fire environmental and public safety impacts, geologic consulting in state demonstration forests and geologic mapping. Prior to that, I spent 6 years (2007-2013) as an engineering geologist with California's Department of Conservation's Office of Mine Reclamation overseeing California's Surface Mining and Reclamation Act (SMARA). My duties included reviewing mining operations, conducting mine inspections, training local agency inspectors and interacting with state and local boards and planning commissions. Work product generated from oversight of mining operations were completed within mandated deadlines pursuant to SMARA. Prior to working with the State, I was employed for 10 years with a San Francisco based engineering firm, Municon Consultants, specializing in geophysical evaluation of heavy construction on adjacent infrastructure and the environment. I have written and presented technical papers to agencies and organizations, including the American Society of Civil Engineers, California Construction and Industrial Materials Association and Association of Environmental and Engineering Geologists.

Geri Hulse-Stevens

Geri Hulse-Stephens is a botanical consultant and wetland delineator with 25 years' experience. She has worked for public agencies, and on tribal and privately held lands as well as conservation organizations. She has conducted botanical surveys on projects for the Willits Bypass in a variety of roles that include rare plant surveys, oak surveys, riparian vegetation surveys, rare plant monitoring, wetland plant monitoring, rare plant seed collection and propagation and rare plant relocation, as well as water quality monitoring, hydrological studies, salmon spawning gravel studies and wetland delineation. She has worked extensively in the North Coast coniferous forest habitat as well as coastal habitats. She has conducted extensive studies of both North Coast Semaphore Grass and Baker's meadowfoam, both are listed plants that grow within the Willits Bypass Mitigation Project area. She has taught classes on wetland ecosystems and difficult wetland taxa for the California Native Plant Society educational program.

Meagan Hynes

Meagan is a Certified Professional Soil Scientist (CPSS) with a BS in Botany from Oregon State University and a PhD in Soils and Biogeochemistry from University of California, Davis. She comes from a multidisciplinary background with experience in soils, water, and plants issues. Under her company, Talus Soil Consulting, she consulted on urban, agricultural, and various natural systems from 2014-2023. During this time, she also taught at California State University, Monterey Bay (CSUMB), with most recently helping to develop classes for their Agricultural Plant & Soil Sciences (AGPS) major. From 2020-23, Meagan was adjunct research faculty at CSUMB for a project implementing healthy soil practices. In October of 2023, Meagan joined MCRCD as the Soil and Water Project Manager. In November 2024, Meagan began as a soil conservationist at USDA NRCS. She is currently the PSSAC president.

Michael Jones

Michael Jones is the University of California Cooperative Extension Forest Advisor for Mendocino, Lake, and Sonoma Counties. He is a forest entomologist by training and specializes in forest health and disturbance ecology of coastal conifer forests and oak woodlands. He promotes a forestry program that focuses on helping keep oak woodlands and coastal conifer forests healthy and resilient to future disturbance by encouraging good stewardship through education and research.

David L. Longstreth

CA Professional Geologist GEO 6436 - CA Certified Engineering Geologist EG 2068

Mr. Longstreth works with the California Geological Survey's Forest and Watershed Geology Program as a Senior Engineering Geologist. Review of CEQA timber harvest documents includes assessment of geologic conditions relative to proposed operations in relation to protection of public safety and minimization of the potential for adverse environmental impacts. In addition to timber harvest review and administrative duties, Mr. Longstreth manages work performed for Cal Fire at State Demonstration Forests. Mr. Longstreth has participated as a team member (engineering geologist) on several federal Burn Area Emergency Response (BAER) and co-leader on California State Watershed Emergency Response Teams (WERT). The teams are formed to assess the impacts of wildfire regarding risk to life and property to post-fire debris flows and flooding. He earned a Masters in Earth Science at State University of New York at Stony Brook and a B.A. in Earth Science from University of California at Santa Cruz.

Susan Marshall

Susan Edinger Marshall is Professor Emeritus of Rangeland Resources and Wildland Soils at Cal Poly Humboldt where she taught for 27 years. She completed her Ph.D. in Soil Science at U.C. Riverside, where she studied the distribution and calcite micromorphology of soils on a granitic pediment in the East Mojave Desert. During her time at Humboldt she has researched soil compaction during timber harvest activities, the incidence of *Phytophthora* in coastal soils, field versus lab tests for soil phosphorus, and belowground carbon in forest soils.

Jeff Peters, ICF

Mr. Peters has 22 years of experience in the environmental industry conducting erosion and channel stability assessment, aquatic habitat, fish passage, and restoration feasibility studies, which he prepares in support of restoration designs and watershed and stream corridor management plans.He conducts streambank and channel stability assessments and monitoring; stream classification surveys; topographic surveys; and streamflow surveys. Jeff also conducts bioassessments (benthic macroinvertebrate collection and algae collection, physical habitat surveys, and water quality assessments). Jeff works on many projects with interdisciplinary teams, including fish biologists, botanists, and restoration engineers.
Jeff has worked on river systems throughout the West Coast and the Rockies, including various watercourses in the Little Lake Valley (northern CA) where he currently conducting post-restoration erosion and geomorphic monitoring associated with the Willits Bypass; the North Fork Feather River (northern CA) where he is currently conducting fish habitat suitability studies in support of potential reintroduction of spring-run Chinook salmon to the watershed; the Middle Fork American River (northern CA) where he has been monitoring the effects of gravel augmentation since 2001; the Napa River (northern CA), where he helped identify areas of severe bank erosion; and the Tongue River (MT), where he assessed geomorphic conditions relative to fish habitat. As a geomorphologist, Jeff focuses on the role of physical habitat and its

relationship with the aquatic, benthic, and algal communities. His passion is restoration, including the design of roughened channels for fish passage that incorporate wood and rock elements that mimic natural conditions. Jeff is very familiar with the Willits Bypass Project and has been working on erosion-related task orders for the project since 2010. He is also a UC Davis Extension instructor. Lives in West Sacramento, CA and enjoys backcountry skiing, backpacking, music, and spending time with his wife and 14 year-old son.

Teresa Sholars

Teacher of Ecology, Botany, and Biology for 50 years. Professor Emeritus of Biology; College of the Redwoods; currently Adjunct Professor at Mendocino College and Jepson workshops series at UC Berkeley and CNPS workshops, curator of the Herbarium at the Mendocino College Coast Campus. Volunteer for the California Native Plant Society as vegetation coordinator for DKY chapter, leading volunteer vegetation surveys teams since 2015. Board member for the CNPS Journal Artemisia and Northern California Botanists. Co-Author for the genus *Lupinus* in the Jepson Manual, all of the efloras and Flora North America. Author of articles and various chapters in books on California vegetation. Botanical consultant from 1975 -2014. Lupine systematist; author of treatments in the Flora of North America, Jepson Manual and Field Guide to California Lupines. She has an extensive publication list focused on topics related to redwood ecosystems, lupines, and the pygmy forest.

David Smith

David worked for 39 years as a soil scientist with USDA Natural Resources Conservation Service (NRCS) before retiring in late 2017. He held various positions within the National Cooperative Soil Survey program including field soil scientist, California Soil Vegetation Survey program leader, California State Soil Scientist, West Regional Leader, National Division Director, and Deputy Chief for Soil Survey and Resource Assessment. Since retiring from USDA, he has worked part-time as an advisor on projects related to soil science and natural resources management. He has previously served as an officer in both PSSAC and CFSC.

Anna Thompson

Anna Thompson works as a Hydrologist for the USFS Pacific Southwest Research Station in Fort Bragg, CA. She manages the field operations and data collection for the Caspar Creek Experimental Watersheds. Anna began by studying geology at Carleton College and Iowa State University, where she specialized in geomorphology and glaciers. She got her start at Caspar Creek as a field technician servicing these study sites and rejoined the team in her current role in 2023.

Lynn Webb

Lynn Webb received a Biology degree from Chico State University and a masters focusing on Forest Ecology from then Humbold State University. She worked for the USDA Forest Service in both the Coast range and Sierra Nevada in both Pine and Mixed Conifer forests. The work spanned fuels management, reforestation, tree improvement and harvests. She earned a Silviculturist Certification. She moved to Jackson Demonstration State Forest in 2001 working on timber harvest planning, biology and invasive weed management. In 2007 she became the Research and Demonstration Program Manager. In that position she helped develop the third Caspar watershed study, multicohort silviculture project and others. Focusing on regional needs she helped develop fire and reforestation research partnerships. After retirement she has continued to work at JDSF on outreach and research projects.

Lodging

Check-in: *Thursday June 5, 2025 after 3pm.*

Lodging: Mendocino Woodlands Campground 3
Address: 39350 Little Lake Rd. Mendocino, CA 95460
Directions from Fort Bragg: Coming from Fort Bragg on Hwy 1, turn left (east) on to Caspar Little Lake Road (409) for about 5 miles. Turn left onto Little Lake Road and continue for 0.4 miles. Bear right (you'll see a sign for the Woodlands) and follow this gravel road out approximately another 3 miles to arrive at the camp. Keep going for about 2 miles along this road until you reach Campground 3.

Directions from the town of Mendocino: From Hwy 1 at the town of Mendocino, go east onto Little Lake Road (the traffic light) and follow it for about 5.5 miles to the end of the pavement. Bear right (you'll see a sign for the Woodlands) and follow this gravel road out approximately another 3 miles to arrive at the camp. Keep going for about 2 miles along this road until you reach Campground 3.

Mendocino Woodlands Campground Rules

1. Notify MWCA staff of anything that is broken, damaged or not working properly (buildings, grounds, equipment, etc.)
2. Do NOT attempt to make repairs on camp property or equipment.
3. No public nudity is allowed.
4. Do NOT go into the other camps without prior permission.
5. Alcohol is not to be SOLD on the Mendocino Woodlands State Park premises.
6. **DO NOT BRING ANIMALS OR PETS TO CAMP.** Violation of this rule will result in forfeiture of the $1,000 Security Deposit. Licensed service dogs are permitted with advance notice is required that a service dog will be present in camp and:
    a. The service dog must be licensed, with the tag attached to a collar showing proof of rabies vaccination.
    b. The dog must not endanger other campers. If the dog presents a hazard, the dog must leave the premises.

c. All service dogs must remain on a physical leash at all times. Electronic control methods are not permitted.
d. Any damage or cleanup is the responsibility of the group the camper and service dog are attending.

7. Bicycle riding on roads or trails only. No off-road or in-camp riding.
8. No nails, tacks, staples or tape are to be used on any of the buildings and structures.
9. Due to the location of the cabins in a natural forest, all forms of food and food waste must be controlled. Animals are attracted by food odors, even if there are no physical signs of food, including nut shells, food wrappers and spills. **Please secure all food, clean up food spills and food waste immediately to minimize wildlife attraction. DO NOT FEED THE ANIMALS.**

SPEED LIMIT AND PARKING

1. **THE SPEED LIMIT ON ALL ROADS IN CAMP IS 5-MILES PER HOUR.**
2. No blocking of roads is allowed. Parking areas are designated. You may park alongside the road as long as you maintain 12-feet of clearance for emergency vehicles.
3. DO NOT PARK IN TURNOUTS: These are for use by safety equipment and vehicles. Brief use for unloading and loading is allowed.
4. Do not run water unnecessarily.
5. Do not flush anything that might plug the sewers, especially tampons, sanitary napkins, flushable wipes, etc.
6. Do not operate any electrical equipment other than lights, coffeepots, and stereo equipment without the permission of MWCA staff.

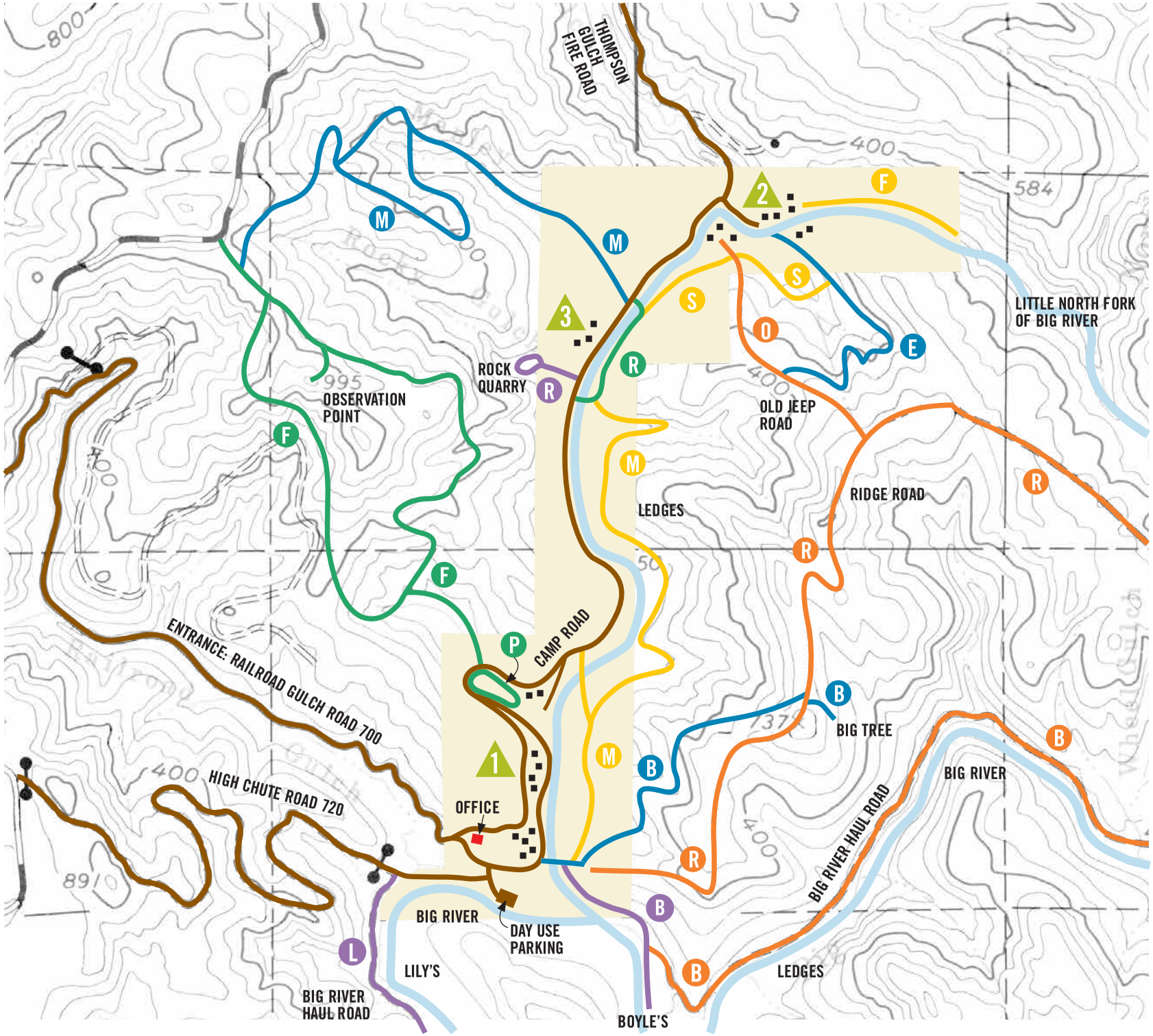
FIRES, FIREPLACES AND FIRE CIRCLES

1. Camps are not allowed to burn downed wood in and around camps. No cutting of trees or old stumps is allowed. Use wood provided from storage areas only.
2. **THE ONLY PLACES FIRES ARE PERMITTED ARE IN THE FIREPLACES AND IN THE FIRE CIRCLES.**
3. No candles, liquid gas lanterns, heaters, etc. with flames are permitted in the buildings, cabins or tents.
4. **NOTIFY THE WOODLANDS STAFF OF ANY FIRE OR USE OF FIRE FIGHTING EQUIPMENT.**
5. Your staff should know where the fire alarms, fire hoses and extinguishers are located.
6. Please inform your campers of the location of their assembly area. All persons in camp should be instructed to go there in case of a fire or at the sound of an alarm.
7. Follow instructions on the fire extinguisher and roll out fire hose completely (no kinks) before turning on water.
8. The California Department of Parks and/or the Park Director has the authority to restrict or limit the use of fires.

ILLEGAL AND CONTROLLED SUBSTANCES

1. No illegal drugs are permitted on MWCA premises.
2. Lawfully possessed controlled substances may require verification of lawful possession and use on MWCA premises.
3. Use of any lawful or controlled substances, even if verified, may be prohibited if it is determined by MWCA to interfere with MWCA operations or if it poses a hazard.

VIOLATION OF ANY PART OF THE RULES AGREEMENT WILL CAUSE YOU TO FORFEIT YOUR SECURITY DEPOSIT, WHETHER THE VIOLATION WAS INTENTIONAL OR NOT.



MENDOCINO WOODLANDS TRAILS*

INTERPRETIVE TRAILS

- P Pond .5 mi.
- F Forest History Loop 4.3 mi.
- R Redwood Riparian .5 mi.

HISTORIC SITES

- R Rock Quarry .4 mi.
- B Boyles Swim Hole 1 mi.
- L Lily's Swim Hole 1.3 mi.

EASY TRAILS

- M Marsh Creek 2.3 mi.
- F Fern .7 mi.
- S Staircase .8 mi.

MODERATE TRAILS

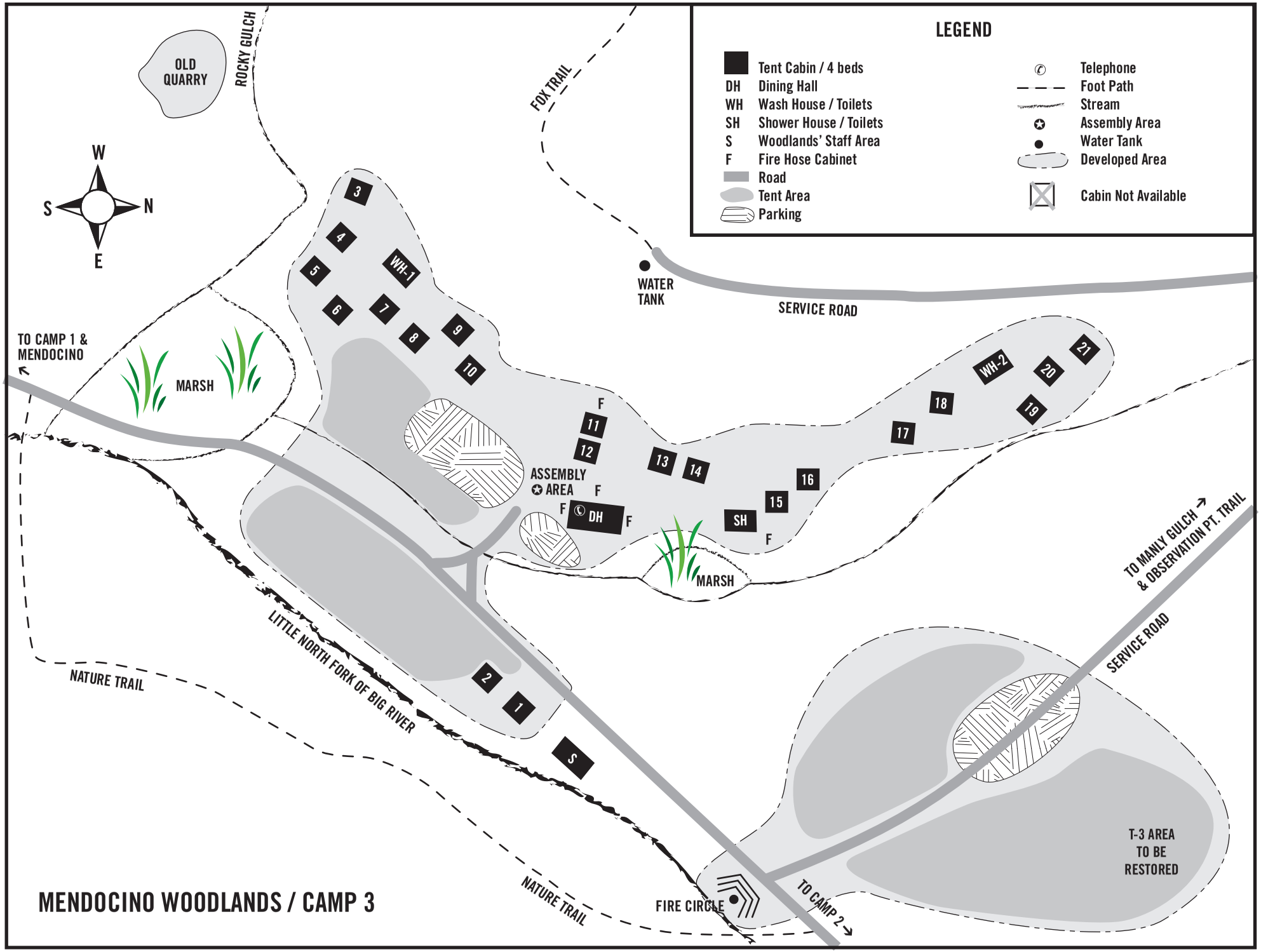
- B Big Tree Trail 1.2 mi.
- M Manly Gulch Loop 2.3 mi.
- E Eagle's Roost .9 mi.

OLD ROADS (foot traffic only)

- O Old Jeep Rd. .8 mi.
- R Ridge Rd.**
- B Big River Haul Rd.**

*Distances are approximate. All are one-way, except loop trails.
**Extends way beyond this map.

= Driveable Roads
= Campgrounds
= Rivers


LEGEND
Tent Cabin / 4 beds
DH Dining Hall
WH Wash House / Toilets
SH Shower House / Toilets
S Woodlands' Staff Area
F Fire Hose Cabinet
Road
Tent Area
Parking
Telephone
Foot Path
Stream
Assembly Area
Water Tank
Developed Area
Cabin Not Available
OLD QUARRY
ROCKY GULCH
FOX TRAIL
W
S
N
E
WATER TANK
SERVICE ROAD
TO CAMP 1 & MENDOCINO
MARSH
WH-1
WH-2
ASSEMBLY AREA
DH
SH
MARSH
TO MANLY GULCH & OBSERVATION PT. TRAIL
SERVICE ROAD
LITTLE NORTH FORK OF BIG RIVER
NATURE TRAIL
NATURE TRAIL
FIRE CIRCLE
TO CAMP 2
T-3 AREA TO BE RESTORED
MENDOCINO WOODLANDS / CAMP 3

Overview of Stop Locations

*There is limited parking at many of our spots! We will need to carpool and take as few cars as possible. For Jackson Demonstration State Forest (**JDSF**), cars should have at least a Subaru height of clearance. Roads are acceptable for 2WD, but many of the roads on June 6th will be dirt and/or gravel. Bathrooms are not available at most stops. This will be a commune with nature tour. Cell phones may have limited coverage, but if lost you can try to contact Meagan Hynes (408-859-9726) or David Smith (916-709-8853).*

As there is limited cell service in areas, before the meeting it can be helpful to download a map for JDSF to your phone and use it with a mapping app. Here is one option to have an offline map:

1. *Visit https://www.fire.ca.gov/what-we-do/natural-resource-management/demonstration-state-forests/jackson-demonstration-state-forest*
2. *In "Forest Stats" download the "JDSF base map."*
3. *In your device's App store search "Avenza" (or other map app) and download this app to your device. The free version allows you to use up to 3 maps.*
4. *In Avenza, press the "plus" symbol in the bottom right corner for Android or the "download" symbol in the top right corner for IOS.*
5. *Import the map from your device download folder.*

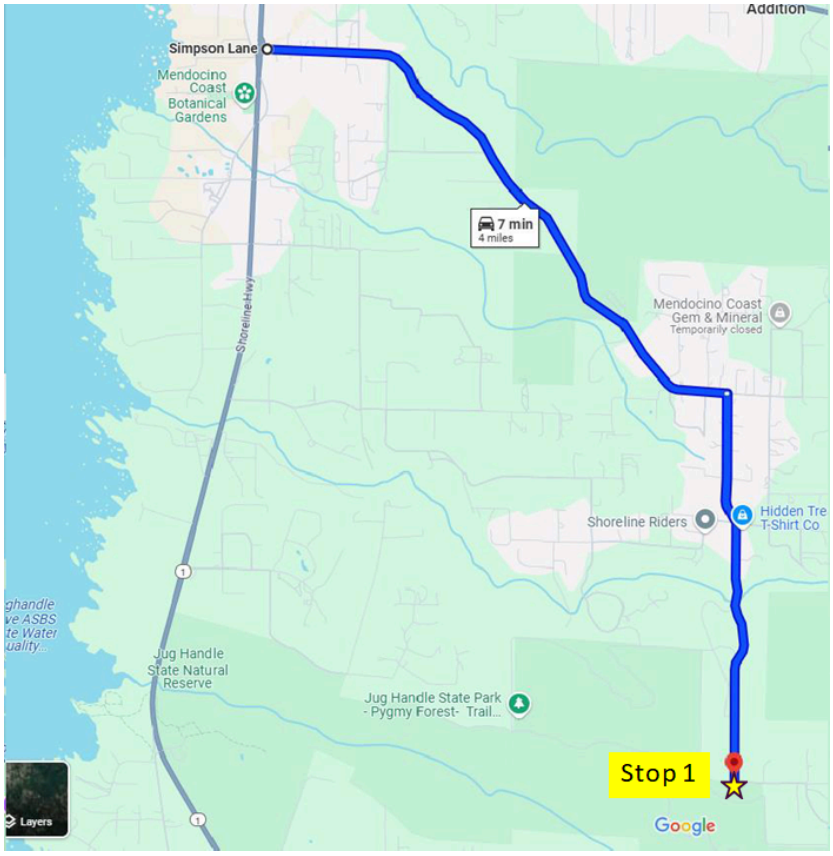
A similar approach can be used for the Android version.

Friday, June 6, 2025

Stop #1

Leave for stop at this time (if camping at Mendocino Woodlands): 7:30 am
Meet at gate at: 8:00 am
Name: Jug Handle State Park East Gate @ Mitchell Creek Drive and Gibney Lane - Jenny Pits Part 1 (JDSF Rd 540 top of Gibney Lane).
Lat/Long: 39.3712526421, -123.774020133
Driving Directions from Mendocino Woodlands Campground 3: Head back out to Mendocino Woodlands sign entrance on Little Lake Rd. Turn left onto Little Lake Rd and go 0.4 miles. Turn right onto Caspar Little Lake Rd (staying on dirt/gravel) and go about 5 miles back to Hwy 1. Turn right (north) onto CA-1 N and go 3.9 miles. At the traffic circle, take the 1st exit onto Simpson Lane heading east for 2.5 miles. Turn right onto Mitchell Creek Dr and proceed 1.5 miles until you get to a sharp left. Park safely and as far off the road as possible near the gate.

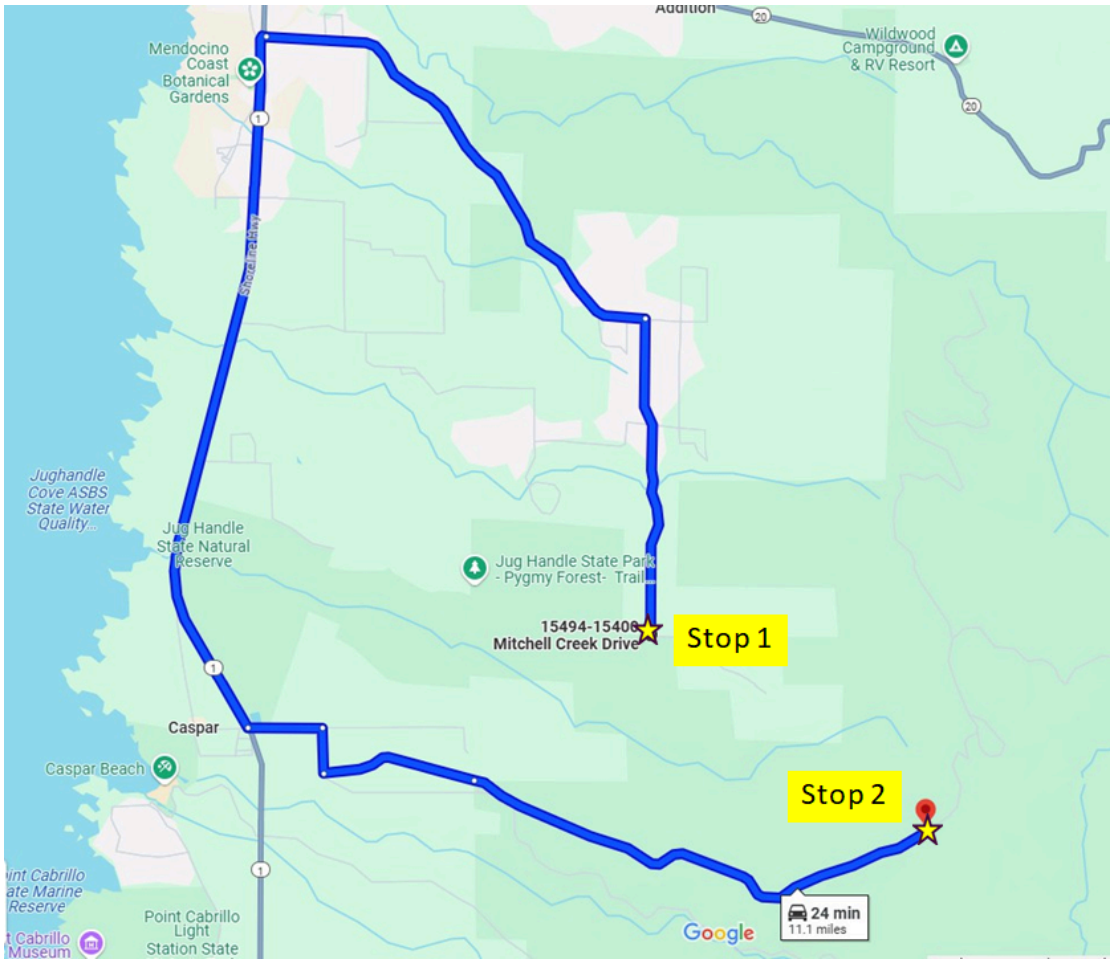
Driving Directions from Hwy 1 (north or south): About 0.5 miles south of the Hwy 20 and Hwy 1 intersection in Fort Bragg, at the traffic circle, take the 1st exit onto Simpson Lane heading east for 2.5 miles. Turn right onto Mitchell Creek Dr and proceed 1.5 miles until you get to a sharp left. Park safely and as far off the road as possible near the gate.

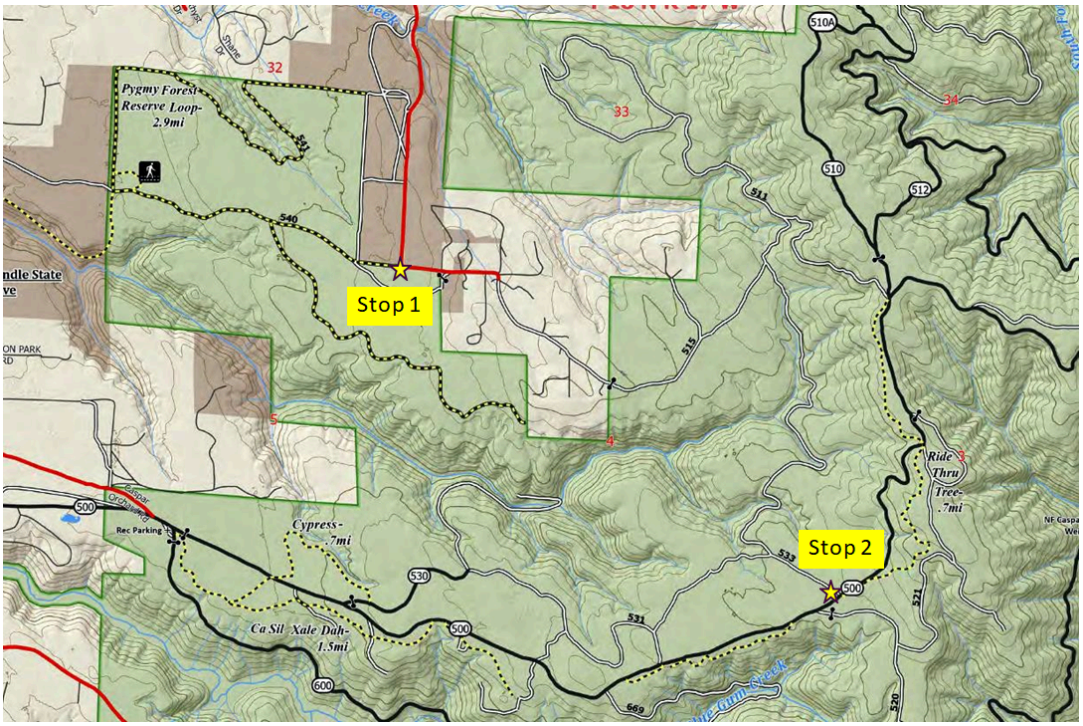


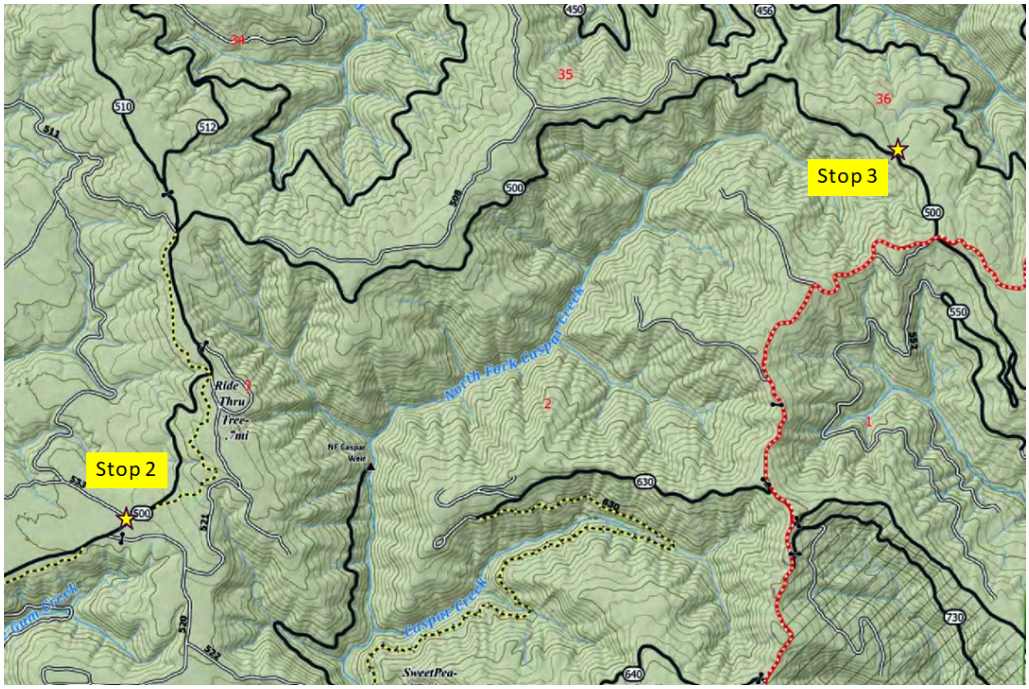
Stop #2

Leave for stop at this time: 10:00 am
Name: Jackson Demonstration Forest - Jenny Pits Part 2 and Pygmy Forest Rx Burn Study
Lat/Long: 39.3578601145, -123.749448988
Driving Directions: Head north on Mitchell Creek Dr for 1.5 miles. Turn left (west) onto Simpson Lane and go 2.4 miles. At the traffic circle, take the 3rd exit onto CA-1 S and go 3.4 miles. Turn left (east) onto Fern Creek Road at Caspar and go 0.4 miles. Turn right onto Caspar Orchard Road for 0.2 miles and continue straight onto Caspar Logging Road (dirt/gravel with hidden speed bumps). Continue for 0.9 miles. This road will turn back into Caspar Orchard Road. There will be a trail entrance on your left (north side of road). Road 533 on the Jackson Demo Forest Map. *Park safely and as far off the road as possible. Do not block the road.*

On the way to the next stop there will be a chance to park your car and join a carpool, if you haven't already.

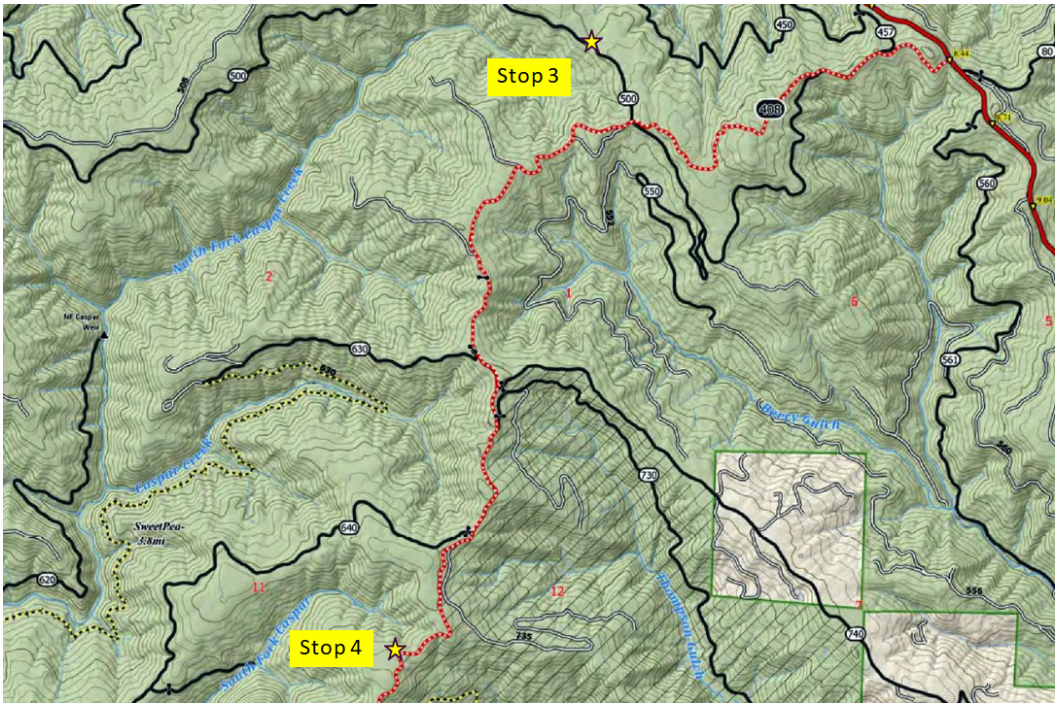

Addition
Wildwood Campground & RV Resort
Mendocino Coast Botanical Gardens
Jughandle Cove ASBS State Water Quality...
Jug Handle State Natural Reserve
Jug Handle State Park - Pygmy Forest- Trail
15494-15408 Mitchell Creek Drive
Stop 1
Caspar
Caspar Beach
Stop 2
Point Cabrillo Light Station State
24 min
11.1 miles
Google


Pygmy Forest- Reserve Loop- 2.9mi
Stop 1
Cypress- .7mi
Ca Sil Xale Dah- 1.5mi
Ride Thru Tree- .7mi
Stop 2



Stop #3

Leave for stop at this time: 12:00 pm
Name: Jackson Demonstration Forest - Lunch Stop and Fire Mitigation Study
Lat/Long: 39.3751282602, -123.706190889
Driving Directions: Continue east on Caspar Orchard Road for 4.2 miles. Stop will be on your left. You know you are getting close when you drive by the gate for road 456. *Park safely and as far off the road as possible. Do not block the road.*

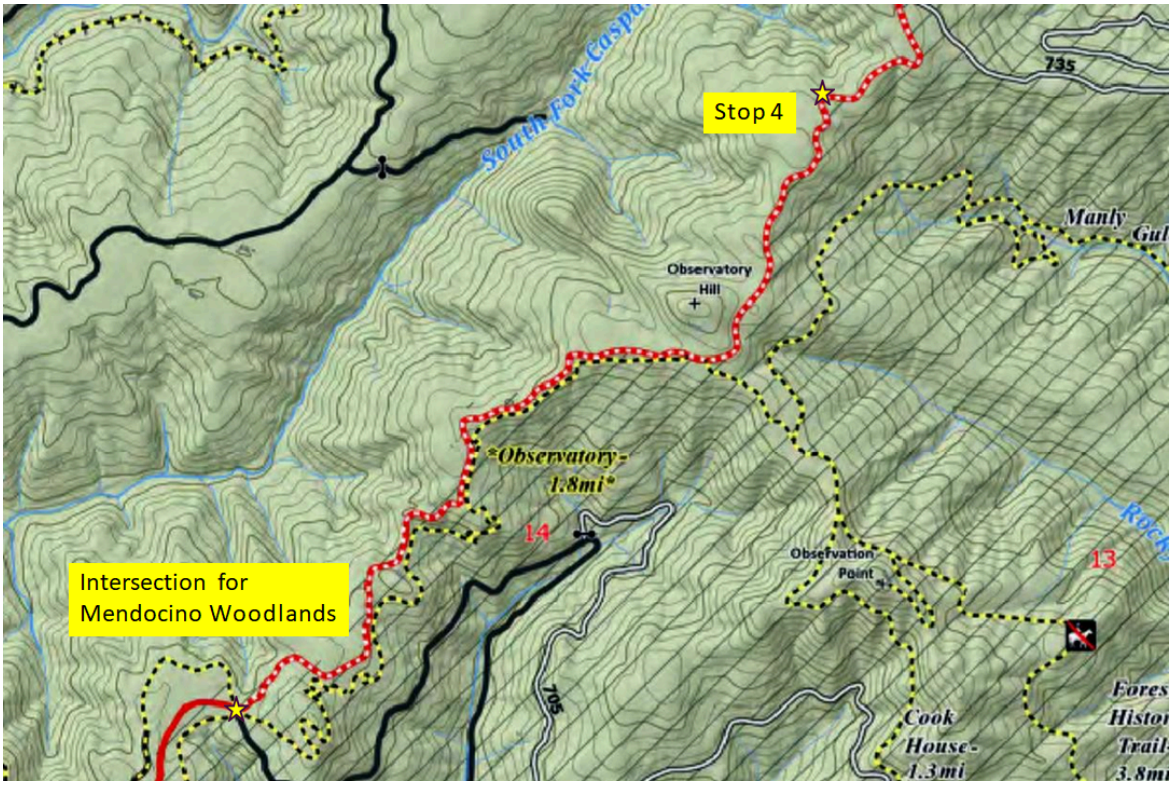


Stop #4

Leave for stop at this time: 2:30 pm
Name: Jackson Demonstration Forest - Caspar Sap Flow Experiment and Turbidity in Watersheds Study
Lat/Long: 39.3464596180171, -123.71674510360499
Driving Directions: Head southeast on Caspar Orchard Rd toward Little Lake Road (Road 408) for 2.4 miles. *Park safely and as far off the road as possible. Do not block the road.*

Head back to Mendocino Woodlands Camp for business meetings and the banquet!

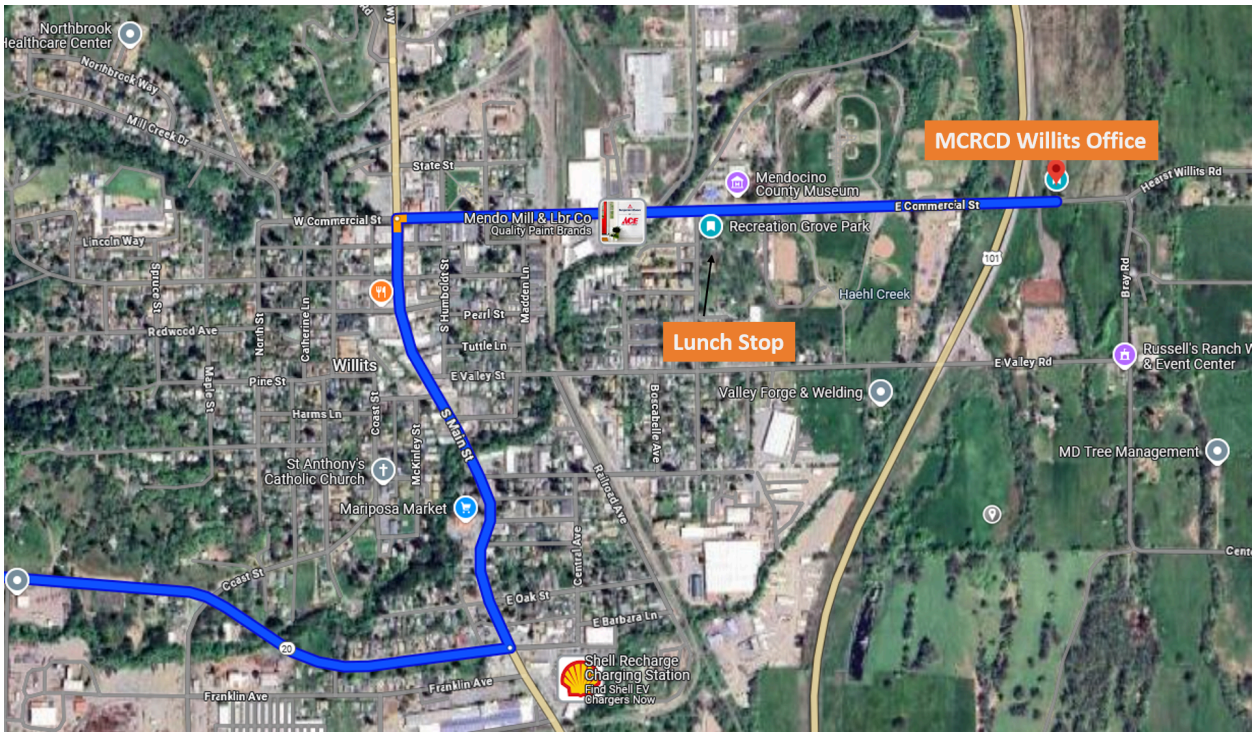
Leave for stop at this time: 4:15 pm
Name: Mendocino Woodlands Campground 3
Lat/Long: 39.34164450098757, -123.6935817699284
Driving Directions: Head southeast on Little Lake Road for 1.7 miles. Turn left (south) at the signs for the Mendocino Woodlands. Follow this gravel road out approximately another 3 miles to arrive at the camp. Keep going for about 2 miles along this road until you reach Campground 3.



Saturday, June 7th, 2025

Morning

*As today's morning stops are behind locked gates, everyone MUST be on time and meet at the **Willits** Mendocino Resource Conservation District office.*



Stop #1

Name: Willits Bypass Mitigation Rendezvous Point - Mendocino County Resource Conservation District Office (*Willits - Not Ukiah office*)
Leave for stop at (from Mendocino Woodlands Campground 3): 7:30 am
Meet time: 8:45 am
Address: 998 Hearst Road, Willits, CA
Lat/Long: 39.41368122604947, -123.33804247186252
Driving Directions: Head back out to Mendocino Woodlands sign entrance on Little Lake Rd. Turn left onto Little Lake Rd and go 0.4 miles. Turn right onto Caspar Little Lake Rd and go about 5 miles back to Hwy 1. Turn right (north) onto CA-1 N and head north on CA-1 N for 3.9 miles. At the traffic circle, take the 2nd exit and stay on CA-1 N and proceed 0.5 miles. Turn right onto CA-20 E/Fort Bragg - Willits Rd (signs for State Route 20). Continue for ~25 miles (40 minutes) until you reach Willits. Turn left at Main Street and continue for 1 mile. Turn right at Commercial Street and continue for 1.0 mile. The office is just after the overpass on the left. Commercial turns into Hearst Road/Hearst Willits Road. We will head to our two stops in Little Lake Valley from here.

Stop #2

Name: Lunch Stop - Recreation Grove Park and Intro to Soil Climosequence
Leave for stop at: 11:45 am

Address: E Commercial Street and S Lenore Ave, Willits, CA 95490
Lat/Long: 39.411748910256364, -123.34615771057491
Driving Directions: From the second wetland stop, Head south on Reynolds Hwy for ~2 miles. Turn right onto Hearst Rd/Hearst Willits Rd and continue for 0.5 mile. Turn right to stay on Hearst Rd/Hearst Willits Rd for 1.7 miles. Again, turn right to stay on Hearst Rd/Hearst Willits Rd. Continue to follow Hearst Rd, which turns into Commercial Drive. for about 1 mile. Turn left onto S Lenore Avenue. Destination will be on the left across from Willits Library and Museum. If you left your car at MCRCD, you can retrieve it on the way.

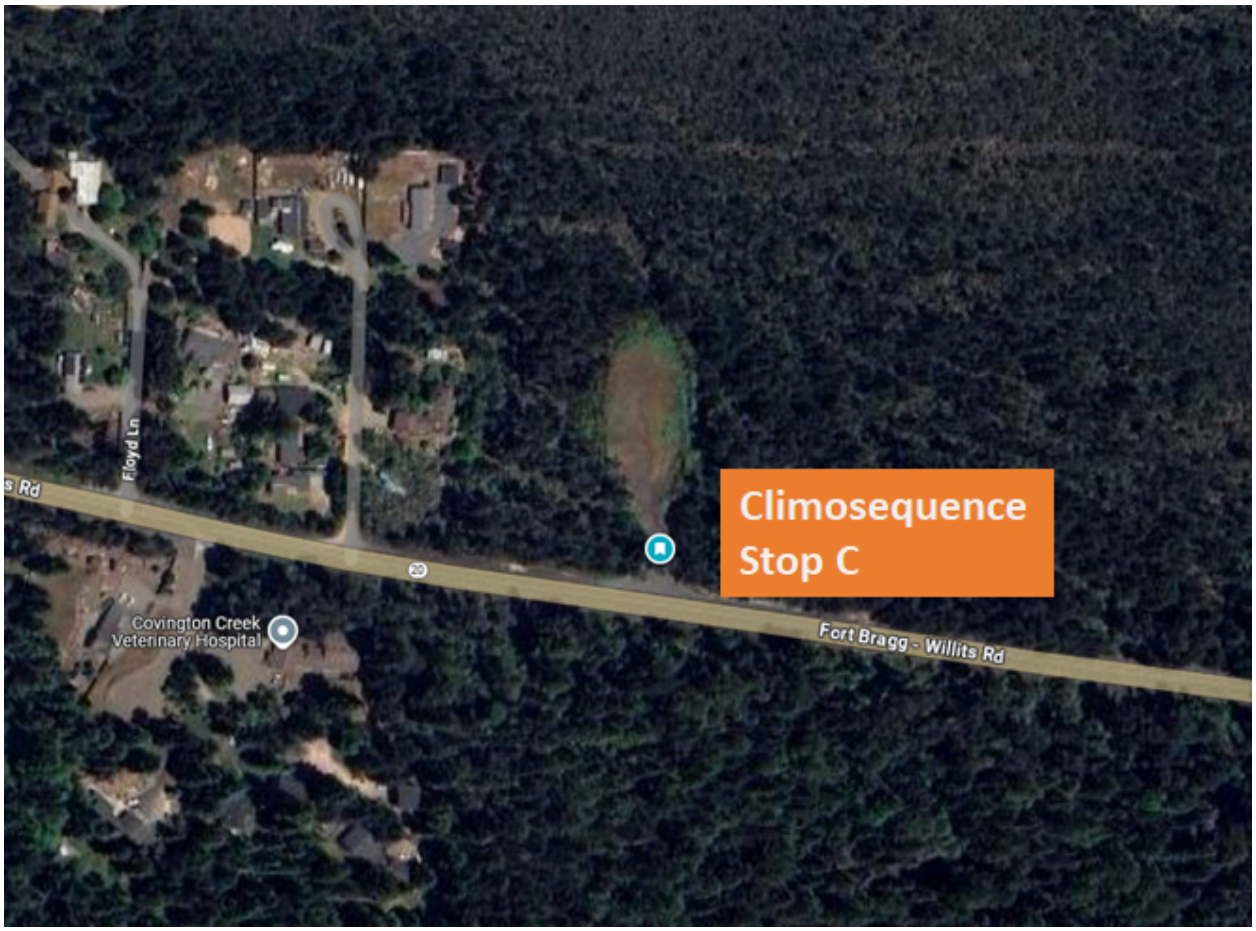
Afternoon

Stop #3

Name: Soil Climosequence Stop A - Gabriel Madrigal Bench
Leave for stop at: 1:20 pm
Address: Highway 20 (9HV2+6V), Brooktrails, CA 95490
Lat/Long: 39.39384251770285, -123.44803569204353
Driving Directions: From Recreation Park, head south on N Lenore Ave toward E Commercial Street. Turn left onto E Commercial Street and go 0.4 miles. Turn left onto S Main Street continuing for 0.6 mile. Turn right onto CA-20 W/Flower St/Fort Bragg Rd/Fort Bragg - Willits Road (Hwy 20). You will be going west for approximately 8 minutes (6.2 miles). Parking will be on your left. There are a couple of areas on the left side to pull over into. *Be very careful when crossing Hwy 20 to park and when leaving! Watch for traffic.*

Stop #4

Name: Soil Climosequence Stop B - Camp 20 Recreation Area
Leave for stop at: 2:10 pm
Address: Hwy 20 across from Road 200A, Fort Bragg, CA 95437
Lat/Long: 39.35305722462059, -123.55812849283421
Driving Directions: From the Gabriel Madrigal Bench, return to Hwy 20 going west for approximately 17 minutes (9.7 miles). Camp 20 will be on your left. Bathrooms available at this stop. *Be very careful when crossing Hwy 20 to park and when leaving! Watch for traffic.*



Stop #5

Name: Soil Climosequence Stop C - JDSF Pygmy Forest
Leave for stop at: 3:15 pm
Address: Hwy 20 near Fort Bragg, CA 95437 (C67V+5J8)
Lat/Long: 39.35305722462059, -123.55812849283421
Driving Directions: From Camp 20 carefully turn left out of the parking lot going West on Hwy 20. Continue for 14 miles. You know you are getting very close when you see Wildwood Campground and RV Resort. It will be on the right after the “020 MEN 3.00” milepost sign. There will be a pullout on your right where you will go through a gate into a clearing.

Stop #6

Name: Soil Climosequence Stop D - Noyo Headlands Park
Leave for stop at: 4:10 pm
Address: Jere Melo Street, Fort Bragg, CA 95437
Lat/Long: 39.431534896806625, -123.81265418702733
Driving Directions: Return to Hwy 20 going west to Fort Bragg. After about 3 miles, turn right on to Hwy 1/Main Street. Turn left onto West Cypress Street. This road will turn into Jere Melo after about 0.3 miles. Follow Jere Melo until it makes a sharp right. At this intersection you will see the signs and parking for Noyo Headlands Park.

Dinner options are CFSC BBQ back at Mendocino Woodlands Camp (by donation), Fort Bragg, or wherever your heart desires!

Indigenous Peoples of Mendocino County

Meagan Hynes, PhD, CPSS

Mendocino County is home to 11 federally recognized tribes. Native peoples in the county descended from Northern Pomo, Coastal Pomo, Cahto, and Yuki tribes believed to have been present in the area for at least 14,000 years. The Northern Pomo was the name for the ancestral people that inhabited areas that we will be touring for this meeting. The name “Pomo” originally referred to “red earth” or ““those who live at red earth hole”. It is thought that this referred to the local Potter Valley iron minerals such as magnetite or hematite that were used to make red beads. Today the name refers to all the Pomo and not just those originally from Southern Potter Valley (inland Mendocino County). To learn more about the Pomo peoples visit the Kelley House Museum in Mendocino, CA or visit the link below: https://www.kelleyhousemuseum.org/exhibits-northern-pomo-mendocinos-first-people/

Down the road from the Mendocino Woodlands Camp is an indigenous and woman owned farm called Xa Kako Dile (pronounced Ha-ka-ko-dee-lay). Their mission is “To respect and steward traditional ecological knowledge, healing Indigenous ancestral lands, building resilience in our communities with culture, food, medicine and education.” Using traditional ecological knowledge (TEK) is part of this process at Xa Kako Dile Farm. Visiting their farm is highly recommended, if you find yourself with some free time during this visit. https://www.xakakodile.org/ 15401 N. Highway 1, #104, Caspar, CA, 95420

One specific practice of TEK used by indigenous people in Mendocino county are cultural burns. The cultural burns are similar to what we typically know as prescribed burning. A local organization called Tribal Ecorestoration Alliance (TERA) (Upper Lake, CA) provides training in this and practices stewardship on lands not just in Lake and Mendocino Counties, but worldwide. Learn more about them here: https://www.tribalecorestoration.org/

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Day 1: Friday, June 6, 2025 - Jug Handle State Natural Reserve and Jackson Demonstration State Forest

Morning

Geology and Geomorphology of the Mendocino Coast

Modified/compiled from listed references by Patrick Brand, May 2025

Mendocino County is located in the Coast Range geomorphic province of California, which is generally characterized by northwest-trending mountain ranges and valleys and an uplifted and terraced coastline. The Mendocino County coast lies along the active margin between the Pacific and North American tectonic plates. The plate boundary is translational; that is, the plates slide past each other, currently at a rate of about 50 millimeters per year. The San Andreas fault, its splays, and other related faults impose a structural grain on the Coast Ranges, creating a rough north-northwest alignment of the region's mountains and valleys. Within the field trip vicinity, the San Andreas fault is offshore, trending parallel to the coastline. The related Maacama fault provides the structural form for the Ukiah and Willits (Little Lake) valleys to the east.

The dynamics of the tectonic plate margin were different during the Mesozoic and early to middle Tertiary. Then, the plates converged, causing the Pacific/Farallon plate to subduct beneath the North American plate. A deep, off-shore basin (a subduction trench) formed and much of the rock that now comprises the Coast Ranges was initially deposited as sediment in this trench. As subduction continued, seafloor sediments and volcanic rocks were scraped off the subducted plate, mixed with sediments derived from the continent, folded, and partially metamorphosed. This created an assemblage of rocks that was progressively added (accreted) and pushed up into the western edge of the overriding North American tectonic plate from the Late Jurassic to Micoene time (Figure 1). This assemblage is the Franciscan Complex, a collection of deformed marine sediments and volcanics, seafloor crust and previously subducted pieces of continental crust.

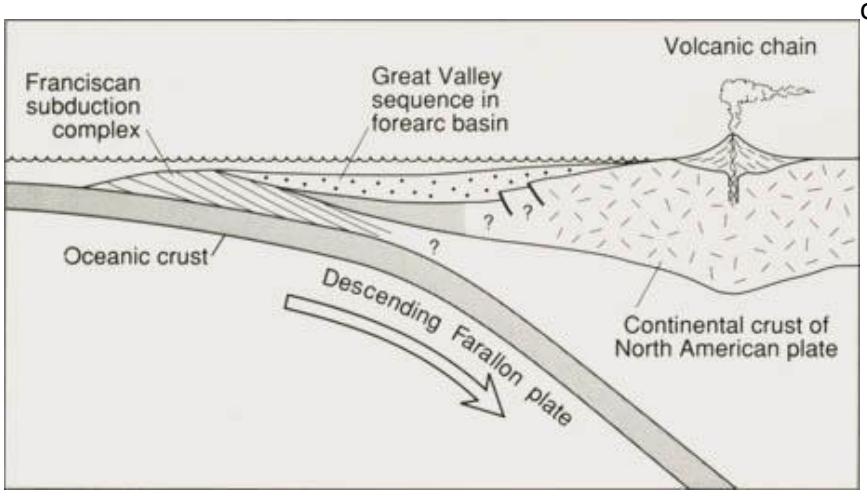

Figure 1. Generalized diagram showing subduction of Farallon plate and accretion of Franciscan Complex (from Wallace, 1990)

The Franciscan Complex bedrock is subdivided into three major northwest-trending belts based on similar geology. The belts align in a north-northwest band, one adjacent to the next. They are, from west to east, the Coastal belt, the Central belt, and the Eastern belt (Figure 2). The belts are generally younger and less metamorphosed to the west.

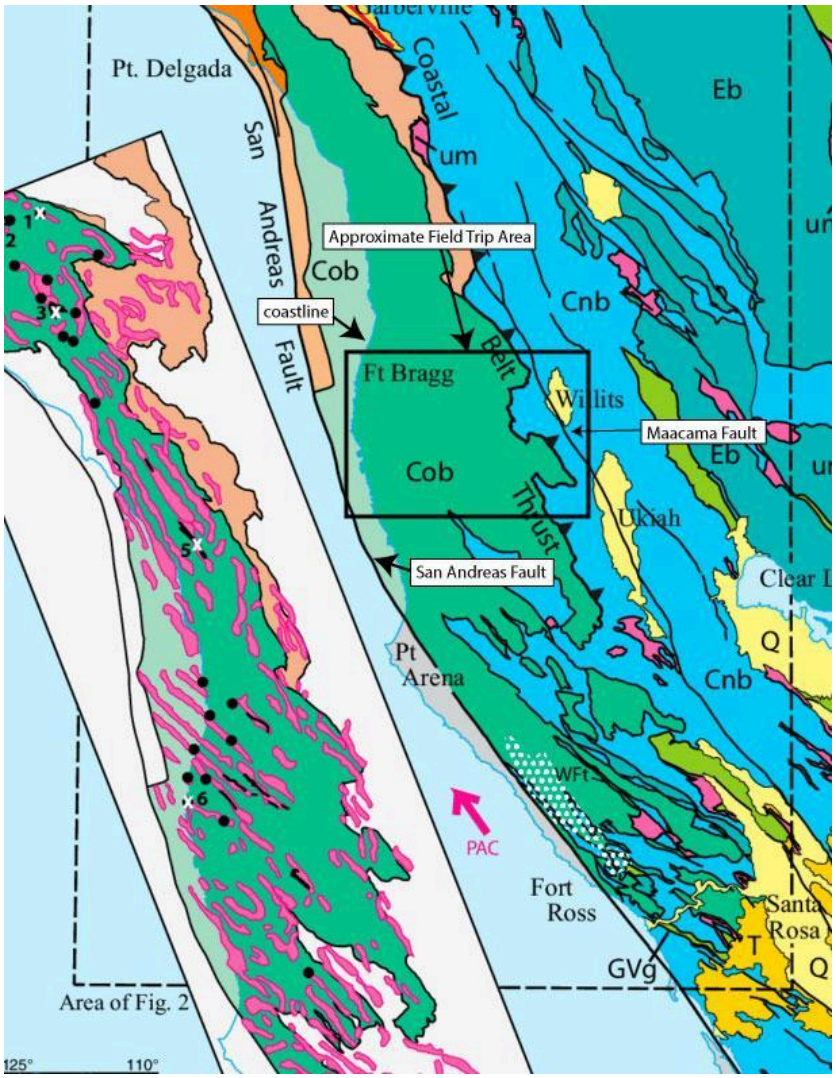

Figure 2.. Generalized geologic map of the Franciscan Complex. Cob = Coastal Belt; Cnb = Central Belt; Eb = Eastern Belt (from Langenheim and others, 2013)

Much of the Mendocino County Coast (i.e. uplifted marine terrace area) is underlain by the Coastal belt of the Franciscan Complex, which consists almost entirely of late Cretaceous to Eocene-age graywacke (sandstone composed of quartz and feldspar grains in a clayey matrix) and shale. It is folded at outcrop scale, and deformation extends from typical broken formation to more severely sheared rock. The more pervasively sheared and disrupted Late Jurassic to Early Cretaceous Central Belt is present to the east (i.e. Willits and Ukiah areas), and generally consists of mélange rock (bedrock that lacks internal continuity with the inclusion of fragments and blocks of all sizes, both exotic and native, in a fragmented matrix of finer-grained material) with numerous small and large bodies of graywacke and metagraywacke. The eastern belt,

which is characterized by intense deformation and blueschist-facies metamorphism, underlies the eastern Mendocino County outside of the field trip area.

As the Farallon plate was consumed through this subduction, the Pacific and North American plates came into contact, forming the right-lateral San Andreas transform fault system. Though this motion is primarily translational, there is a small element of compression resulting in uplift of the Coast Ranges, beginning about 8 million years ago in central Mendocino County.

While the uplift of the Coast Ranges continued, sea-level fluctuated due to the growth and decay of continental glaciers during various ice ages beginning about 2 million years ago, with low sea levels during periods of glaciation and high sea levels during interglacial periods. During the interglacial periods, the sea level would rise and shoreline processes eroded broad, wave-cut platforms (terraces), into the Fracniscan bedrock, terminating in a steep sea cliff at the shoreward side of the platform. Wave-tossed quartz sand and gravel accumulated on the terraces. Continued uplift of the Coast Ranges during subsequent low sea level periods then lifted these terraces above sea level, preserving the elevated marine terrace. This process continued cyclically via the interplay between the uplift and sea-level fluctuations to create a series of stepped marine terraces along the Mendocino coast (Figure 3). Published geologic maps define seven terrace surfaces at approximate elevations of 100, 130, 190, 270, 365, 465, and 600 feet above the current mean sea level. Over time, colluvial and alluvial sediments from the surrounding uplands and eolian sand dune deposits spread across each uplifted terrace and its marine sediments creating an additional top layer (Figures 3 and 4).

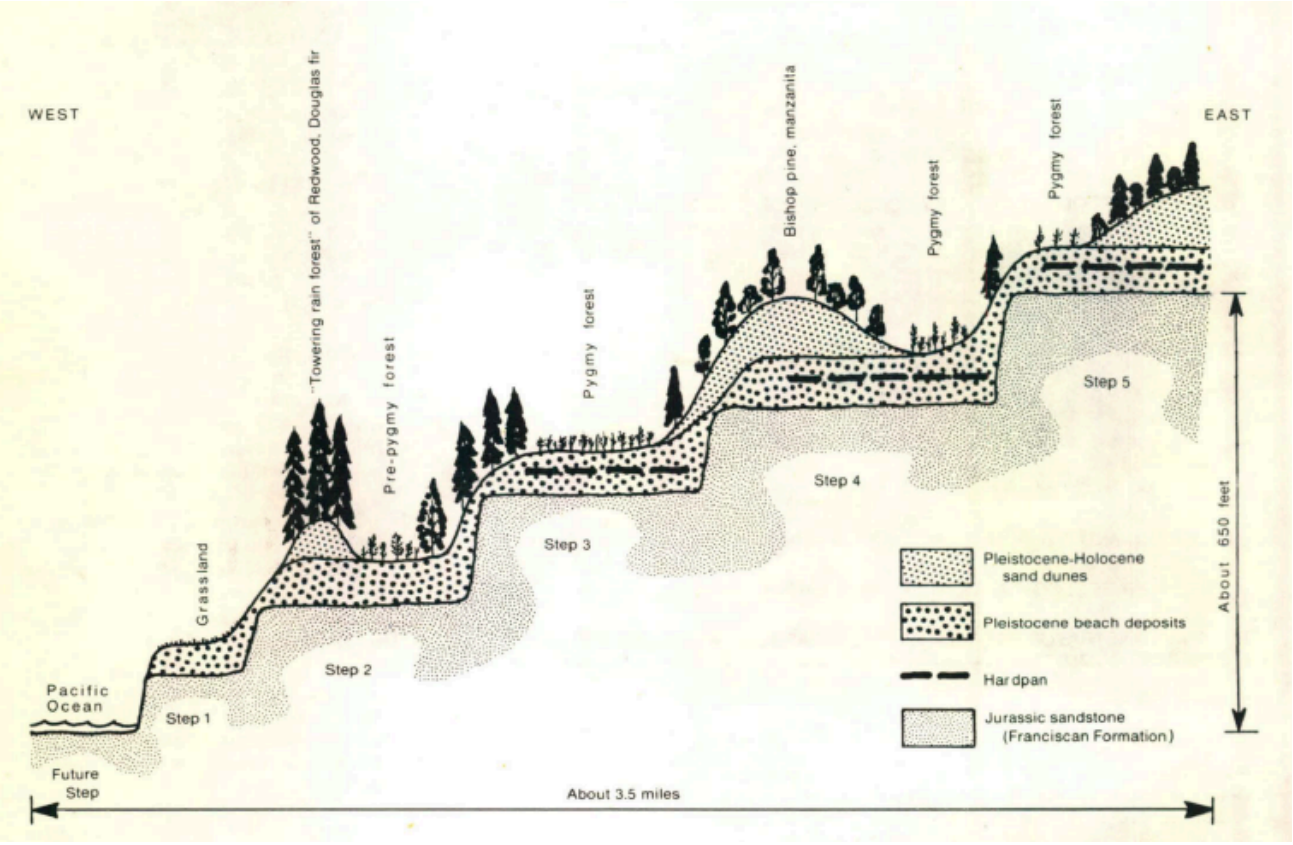

Figure 3. Schematic cross-section of marine terraces depicting the ecological staircase in Mendocino County (from Fox, 1976)

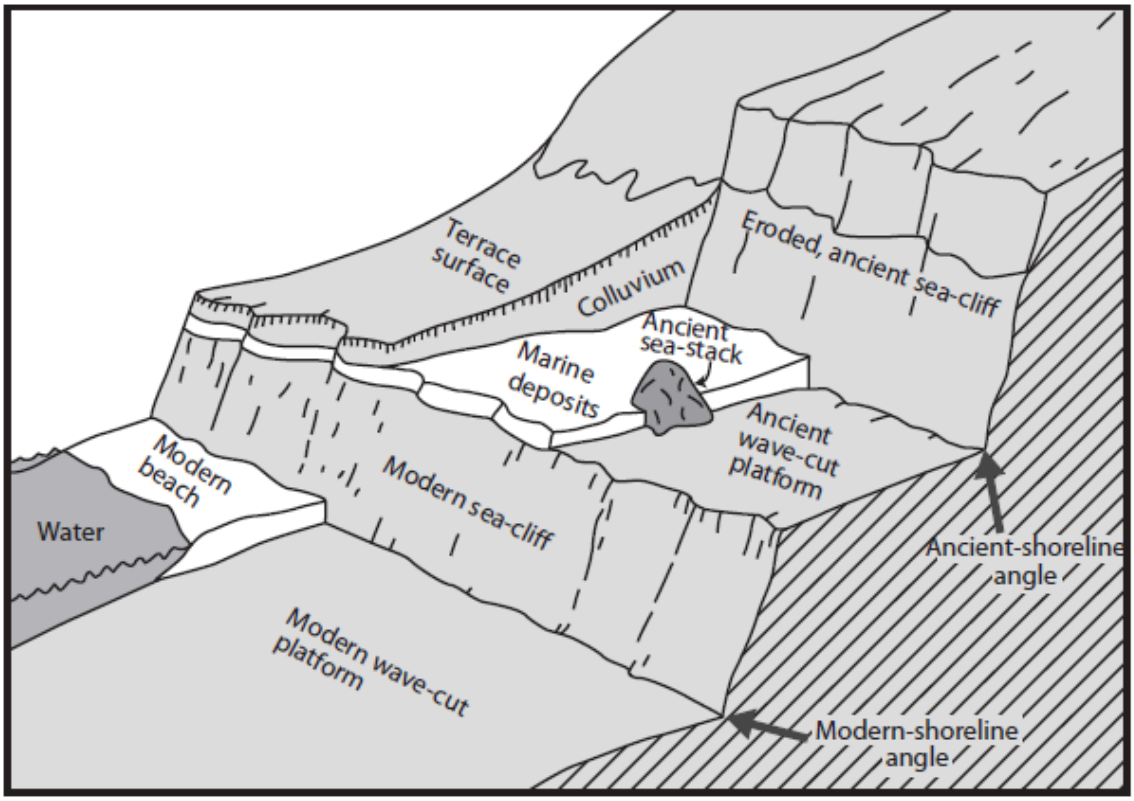

Figure 4. Schematic diagram of marine terraces showing characteristic topography and deposits. Front of figure shows features with complete erosion and back part shows terraces as covered by deposits (from Bowles and Cowgill, 2012)

This series of marine terraces has come to be referred to as the Ecological Staircase in this area, with each step (terrace level) of the staircase supporting a different ecological community depending on distance from the ocean, soil type, and age. Iron-rich hardpan has developed on most of these terraces, creating poor drainage that has inhibited vegetation growth on the terraces. Forests of mature but small trees have grown on some of the marine terraces. These forests are commonly called pygmy forests.

During the late Wisconsin glaciation, 25,000 to 10,000 years ago, the sea level was about 400 feet lower than it is today. River gradients were greatly steepened from the combined effects of lowered sea level and tectonic uplift. This resulted in the deep incisions of the river canyons through the marine terraces and underlying Franciscan Complex bedrock. At the end of this glaciation, the sea level rose. The mouths of coastal rivers were flooded and extensive estuaries, like the Big River estuary, formed. These estuaries are now zones of sediment deposition rather than downcutting.

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Jughandle State Natural Preserve, Pygmy Forest, Hans Jenny, & Factors of Soil Formation

Meagan Hynes & Dave Smith

The Friday tour will mostly be in Jackson State Demonstration Forest, with part of Stop 1 in Jughandle State Natural Preserve. The preserve features the 2.5-mile Ecological Staircase trail, which starts in a coastal prairie and moves inland through Sitka spruces, Grand firs, Bishop pines, redwoods, and ends in the Pygmy Forest.

Hans Jenny, professor of soil science at UC Berkeley, conducted research in the pygmy forest, expanding on his theory of soil forming factors. His influential 1941 book "*Factors of Soil Formation. A System of Quantitative Pedology*," formalized the understanding that soil properties are a function (*f*) of several independent state variables: climate, organisms, parent material, relief, and time, or "S = f(CLORPT)". His studies clarified the dynamic interactions and feedback loops between these factors, especially between vegetation and soil. Jenny's work demonstrated how climate, parent material, and duration above sea level impact soil formation. For more details on the pygmy forest soil and vegetation relationships, see the *Vegetation* section by Teresa Scholars in this field guide.

Soil scientists have long studied the processes that develop horizons in pygmy forest soils. Much of the research discusses *podzolization*, originally a Russian term (pod = under, zola = ash) referring to a layer resembling ash due to its bleached color from loss of organic matter, iron, aluminum, and clays. This typically occurs in sandy, well-drained soils, mobilization of the elements and silicate decomposition and translocation or clay illuviation can take place. These soils are characterized by high acidity and low nutrient content. In the U.S., “podzol” has been replaced with “spodic horizon” within the soil order "Spodosols". Detailed definitions can be found in the latest Keys to Soil Taxonomy 2022.

In the pygmy forests, dune sand overlying greywacke sandstone bedrock creates a sandy, well-drained upper layer. This allows water infiltration that leaches organic matter, aluminum, and iron, forming a restrictive hardpan layer of cemented iron or dense clay. These layers cause upper horizons to remain saturated and ponded for much of the year, creating a perched water table. Soil stays moist until June and doesn't fully dry out until November in some areas. The hardpans and perched water tables limit root growth, contributing to the small, stunted size of vegetation.

Jenny was familiar with the “podzolization” process from his work in Europe. He found that European podzol soils were younger than those in Mendocino County, where the terraces are estimated to be 100,000 to 500,000 years old.

Many people have worked with Hans Jenny, including some PSSAC and CFSC members. During the meeting, we will share stories about working with him and his wife, Jean.

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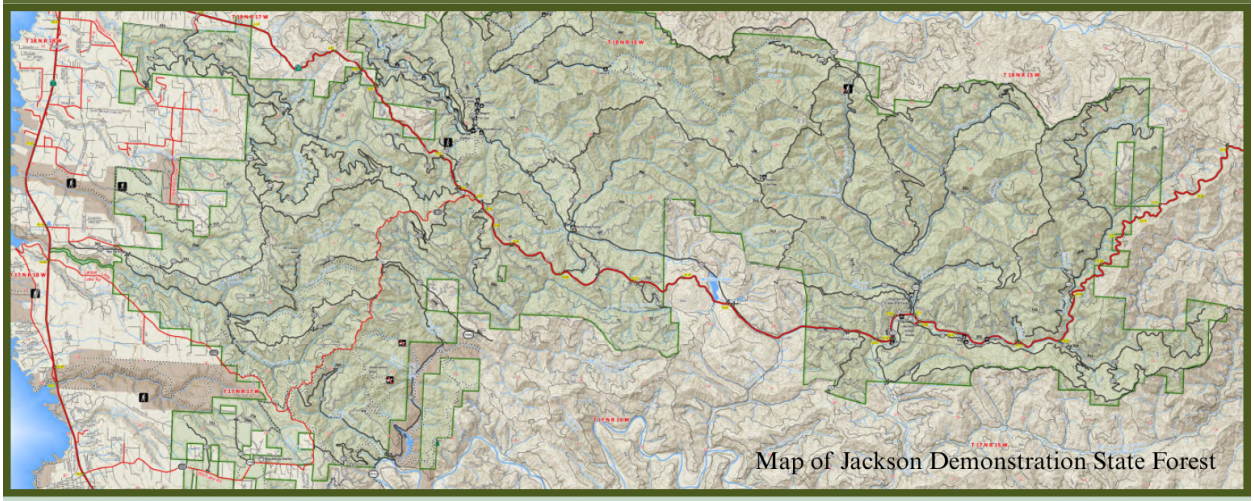
Jackson Demonstration State Forest



Map of Jackson Demonstration State Forest

What is a Demonstration State Forest?

The California Department of Forestry and Fire Protection (CAL FIRE) manages 14 Demonstration State Forests, allowing for interdisciplinary research, sustainable timber production, recreation, and various other activities across common Californian forest types.

What is Jackson Demonstration State Forest?

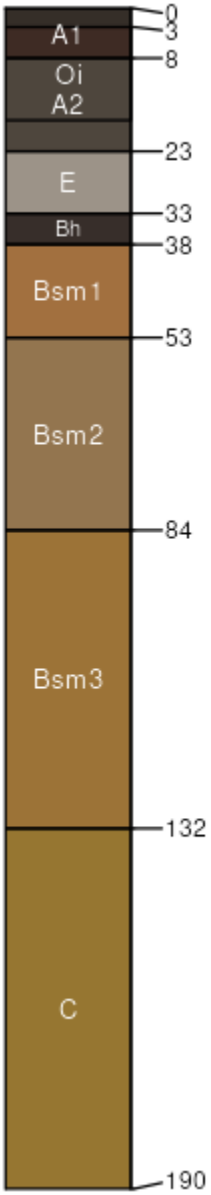
Jackson Demonstration State Forest (JDSF) is the largest of CAL FIRE's demonstration forests at approximately 49,000 acres of primarily coast redwood forest. JDSF was purchased from private owners in 1947, which marked a transition to sustainable harvesting techniques and multi-goal management.

Today, JDSF aims to use its unique status as a working, multi-use redwood forest to balance multi-institutional research efforts, opportunities for public recreation, and the demonstration of different forest management techniques for private land owners.

JACKSON DEMONSTRATION STATE FOREST

Pygmy Forest Soils - From USDA NRCS Soil Survey, Mendocino County Western Part 1999. *Portions of text removed for brevity.* Profile images from SoilWeb: An Online Soil Survey Browser | California Soil Resource Lab." Accessed May 8, 2025. https://casoilresource.lawr.ucdavis.edu/gmap/.

Friday, June 6, 2025 - Stop 1



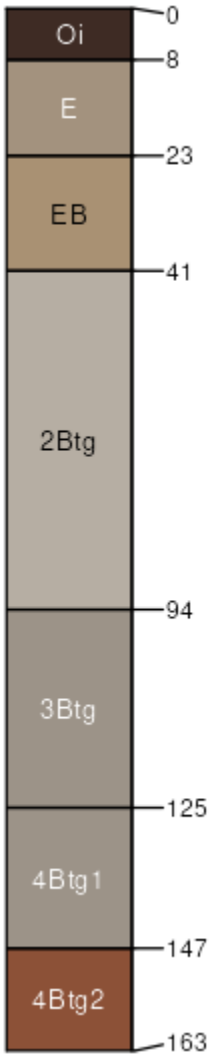
108—Blacklock and Aborigine soils, 0 to 5 percent slopes This map unit is on marine terraces. The vegetation is mainly stunted Mendocino cypress, which is known locally as "pygmy forest." Elevation ranges from 250 to 650 feet. The average annual precipitation is 50 to 65 inches, the average annual air temperature is about 53 degrees F, and the average frost-free period is 270 to 330 days.

←*Blacklock Series - Typical Profile from California Resource Lab - Soil Web*

Taxonomic class: *Sandy, mixed, isomesic, ortstein, shallow Typic Duraquods*

Diagnostic horizons and features: *Albic horizon* (E horizon); *Spodic horizon* (Bh, Bsm1, Bsm2, Bsm3 horizons); *Ortstein layer* (Bh, Bsm1, Bsm2, Bsm3 horizons)

The Blacklock soil is shallow to a hardpan and is very poorly drained. It formed in marine sediments. Typically, the surface is irregularly covered with a mat of litter about 1/2 inch thick. The surface layer is gray loamy sand about 7 inches thick. The subsurface layer is white and brown sandy loam about 7 inches thick. The next layer is a hardpan about 47 inches thick. It is weakly cemented to strongly cemented. The underlying material to a depth of 64 inches or more is very pale brown loamy sand that has yellowish red mottles. Permeability is very slow in the Blacklock soil. Available water capacity is very low. The effective rooting depth is limited by the hardpan at a depth of 12 to 20 inches. The soil is saturated for long periods following episodes of heavy rain from December through April. The saturated zone starts at the surface and extends to the top of the hardpan. Surface runoff is very slow or slow, and the hazard of water erosion is slight if the surface is left bare.



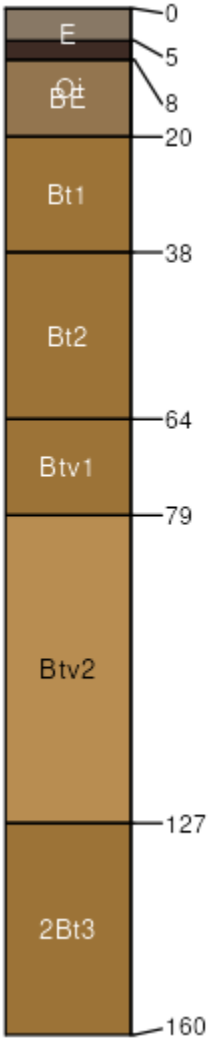
Aborigine Series - Typical Profile from California Resource Lab - Soil Web →

Taxonomic class: *Fine, mixed, semiactive, isomesic Typic Albaquults*

Diagnostic horizons and features: *Ochric epipedon* - Albic horizon (E, EB); *Argillic horizon* (2Btg, 3Btg, 4Btg1, 4Btg2); *Aquic moisture regime* - Soil saturated from

Dec through Apr. Dominant moist chromas of 2 or less in argillic horizon, with associated high chroma mottles. Ped surfaces have moist chromas of 1 or less in 2Btg, 3Btg, 4Btg1, 4Btg2

The Aborigine soil is very deep and is very poorly drained. It formed in marine sediments. Typically, the Mendocino County, California, Western Part 29 surface is covered with a mat of litter about 3 inches thick. The surface layer is light gray and white sandy loam about 6 inches thick. The next 7 inches is very pale brown loam that has brownish yellow mottles. The subsoil to a depth of 61 inches or more is light gray, white, and gray clay and sandy clay that have red and brownish yellow mottles. Permeability is very slow in the Aborigine soil. Available water capacity is high. The effective rooting depth is limited by saturation for long periods following episodes of heavy rain from December through April. The saturated zone starts between the surface and a depth of 12 inches and extends to a depth of more than 60 inches. Surface runoff is very slow, and the hazard of water erosion is slight if the surface is left bare. This unit is used mainly as wildlife habitat or for homesite development. Some areas are used for recreation. A few areas have been preserved for ecological study. A combination of unfavorable soil properties, including extreme acidity, aluminum toxicity, low nutrient content within the rooting zone, and the seasonally saturated soil conditions, results in the stunted plant growth in areas of this unit. The main limitations affecting homesite development are low strength, the seasonally saturated soil conditions, the hardpan in the Blacklock soil, and the very slow permeability in the subsoil of the Aborigine soil.



199—Shinglemill-Gibney complex, 2 to 9 percent slopes This map unit is on marine terraces. The vegetation is mainly bishop pine and huckleberry. Elevation ranges from 200 to 750 feet. The average annual precipitation is 40 to 65 inches, the average annual air temperature is about 53 degrees F, and the average frost-free period is 270 to 330 days.

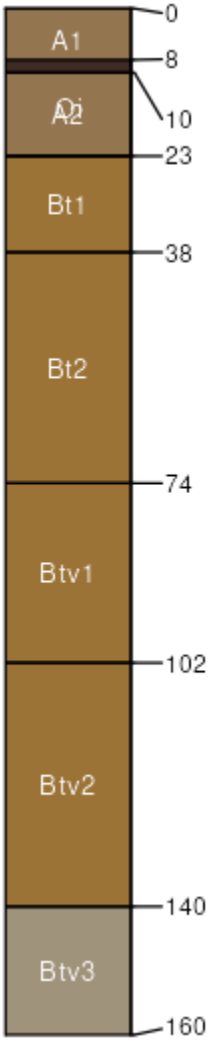
← *Shinglemill Series - Typical Profile from California Resource Lab - Soil Web*

Taxonomic class: *Fine, mixed, semiactive, isomesic Aquic Hapludults*

Diagnostic horizons and features: *Ochric epipedon* (E horizon); *Argillic horizon* (Bt1, Bt2, Btv1, Btv2, Btv3); *Aquic feature* - saturation and redox depletions in the upper part of the Bt horizon

The Shinglemill soil is very deep and is poorly drained. It formed in marine sediments. Typically, the surface is covered with a mat of litter about 2 inches thick. The surface layer is light gray, light brownish gray, and very pale brown loam about 3 inches thick. The next layer is very pale brown and reddish yellow loam about 5 inches thick. The upper 7 inches of the subsoil is very pale brown loam. The next 10 inches is light yellowish brown clay. The lower part of the subsoil to a depth of 63 inches or more is light yellowish brown, yellow, and brownish yellow clay and sandy clay that have light gray, white, and red mottles. In some areas the surface layer is sandy loam. Permeability is slow in the Shinglemill soil. Available water capacity is high. The effective rooting depth is limited by saturation for long periods following

episodes of heavy rain from December through April. The saturated zone starts between the depths of 12 and 30 inches and extends to a depth of more than 60 inches. Surface runoff is slow or medium, and the hazard of water erosion is slight or moderate if the surface is left bare.



Gibney Series - Typical Profile from California Resource Lab - Soil Web →

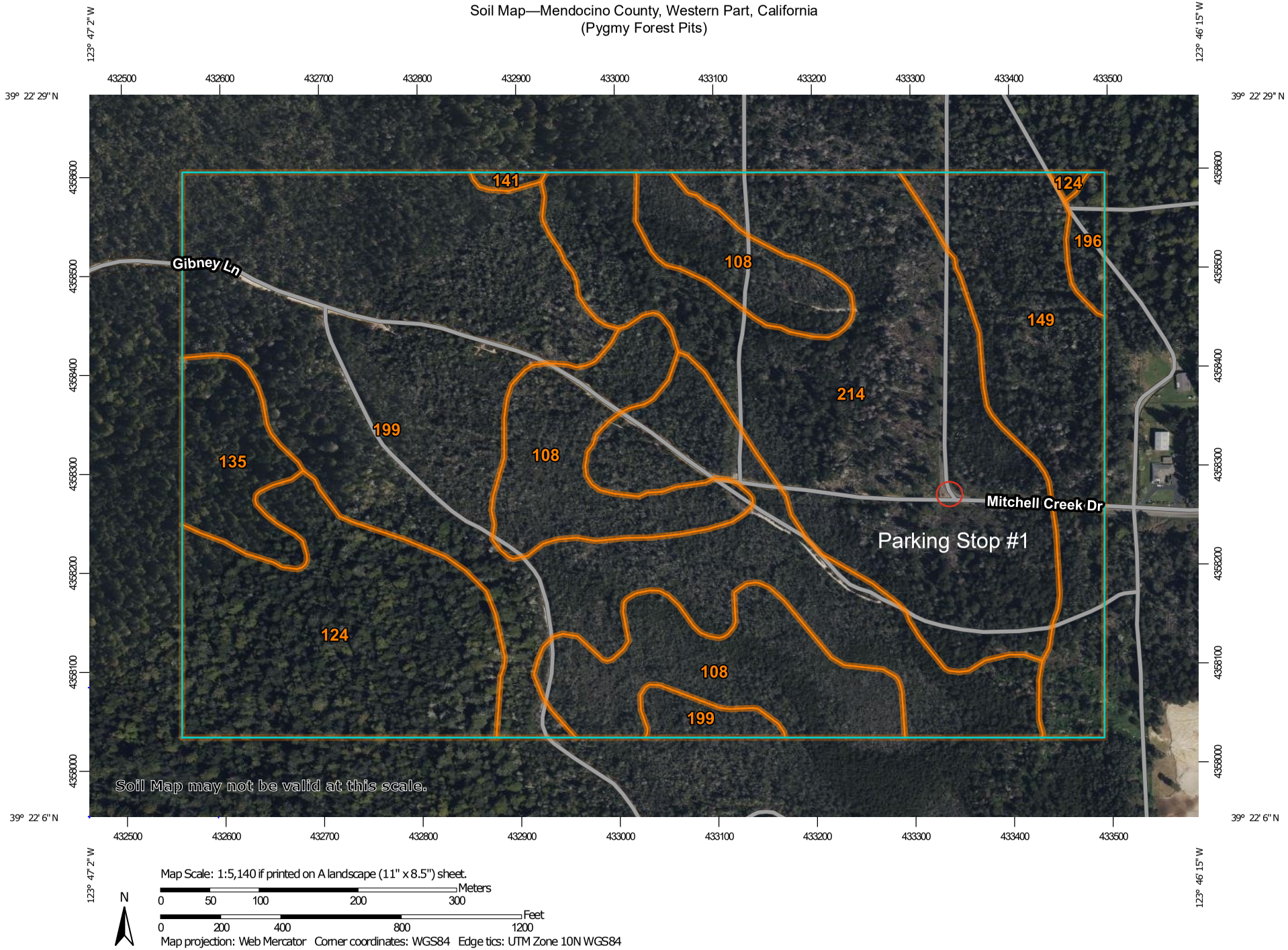
Taxonomic class: *Fine, mixed, active, isomesic Typic Hapludults*

Diagnostic horizons and features: *Ochric epipedon* (A1, A2); *Argillic horizon* (Bt1, Bt2,Btv1, Btv2, Btv3)

The Gibney soil is very deep and is somewhat poorly drained. It formed in marine sediments. Typically, the surface is covered with a mat of litter about 3 inches thick. The surface layer is pale yellow loam about 9 inches thick. The upper 6 inches of the subsoil is brownish yellow sandy clay loam. The next layer is yellowish brown clay loam about 14 inches thick. Below this is 11 inches of yellowish brown clay that has strong brown and red mottles. The next layer is brownish yellow clay that has strong brown, red, and light gray mottles. It is about 15 inches thick. The lower part of the subsoil to a depth of 63 inches or more is light gray sandy clay loam that has strong brown and red mottles. In some areas the surface layer is sandy loam. Permeability is slow in the Gibney soil. Available water capacity is high. The effective rooting depth is limited by saturation for brief or long periods following episodes of heavy rain from December through April. The saturated zone starts between the depths of 24 and 48 inches and extends to a depth of more than 60 inches. Surface runoff is slow or medium, and the hazard of water erosion is slight or moderate if the surface is left bare.

214—Tropaquepts, 0 to 15 percent slopes These very deep, very poorly drained soils are on marine terraces at the heads of drainageways, along drainageways, or in shallow depressions. They formed in marine sediments. In some areas the vegetation is mainly dense stands of Mendocino cypress and Labrador tea. In other areas it is mainly perennial grasses, sedges, and waxmyrtle. Elevation ranges from sea level to 600 feet. The average annual precipitation is 40 to 65 inches, the average annual air temperature is about 53 degrees F, and the average frost-free period is 250 to 365 days. A representative profile has a surface layer of dark gray clay loam about 7 inches thick. The upper 17 inches of the subsoil is light gray clay that has brownish yellow mottles. The lower 5 inches is gray sandy clay loam. The substratum to a depth of 63 inches or more is light brownish gray, light gray, and pale yellow loamy sand and sand.
Permeability and available water capacity are extremely variable in the Tropaquepts. The effective rooting depth is limited by continuous saturation from December through April. The saturated zone starts between the surface and a depth of 10 inches and extends to a depth of more than 60 inches. Water may be ponded on the surface for brief or long periods following episodes of heavy rain. Surface runoff ranges from ponded to medium, and the hazard of water erosion is slight or moderate if the surface is left bare.

Soil Map—Mendocino County, Western Part, California
(Pygmy Forest Pits)



Map Scale: 1:5,140 if printed on A landscape (11" x 8.5") sheet.

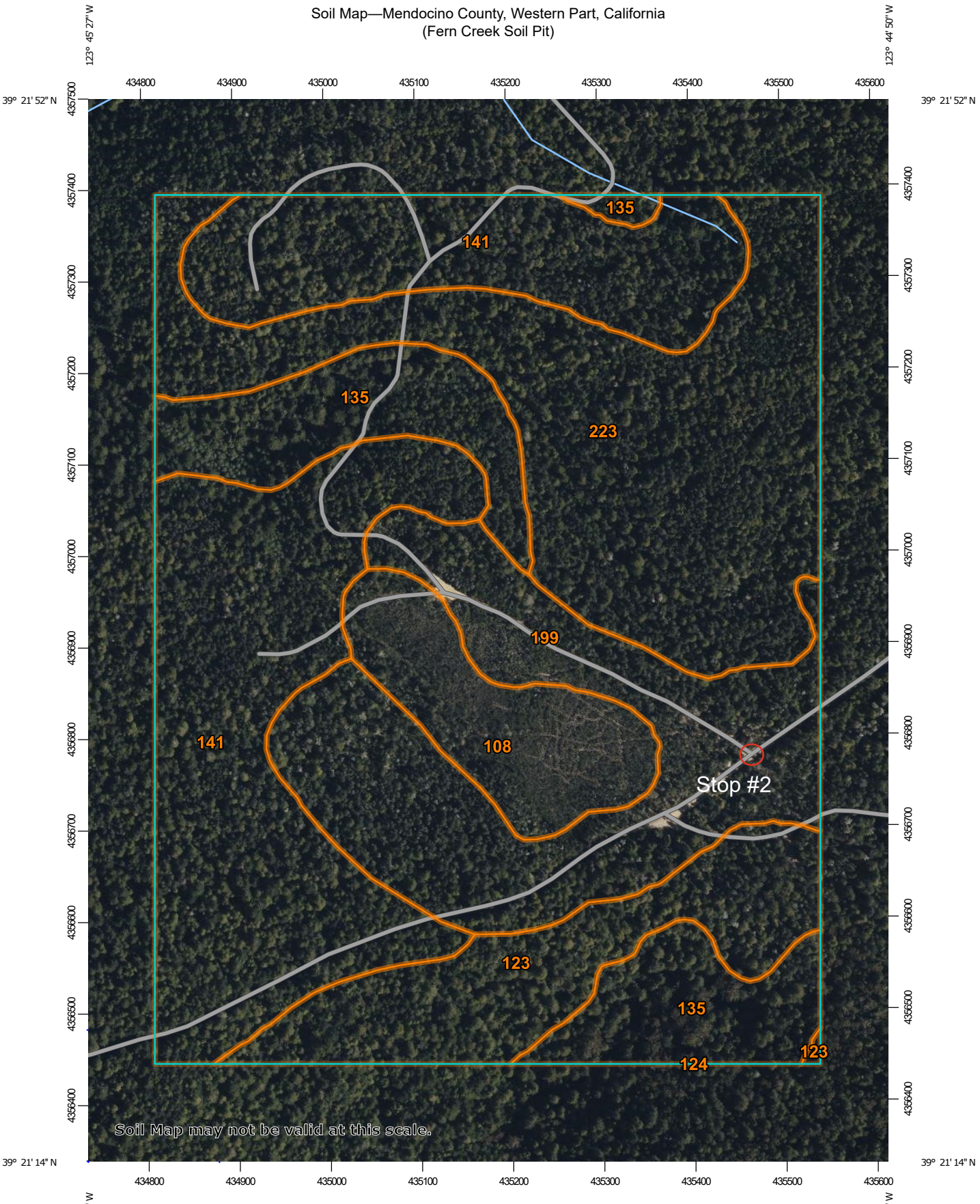
N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

Soil Map—Mendocino County, Western Part, California
(Fern Creek Soil Pit)



Map Scale: 1:5,660 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

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Abbreviated history of classification of and conservation of the pygmy forests (Mendocino Cypress Woodlands and associated plant communities)

To give you all a little background on my experience on the pygmy forest vegetation type. In 1974 my husband and I both started studying the pygmy forest. He did his doctoral dissertation on the pygmy vegetation. His research showed that the plants in this vegetation were not water stressed because the soils are between saturation and field capacity from January to June and the plants are not growing enough from July to November to be water stressed.

My master's research was on the correlation between pygmy vegetation and the hardpan. I dug hundreds of holes along line transects of vegetation. I found wherever there was hard pan there was pygmy vegetation, but pygmy vegetation did occur where the hardpan was not present. The hardpan was uneven in its distribution. This data set burned up in our house fire of 1980.

Rob and I worked for years with both Hans and Jean Jenny on the pygmy forest. (Hans Jenny: was a past professor of soil science at UC Berkeley who wrote the first major book on the fundamentals of soil science and who studied the soils of the pygmy forest). Hans always was anxious that we plant ecologists got involved in doing research on the pygmy. He was concerned that we did not lose sight of the fact that it is an edaphic community correlated with Blacklock soils. Certainly, fires influence plant reproduction in the community, but the factors that influence dwarfing are due to the soils. Plant species that occur there are adapted to fire (the conifers have serotinous cones and most of the rest of the plants stump sprout)

Rob worked with Jean Jenny to sue Mendocino County for not protecting the pygmy forest. The year Rob passed away (1988) the Sierra club was successful in this lawsuit that classified the pygmy forest as an Environmentally Sensitive Habitat Area (ESHA). Unfortunately, ESHA's are regulated only within the coastal zone of Mendocino County. The community itself was not protected outside the coastal zone. In 2014, Teresa worked with veg camp, the scientific division for mapping and classifying California vegetation within the California Department of Fish and Wildlife (CDFW). After 5 years of collecting data the "pygmy forest" was classified into 6 associations that mostly occur on oligotrophic soils. These are ranked as rare by CDFW, California Native Plant Society (CNP) and Nature Serve and mapped on the Bios viewer https://apps.wildlife.ca.gov/bios6/

The dominant plants that appear in this community associated with pygmy cypress are Bolander pine and Fort Bragg manzanita. The cypress does occur on other soils without the association of Bolander Pine. We are not sure what exact factors cause the stunting except we know that it is edaphic in nature. It probably relates to extreme low pH and low fertility.

PYGMY FOREST NATURAL HISTORY

PHYSICAL FEATURES: This community is unique to the Mendocino Coast of California. Pygmy vegetation is located on the third, fourth, and fifth terraces, two to five miles from the ocean from Navarro River to Ten-Mile with the prime area occurring between Albion ridge and Fort Bragg. Pygmy-like vegetation, but without Bolander Pine, occurs in southern Mendocino and northern Sonoma counties. Pygmy soil is highly leached, very acid, nutrient-poor and mostly saturated (bog-like) year-round, some with an iron concreted hard pan. Pygmy vegetation occurs on old, relatively flat terraces with little nutrient run-off available from higher slopes because adjacent communities are always down slope from the pygmy.

ECOLOGY: The forest is stunted from 1 to 3 (5) meters tall with occasional taller trees. Vigorous growth is usually lacking. The soil is covered with many species of lichens, especially *Cladonia portentosa* ssp*. pacifica*, which in Mendocino County is usually restricted to this community. A cryptogamic crust is important in inhibiting erosion in this highly leached edaphically (soil) based community.

RARE ANIMAL SPECIES: 3 rare aquatic beetle species occur in these pygmy forests: Sanfilippodytes *adelardi , S. setifer, S. bidessoides,* Dytiscidae. The adults are called predaceous diving beetles and the larvae, Water Tiger Beetles. They are obligate wetland species.

HUMAN IMPACT: Even foot-traffic in the Pygmy forest destroys the fragile cryptogamic crust. Roads and their accompanying ditches create an erosion potential which carries nutrients and water out of the site. Where roads are built the vegetation is taller due to the fertility of the soil-mixed water running through the ditches. Where people build homes in the pygmy, leach lines do not percolate and added nutrients from leach lines increase the size of the natural growth.

PLANT ADAPTATIONS: Plants in this community grow slowly because the soil is highly acidic and nutrient deficient. They exhibit a tolerance for the harsh conditions but show stress by being stunted, gnarled and lichen encrusted. Most of the plant species are adapted to fire by either stump sprouting or serotinous cones. All of the plants in the pygmy forest are tolerant of inundation during their growing season.

A few pertinent references

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CDFW Biogeographic Data Branch Tutorials and Training Tutorials and Training by Program Sensitive Natural Communities

https://wildlife.ca.gov/Data/Training#563222949-vegetation-classification-and-mapping-program-vegcamp; Section 8 - Teresa Sholars, CNPS, Mendocino College: Mendocino cypress in Mendocino and Sonoma counties (PDF)(opens in new tab).

Classification and Mapping of Mendocino Cypress (Hesperocyparis pygmaea) Woodland and Related Vegetation on Oligotrophic Soils, Mendocino and Sonoma Counties, California (PDF)

A Partial Checklist of Pygmy Forest Plants - *Sensitive species in **bold***

Scientific Name	Common Name	Family
Arceuthobium campylopodum	pine dwarf mistletoe	Viscaceae
Arctostaphylos columbiana	hairy manzanita	Ericaceae
Arctostaphylos glandulosa (check for burl)	manzanita	Ericaceae
Arctostaphylos nummularia ssp. Mendocinoensis	pygmy manzanita	Ericaceae
Arctostaphylos nummularia ssp. nummularia	Ft. Bragg manzanita	Ericaceae
Carex californica	Calif. sedge	Cyperaceae
Castilleja affinis	coast paintbrush	Orobanchaceae
Ceanothus gloriosus var. exaltatus	glory bush	Rhamnaceae
Chrysolepis chrysophylla	giant chinquapin	Fagaceae
Crocanthemum scoparium var. scoparium	dwarf rock-rose	Cistaceae
*Darlingtonia californica**	cobra lily	Sarraceniaceae
Drosera rotundifolia	sundew	Droseraceae
Endocronartium harknessii	western gall rust	Cronartiaceae
Gaultheria shallon	salal	Ericaceae
Gentiana affinis var. ovata	Oregon gentian	Gentianaceae
Gentiana sceptrum	sceptre gentian	Gentianaceae
Hesperocyparis pigmaea	Mendocino cypress	Cupressaceae
Juncus bufonis var. occidentalis	western toad rush	Juncaceae
Juncus supiniformis	hair-leaved rush	Juncaceae
Luzula comosa	common wood rush	Juncaceae
Morella californica	wax myrtle	Myricaceae
Pedicularis densiflora	Indian warrior	Orobanchaceae
Pinus contorta ssp. bolanderi	Bolander pine	Pinaceae
Pinus muricata	Bishop pine	Pinaceae
Polygala californica	Calif. milkwort	Polygalaceae
Rhododendron columbianum	Labrador tea	Ericaceae
Rhododendron macrophyllum	Calif. rhododendron	Ericaceae
Rhynchospora alba	white beaked rush	Cyperaceae
Triantha occidentalis ssp. occidentalis	western tofieldia	Tofieldiaceae
Vaccinium ovatum	blue huckleberry	Ericaceae
Vaccinium parvifolium	red huckleberry	Ericaceae
Xerophyllum tenax	bear grass	Melanthiaceae

Species that only occur in sphagnum fens (bog sites or very wet sites)

Scientific Name	Common Name	Family
Agrostis hallii	Hall's bent grass	Poaceae
Agrostis scabra	rough bent grass	Poaceae
Aira praecox	yellow hairgrass	Poaceae
Ceanothus thyrsiflorus	blue blossom	Rhamnaceae
Ceanothus velutinus	tobacco brush	Rhamnaceae
Notholithocarpus densiflorus	tan oak	Fagaceae
Pseudotsuga menziesii var. m.	Douglas-fir	Pinaceae
Pteridium aquilinum var. pubescens	western bracken fern	Dennstaedtiaceae
Sequoia sempervirens	coast redwood	Cupressaceae
Tsuga heterophylla	western hemlock	Pinaceae
Viola sempervirens	redwood violet	Violaceae

Species that occur that are not characteristic of oligotrophic soils

Scientific Name	Common Name	Family
Calamagrostis nutkaensis	Pacific reed grass	Poaceae
Campanula californica	swamp bluebell	Campanulaceae
Carex saliniformis	deceiving sedge	Cyperaceae
Cornus canadensis	bunchberry	Cornaceae
Drosera rotundifolia	sundew	Droseraceae
Helenium bolanderi	coast sneezeweed	Asteraceae
Hypericum anagalloides	tinker's-penny	Hypericaeae
Juncus supiniformis	hair-leaved rush	Juncaceae
Lilium maritimum	coast lily	Liliaceae
Rhynchospora alba	white beaked-rush	Cyperaceae
Veratrum fimbriatum	corn lily	Melanthiaceae
Struthiopteris spicant	deer fern	Blechnaceae
Carex obnupta	slough sedge	Cyperaceae
Juncus effusus	green rush	Juncaceae

Oligotrophic Soils Where Pygmy Vegetation Occurs

Soil Series	Drainage	Texture	Soil Great Group	Hydric	Restrictive Layer
Aborigine	Very poor	Clayey	Albaquults	Yes	High clay content
Blacklock	Poor	Sandy	Duraquods	Yes	Duripan
Cleone	Somewhat poor	Sandy loam	Hapludults	No	-----
Gibney	Somewhat poor	Clayey	Hapludults	Maybe	Iron "pan"
Gibwell	Well	Clayey	Hapludults	No	-----
Noyo	Poorly	Clayey loam	Albaquults	Yes	Cemented "pan"
Seaside	Excessively	Loamy	Xerorthents	No	Bedrock
Shinglemill	Poorly	Clayey	Hapludults	Maybe	Iron "pan"
Tregoning	Poorly	Sandy loam	Epiaquepts	Yes	Cemented "pan"
Tropaquepts	Poorly	varies	Tropaquepts	Yes	Probably

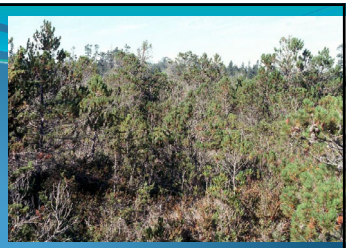
"Pans" are usually cemented with silica, iron and or clay.

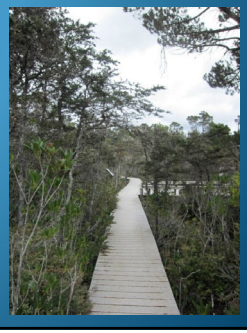
Mapping and Vegetation Classification of Mendocino Cypress Woodlands as the Path Toward Effective Conservation

Teresa Sholars
CDFW/CNPS Webinar
Dec 2, 2021

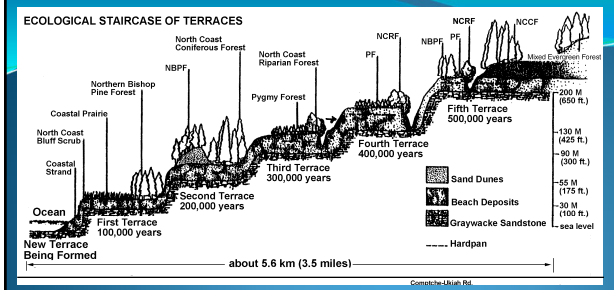
The Problem

The pygmy forest has long been recognized as a rare plant community filled with rare plants. However, our conservation efforts have been hampered by the ambiguous nature of defining what is pygmy forest and what it isn't.



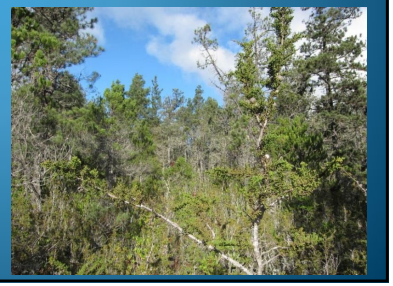


This is because **only some** of the forest types are short in stature.



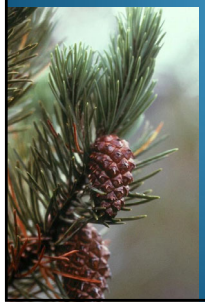
This is the classic definition but it is more complicated

"A series of terraces were uplifted flat in just a few areas; setting the stage for the creation of old, nutrient poor highly acidic soils dominated by the Mendocino cypress known as the Pygmy forest".



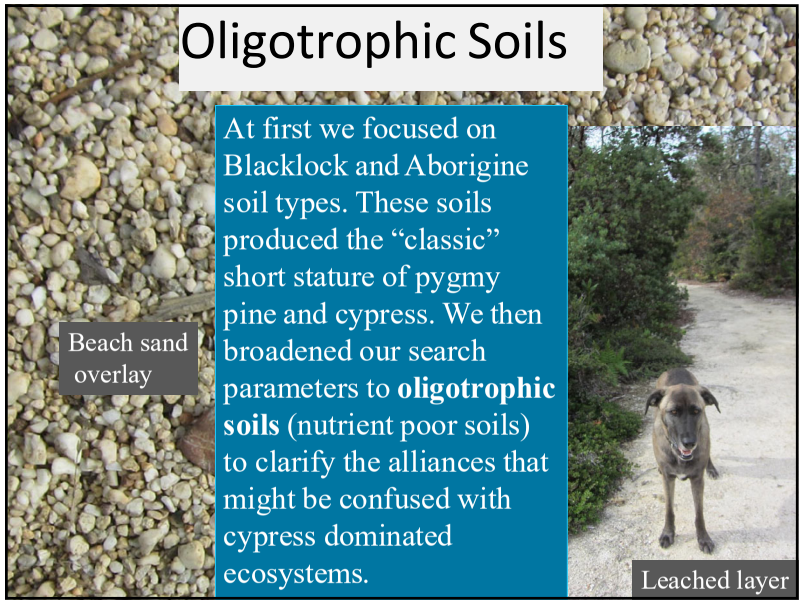
Defining the Community

In the past we have generally defined pygmy forest as a plant community that is dominated by the pygmy cypress (*Hesperocyparis pygmaea*) and Bolander or pygmy pine (*Pinus contorta ssp. bolanderi*).



But the growth stature of cypress and pine is determined by the soils resulting in a high diversity of heights and species composition.

Oligotrophic Soils



At first we focused on Blacklock and Aborigine soil types. These soils produced the "classic" short stature of pygmy pine and cypress. We then broadened our search parameters to **oligotrophic soils** (nutrient poor soils) to clarify the alliances that might be confused with cypress dominated ecosystems.

"It looks like pygmy forest"

There is a lot of vegetation called pygmy that lacked the cypress on oligotrophic soils

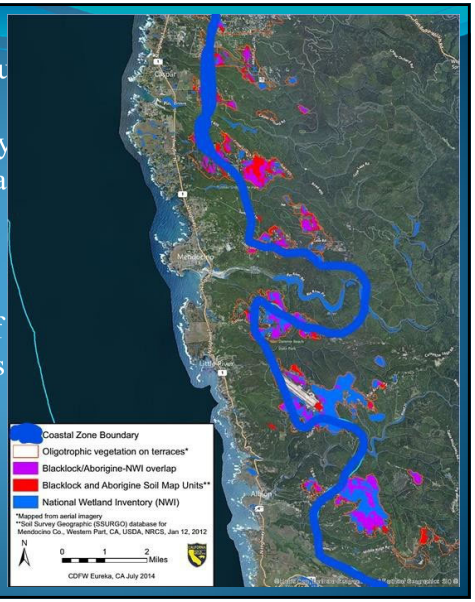
Oligotrophic Soils

= nutrient poor soils: Blacklock, Aborigine Shinglemill-Gibney complex, Tropoquept Gibney-Gibwell complex, Gibwell loamy sand, Noyo, Seaside-Rock outcrop complex, Tregoning-Cleone complex

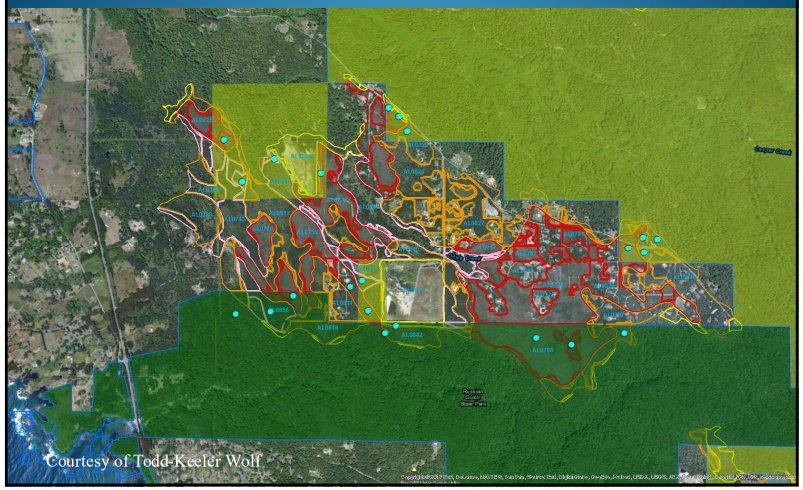
Courtesy of L. Miller CDFW

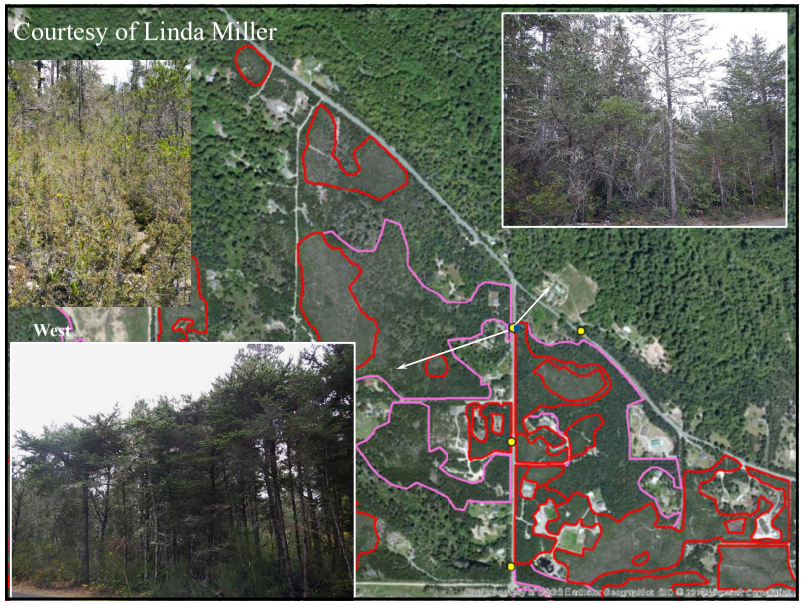
CDFW's Vegetation Classification and Mapping Program (VegCAMP) and local staff partnered with CNPS, landowners, and volunteers to conduct vegetation sampling to classify, map, and quantify Mendocino Pygmy Cypress Woodland (MPCW), also known as "pygmy forest," and closely related habitats

Before completion of ou mapping project Mendocino County only protected Environmenta Sensitive Habitat Areas (ESHAs) in the coastal zone, delineated by the blue line. Note much of the pygmy ecosystem is outside the zone.



Sample selections based on oligotrophic polygon type, veg signature, and access.





Vegetation sampling used CNPS/CDFW protocol and broke into multiple teams to collect info on:

- Species list – vascular plant composition and cover
- Community composition - vertical structure and physiognomy of vegetation by strata

Courtesy of Todd Keeler-Wolf

To finish the project accuracy assessment was completed in 2018

- Polygons with similar vegetation signatures were ground truthed.

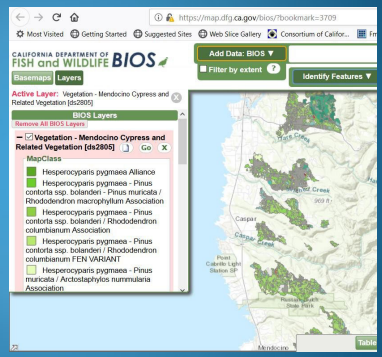
Haley Ross photo

Changing the name from pygmy

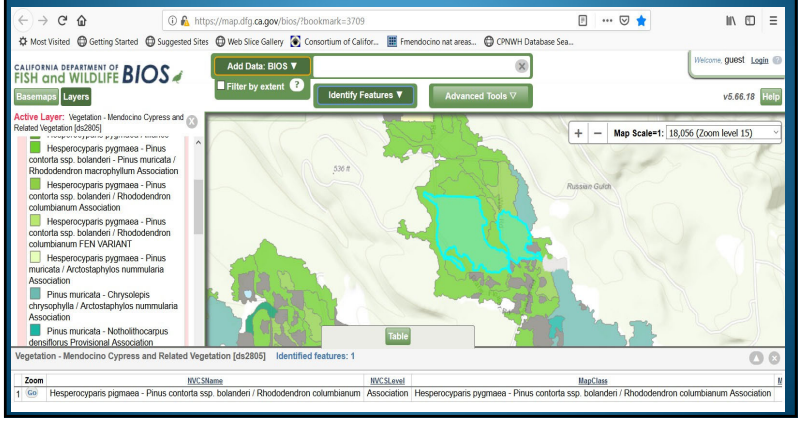
- Our work produced rankings for sensitive vegetation types historically known as pygmy forests.
- They are now classified as Mendocino cypress Woodlands and associated vegetation types that occurs “oligotrophic” (nutrient poor) soils..

The majority of the data was collected 2015-18

All of these associations & their alliances are available on CDFW’s BIOS website.

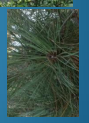
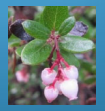


Each association has data tied to polygons on BIOS.



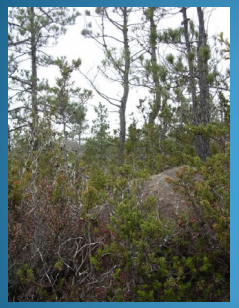
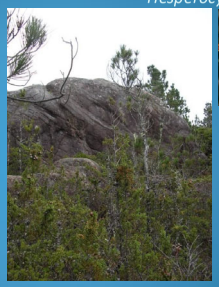
This vegetation classification and mapping project on oligotrophic soils resulted in: six new rare associations within four alliances.

1. Mendocino cypress woodland **Alliance**. G1/S1
2. Bishop or Monterey pine forests **Alliance**. G3/S3
3. Glossy leaf manzanita - Golden chinquapin chaparral Shrubland Alliance G2/S2
4. *Redwood forest **Alliance**. G3/S3.2*

Mendocino cypress **Alliance** G1/S1

Hesperocyparis pygmaea


Association 1: Mendocino cypress/ Bishop pine/ Ft. Bragg manzanita

Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia

620 acres

Mendocino cypress **Alliance** G1/S1

Hesperocyparis pygmaea





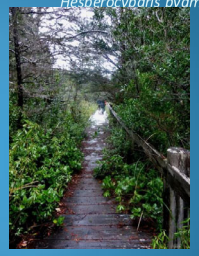

Association 2: Mendocino cypress/ Bolander pine/Labrador tea

Hesperocyparis pygmaea - Pinus contorta var. *bolanderi / Rhododendron columbianum*

2,029 acres

Mendocino cypress **Alliance** G1/S1

Hesperocyparis pygmaea



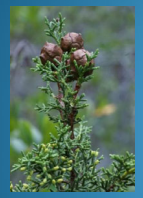
Association 2: Mendocino cypress/Bolander pine/Labrador tea (**fen variant**)

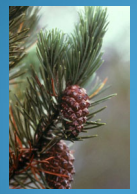
Hesperocyparis pygmaea - Pinus contorta var. *bolanderi / Rhododendron columbianum*

9 acres

Mendocino cypress **Alliance** G1/S1

Hesperocyparis pygmaea





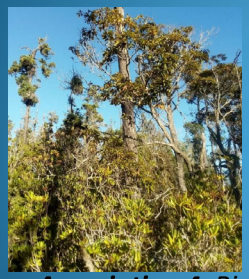
Association 3: Mendocino cypress/Bolander pine/rhododendron

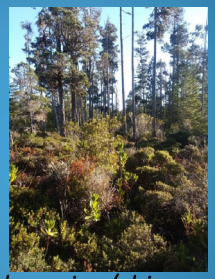
Hesperocyparis pygmaea - Pinus contorta ssp. *bolanderi - Pinus muricata /*
Rhododendron macrophyllum

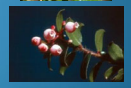
2,292 acres

Bishop (or Monterey) Pine **Alliance** G3

Pinus muricata or P. radiata







***Association 4**: Bishop pine/chinquapin/ Ft Bragg manzanita* G2/S2

Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia

1,835 acres

Glossy leaf manzanita - Golden chinquapin chaparral Shrubland Alliance G2/S2

Arctostaphylos (nummularia, sensitiva) - Chrysolepis chrysophylla

Association 5: Chinquapin/huckleberry (G2/S2) *Chrysolepis chrysophylla / Vaccinium ovatum*

55 acres

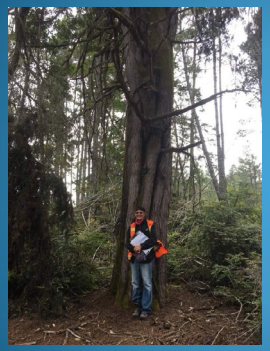
Glossy leaf manzanita - Golden chinquapin chaparral Shrubland Alliance G2/S2

Arctostaphylos (*nummularia, sensitiva*) - *Chrysolepis chrysophylla*

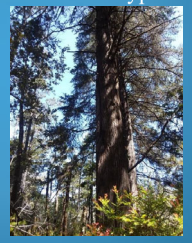
Association 6: Ft. Bragg manzanita
Arctostaphylos nummularia

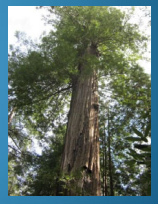
473 acres

*Redwood **Alliance** S3.2 G3*



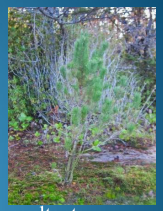
This provisional association does not grow on true oligotrophic soils but has large Mendocino cypress





Association 7 *Redwood/Mendocino cypress* G1/S1

Collaborative science leads to more effective conservation!

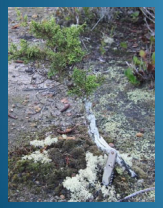


The mapping project would never have been accomplished without the support and leadership of CDFW VegCAMP group in Sacramento, Eureka, Fort Bragg and local and regional **volunteers.** Thirty five people from 14 groups were represented:: **No external funding was used!!**

CDFW
CNPS
Botanical consultants
California State Parks
Coastal Commission
Mendocino Land Trust
TNC
Mendocino Redwood Co
Campbell Global Timber
Mendocino Botanical Gardens
CDF
CSUSF
CSC arboretum

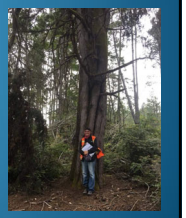
Mendocino and other coast cypress alliance

- A report has been completed, the NVC and MCV classifications will combine some of the cypress alliances to Mendocino and other coastal cypress woodland alliance (S1 to S2 ranking)



Names change as we know more

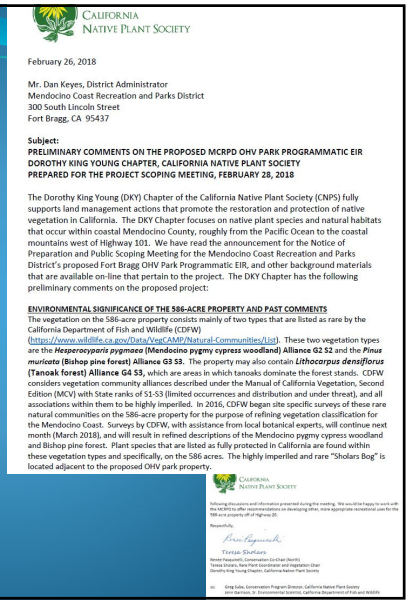
pygmy cypress -> Mendocino cypress



Cupressus goveniana var. "*pigmaea*" (1895) ->*Cupressus pygmaea* (1901) -> *Cupressus goveniana* subsp. *pygmaea* (1914) ->*Callitropsis pigmaea* (2006)-> ***Hesperocyparis pygmaea (2009)***

Conservation successes

- A proposed OHV park on MCPR land.
- Surveys were done during the Mendocino Cypress Woodland mapping process.
- Letter written by DKY chapter of CNPS



California Native Plant Society

February 26, 2018

Mr. Dan Keyes, District Administrator
Mendocino Coast Recreation and Parks District
300 South Lincoln Street
Fort Bragg, CA 95437

Subject:
PRELIMINARY COMMENTS ON THE PROPOSED MCRPD OHV PARK PROGRAMMATIC EIR
DOROTHY KING YOUNG CHAPTER, CALIFORNIA NATIVE PLANT SOCIETY
PREPARED FOR THE PROJECT SCOPING MEETING, FEBRUARY 28, 2018

The Dorothy King Young (DKY) Chapter of the California Native Plant Society (CNPS) fully supports land management actions that promote the restoration and protection of native vegetation in California. The DKY Chapter focuses on native plant species and natural habitats that occur within coastal Mendocino County, roughly from the Pacific Ocean to the coastal mountains west of Highway 101. We have read the announcement for the Notice of Preparation and Public Scoping Meeting for the Mendocino Coast Recreation and Parks District's proposed Fort Bragg OHV Park Programmatic EIR, and other background materials that are available on-line that pertain to the project. The DKY Chapter has the following preliminary comments on the proposed project:

ENVIRONMENTAL SIGNIFICANCE OF THE 586-ACRE PROPERTY AND PAST COMMENTS
The vegetation on the 586-acre property consists mainly of two types that are listed as rare by the California Department of Fish and Wildlife (CDFW) (https://www.wildlife.ca.gov/Data/VegCAMP/Natural-Communities/List). These two vegetation types are the ***Hesperocyparis pygmaea*** **(Mendocino pygmy cypress woodland) Alliance G2 S2** and the ***Pinus muricata*** **(Bishop pine forest) Alliance G3 S3.** The property may also contain ***Lithocarpus densiflorus*** **(Tanoak forest) Alliance G4 S3,** which are areas in which tanoaks dominate the forest stands. CDFW considers vegetation community alliances described under the Manual of California Vegetation, Second Edition (MCV) with State ranks of S1-S3 (limited occurrences and distribution and under threat), and all associations within them to be highly imperilled. In 2016, CDFW began site specific surveys of these rare natural communities on the 586-acre property for the purpose of refining vegetation classification for the Mendocino Coast. Surveys by CDFW, with assistance from local botanical experts, will continue next month (March 2018), and will result in refined descriptions of the Mendocino pygmy cypress woodland and Bishop pine forest. Plant species that are listed as fully protected in California are found within these vegetation types and specifically, on the 586-acres. The highly imperilled and rare "Scholars Bog" is located adjacent to the proposed OHV park property.

California Native Plant Society

Following discussions and information presented during the meeting. We would be happy to work with the MCRPD to offer recommendations on developing other, more appropriate recreational uses for the 586-acre property off of Highway 20.

Respectfully,

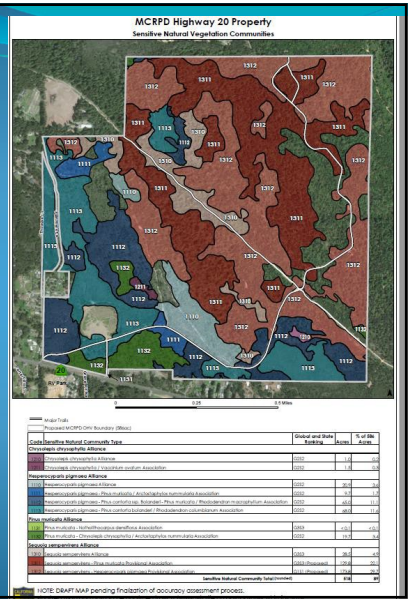
Teresa Sholars

Renée Pasquinelli, Conservation Co-Chair (North)
Teresa Sholars, Rare Plant Coordinator and Vegetation Chair
Dorothy King Young Chapter, California Native Plant Society

cc: Greg Suba, Conservation Program Director, California Native Plant Society
Jenn Garrison, Sr. Environmental Scientist, California Department of Fish and Wildlife

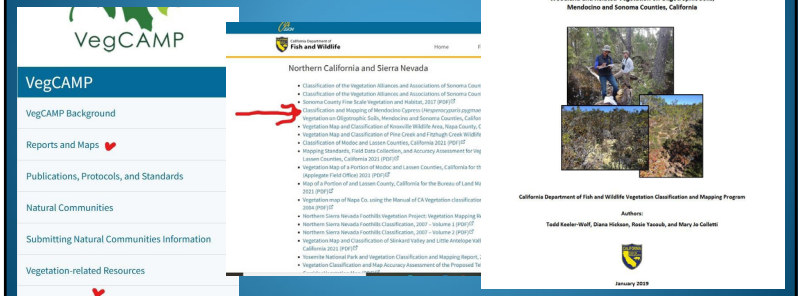
SNC map of MCPR Hw 20 site

- The data on this map is now on the BIOS site.
- 89% (518 acers) of this site is covered with SNC's
- OHV project not approved by MCPR Board



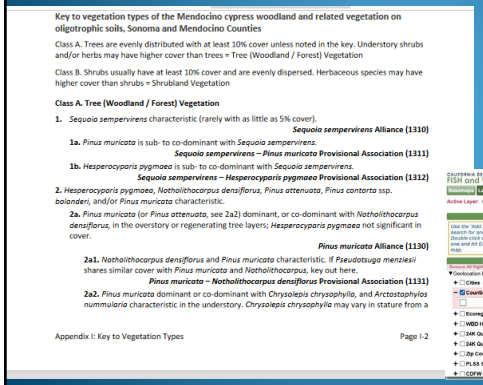
Challenges for conservation

- Information for SNC's is hard to find, even if the report and mapping are done.



Challenges for conservation

- Key to SNC from report.
- Pathway to vegetation maps of vegetation in BIOS



Key to vegetation types of the Mendocino cypress woodland and related vegetation on oligotrophic soils, Sonoma and Mendocino Counties

Class A. Trees are evenly distributed with at least 10% cover unless noted in the key. Understory shrubs and/or herbs may have higher cover than trees = Tree (Woodland / Forest) Vegetation

Class B. Shrubs usually have at least 10% cover and are evenly dispersed. Herbaceous species may have higher cover than shrubs = Shrubland Vegetation

Class A. Tree (Woodland / Forest) Vegetation

1. *Sequoia sempervirens* characteristic (rarely with as little as 5% cover).
   ***Sequoia sempervirens* Alliance (1310)**
   1a. *Pinus muricata* is sub- to co-dominant with *Sequoia sempervirens*.
   ***Sequoia sempervirens – Pinus muricata* Provisional Association (1311)**
   1b. *Hesperocyparis pygmaea* is sub- to co-dominant with *Sequoia sempervirens*.
   ***Sequoia sempervirens – Hesperocyparis pygmaea* Provisional Association (1312)**
2. *Hesperocyparis pygmaea, Notholithocarpus densiflorus, Pinus attenuata, Pinus contorta* ssp. *bolanderi*, and/or *Pinus muricata* characteristic.
   2a. *Pinus muricata* (or *Pinus attenuata*, see 2a2) dominant, or co-dominant with *Notholithocarpus densiflorus*, in the overstory or regenerating tree layers; *Hesperocyparis pygmaea* not significant in cover.
   ***Pinus muricata* Alliance (1130)**
   2a1. *Notholithocarpus densiflorus* and *Pinus muricata* characteristic. If *Pseudotsuga menziesii* shares similar cover with *Pinus muricata* and *Notholithocarpus*, key out here.
   ***Pinus muricata – Notholithocarpus densiflorus* Provisional Association (1131)**
   2a2. *Pinus muricata* dominant or co-dominant with *Chrysolepis chrysophylla*, and *Arctostaphylos nummularia* characteristic in the understory. *Chrysolepis chrysophylla* may vary in stature from a

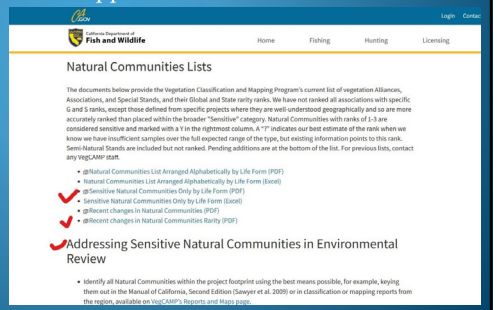
Appendix I: Key to Vegetation Types — Page I-2

Challenges for conservation

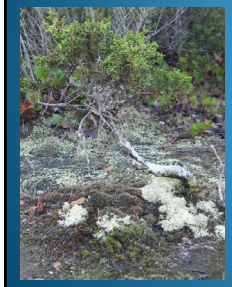
Its important to check CDFW and MCV web sites before writing or reviewing Botanical Surveys! Most SNC's have not been mapped in northwestern Ca.

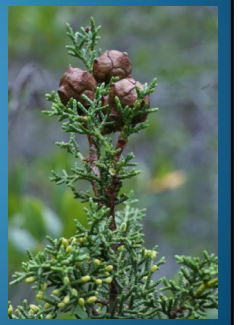
VegCAMP

- VegCAMP
- VegCAMP Background
- Reports and Maps
- Publications, Protocols, and Standards
- Natural Communities
- Submitting Natural Communities Information
- Vegetation-related Resources
- VegCAMP, ACE, BIOS, and CNDDB Training



Questions and Answers





New Pygmy Forest Rx Burn Study

Michael Jones

Pygmy Disturbance and Restoration Project

Prescribed fire and restoration thinning serve as two important strategies for lowering the risk of catastrophic wildfire. Yet, critical knowledge gaps exist in understanding how prescribed fire and vegetation treatments (i.e., mastication, manual cutting) collectively influence both plant regeneration and succession and also forest soil properties, the soil microbiome, and the spread of soilborne pathogens in protected, high human use environments historically managed by wildfire suppression.

The Mendocino Cypress Woodland Alliance, referred to herein as Pygmy Forest, represents one of the rarest and most threatened ecosystems in the state as the stunted, fire-susceptible forests only grow in extremely nutrient-poor, acidic soils formed from ancient coastal marine terraces found in pockets along the coasts of Mendocino and Sonoma counties, and sporadically in marine terrace soils elsewhere in California. A large proportion of Pygmy Forest has already been lost to human activities (e.g., residential development, solid waste disposal sites, construction of airports), which prompted its designation and protection as a National Landmark in the 1960s. Much of the remaining Pygmy Forest falls within the WUI given its proximity to the coastline, making this system an important research priority for wildfire mitigation and biodiversity conservation.

The project centers on the following questions, what are the impacts to the plant community, belowground microbial fungal symbionts, pathogen communities, and the supporting soil environment following treatments (mastication, prescribed burning only, and mastication + prescribed burning) in the Pygmy Forest Ecosystems encompassed by Jackson Demonstration State Forest?” JDSF represents an ideal research and demonstration forest that synergistically combines a history of wildfire suppression with high human use recreation in the wildland-urban interface and the presence of soilborne pathogens in the Pygmy Forest. The research framework and treatment strategies tested here will translate to additional high-use wilderness and forested areas in California that are undergoing management for both fire and soilborne pathogens.

Vegetation data will be collected summer 2025 with vegetation treatments expected to be implemented 2026, and prescribed burns to be conducted in late 2026 or early 2027.

This is a collaborative research project with folks from UC Davis, UCCE, CAL FIRE, UC Berkeley, Stanford, Yale, and Colorado State University.

Jackson Demonstration State Forest

California Department of Forestry and Fire Protection-Mendocino Unit

Jughandle Pygmy Forest Restoration & Research Project - Vegetation Map - Overview

Projection: Teale Albers
Datum: NAD 83

1:6,000
Revision Date:9/27/2024

0 0.25 0.5 1 Miles

N W E S

All visitors are responsible for knowing State Forest Regulation and fees. Contact JDSF Headquarters for questions.
802 N Main St
707-964-5674

DRAFT

WEST

EAST

SOUTH

NVCSName
- Arctostaphylos nummularia
- Chrysolepis chrysophylla / Vaccinium ovatum
- Hesperocyparis pigmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
- Hesperocyparis pigmaea - Pinus contorta ssp. bolanderi / Rhododendron columbianum
- Hesperocyparis pigmaea - Pinus muricata / Arctostaphylos nummularia
- Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
- Rubus armeniacus
- Urban
- Transition

Legend

ES_Project_Trails
Type
- Proposed Trail
- Public Trail
- Trail Abandonment
- Proposed Handline
- Proposed Abandonment
- Existing Dozer Skid Trail
- Seasonal Road
- Gates

Roads
- County
- Secondary
- Private; City
- Spur
- Primary Forest Road

Streams
Class
- 1
- 2

- JDSF Boundary
- Stateparks

Afternoon

Fire Mitigation Study

Michael Jones

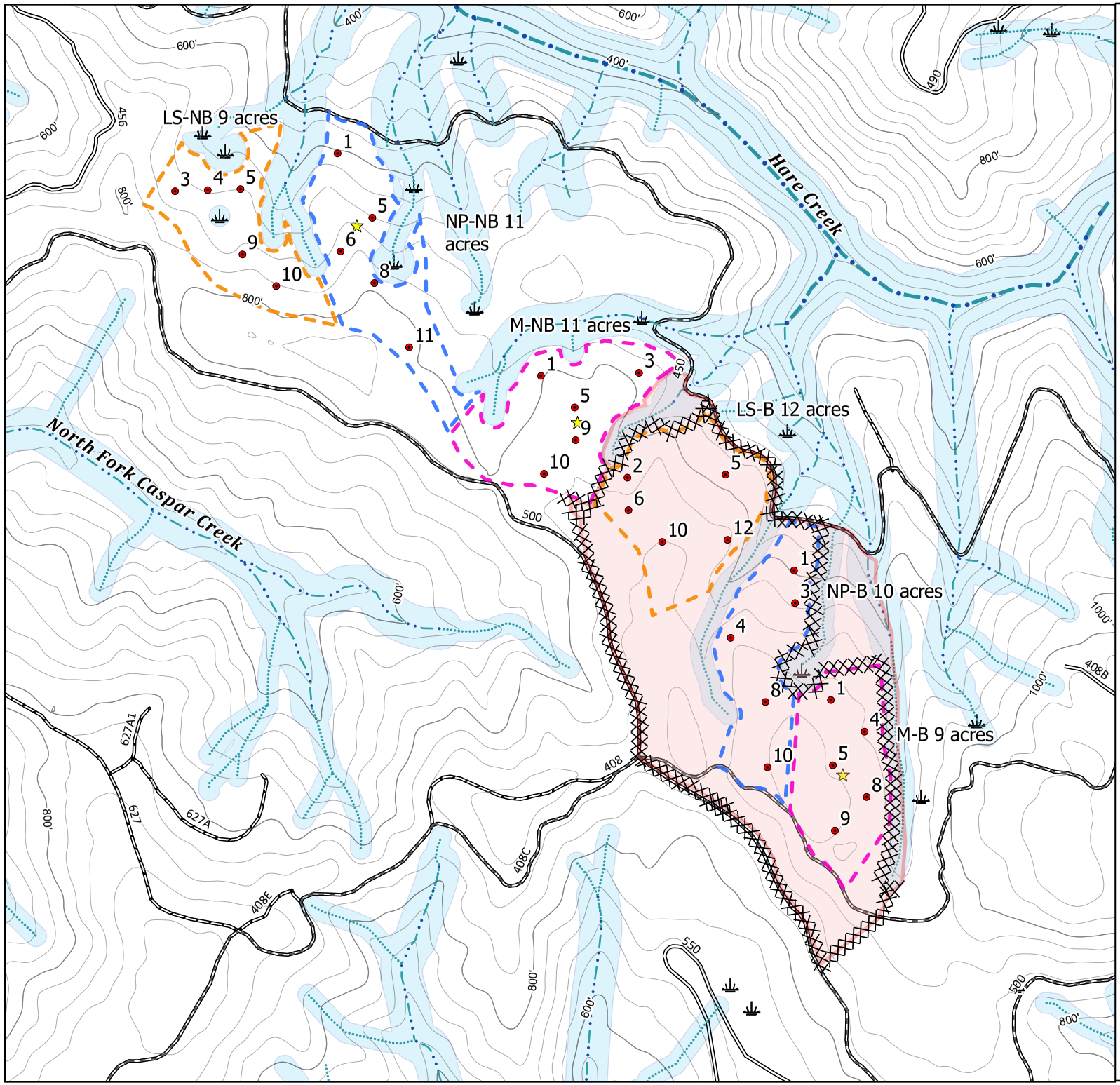
Mitigating Wildfire Hazard in the Redwoods: Effectiveness and Tradeoffs of Fuels Treatments

Destructive and deadly wildfires ravaging California are prompting timberland owners to seek guidance on mitigating risks. At present, little guidance is available for the redwood region where severe wildfire was relatively uncommon until the last decade!

Some coastal forests that regenerated after harvesting long ago are becoming progressively denser and need management to promote forest health, reduce hazardous fuel loads, and to space trees further apart before the next wildfire. Other coastal forests are actively managed for timber and other objectives, but without knowledge of how prescription choices could alter fire severity. Research is needed to answer the burning question: “how does fire behave under different approaches to silviculture combined with different fuels treatments? and how does fire behavior change over time since treatment?”. Such information would guide redwood region landowners and managers seeking to mitigate the risk of high-severity wildfire by implementing combinations of timber harvest or precommercial thinning, and/or fuels treatments that are suitable for their particular conditions and objectives.

This study was established at Jackson Demonstration State Forest to explore how different fuels treatments can be used to mitigate wildfire behavior while managing for other goals and objectives (e.g., timber, wildlife, etc.). Six treatments were established in 2022: Lop and Scatter, Mastication, Lop and Scatter + Prescribed Burn, Mastication + Prescribed Burn, Prescribed Burn only, and Control (no treatment). Vegetation treatments were implemented from 2023 to early 2024 in sites that had been harvested 7-10 years prior. Prescribed burns were successfully conducted in late October 2024 and post-prescribed burn data are be collected and analyzed. Preliminary observations indicate the fire behavior varied between vegetation treatments but burns successfully reduced fine fuels in all treatments. While fire severity appears to be generally low to moderate, additional surveys in subsequent years will be needed to determine long-term impacts to vegetation and timber value. Additionally, things like slope and aspect can be important factors in fire behavior regardless of vegetation treatment.

This is a collaborative research project with folks from Cal Poly Humboldt, UC Berkeley, UCCE, and CAL FIRE.



JACKSON DEMONSTRATION STATE FOREST

Top of Hare

Legend

- JDSF Property Line

Units

- LS-B
- LS-NB
- Mastication-Burn
- Mastication-No Burn
- NP-B
- NP-NB
- Project Burn Prescriptions
- Handline
- Dozer Line
- WLPZ Buffer

Plots

- Completed

Stream Class

- Class I
- Class II L
- Class II S
- Class III
- Springs - Seeps - Wet Areas
- Acoustic Monitors
- Botany STA
- Equipment Exclusion Zone

Road Class

- Existing Permanent Road
- Existing Seasonal Road
- Existing Temporary Road

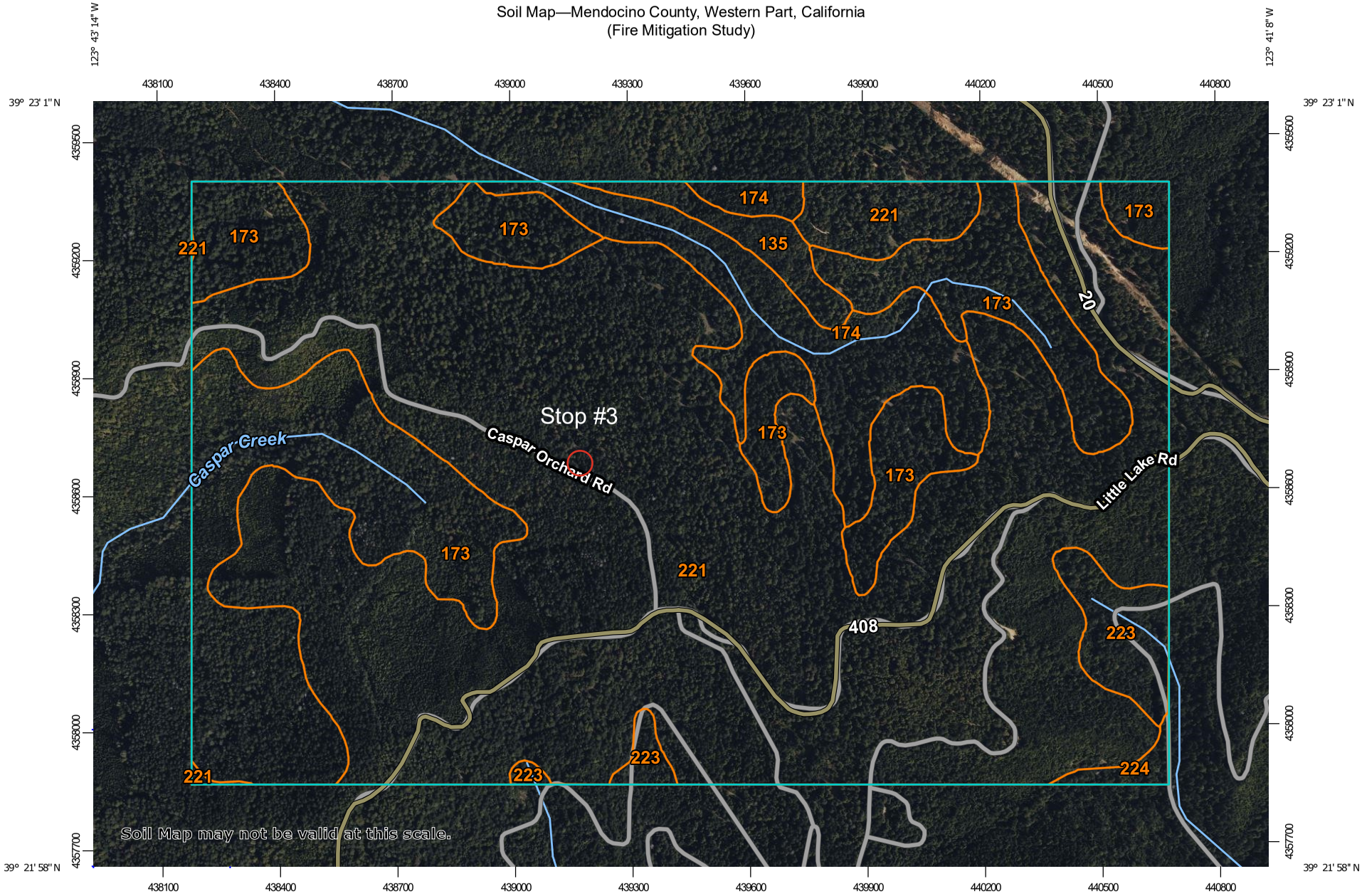
N

0 250 500 1,000

Feet

Created by F.Egan 7/18/2024

Soil Map—Mendocino County, Western Part, California
(Fire Mitigation Study)



Map Scale: 1:13,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

Caspar Study Summary

Mairead Brogan

This research investigates ecohydrological processes in a managed second growth coast redwood, with the aim of understanding the resilience of these forests. Specifically, I will look at water movement, use and stress under variable canopy cover and density conditions in coast redwood (Sequoia sempervirens) and Douglas-fir (Pseudotsuga menziesii) trees. I will unpack seasonal variation in transpiration rates and sensitivity to soil and atmospheric water availability. I will also investigate carbon discrimination and water stress, comparing conditions before and after logging. Investigating the specific resilience and vulnerability of coast redwood in managed forests can help us better protect these landscapes under the pressures of a changing climate.

Summary of California Department of Conservation Study

A Preliminary Comparison of Rock Strength and Turbidity in the Coastal Belt Franciscan Assemblage, South Fork Wages Creek versus South Fork Caspar Creek, using the Hoek-Brown Criterion, Mendocino County, California: Implications for methodology in understanding turbidity within harvested watersheds.

David Longstreth, California Geological Survey, david.longstreth@conservation.ca.gov; Patrick Brand, patrick.brand@conservation.ca.gov; Kevin Doherty kevin.doherty@cconservation.ca.gov; Morgan Renner morgan.renner@conservation.ca.gov;

Our study compares rock strength between the South Fork Wages Creek watershed and the South Fork Caspar Creek experimental watershed in Mendocino County, California. The SF Caspar Creek watershed has been studied by the USFS and State of California since the 1980's, researching the effects of historic and ongoing timber management. The SF Wages Creek watershed has been managed for timber resources by various landowners; most recently by the Lyme Timber Company. Published geological maps show both watersheds as being underlain by the same rock unit, the Coastal Belt Franciscan Assemblage, deformed rocks accreted to the western North American coastline. Both watersheds have historically and recently undergone timber harvest activities with similar levels and types of harvest. Turbidity studies conducted after activities show higher turbidity values measured in the SF Caspar Creek. The Generalized Hoek-Brown Criterion, a method used to estimate the strength of a rock mass based on an evaluation of the physical properties of a rock exposure, was used to characterize rock strengths in both watersheds. Rock strength and deformational properties were determined by estimating Uniaxial Compressive Strength, Material Constant, Modulus Ratio, and Geological Strength Index at sample locations using an ESRI based Collector app. Bedding orientations, where present, were also measured. Preliminary results suggest higher rock strengths in the SF Wages Creek watershed where intact turbidites were observed compared to deformed rock in the SF Caspar Creek. Ongoing work includes rebound hammer measurements, laboratory testing including sodium sulfate soundness, slake durability, L.A. abrasion testing, as well as Wolman Pebble Count surveys. Preliminary results emphasize the importance of characterizing rock strength and susceptibility to weathering when evaluating water quality and management activities, and that geologic mapping of the Coastal Belt Franciscan Assemblage along the Mendocino County coastline could be better differentiated.

Day 2: Saturday, June 7th, 2025 - Journey from Willits to the Coast

Morning

Willits Bypass Mitigation Project

Christopher Bartow, Mendocino County Resource Conservation District

Project Description

The California Department of Transportation (Caltrans) in conjunction with the Federal Highway Administration constructed the Willits Bypass roadway beginning in 2014 which consisted of a new section of U.S. Highway 101 that bypassed the city of Willits in Mendocino County. The bypass project resulted in impacts to natural resources in and adjacent to the bypass right-of-way which led to the compensatory mitigation effort that is the Willits Bypass Mitigation Project.

The Mendocino County Resource Conservation District (MCRCD) has contracted with Caltrans to manage the Willits Bypass Mitigation project starting in 2014. Currently operating under an interim cooperative agreement until success criteria is met on the project, at which point MCRCD will take the project lands in fee and title and begin the long-term management phase. Consisting of over 2,000 acres adjacent to the town of Willits, the project was designed to meet regulatory requirements to offset impacts by the roadway construction, but also to enhance the ecological values in the Litle Lake Valley overall. The vision of the projects' compensatory mitigation strategy was to establish, rehabilitate, reestablish, and preserve a mosaic of high functioning habitats in perpetuity, thus increasing the ecological value and improving water quality in the Eel River Basin.

Impacts of Construction

- 48.5 acres of wetlands (permanently displaced)
- 25 acres of wetlands (temporarily displaced)
- 2.6 acres of other waters of the U.S. (permanently displaced)
- 3.5 acres of other waters of the U.S. (temporarily displaced)
- 0.3 acres of North Coast semaphore grass
- 121 acres of Baker's meadowfoam habitat
- 16.1 acres of Riparian corridor
- 12.5 acres of Oak woodland (tree canopy) habitat
- 53 acres of Oak woodland (grassland) habitat

Compensatory Mitigation

- Wetlands establishment (60.5 acres)
- Wetlands enhancement (442.6 acres)
- Riparian preservation (201 acres) and
- Riparian establishment (53.5 acres)
- Oak woodland preservation (230.3 acres)

- Oak woodland establishment (6.5 acres)
- Conservation grazing lands (1,078 acres)

Mitigation and Monitoring Goals

- Maintain and expand populations of Baker's meadowfoam and North Coast semaphore grass
- Reduce targeted invasive plant species
- Maintain and improve the structure and function of seasonal wetlands, oak woodlands, and riparian habitats
- Provide ecologically and economically sustainable management of the grazed mitigation lands
- Support a cooperative and effective partnership with the grazing tenants
- Protect cultural resources

Staffing

- Project Manager: Chris Bartow
- Assistant Project Manager: Robert Kunicki
- Project Technician: Jacob Stubberfield
- Project Biologist/Interpreter: Marisela de Santa Anna

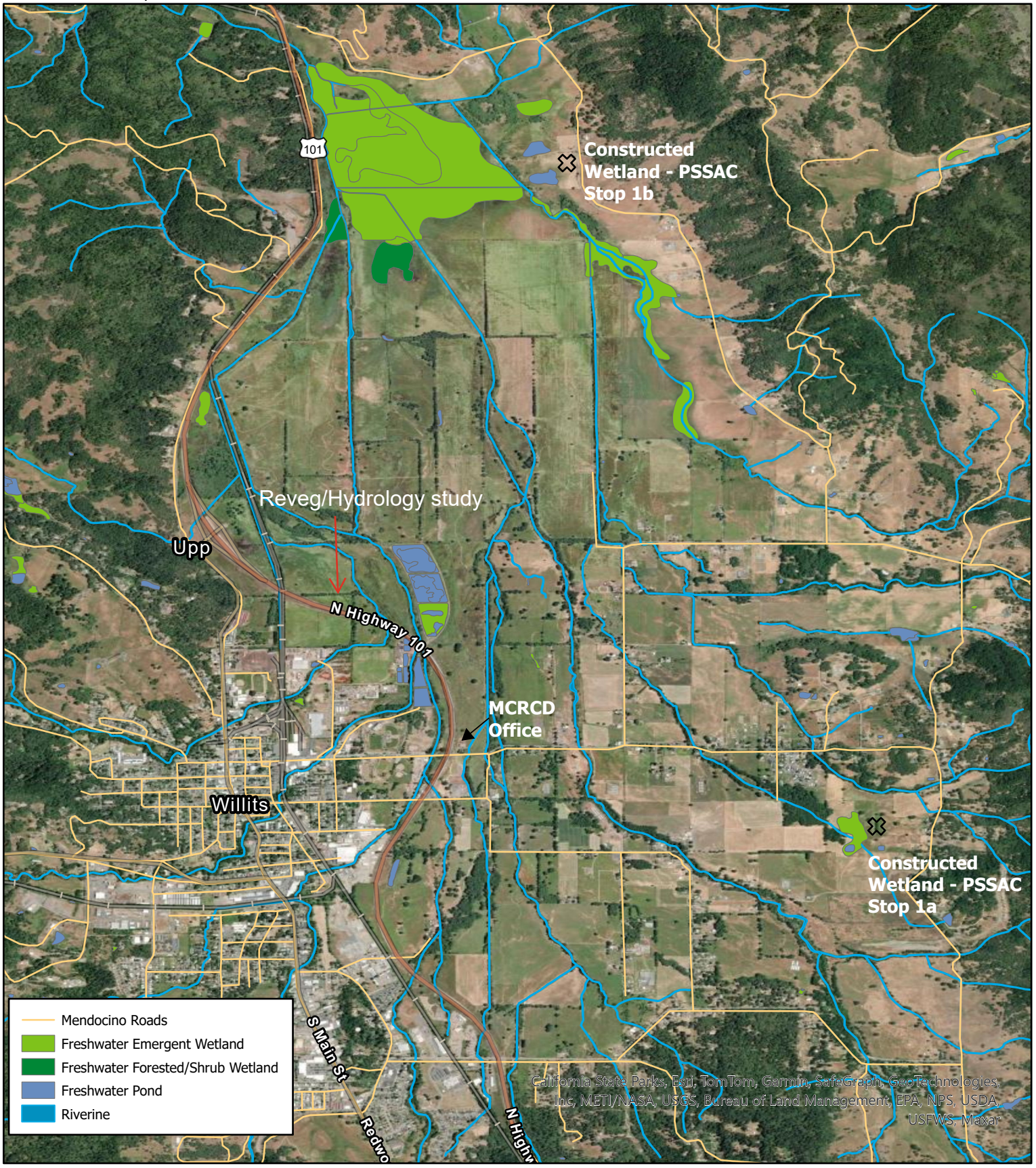
Mitigation Funding

- Caltrans
    - 3 years of wasting I &C funding (years 1-3)
    - Long-term endowment based annual funding (Years 4-99)

Little Lake Valley - National Wetlands Inventory

Location: Willits, California

NRCS Field Office: Ukiah



Disclaimer Language

Maps prepared for informational purposes only. Image depicts a combination of publicly available data and observations made of on-the-ground conditions at the time of the site visit. No liability is assumed for the accuracy of the information or data displayed. All lines are approximate.

Miles

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Scale is 1:40,000

Last updated on Friday, May 2, 2025

N

Joel Butterworth

Willits Bypass Project Geology, Geomorphology, Hydrology and Soils

This section describes the geology, geomorphology, hydrology and soils of Little Lake Valley, with an emphasis on the habitat mitigation areas associated with the Willits Bypass Project. The section is a condensation of various documents prepared by ICF Jones & Stokes for Caltrans.

General Physiography

Outlet Creek Basin (Basin) is part of the (Northern California) Coast Range Geomorphic Province, located in northern Mendocino County. The Basin is the southwestern headwaters of the Eel River, the third largest river system in California. The Basin represents an area of approximately 160 square miles (mi^2) (90,527 acres) or about 4% of the Eel River watershed. Outlet Creek, which drains Little Lake Valley, is approximately 30 miles long from its headwaters to its confluence with the Eel River and receives water from no fewer than 12 major tributary streams.

Geology

The dominant geology in the Basin is the Tertiary-Jurassic Central Belt, which is very soft to soft geology that is highly erodible. In Little Lake Valley, Quaternary alluvium is dominant. On the southern boundary of the Valley, where alluvial fans are present, Pliocene-Pleistocene fill is present. Fine sediment is consistently contributed from the Basin into the Eel River.

Little Lake Valley is underlain by a layer of Holocene alluvium that is estimated to be a maximum of 250 feet thick. The alluvium is composed of silt, clay, gravel, and sand. A layer of continental basin deposits is located under the alluvium, and Franciscan Complex bedrock is located under the continental basin deposits.

Structurally, Little Lake Valley is considered a graben (i.e., an intermountain valley bounded by faults and associated ridges on each side, locally widened into a basin or dropped downward in relation to adjacent portions).

Historical Alterations to Hydrology and Geomorphology in Little Lake Valley

Prior to the relocation and dredging of stream channels in the 1900s, Little Lake Valley functioned as a large, shallow lake and wetland (Little Lake) until late spring or early summer, depending upon the amount of rainfall of that year. Furthermore, the various drainageways in the Valley lacked a discernible hydrologic connection to Outlet Creek.

To a certain extent, this same process of channel filling occurs today, especially on smaller unnamed drainages and within wetlands on the floodplains. However, around the beginning of

the last century, artificial channels were created by ox and plow to facilitate the draining of Little Lake into Outlet Creek for agricultural purposes, such as potato production and railroad construction. The largest artificial channel appears to have been dredged from the confluence of Outlet Creek south through Little Lake where it joined Mill Creek. This channel was straightened and moved to the east to accommodate the railroad tracks.

One of the original channels (possibly the thalweg) through the lake is still visible and is referred to as the Outlet Creek overflow. This channel was later dredged straight south and merged with the confluence of Broaddus and Baechtel creeks. This dredged channel was named Outlet Creek and is noted as such on maps today. Historical and current maps indicate that lower Berry and Davis creeks also were straightened along property ownership lines to facilitate the drainage of Little Lake. By the end of the 1930s, Baechtel, Broaddus, Berry, and Davis creeks were straightened, relocated, and/or levied so the land area could be used for expanding agricultural and transportation activities.

Groundwater Overview

The aforementioned Holocene alluvium layer is the most productive aquifer for groundwater wells because it generally has relatively high porosity and permeability (Farrar 1986). The presence of sheets of fine-grained sediments in the alluvium causes much of the aquifer to be confined or semi-confined. While the City of Willits obtains its water from Morris Reservoir, groundwater wells are used for agriculture and residential use outside of Willits.

The California Department of Water Resources (DWR) reported well depth and elevation measurements from five wells in Little Lake. Measurements from these wells indicate that groundwater may be close to the ground surface (i.e., shallow), particularly in the wells located away from the edges of the Valley. This shallow groundwater supports many depressional wetlands that occur throughout Little Lake Valley. It is difficult to determine with certainty whether the groundwater supporting wetlands in the Valley is perched on impermeable layers located above the main aquifer or whether it represents the top elevation of the main aquifer. Regardless of the mechanism (perched groundwater versus main aquifer), the abundance of wetlands in Little Lake Valley indicates shallow groundwater is present to support both existing and established (i.e., created) wetlands.

The DWR well data indicate that groundwater elevations may fluctuate seasonally from 5 to 15 feet. Seasonal fluctuations in groundwater level result primarily from pumping and precipitation, although other factors such as groundwater movement to and from streams, evapotranspiration, and recharge from irrigation play a role. The well data also indicate that groundwater levels in the Valley may decrease slightly during periods of drought.

The presence of groundwater discharge at a large marsh at the north end of the Valley, located where water leaves the Valley via Outlet Creek, further indicates that groundwater levels are close to the soil surface. During particularly wet winters, the marsh becomes a shallow lake as a result of both groundwater and surface water inflow.

Groundwater Level Monitoring

Groundwater level fluctuations were monitored in the impact area and mitigation areas through the installation of numerous shallow groundwater monitoring wells in 2010 to provide information on existing conditions in existing wetlands and special-status plant populations, as well as to support mitigation site selection and mitigation design.

The groundwater monitoring well construction and installation techniques generally followed those described by Sprecher (2008). The wells were installed to a depth of approximately 30 inches and consist of 1- to 2-inch inside diameter Schedule 40 polyvinylchloride (PVC) pipe with a bottom cap and top (vented) cap. The lower section of the pipe is slotted. The remainder of the pipe is not slotted and extends approximately 10 inches above ground level. Because the soils are medium- to fine-textured at the groundwater well sites, sand-filter packing was placed around the slotted section of the pipe to prevent clogging of the slots and to promote free rise and fall of groundwater levels. Bentonite chips were mixed with native soil to create an annular seal at the ground surface. Small exclosure fencing was installed around groundwater wells on actively grazed parcels in order to minimize damage to the wells by cattle. The locations of all wells were mapped using a sub-meter-accurate GPS unit.

At each well, the depth to groundwater was measured using a roughened steel tape to which colored carpenter's chalk had been applied. The tape was inserted into the well, and measurement was taken from the wetted point on the chalk. The depth to groundwater in the wells was measured from December 2010 through March 2011 at monthly intervals.

Soils

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey for parts of Mendocino and Trinity counties (Howard and Bowman 1991) provides the most recent mapping of soils in Little Lake Valley. As mapped by the SCS and as shown by the NRCS Web Soil Survey, the soils at the wetland and special-status plant species mitigation parcels generally are weakly to moderately developed, such that in many cases the surface, subsurface, and subsoil layer textures do not differ markedly within a given profile. None of the mapped soil series and other soils mapped at the subgroup taxonomic level have profiles that usually contain a well-defined subsurface restrictive layer, such as a claypan or a duripan. Among the soil series mapped at the wetland establishment sites and their adjoining wetlands, the most strongly developed soils are the Cole and Pinole series, which are both Argixerolls, indicating that they have an argillic (subsoil) horizon with a minimum 20% increase in clay content relative to the overlying horizon.[1] However, in the modal pedon (i.e., most commonly occurring profile) described for the Cole and Pinole series, the argillic horizons have only a clay loam texture, which would be too permeable to cause a shallow perched water table. For the Cole series, the SCS soil survey indicates that in some areas the argillic horizon subsoil may be silty clay or clay, which could cause a perched water table to form and persist for an undetermined period. (The presence of such a clayey subsoil in the Cole series was observed in profiles described in a few of the existing wetlands at all of the wetland establishment sites.)

[1] For reference, Haplaquepts may contain subsoil layers and substrates that are silty clay or clay. These layers appear to be depositional, rather than pedodenic layers and therefore do not indicate strong soil development.

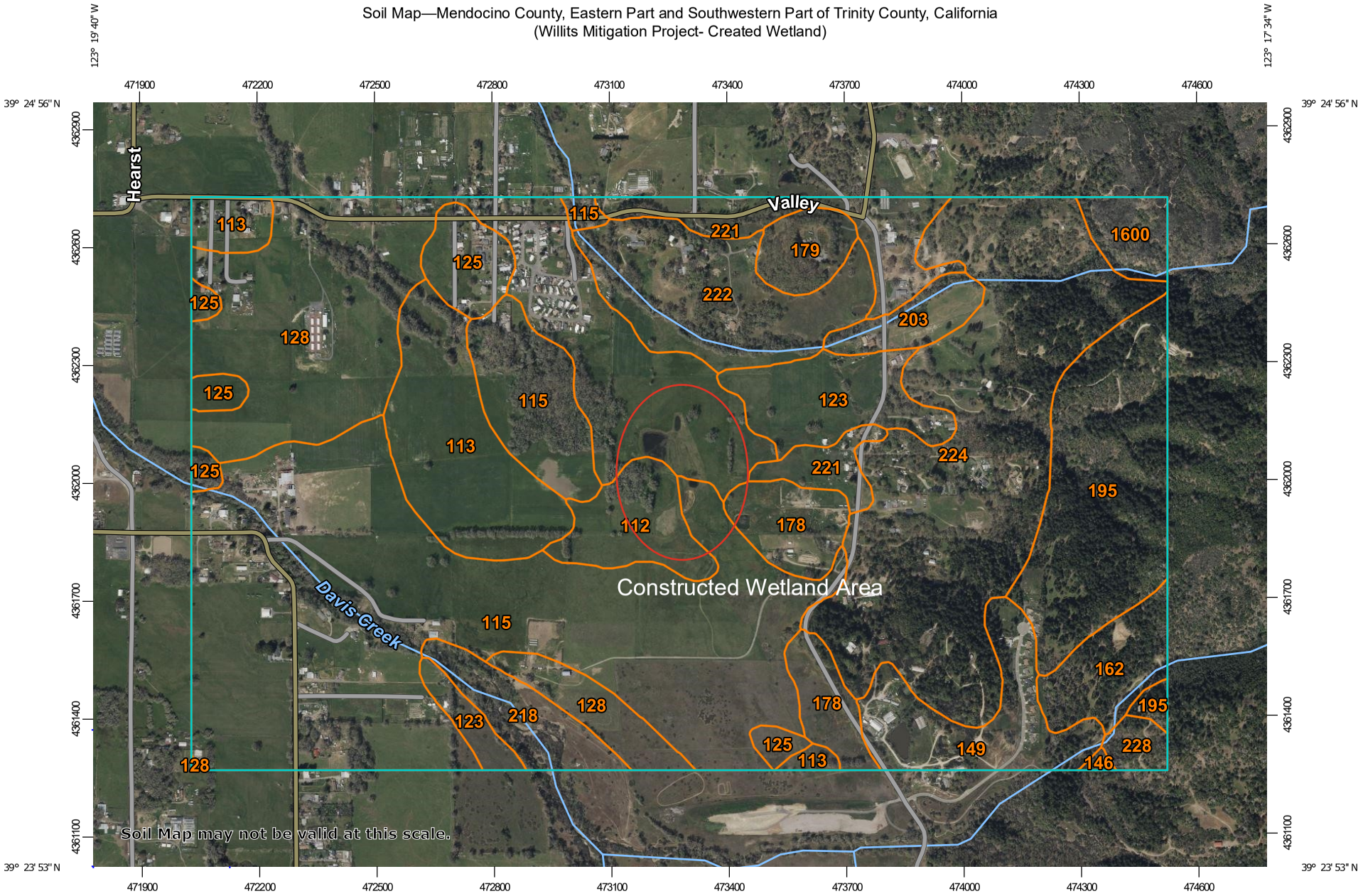
As mapped in the soil survey, the soils at all the parcels at which the North Coast semaphore grass (Pleuropogon hooverianus) (PLHO) (a special-status plant species) populations occur are not strongly developed, such that the surface, subsurface, and subsoil layer textures do not differ markedly within a given profile. The soils formed under well to poorly drained conditions, but in some areas the internal drainage has been improved as a result of stream incision and ditch construction.
The official series descriptions for the Cole (fine, mixed, superactive, thermic Pachic Argixerolls) and Gielow (fine-loamy, mixed, superactive, mesic Cumulic Endoaquolls) soils, which frequently occur in the vicinity of the natural and created wetlands in Little Lake Valley, are provided for reference.

References Cited (selected references only)

Howard, R. and R. Bowman 1995. Soil survey of Mendocino County, eastern part, and Trinity County, southwestern part, California. USDA Soil Conservation Service. Available: https://archive.org/details/usda-mendocinotrinityCA1991/page/n13/mode/2up

Sprecher. D. 2005. Technical Standard for Water-Table Monitoring of Potential Wetland Sites. ERDC TN-WRAP-05-2. June. Wetlands Regulatory Assistance Program, U.S. Army Corps of Engineers. Available: https://www.nrc.gov/docs/ML1327/ML13276A040.pdf

Soil Map—Mendocino County, Eastern Part and Southwestern Part of Trinity County, California
(Willits Mitigation Project- Created Wetland)



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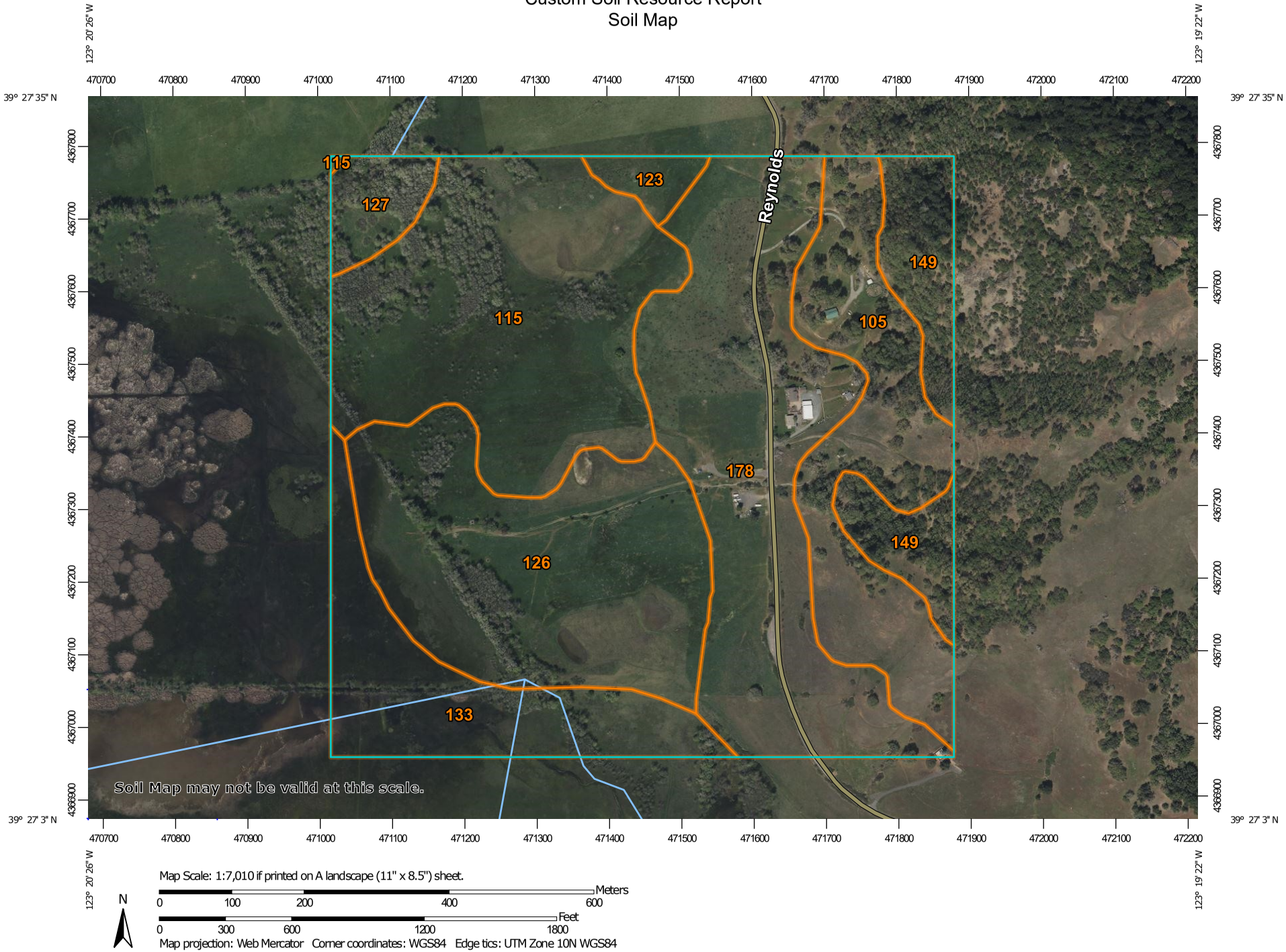
Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

Custom Soil Resource Report
Soil Map



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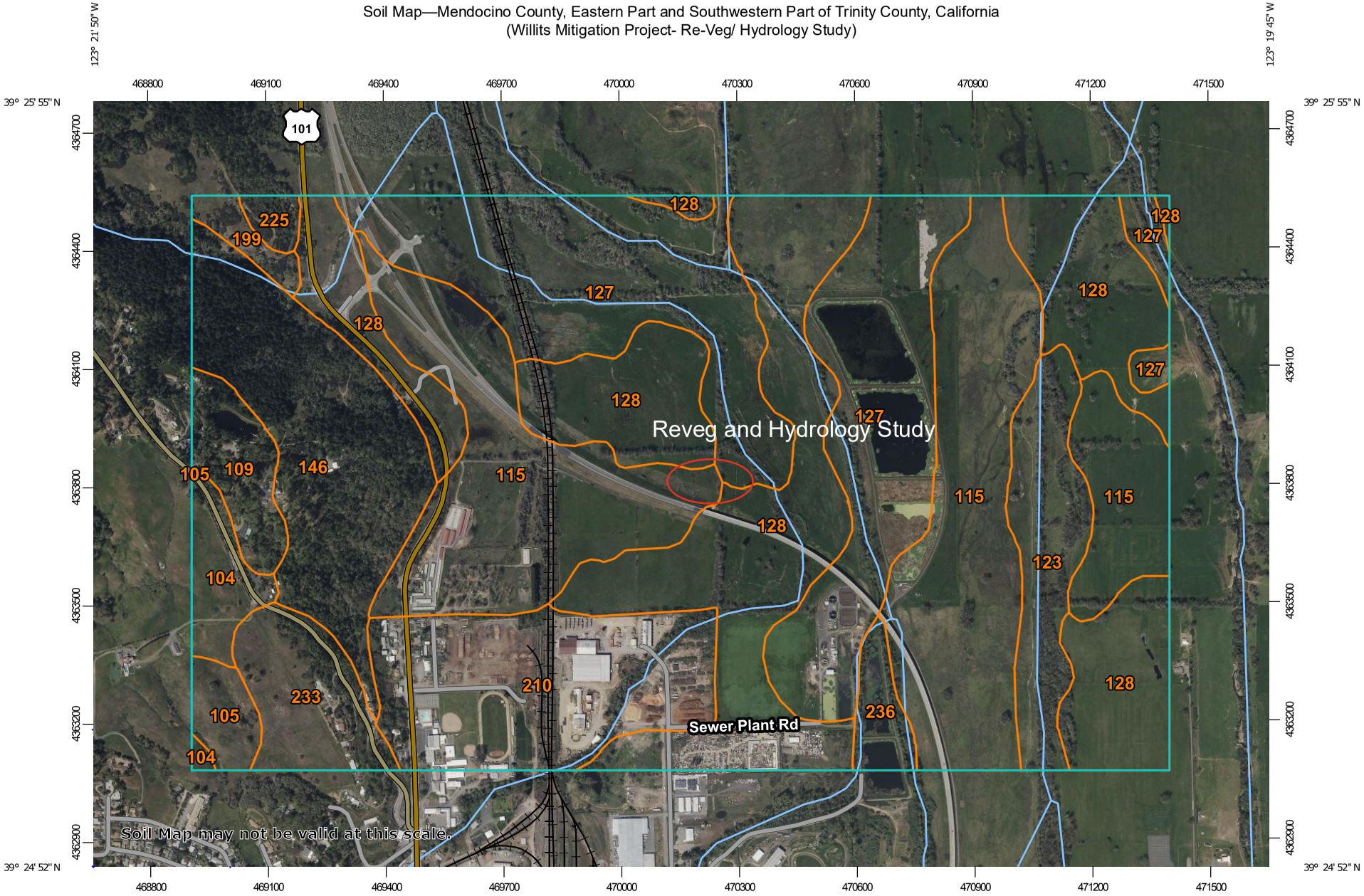
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

Soil Map—Mendocino County, Eastern Part and Southwestern Part of Trinity County, California
(Willits Mitigation Project- Re-Veg/ Hydrology Study)



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Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

Afternoon

Soil Climosequence

Introduction

Soil climosequences are soil sequences influenced by local climate variations, despite having similar material and topography. Vegetation typically varies with climatic gradients. We will study a climosequence along Highway 20 in Mendocino County. Starting at Garbiel Madrigal Bench, 28 miles inland at 1,900 feet elevation. Next is Camp 20 Recreation Area, 18 miles inland in a river valley at 380 feet elevation, surrounded by forested slopes up to 1,000 feet. Stop 3 is on marine terraces near the coast at 350 feet elevation. The final stop is Noyo Headlands Park, 85 feet above the ocean in Fort Bragg.

The Climate of Mendocino County

Mendocino County's climate differs greatly between the coast and interior. The Pacific Ocean keeps the coastal region cool and adds moisture through fog, leading to foggy summers and rainy winters. Inland areas experience a Mediterranean climate with warm, dry summers and cool, rainy winters. Vegetation and soil change as the climate becomes more continental. Precipitation ranges from 35 to 80 inches annually, mostly between October and April, and average air temperatures are between 53 to 57 degrees Fahrenheit.

Soil Moisture and Temperature Regimes (SMTR) (Appendix A contains detailed definitions)

Summer marine air and fog near the coast and following river and stream channels reduce evapotranspiration, alleviate vegetation moisture stress, slow soil moisture loss, and add moisture through "fog drip". The soil moisture regime (SMR) in these areas is classified as **"udic"**, indicating that the soil remains moist for most of the year. Further east, in forest areas less affected by marine air, there exists an **"ustic"** SMR where soil remains moist for half to three-quarters of the time and is never dry for more than 45 consecutive days in summer. In the interior regions characterized by a Mediterranean climate, the SMR is termed **"xeric"**, meaning that the soil is moist in winter and spring but dries out for over 45 consecutive days during summer and fall.

The marine air at Fort Bragg keeps the temperature difference between January and September to 8°F, while at Branscomb, located 11 miles inland, the difference is 23°F. When air temperature varies little, soil temperature remains stable as well (USDA, 1975). Consequently, the western coastal area has an **"isomesic"** soil temperature regime. This transitions to predominantly **"mesic"** further east. Interior areas with annual grass and forb vegetation commonly have a **"thermic"** soil temperature regime.

Soil Formation

Climate significantly influences the heat and moisture levels that affect soil development. Soil temperature and moisture content have a considerable impact on chemical and biological reactions within the soil. Increased temperatures and moisture levels generally accelerate various reactions, including mineral weathering in the parent rock, clay mineral formation within the soil, and organic matter decomposition.

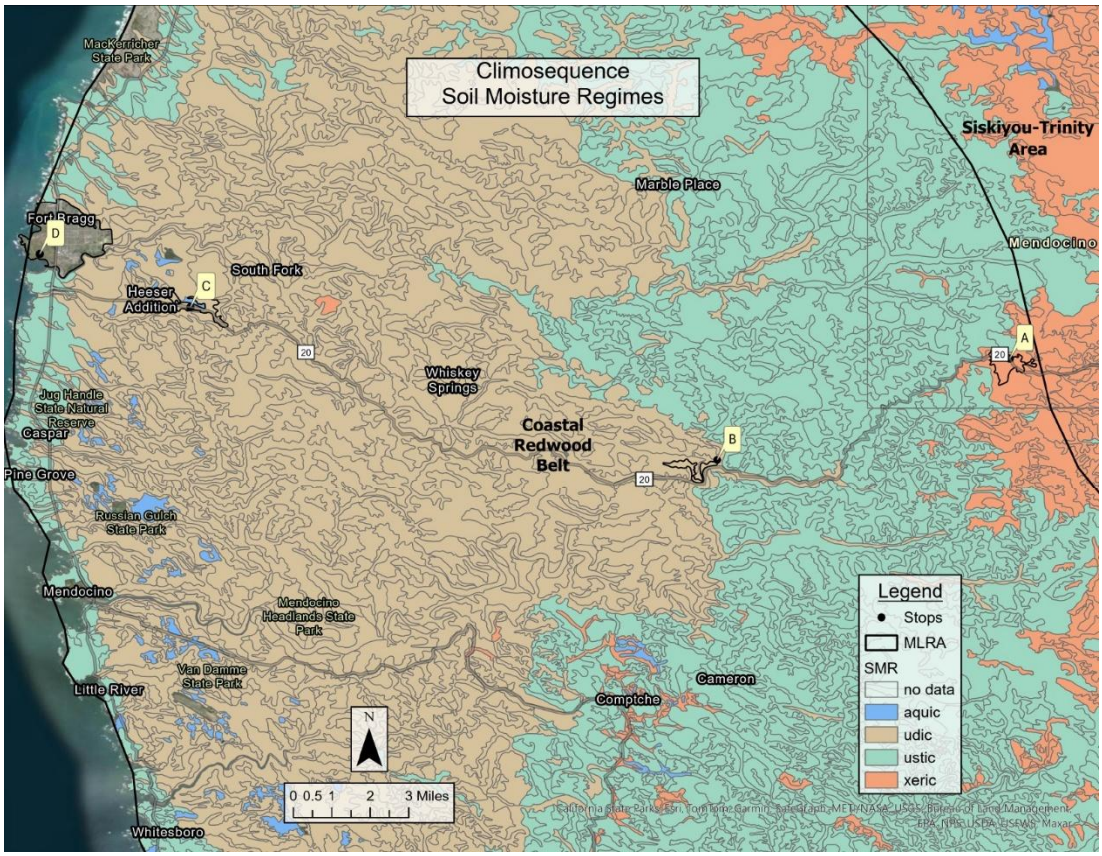
Topography and vegetative canopy modify soil climate by affecting solar energy and moisture levels, creating micro-climates. The high rainfall in the county has resulted in the leaching of cations such as calcium, magnesium, and sodium, thereby rendering the soils acidic and low in

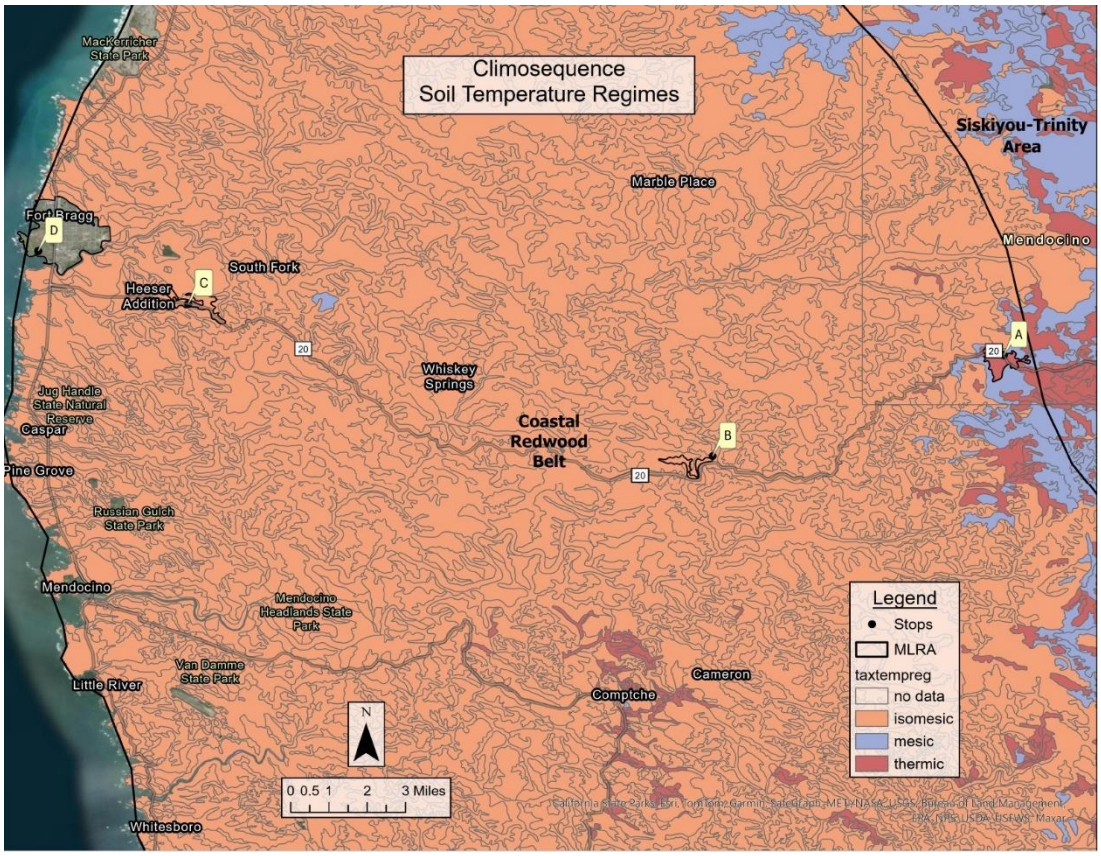
base saturation. Ultisols are present in the moist western region. Moving eastward, most forest soils are Alfisols with low base saturation in the Ultic subgroup.

Leaching during the cool season and cycles of wetting and drying contribute to the formation of argillic horizons. The removal of carbonates facilitates the mobility of clay particles, allowing them to migrate downward with water. Clay accumulates in the subsoil during alternating wet and dry periods. Most soils in the survey area possess an argillic horizon, except for younger soils that have not been established long enough.

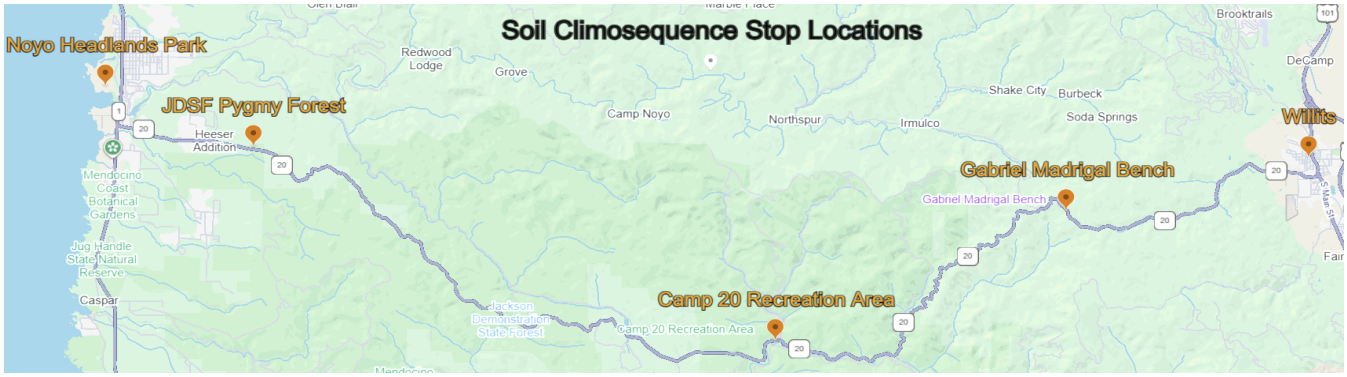
The high winter rainfall and foggy summers in the western part of the survey area promote moist soil conditions, leading to deep weathering of the underlying bedrock. Many of the soils in this region are underlain by a paralithic contact with soft, highly weathered rock. Often, the transition between soil material and the underlying rock is gradual and difficult to discern.

Thematic maps[1] display soil moisture and temperature regimes in the Western Mendocino County area of soil climosequence field stops:



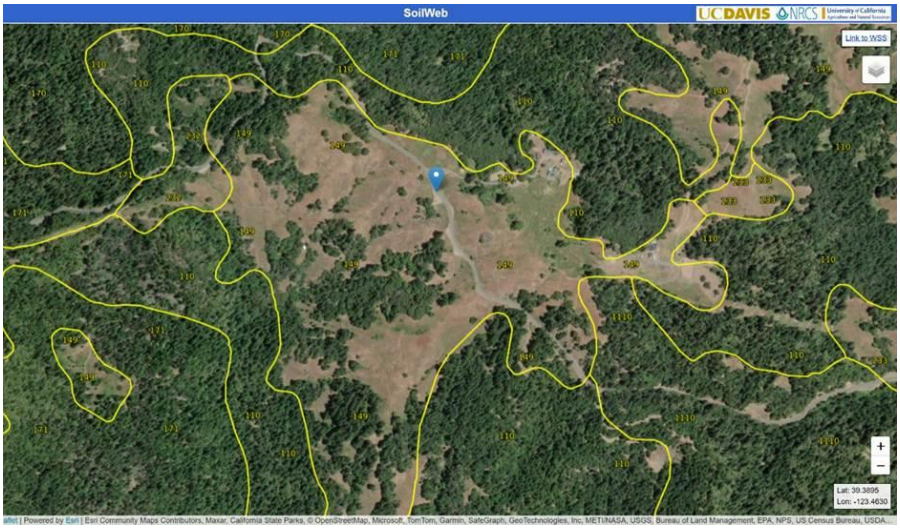


[1] Maps created by Miayla Allan, USDA, NRCS from soil survey data, May 2025.



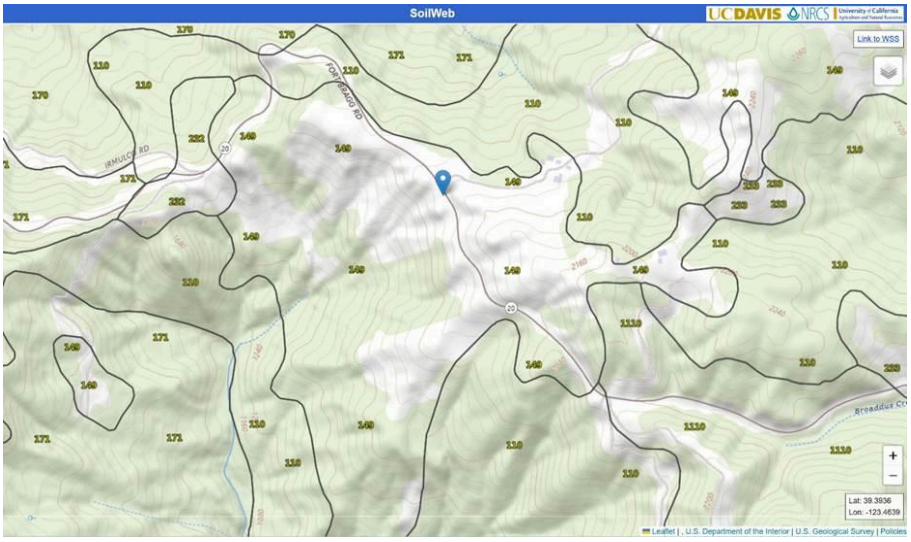
Stop A - Soil Climosequence: Gabriel Madrigal Bench

The Gabriel Madrigal Bench highlights a change going from xeric/mesic to ustic/isomesic forests. East on Highway 20 towards Willits is mainly xeric/mesic, while traveling west moves into ustic/isomesic, and eventually udic/isomesic near the coast. We can observe four different SMTR-vegetation relationships here at Stop A:



A.1. *xeric/thermic* SMTR with annual grasses & forbs

The parking area is situated within the soil survey map unit 149 - Hopland-Witherell-Ashokawna complex, 30 to 50 percent slopes. The **Whitherell soils** and Ashokawna soils contain a higher rock fragment content or have a shallower depth compared to other nearby soils. This results in reduced water retention, creating a drier and warmer environment that mainly supports herbaceous vegetation.



A.2. *xeric/mesic* SMTR with oak woodland

The **Hopland soils** component of mu149 is moderately deep to a paralithic material and has relatively high base saturation (thereby in the “Typic” subgroup of Haploxeralfs). It supports woodland of black oak, Pacific madrone, canyon live oak, blue oak, and manzanita.

A.3. *xeric/mesic* SMTR with Douglas-fir-tanoak forest

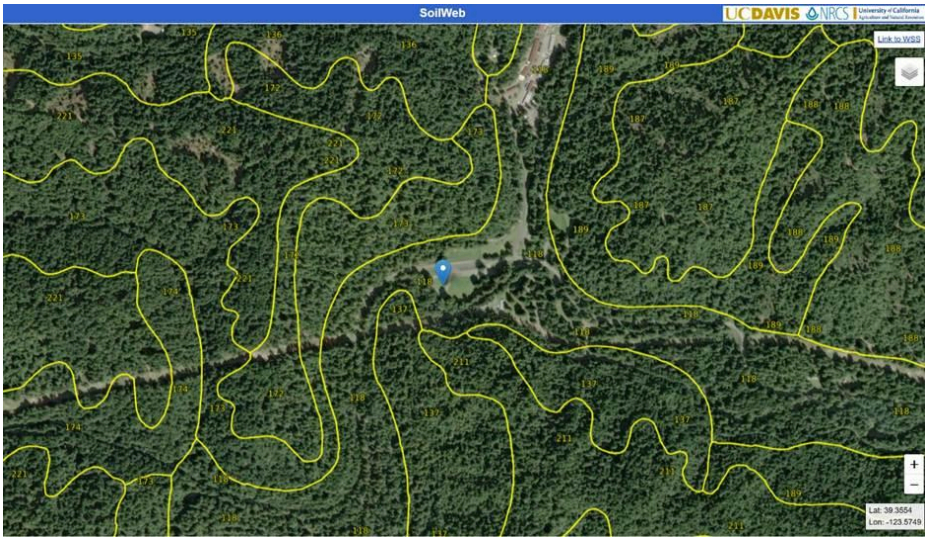
To the south and east of mu149, areas of map unit 110 - Casabonne-Wohly loams, 30 to 50 percent slopes are observable. **Casabonne soils**, characterized by lower base saturation, are classified as deep "Ultic" Haploxeralf over paralithic material. This soil type supports conifer forests that include Douglas-fir, tanoak, Pacific madrone, and western bracken fern.

A.4. *ustic/isomesic* SMTR with Douglas-fir-tanoak forest

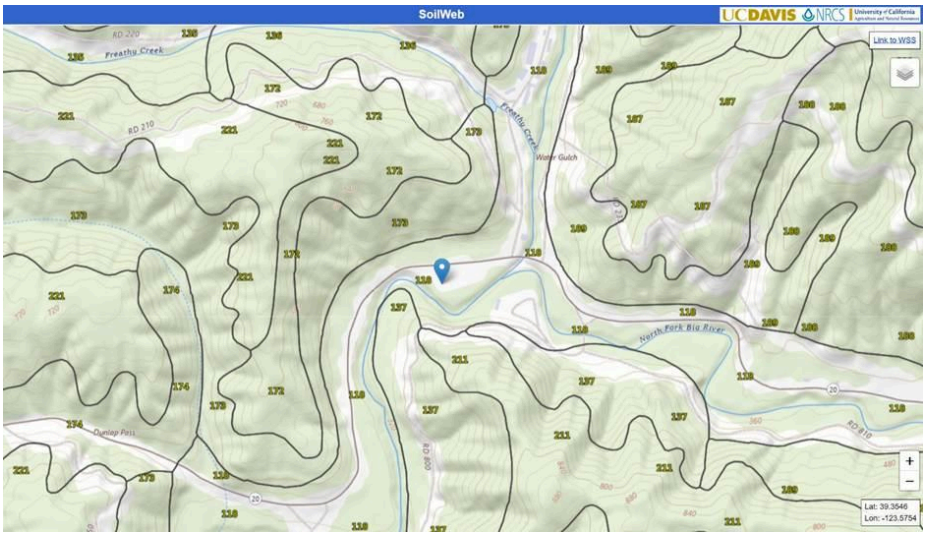
West, southwest, and northwest beyond mu149 and mu110 are regions of map units 170 and 171, consisting of Ornbaun-Zeni loams 30 to 50 percent and 50 to 75 percent slopes. These regions receive marine air and fog, resulting in an ustic/isomesic climate. **Ornbaun soils** are deep and weathered from sandstone. They support vegetation such as Douglas-fir, redwood, tanoak, madrone, and California huckleberry.

Stop B - Soil Climosequence: Camp 20 Recreation Area

After leaving the last stop, we continued down highway 20's steep slopes through ustic/isomesic SMTR above James Creek. Near the North Fork Big River confluence, the road flattened and entered the redwood forest on alluvial bottoms and lower side slopes. At Camp 20 parking area, we will observe the soil-vegetation relationships in these two settings.



B.1. *udic/isomesic* SMTR with redwood forest

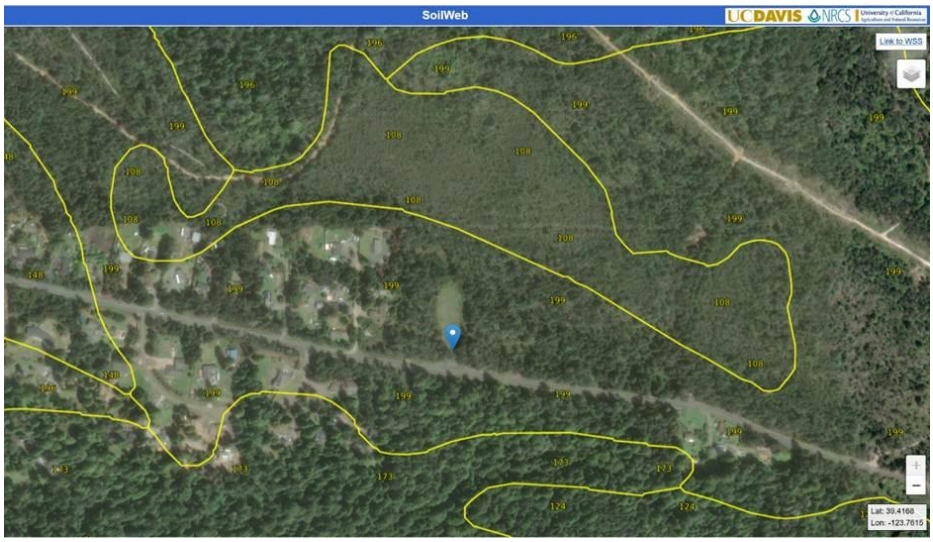


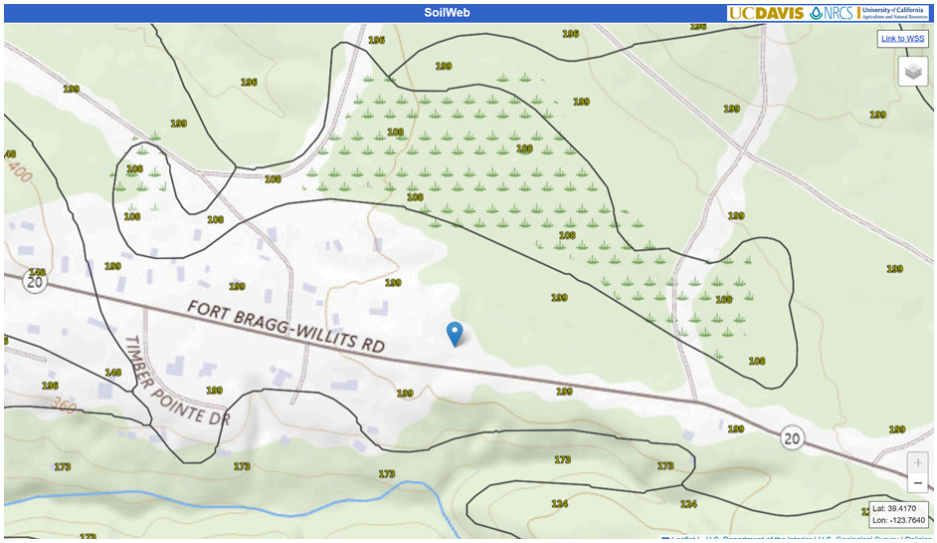
The parking area is located within map unit 118 - Carlain loam, 2 to 9 percent slopes. The adjacent hillslopes to the west, northwest, and southwest are designated as 173, 174 - Irmulco-Tramway complex, with slopes of 30 to 75 percent, or 221 - Vandamme loam, 9 to 30 percent slopes. These regions, influenced by marine air and fog, feature deep, moist, highly weathered soils. **Irmulco soils** classify as Ultic Hapludalfs and **Vandamme Soils** as Typic Haplohumults. These udic/isomesic soils support redwood, Douglas-fir, Grand fir, tanoak, huckleberry, rhododendron, swordfern, and oxalis.

B.2. *ustic/isomesic* SMTR with redwood-Douglas-fir forest

The south- and west-facing slopes east of the parking area experience slightly less marine air and fog, creating ustic/isomesic SMTR conditions. Example map units include 187 and 188 - Ornbaun-Zeni complex with 30 to 75 percent slopes. The **Ornbaun soils** support redwood, Douglas-fir, tanoak, and huckleberry vegetation.

Stop C - Soil Climosequence: JDSF Pygmy Forest





The drive from Camp 20 encompassed 14 miles, predominantly through redwood forests thriving in optimal udic/isomesic soils. Approximately one mile before reaching this destination, the route transitioned from the Coast Range hills and mountains to marine terraces that extend four miles westward to the ocean. These coastal terraces are significantly influenced by marine air and fog, where udic/isomesic SMTRs are prevalent in forest soil environments. However, certain terrace soils have developed restrictive layers and water tables, resulting in aquic/isomesic SMTRs. This stop will involve observations of these two SMTR settings and their corresponding soil-vegetation relationships.

C.1. *udic/isomesic* SMTR with bishop pine on marine terraces

The parking area is located in map unit 199 - Shinglemill-Gibney complex, 2 to 9 percent slopes. **Shinglemill soils** are strongly acidic, very deep, poorly drained Ultisols formed in marine sediments. The proximity to the coast with the influence of salty coastal winds affects both the soils and vegetation. Vegetation includes Bishop pine, Mendocino cypress, California huckleberry, glossyleaf manzanita, rhododendron, and bear grass.

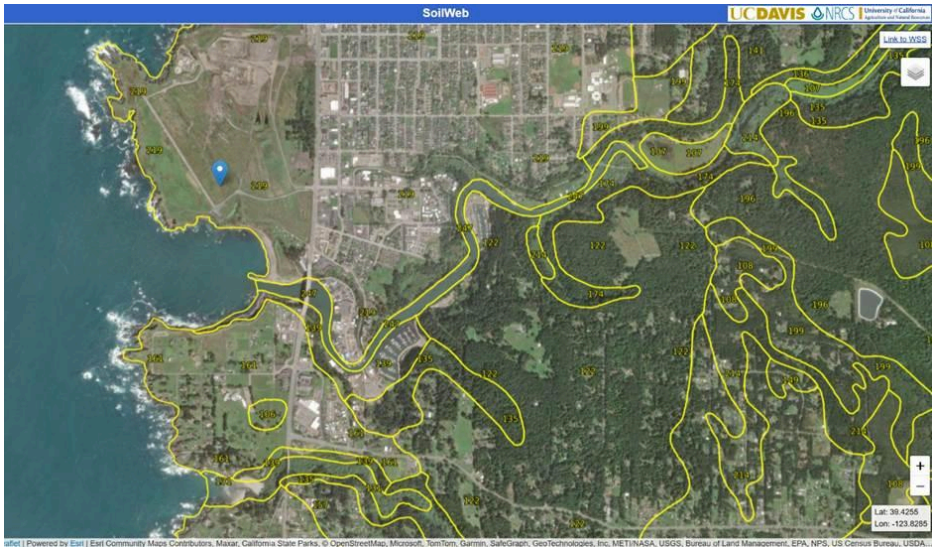
C.2. *aquic/isomesic* SMTR with pygmy cypress forest on marine terraces

North of the parking area is map unit 108 - Blacklock and Aborigine complex, 0 to 5 percent slopes. **Blacklock soils** are strongly acidic, poorly drained, shallow, and formed in sandy

marine sediments, which stunts plant growth. The high water table and the influence of salty coastal winds also affects both the soils and vegetation. Common plants include shorepine, Sitka spruce, Mendocino pygmy cypress, Port-Orford-cedar, western hemlock, evergreen huckleberry, rhododendron, salal, swordfern, azalea, spirea, sedges, rushes, and water-tolerant grasses.

Stop D - Soil Climosequence: Noyo Headlands Park

Eolian sands form much of Mendocino County's coastal marine terraces. Despite marine air influence, the soil moisture regime is ustic due to drying effects from solar energy and wind. The coastal headlands are used for crops, pastureland, or urban development.



D.1. *Ustic/Isomesic* SMTR with perennial & annual grasses & forbs on headlands

The Park is situated within map unit 210 – Urban Land, classified as a soil survey "miscellaneous land type". This classification corresponds to its location within the City of Fort Bragg and reflects the practicality of mapping at this scale. The nearby headland to the south has similar soil, serving as a reference. That area is designated mu 161 - Heeser sandy loam, 2 to 15 percent slopes. **Heeser soils** are acidic, coarse-loamy, somewhat excessively drained soils formed in eolian sands on marine terraces. Sea spray influences both the soils and vegetation. Vegetation is typically perennial and annual grasses and forbs.

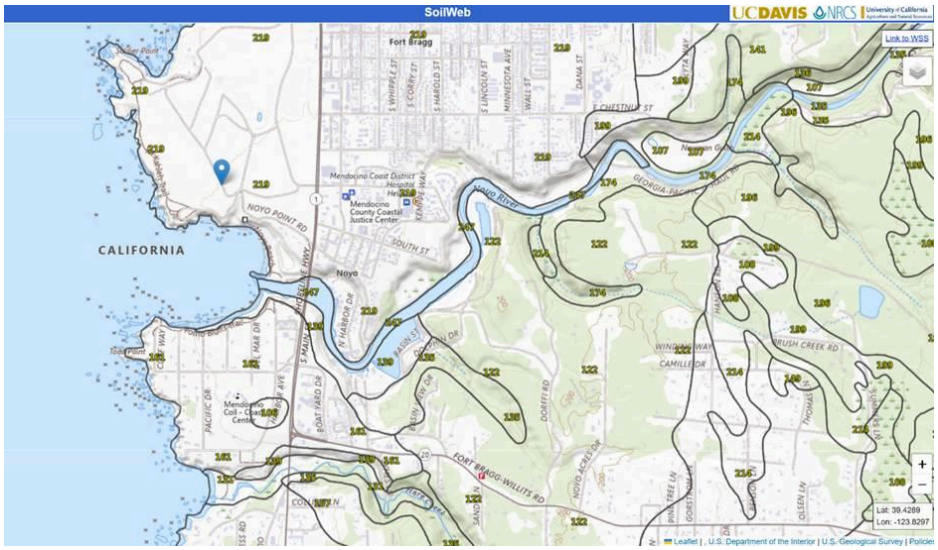


Table summarizing classification of representative soil series

SMTR	***Soil series name***	***Soil Classification***	**Diagnostic horizons and features**
Stop A: Gabriel Madrigal Bench			
Xeric/ thermic	Witherell	Fragmental, mixed, thermic Typic Haploxerepts	*Ochric epipedon*: (A horizon) *Cambic horizon*: (Bw, Bt horizons) There is a slight increase in clay content over the A horizon, but it is not enough to meet the requirements of an argillic horizon *Particle-size control section* - the zone from 25 to 100 cm has 1% clay by weight, and 89% gravel by vol (Bt and C horizons) *Fragmental material* - the zone from 30 to 200 cm (C horizon)
Xeric/ mesic	Hopland	Fine-loamy, mixed, active, mesic Typic Haploxeralfs	*Ochric epipedon* - (A horizon) *Argillic horizon* - (Bt1 and Bt2 horizon) *Paralithic material* - C horizon 79 to 200 centimeters
Xeric/ mesic	Casabonne	Fine-loamy, mixed, superactive, mesic Ultic Haploxeralfs	*Ochric epipedon* - (O and A horizons) *Argillic horizon* - (Bt1, Bt2, Bt3)
Ustic/ isomesic	Ornbaun	Fine-loamy, mixed, superactive, isomesic Ultic Haplustalfs	*Ochric epipedon* – (A horizon) *Argillic horizon* - (Bt1, Bt2, Bt3, Bt4 horizons) *Paralithic material*, when present, has a similar available water capacity and bulk density to the overlying B horizon
Stop B: Camp 20 Recreation Area			
Udic/ isomesic	Irmulco	Fine-loamy, mixed, superactive, isomesic Ultic Hapludalfs	*Ochric epipedon* - (A horizon) *Argillic horizon* - (Bt1, Bt2, Bt3, Bt4 horizon) *Particle-size control section* - 6 to 26 inches = 20% clay *Base saturation (sum)* - Bt4 = 36%
Udic/ isomesic	Vandamme	Clayey, mixed, isomesic Typic Haplohumults	*Ochric epipedon* - (A1, A2 horizons) *Argillic horizon* - (Bt1, Bt2, Bt3, Bt4 horizons) *Base saturation (sum)* - Bt horizons) = 5 to 35%
Stop C: JDSF Pygmy Forest			
Udic/ isomesic	Shinglemill	Fine, mixed, semiactive, isomesic Aquic Hapludults	*Ochric epipedon* - (E horizon) *Argillic horizon* - (Bt1, Bt2, Btv1, Btv2, Btv3) *Aquic feature* - saturation and redox depletions in the upper part of the Bt horizon
Aquic/ isomesic	Blacklock	*Sandy, mixed, isomesic, ortstein, shallow Typic Duraquods*	*Albic horizon* - (E horizon) *Spodic horizon* - (Bh, Bsm1, Bsm2, Bsm3 horizons) *Ortstein layer* - (Bh, Bsm1, Bsm2, Bsm3 horizons)
Stop D: Noyo Headlands Park			
Ustic/ isomesic	Heeser	Coarse-loamy, mixed, superactive, isomesic Humic Dystrustepts	*Umbric epipedon* - (A1, A2, A3, A4, A5, AC)

Summary Table of Soil and Vegetation Relationships

SMTR	Soil series name	CNPS/MCV Common Name[1] (see Scientific Name in footnote)	Woodland Productivity (Site indices for Redwood & Douglas-fir[2])	Ecological Site
Stop A: Gabriel Madrigal Bench				
Xeric/ thermic	Witherell	Wild oats & annual brome grasslands[3]	na	R015XD103CA Shallow Loamy (Annual Grass)
Xeric/ mesic	Hopland	Mixed oak forest and woodland[4]	na	F015XY101CA Hills >40"ppt
Xeric/ mesic	Casabonne	Douglas fir - tanoak forest - madrone forest and woodland[5]	na and 153	F005XZ010CA Very Deep Gravelly Mesic Hills 40-60"ppt
Ustic/ isomesic	Ornbaun	Redwood forest and woodland[6]	152 and 155	F004BK102CA Fog-Influenced, Lower Elevation Mtn Slopes
Stop B: Camp 20 Recreation Area				
Udic/ isomesic	Irmulco	Redwood forest and woodland	165 and 191	F004BK102CA Fog-Influenced, Lower Elevation Mtn Slopes
Udic/ isomesic	Vandamme	Redwood forest and woodland	165 and 179	F004BK102CA Fog-Influenced, Lower Elevation Mtn Slopes
Stop C: JDSF Pygmy Forest				
Udic/ isomesic	Shinglemill	Bishop pine - Monterey pine forest and woodland[7]	na	F004BL102CA Salt-Affected Marine Terr w/ Eolian Sand
Aquic/ isomesic	Blacklock	California coastal cypress woodland[8]	na	F004BL100CA Poorly Drained, Very Acidic Marine Terraces
Stop D: Noyo Headlands Park				
Ustic/ isomesic	Heeser	Perennial rye grass fields[9]	na	R004BY060CA Sandy Loam Terrace (Perennial Grass)

[1] California Native Plant Society. *A Manual of California Vegetation*, Accessed May 9, 2025, Available from: https://vegetation.cnps.org/.

[2] From Western Mendocino County Coil Survey report. They used 100-yr base age curves: Linquist and Palley (1963) for redwood and McArdle and Meyer (1961) for Douglas-fir.

[3] *Avena ssp-Bromus ssp* Alliance

[4] *Quercus* (*agrifolia*, *douglasii*, *garryana*, *kelloggii*, *lobata*, *wislizeni*) Forest & Woodland Alliance

[5] *Pseudotsuga menziesii - Notholithocarpus densiflorus - Arbutus menziesii* Forest & Woodland Alliance

[6] *Sequoia sempervirens-Pseudotsuga menziesii* Forest Alliance

[7] *Pinus muricata - Pinus radiata* Forest & Woodland Alliance

[8] *Hesperocyparis* (*pigmaea*, *abramsiana*, *macrocarpa*, *goveniana*) Woodland Alliance

[9] *Lolium perenne* Herbaceous Semi-Natural Alliance

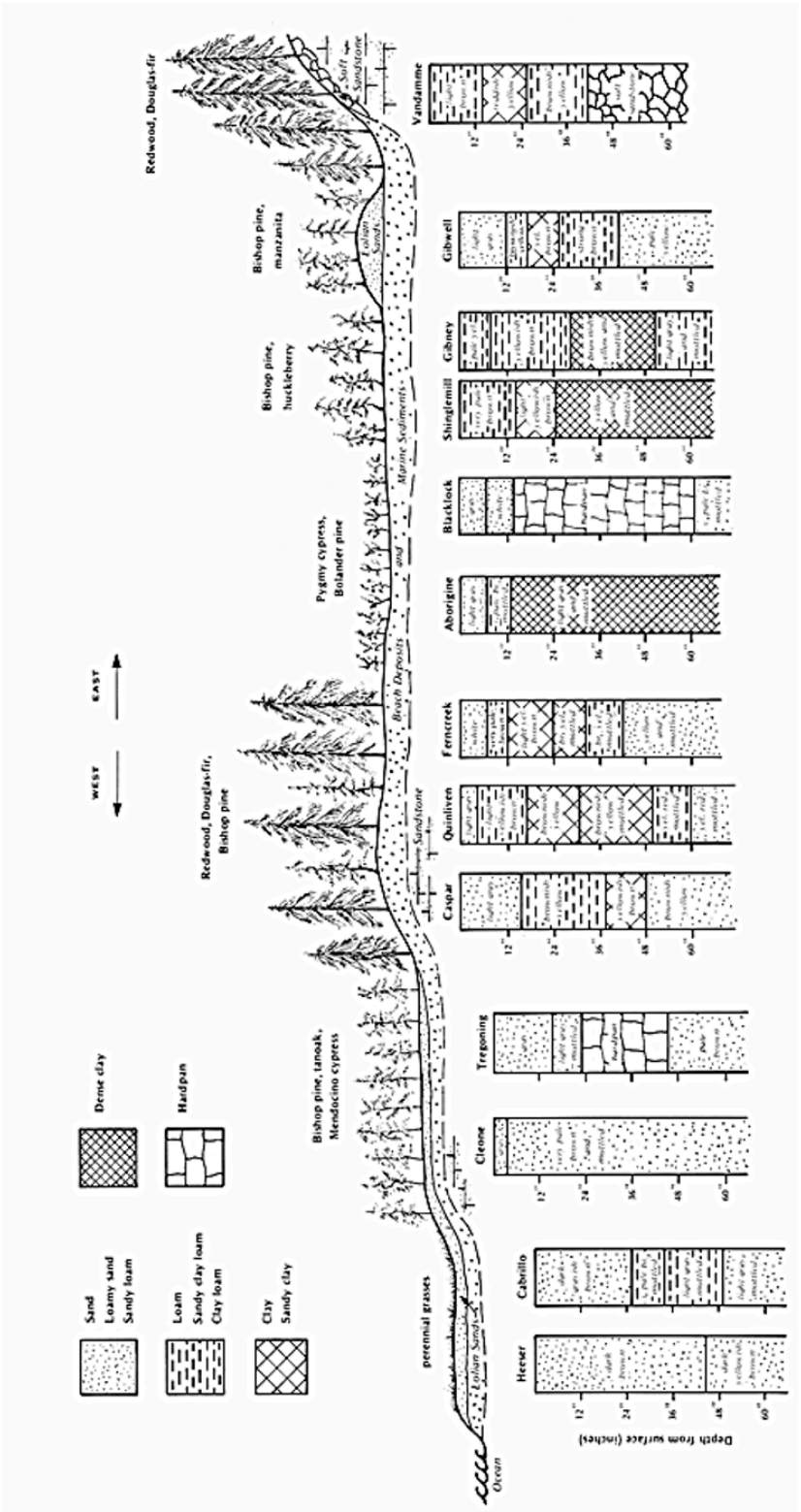


Figure 10.—Idealized illustration of the general relationships among marine terrace soils. This simplified cross-section is typical of the marine terraces near the town of Caspar. The width of the terrace system, from the ocean on the west to the mountainous uplands on the east, is approximately 4 miles at this location. Other cross-sections of the terrace system would reveal different combinations of soils. The upper terrace in this diagram represents perhaps three or more terrace levels. The diagram is not to scale.

APPENDIX A: Soil moisture and temperature regime definitions

Soil Moisture Regimes[i]: Soil moisture regimes are used as a soil classification criterion because they affect soil genesis (formation), affect the use and management of soils, and can be used to group soils with similar properties and morphology.

SOIL MOISTURE REGIMES (SMR) CONCEPT—cumulative and consecutive periods of dryness and moistness in the soil moisture control section. Dry—water potential less than -1500 kPa (- 15 bars). Moist—water potential greater than -1500 kPa.

SOIL MOISTURE CONTROL SECTION (SMCS) Upper boundary—depth to which dry (but not air-dry) soil is wet by 2.5 cm of water in 24 h. Lower boundary—depth to which dry soil is wet by 7.5 cm of water in 48 h. All moisture regimes, except aquic, are based on regional climate. Aquic moisture regimes are based on the length of the period that the soil was saturated.

The soil moisture regime classes include:

1. **Aquic (or Perudic):** Saturated with water long enough to cause oxygen depletion.
2. **Udic:** Humid or subhumid climate. SMCS dry < 90 cumulative days and < 45 consecutive days in summer.
3. **Ustic:** Semiarid climate. SMCS moist ½ to ¾ of time or moist 90 consecutive days. SMCS dry < 45 consecutive days in summer.
4. **Xeric:** Mediterranean climate (moist, cool winters and dry, warm summers). SMCS moist ½ to ¾ of time, moist > 45 consecutive days in winter, and dry > 45 consecutive days in summer.
5. **Aridic (or Torric):** Arid climate. SMCS dry > ½ the time that T50 > 5 °C and not moist for 90 consecutive days when T50 > 8° C.

Soil Temperature Regimes[ii]: In soil taxonomy, soil temperature regimes are based on mean annual soil temperatures. Soil temperatures are taken at a depth of 50 cm from the soil surface, using the Celsius (centigrade) scale. These regimes greatly affect the use and management of soils, particularly for the selection of adapted plants.

The **pergelic** soil temperature regime has mean annual soil temperatures of less than 0 °C at 50 cm below the surface. In this temperature regime, permafrost is present.

The **cryic** soil temperature regime has mean annual soil temperatures of greater than 0 °C, but less than 8 °C, with a difference between mean summer and mean winter soil temperatures greater than 5 °C at 50 cm, and *cold* summer temperatures.

The **frigid** soil temperature regime has mean annual soil temperatures of greater than 0 °C, but less than 8 °C, with a difference between mean summer and mean winter soil temperatures greater than 5 °C at 50 cm below the surface, and *warm* summer temperatures.

The **mesic** soil temperature regime has mean annual soil temperatures of 8 °C or more, but less than 15 °C, and the difference between mean summer and mean winter soil temperatures is greater than 5 °C at 50 cm below the surface.

The **thermic** soil temperature regime has mean annual soil temperatures of 15° C or more, but less than 22 °C; and a difference between mean summer and mean winter soil temperatures of greater than 5 °C at 50 cm below the surface.

The **hyperthermic** soil temperature regime has mean annual soil temperatures of 22 °C or more and a difference between mean summer and mean winter soil temperatures of less than 5 °C at 50 cm below the surface.

The **isothermic** soil temperature regime has mean annual soil temperatures of 15 °C or more but, 5 °C difference between mean summer and mean winter soil temperatures at 50 cm. below the surface.

The **isomesic** soil temperature regime has mean annual soil temperatures of 8 °C or more, but a difference between mean summer and mean winter soil temperatures of less than 5 °C at 50 cm below the surface.

The **isofrigid** soil temperature regime has mean annual soil temperatures of greater than 0 °C, but less than 8 °C, with a difference between mean summer and mean winter soil temperatures of less than 5 °C at 50 cm. below the surface, and *warm* summer temperatures.

The **isohyperthermic** soil temperature regime has mean annual soil temperatures of 22 °C or more and a difference between mean summer and mean winter soil temperatures of less than 5 °C at 50 cm below the surface.

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[i] Soil Survey Staff. 1999. Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436

https://lawr.ucdavis.edu/classes/ssc120/acrobats/smr.pdf (online)
https://passel2.unl.edu/view/lesson/69c7561e50b3/12 (online)

[ii] Soil Survey Staff. 1999. Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436

https://passel2.unl.edu/view/lesson/69c7561e50b3/11 (online)

Ecological site group F004BK102CA
Fog-influenced, lower elevation mountain slopes

Last updated: 03/07/2025
Accessed: 05/05/2025

Key Characteristics

- Not like the previous LRUs – LRU K
- Fog-influenced, low elevation mountain slopes

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Physiography

This ESG dominates the low elevations of the mountains of LRU K that are solidly within the coastal fog influence, especially during the summer months. Slopes are generally over 30%, but can be gentler in some areas and elevations are generally under 1500 ft.

Climate

The average annual precipitation in this MLRA is 23 to 98 inches (585 to 2,490 millimeters), increasing with elevation inland. Most of the rainfall occurs as low-intensity, Pacific frontal storms. Precipitation is evenly distributed throughout fall, winter, and spring, but summers are dry. Snowfall is rare along the coast, but snow accumulates at the higher elevations directly inland. Fog is a significant variable that defines this MLRA from other similar MLRAs. Summer fog frequency values of greater than 35% are strongly correlated to the extent of coast redwood distribution, which is a primary indicator species in this MLRA. Nightime fog is approximately twice as common as daytime fog and seasonally, it reaches its peak frequency in early August, with the greatest occurrence of fog from June through September (Johnstone and Dawson 2010). The average annual temperature is 49 to 59 degrees F (10 to 15 degrees C). The freeze-free period averages 300 days and ranges from 230 to 365 days, decreasing inland as elevation increases.

Unlike the conifer-dominated forests of LRU I to the north, these central redwood forests in LRU K are typically more a mixture of conifers and hardwoods. Vegetation includes a multi-story canopy of redwood, Douglas-fir, tanoak, bigleaf maple, evergreen shrubs, and various grasses. The near-coastal part of the region that is influenced more by fog has more redwoods and similarities to LRU I to the north, however the drier summers and more limited duration of coastal fog limits the competitive advantage of the coastal redwoods in this LRU. This creates limited areas that remain dominated by coast redwood and a larger portion of the LRU dominated by Douglas-fir and other hardwoods, with some redwoods near the lower parts of the mountain slopes where fog still has some influence or the drainages are narrower and remain cooler in the summers, limiting evapotranspiration losses.

Soil features

Although coast redwood and Douglas-fir can grow on a variety of soils, the soils most associated with this concept are primarily found on colluvium and residuum materials derived from sandstone, conglomerate and mudstone, with soils that are loamy textured and can be skeletal. Soil depth ranges but most all of the soils have a lithic or paralithic contact within 60 inches.

Vegetation dynamics

This provisional ecological site concept attempts to describe the coast redwood-Douglas-fir dominated mountain slopes that can be found within LRU K. This concept is primarily supported through literature and available information from the Humboldt County Surveys. This provisional ecological site concept covers the mountains within proximity to the coast and at the lower elevations that spend longer periods within the summer coastal fog. The ustic-isomesic soil climate regime of this LRU is mainly at elevations between 500 and 2,000 feet. It is within the zone of moderate marine influence. The fog influence is less pronounced than in the udic moisture regime, but some moisture is added to the soil where the tree canopy causes water to precipitate from the fog. The fog is less dense and does not blanket this zone as frequently as in the wetter zone at the lower elevations. The soils are dry for part of the summer, and there is little variation between summer and winter soil temperatures at a depth of 20 inches. The first continuous north-south range of mountains inland from the coast that reaches 2,000 feet forms an effective barrier to the encroachment of marine air. In some drainageways, such as the Noyo River watershed, this zone extends inland 20 miles or more. In other areas, such as along Elkhorn Ridge 7 miles north of Branscomb, the marine influence stops within 8 miles of the coast. Future work will need to be done to better understand the soil and site characteristics that drive the vegetation expression for this provisional ecological site concept.

Coast redwood attains a height of 395 ft (~120 m), and an age of at least 2200 years. Roots are shallow without a taproot. Trees begin bearing cones by 5 to 15 years of age and seed production is generally high, however seed viability is low. Wind and gravity disperse the seeds, with most falling within 395-400 ft of the parent tree. Seedling establishment is best on moist soil lacking litter but can occur on duff or logs. Plants are moderately shade tolerant, but they grow faster in higher light levels if soil moisture is present (MCV 2018).

Douglas-fir is a large, coniferous, evergreen tree. Adapted to a

moist, mild climate, it grows bigger and more rapidly than the inland variety. Trees 5 to 6 feet (150-180 cm) in diameter (150-180 cm) and 250 feet (76 m) or more in height are common in old-growth stands. These trees commonly live more than 500 years and occasionally more than 1,000 years. Old individuals typically have a narrow, cylindric crown beginning 65 to 130 feet (20-40 m) above a branch-free bole. It often takes 77 years for the bole to be clear to a height of 17 feet (5 m) and 107 years to be clear to a height of 33 feet (10 m). In wet coastal forests, nearly every surface of old-growth Douglas-fir in this ecological site is often covered by epiphytic mosses and lichens (FEIS, 2018). This tree's rooting habit is not particularly deep. The roots of young Douglas-fir tend to be shallower than roots of many of the same aged conifers like ponderosa pine, sugar pine, or incense-cedar. Some roots are commonly found in organic soil layers or near the mineral soil surface.

This ecological site group is dominated by a multi-tiered canopy of conifers, with coast redwood making up 15-50% of the stands basal area and Douglas-fir and other hardwoods accounting for between 30-50%. Pacific rhododendron and tanoak readily establish after disturbance and may dominate the overstory for several years post-disturbance. Fallen logs are an essential part of this concept, providing significant habitat for wildlife species and conifer recruits. Conifer recruitment on the bare mineral soil is rare, due to the thick litter layer and organic surface soil and is therefore relegated only to areas of surface soil disturbance from mass wasting, logging practices, wind throw, and recreation trails.

Primary Disturbances

Fire is the principal disturbance agent in both young-growth and old-growth stands. Lightning-ignited fires do occur (Van Wagtendonk and Cayan, 2008, Kalashnikov et al 2022), however, Native American burning is thought to have also played a major role with fires set in areas adjacent to redwood forest burning into the redwood zone (Greenlee and Langenheim, 1990, Veirs, 1996). The northern range of redwoods evolved within a low to moderate natural disturbance regime (Veirs, 1980). The mean fire interval is quite variable. Old-growth stands show evidence of three or more severe fires each century, and the distribution of fires appears as a natural pattern of several short intervals between fires followed by one or more long interval (Stuart 1987, Jacobs et al. 1985). The co-dominance of Douglas-fir and hardwoods in this provisional ecological site concept indicates a more regular occurrence of fires and disturbance, since Douglas-fir would only dominate in this type of forest if there were adequate openings and mineral soils periodically exposed to facilitate regeneration. Fire scars are abundant throughout old-growth stands and are evidence of this fire history. Previous harvesting and the use of fire to treat logging slash in this area has also changed species composition on many formerly redwood-dominated sites (Noss et al, 2000).

Redwood, tanoak and other hardwoods can re-sprout following fire. After fire, redwood may sprout from the root crown or from dormant buds located under the bark of the bole and branches (Veirs, 1996, Noss, 2000), while tanoak and other hardwoods sprout from the root crown, root collar, lower part of the stem and underground burls (McDonald and Tappeiner 1986). The sprouting ability of redwood is most vigorous in younger stands and decreases with age, while the ability to survive fire increases with age as its fibrous bark thickens. Frequent fire reduces tanoak’s sprouting ability and tends to keep understories open (Arno, 2002). Fire exclusion would allow for the gradual increase of tanoak in the understory (McMurray, 1989). Surface fires likely modified the tree species composition by favoring the thicker-barked redwood and killing young tanoak. Fires also expose the mineral-rich soil and reduce competition from other plants, thereby increasing the establishment of Douglas-fir (Veirs, 1980, Agee, 1993). Tanoak seedlings and sapling-sized stems are often top-killed by surface fire, though larger stems may survive with only basal wounding (Fryer, 2008).

A moderate fire could lead towards more of a mosaic in regeneration patterns. Patches of trees would be killed leaving others slightly damaged or unharmed. Douglas-fir regeneration would be favored in the large gaps that are created following a moderate fire, potentially leading to a larger proportion of Douglas-fir to redwood for several centuries (Agee, 1993). Without these gaps caused by fire, Douglas-fir regeneration is unsuccessful, and with continued lack of disturbance it may slowly be replaced by redwood as the dominant canopy species (Veirs, 1980, 1996).

Other potential disturbances in the redwood zone include winter storms that can cause top breakage and blowdown. This breakage may kill individual or groups of trees and create small openings from windfall (Noss, 2000). This would likely favor the establishment of redwood and other shade tolerant conifers.

Significant disturbance to this ecological site would occur if there are climatic changes great enough to impact the amount of fog influence this ecological site experiences on a yearly basis. Coast redwoods reliance on fog is crucial to its survival and without the moisture available in the summer from the daily blanket of fog, redwoods may begin to die out and Douglas-fir would begin replacing those redwood stands. Well established redwoods may persist where access to water is still available (concave depressions, valley bottoms, etc.) until removed by fire or other types of human disturbance.

Coast redwood is one of the signature trees of California, with 95% of its range existing within the state. Years of logging have left significantly lower amounts of the original forest (Sawyer et al. 2000b). Old-growth stands exist mainly in protected areas including parks, experimental forests, and private reserves. Asexual regeneration is prolific and many stands of younger trees exist, but many areas are on the third cycle of regeneration with collateral impacts of erosion, streambed siltation, and alteration to watershed and wildlife values. Residential development is an increasing concern.

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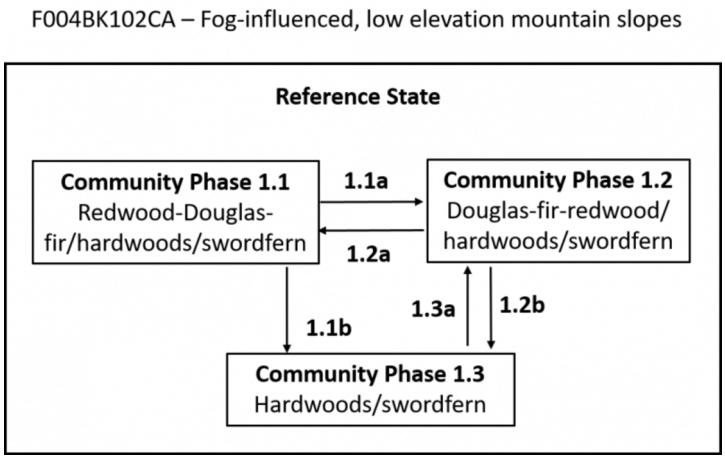
Major Land Resource Area

MLRA 004B
Coastal Redwood Belt

Stage

Contributors

State and transition model



State 1
Reference State

The dynamics described below are general to the level that the site concept has been developed for provisional ecological site concept identification and further investigation purposes only. It is meant to give a general overview of the ecological dynamics of the system and should not be viewed as a model for a specific ecological site level management. It is supported by the current available literature that was reviewed for a general understanding of the system and basic understanding of the abiotic and biotic drivers. Further investigations and soil-site data collection and analysis should be conducted before specific land management can be applied at the ecological site specific scale. This STM only serves to explain the general ecology and dynamics. No alternative states were found during the literature review, however that does not mean they do not exist and more time should be spent determining whether or not this model captures all the dynamics of this system, especially once more is known about the soil-site characteristics of this LRU and ecological site concept. Reference State (State 1) – The reference state for this provisional ecological site concept is dominated by *Sequoia sempervirens* (coast redwood) and Pseudotsuga menzeisii (Douglas-fir), with a significant component of *Notholithocarpus densiflorus* (tanoak) and Arbutus menzeisii (Pacific madrone) in the lower canopy. The ecological dynamics represented in the reference state are driven primarily by periodic fires that create the complex dynamics and plant expressions reflected by the community phases described. Depending on the intensity, severity, timing, and weather conditions associated with each fire and which community phase is impacted by the fire, this ecological site will respond to varying degrees. At this very general scale, this reference state only really captures the generalities related to the functional groups that are most dominant and does not capture the more specific dynamics and patterns that would be found at the more detailed and refined ecological site scale that focuses on specific abiotic factors that drive some of these various complex plant expressions. More data and refinement is needed to capture the information needed in order to make specific land management decisions at the ecological site-component scale.

Community 1.1
Reference Community Phase

The reference community for this site is a redwood and Douglas-fir forest. Coast redwood dominates in the overstory, with Douglas-fir and tanoak and Pacific madrone found as associates in the subcanopy. The understory is shrub-dominated with *Vaccinium ovatum* (California huckleberry), Arbutus menzeisii (Pacific madrone), and *Gaultheria shallon* (salal). Occasionally *Polystichum munitum* (western swordfern) may be found in the understory layer, but forb cover is generally low. The estimated age for this community is 200 years or more. Windthrow from winter storms or small partial cuts can create small gaps which will provide openings for Douglas-fir and hardwoods to maintain their subcanopy dominance and potentially increase the cover of shrubs as well.

Community 1.2

This community phase represents a stand primarily dominated by Douglas-fir with redwoods as a sub-dominant with a higher cover of tanoak and/or Pacific rhododendron in the subcanopy and heavier cover of a variety of shrubs. This community phase will look very similar to the provisional ecological site concept that is dominated by Douglas-fir as the reference condition, so it will be important to understand the abiotic factors and influences of the site in order to distinguish this community phase from another provisional ecological site concept.

Community 1.3

Tanoak and/or Pacific madrone, blueblossom ceanothus, and western swordfern will rapidly establish the site after a disturbance with Douglas-fir and redwood seedlings present.

Pathway 1.1a
Community 1.1 to 1.2

The reference community may transition to Community Phase 1.2 following a temporary change in weather patterns that reduces the fog influence and summer moisture required for redwoods, opening the canopy as redwood mortality occurs providing more niche space for the more shade intolerant Douglas-fir. This community pathway could also occur if the timing of a moderate-intensity fire that removed many of the conifers occurred in combination with a short-term weather change that limited the moisture availability for redwoods to re-establish, giving significant edge to the Douglas-fir to establish and dominate. A selective timber harvest for redwoods would produce a similar result, albeit different in the impacts associated.

Pathway 1.1b
Community 1.1 to 1.3

The reference community may transition to Community Phase 1.3 following a significant fire that removes the conifers and hardwoods from the canopy and allows the understory shrubs to dominate for a short time as the conifers and hardwoods attempt to re-establish.

Pathway 1.2a
Community 1.2 to 1.1

With time, redwoods should gradually re-establish and will eventually take over dominance once again in the upper most canopy layer returning the site to Community Phase 1.1.

Pathway 1.2b
Community 1.2 to 1.3

This community phase may transition to Community Phase 1.3 following a significant fire that removes the conifers and hardwoods from the canopy and allows the understory shrubs to dominate for a short time as the conifers and hardwoods attempt to re-establish.

Pathway 1.3a
Community 1.3 to 1.2

With time, the conifers will re-establish dominance and overtop the shrubs. Douglas-fir will likely be the dominant conifer in the overstory for several years, since it more shade intolerant, requires less moisture to establish and grows quickly. Redwoods will regain dominance over time and thin out the Douglas-fir as it develops enough canopy to begin shading out the Douglas-fir.

APPENDIX C: Official Soil Series Descriptions (OSD)

Relevant Map Units - Mendocino County, Western Part, California

108—Blacklock and Aborigine soils, 0 to 5 percent slopes

110—Casabonne-Wohly loams, 30 to 50 percent slopes

199—Shinglemill-Gibney complex, 2 to 9 percent slopes

161—Heeser sandy loam, 2 to 15 percent slopes

187 and 188—Ornbaun-Zeni complex with 30 to 75 percent slopes

173, 174—Irmulco-Tramway complex, with slopes of 30 to 75 percent

214—Tropaquepts, 0 to 15 percent slopes

221—Vandamme loam, 9 to 30 percent slopes

222—Vandamme loam, 9 to 30 percent slopes

Relevant Map Units - Mendocino County, Eastern Part, California

112—Clear Lake clay, high precip, 0 to 2 percent slopes, MLRA 14

115—Cole silty clay loam, 0 to 1 percent slopes, MLRA 14

126—Feliz clay loam, gravelly substratum, 2 to 8 percent slopes

128—Gielow sandy loam, 0 to 5 percent slopes

149—Hopland-Witherell-Ashokawna complex, 30 to 50 percent slopes

178—Pinole gravelly loam, 2 to 8 percent slopes

LOCATION ABORIGINE CA

Established Series
Rev. ACF-CAR-DJE-ET
01/2023

ABORIGINE SERIES

The Aborigine series consists of very deep, very poorly drained soils formed in marine or lacustrine sediments. Aborigine soils are on marine terraces and have slopes of 0 to 5 percent. The mean annual precipitation is about 1270 millimeters (50 inches) and the mean annual temperature is about 11 degrees C (53 degrees F).

TAXONOMIC CLASS: Fine, mixed, semiactive, isomesic Typic Albaquults

TYPICAL PEDON: Aborigine sandy loam - on a southwest facing slope of 5 percent under Mendocino cypress and Bolander pine at 600 feet elevation. Colors are for dry soil unless otherwise stated. When described on October 6, 1983 the soil was moist below 33 centimeters (13 inches).

Oi--0 to 8 centimeters (0 to 3 inches); fresh through decomposed litter of Mendocino cypress and Bolander pine.

E--8 to 23 centimeters(3 to 9 inches); variegated light gray (10YR 7/1) and white (N8/) sandy loam; light brownish gray (10YR 6/2) moist; massive; hard, friable, slightly sticky and nonplastic; slightly brittle when moist, slightly smeary; common very fine, fine and medium roots; common very fine and fine tubular and common very fine interstitial pores; extremely acid (pH 4.4); clear wavy boundary. (5 to 18 centimeters thick)

EB--23 to 41 centimeters(9 to 16 inches); very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; many fine and medium distinct brownish yellow (10YR 6/8) mottles, yellowish red (5YR 5/8) moist; weak fine and medium angular and subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine, fine and medium roots; common very fine tubular pores; 3 percent hard rounded very dusky red (10R 2.5/2) iron and manganese nodules (5-10mm); strongly acid (pH 5.5); abrupt wavy boundary. (0 to 23 centimeters thick)

2Btg--41 to 94 centimeters(16 to 37 inches); light gray (N7/) clay, light gray (10YR 7/1) moist; common medium and coarse prominent brownish yellow (10YR 6/8) and red (2.5YR 4/6) mottles, brownish yellow (10YR 6/8) and red (2.5YR 4/6) moist; strong coarse and very coarse prismatic structure parting to strong coarse a angular blocky; ped faces are stained gray (10YR 5/1, 6/1) with humic material; hard, firm, sticky and plastic; few very fine, fine and medium roots that are confined to areas between peds; few very fine tubular pores; many moderately thick and thick clay films on peds; extremely acid (pH 4.2); gradual dual wavy boundary. (38 to 64 centimeters thick)

3Btg--94 to 125 centimeters (37 to 49 inches); white (N8/) sandy clay, gray (10YR 6/1) moist; many coarse prominent red (10R 4/8) and common coarse prominent brownish yellow (10YR 6/8) mottles, red (2.5YR 4/6) and brownish yellow (10YR 6/8) moist; strong coarse prismatic structure parting to moderate coarse angular blocky structure; ped faces are stained gray (10YR 5/1, 6/1) with humic material; hard, firm, sticky and plastic; few very fine, fine and medium roots that are confined to areas between peds; few very fine tubular pores; many moderately thick and thick clay films on peds; extremely acid (pH 4.2); gradual dual wavy boundary. (25 to 50 centimeters thick)

4Btg1--125 to 147 centimeters(49 to 58 inches); white (N8/) sandy clay, gray (10YR 6/1) moist; common coarse prominent red (10YR 4/8) and brownish yellow (10YR 6/8) mottles, red (2.5YR 4/6) and brownish yellow (10YR 6/8) moist; moderate coarse angular blocky structure; extremely hard, firm, sticky and plastic; few very fine and fine roots that are confined to areas between peds; few very fine tubular pores; many moderately thick and thick clay films on peds; extremely acid (pH 4.2); clear wavy boundary. (5 to 15 inches thick)

4Btg2--147 to 163 centimeters(58 to 64 inches); gray (N6/) clay, gray (N5/) moist; common medium and coarse prominent brownish yellow (10YR 6/8) and red (10YR 4/8) mottles; brownish yellow (10YR 6/8) and red (2.5YR 4/6) moist; weak coarse angular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots that are confined to areas between peds; few very fine tubular pores; many moderately thick and thick clay films on peds; extremely acid (pH 4.2). (Combined thickness of 4Btg horizons is 13 to 38 centimeters thick)

TYPE LOCATION: Mendocino County, California; about 107 meters (350 feet) north and 1402 meters (4600 feet) west of the southeast corner of sec. 3, T.17N., R.17W., MDBM, Comptche SW quadrangle.

RANGE IN CHARACTERISTICS:

Soil Moisture: The soil is saturated for extended periods during the months of December through April. These soils have an aquic moisture regime.

Soil Temperature: The mean annual soil temperature ranges from 10 to 13 degrees C (50 to 56 degrees F). The difference between the mean summer and mean winter temperature is 6 to 9 degrees F. These soils have an isomesic temperature regime.

Reaction is extremely through strongly acid (4.0 to 5.5).

Thickness of the solum and depth to bedrock is greater than 152 centimeters (60 inches).

O horizon:

Hue: 10YR.
Value: 2 through 6 dry and moist.
Chroma: 1 through 4 dry and moist.

Texture: slightly decomposed organic material.
Wood fragments: 0 to 35 percent.
Reaction: moderately to very strongly acid.

E horizon:

Hue: N, 5Y or 10YR.
Value: 5 through 8 dry, 3 through 7 moist.
Chroma: / though 3 dry, 1 through 3 moist.

Texture of fine earth: sandy loam or silt loam.
Rock fragments: 0 to 3 percent gravel.
Clay content: 5 to 27 percent.
Redoximorphic features: iron-manganese nodules in the matrix
Quantity: few or common

Some pedons have Eg horizons:

Eg horizon

Hue: 10YR.
Value: 6 through 8 dry, 4 through 6 moist.
Chroma: 1 through 2 dry or moist.

Texture of fine earth: silty clay loam.
Clay content: 35 to 40 percent.

Redoximorphic features: fine iron-manganese masses in the matrix, iron stains lining root channels and/or pores
Quantity: few to many
Hue: 10YR or 7.5YR
Value: 5 or 6
Chroma: 4 through 8

Btg horizon:

Hue: N, 5Y, 2.5Y, 10YR or 7.5YR.
Value: 6 through 8 dry, 5 through 8 moist.
Chroma: / through 3 dry or moist.

Texture of fine earth: clay loam, silty clay loam, sandy clay silty clay or clay
Rock fragments: 0 to 10 percent gravel; 0 to 45 percent paragravels.
Clay content: 35 to 55 percent.
Base saturation by barium chloride-TEA (pH 8.2) is 2 to 10 percent.

Redoximorphic features: fine iron-manganese masses in the matrix, iron stains lining root channels and/or pores
Quantity: few to many
Hue: 10YR, 7.5YR, 5YR, or 2.5YR
Value: 5 through 7
Chroma: 4 through 8

Some pedons have 2Bg horizons

2Bg horizon:

Hue: 10YR.
Value: 5 through 8 dry, 5 through 7 moist.
Chroma: 1 through 3 dry or moist.

Texture of fine earth: stratified layers of sandy clay loam, silty clay loam, sandy clay or silty clay.
Rock fragments: 0 to 5 percent gravel; 0 to 5 percent paragravels.
Clay content: 30 to 45 percent.

Redoximorphic features: fine or medium iron-manganese masses in the matrix, iron stains lining root channels and and/or pores
Quantity: common to many
Hue: 10YR or 7.5YR
Value: 5 to 6
Chroma: 4 through 8

Some pedons have 3Cg horizons
3Cg horizon:

Hue: N, 10BG or 5Y.
Value: 7 or 8 dry, 5 through 8 moist.
Chroma: / through 3 dry or moist.

Texture of fine earth: fine sandy loam or sandy clay loam
Rock fragments: 0 to 5 percent gravel; 0 to 5 percent paragravels.
Clay content: 15 to 25 percent.

Redoximorphic features: fine iron-manganese masses in the matrix, iron stains lining root channels and/or pores
Quantity: few to common
Hue: 10YR or 7.5YR
Value: 5 to 6
Chroma: 5 through 8

COMPETING SERIES: There are no other series in this family.

GEOGRAPHIC SETTING: Aborigine soils are on marine terraces and have slopes of 0 to 5 percent. The soils formed in marine or lacustrine sediments. Elevations are 76 to 244 meters (250 to 800 feet). The climate is humid with cool foggy summers and cool moist winters. A strong marine influence limits the diurnal and annual range of temperature. Mean annual precipitation ranges from 1015 to 1800 millimeters (40 to 70 inches). Mean January temperature is 48 degrees F., mean July temperature is 57 degrees F., and the mean annual temperature is 53 degrees F. The frost-free period is 260 to 330 days.

GEOGRAPHICALLY ASSOCIATED SOILS: This is the Blacklock and Burriscreek soils. Blacklock soils occur on the same landscape position and have an iron cemented hardpan (ortstein) at a depth of 25 to 50 centimeters (10 to 20 inches). Burriscreek soils are fine-silty with less than 35 percent clay in the particle size control section and well drained without redoximorphic features within 100 centimeters (40 inches). Burriscreek soils are found on linear to slightly convex, gently sloping shoulder and summit positions generally below the Savagecreek soils.

DRAINAGE AND PERMEABILITY: Very poorly drained. The soil is saturated with water for extended periods following episodes of heavy rain from December through April. The saturated zone starts between the surface and a depth of 25 centimeters (10 inches) and extends to greater than 152 centimeters (60 inches). The subsoil remains moist or wet throughout the year. Surface runoff under bare soil conditions is very slow or slow; very slow permeability.

USE AND VEGETATION: This soil is used as wildlife habitat and watershed. A few areas are used for homesites and commercial timber. Vegetation consists of Mendocino cypress, Bolander pine, shore pine, redwood, Douglas-fir, California huckleberry, Labrador tea and salal.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is not extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, Western Part, 1988.

REMARKS: The activity class was added to the classification in January of 2003. Competing series were not checked at that time. - ET

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - Albic horizon - 0 to 13 inches (E, EB) Clay content (Davis hydrometer) E = 6 percent, EB = 20 percent.

Argillic horizon - 13 to 61 inches 2Btg, 3Btg, 4Btg1, 4Btg2. Clay content (Davis hydrometer); 2Btg = 45 percent, 3Btg = 39 percent, 4Btg1 = 37 percent, 4Btg2 = 44 percent. Base saturation (Davis, Barium chloride pH 8.2). 2Btg = 5 percent, 3Btg = 7 percent, 4Btg1 = 6 percent. Discontinuities based on very fine sand fraction on a clay free basis.

Aquic moisture regime - Soil is saturated from December through April. Dominant moist chromas of 2 or less in

argillic horizon, with associated high chroma mottles. Ped surfaces have moist chromas of 1 or less - 2Btg, 3Btg, 4Btg1, 4Btg2

Mineralogy assumed to be mixed but influenced by kaolinite.

Isomesic temperature regime - based on west Mendocino temp. site 5a that was in an area mapped as Aborigine. Site 5a had a difference between mean summer and mean winter temperatures of 9 degrees F.

Laboratory Analysis by U.C. Davis soil morphology lab sample No. 84-045-8 (1609).

Many areas mapped as Aborigine soils were mapped as the Blacklock series in the Wildlands Soils and Associated Vegetation of Mendocino County, by the State Cooperative Soil Vegetation Survey 1947-1950.

Scanned by SSQA 11/93. Last revised by state 10/90

National Cooperative Soil Survey
U.S.A.

Established Series
Rev. JTH-GLG-TDT
03/2004

BLACKLOCK SERIES

The Blacklock series consists of poorly drained soils that are shallow to an ortstein pan, and formed in sandy marine sediments. These soils are in depressions on marine terraces. They are underlain by a cemented pan at a depth of 12 to 20 inches. Slopes range from 0 to 7 percent. The mean annual precipitation is about 70 inches and mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Sandy, mixed, isomesic, ortstein, shallow Typic Duraquods

TYPICAL PEDON: Blacklock fine sandy loam, 0 to 1 percent slopes. (Colors are for moist soil unless otherwise stated.)

Oi--1 inch to 0; litter of leaves, twigs, root mat and moss; abrupt smooth boundary. (0 to 4 inches thick)

A1--0 to 3 inches; black (10YR 2/1) fine sandy loam, dark gray (10 YR 4/1) dry; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine and fine tubular pores; very strongly acid; abrupt smooth boundary, (2 to 4 inches thick)

A2--3 to 9 inches; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 6/1) dry; massive; hard, friable, nonsticky and nonplastic; many very fine, fine and medium roots; few very fine and fine tubular pores; very strongly acid; abrupt wavy boundary. (2 to 7 inches thick)

E--9 to 13 inches; gray (10YR 6/1) loamy fine sand, white (N 8/0) dry; dark grayish brown (10YR 4/2) exped staining, gray (10YR 6/1) dry; massive; hard, friable, nonsticky and nonplastic; many very fine, fine and medium roots; few very fine and fine tubular pores; very strongly acid; abrupt wavy boundary. (3 to 10 inches thick)

Bh--13 to 15 inches; black (5YR 2/1) mucky loam, dark reddish gray (5YR 4/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; many very fine, fine, medium and coarse roots; common very fine and fine tubular pores; very strongly acid; abrupt wavy boundary. (0 to 3 inches thick)

Bsm1--15 to 21 inches; strong brown (7.5YR 5/6) strongly cemented sands, yellowish brown (10YR 5/6) dry; massive; extremely hard, extremely firm, nonsticky and nonplastic; very few very fine flattened roots; very few very fine tubular pores; medium acid; clear wavy boundary. (4 to 10 inches thick)

Bsm2--21 to 33 inches; yellowish brown (10YR 5/4) strongly cemented sands, yellowish brown (10YR 5/6) dry; reddish brown (5YR 4/4) and dark red (2.5YR 3/6) stains and seams in the hardpan, brown (7.5YR 4/4) and yellowish red (5YR 5/6) dry; massive; extremely hard, extremely firm, nonsticky and nonplastic; very few very fine roots in horizontal root mats; very few very fine tubular pores; medium acid; clear wavy boundary. (5 to 15 inches thick)

Bsm3--33 to 52 inches; yellowish brown (10YR 5/6) strongly cemented sands, very pale brown (10YR 7/4) dry, strong brown (7.5YR 5/6) streaks; massive; very hard, very firm, nonsticky and nonplastic; very few very fine roots in horizontal root mats; very few very fine tubular pores; medium acid; clear wavy boundary. (0 to 20 inches thick)

C--52 to 75 inches; light olive brown (2.5Y 5/6) sand with red (2.5YR 4/6) and brown (7.5YR 4/4) stains; massive; friable, nonsticky and nonplastic; medium acid.

TYPE LOCATION: Coos County, Oregon; on the west side of Seven Devils Road; 100 feet north, 1,750 feet east of the southwest corner, sec. 33, T. 27 S., R. 14 W.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 30 to 60 inches. Depth to bedrock is greater than 60 inches. Depth to the ortstein layer and effective rooting depth range from 12 to 20 inches. The mean annual soil temperature is about 54 degrees F. The solum is medium to extremely acid and acidity commonly decreases with increasing depth. The substratum is slightly acid to strongly acid. The difference between mean summer and mean winter soil temperature varies from 5 to 9 degrees F. The surface when mixed to a depth of 10 inches has value of 2 or 3 moist, 5 dry and chroma of 1 or 2 moist and dry.

The A horizon has value of 2 or 3 moist and chroma of 1 or 2 moist and dry. It is fine sandy loam, loamy sand or loamy fine sand high in organic matter and contains many roots. The E horizon has hue of 10YR or is neutral, value of 5 to 7 moist and 6 to 8 dry, and chroma of 0 to 2.

The Bh horizon has hue of 10YR or 5YR and chroma of 1 or 2 moist and dry. It is loam or fine sandy loam high in organic matter and contains many fibrous roots. A decomposed root mat is at the base of the Bh horizon in moist pedons. The Bsm horizon has hue of 5YR to 10YR, values of 3 to 5 moist and chroma of 4 to 6. Mottles have chroma of 0 to 6. It is loamy sand or sand. Cementation is weak to strong. The ratio of free iron to carbon ranges from 0.2 to 2.0. BC horizons when present have the same color range as Bsm horizons but are loamy sand or loamy fine sand and have weak or no cementation.

The C horizon is variegated loamy fine sand, loamy sand or sand with lenses cemented by iron or aluminum at a depth of 10 or 12 feet or more.

COMPETING SERIES: There are no other series in this subgroup. The Joeney series is similar and it is in the loamy family.

GEOGRAPHIC SETTING: The Blacklock soils are on marine terraces. They are usually in depressions or flats between low ridges or hummocks but are also in poorly drained areas of gently sloping old sand dunes. They formed in unconsolidated sandy marine sediments and eolian deposits. Elevations range from 25 to 650 feet. Slopes range from 0 to 7 percent. The climate is humid, temperate and marine with a dry season during the summer. Average annual precipitation ranges from 50 to 80 inches, mean annual temperature ranges from 51 to 53 degrees F, and the frost-free period is 200 to 330 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Bandon, Bullards, Ferrelo, Knappa, and Netarts soils. All of these soils are well drained. In addition, the Bandon soils are coarse-loamy. Bullards and Netarts soils lack ortstein. The Ferrelo and Knappa soils lack a spodic horizon.

DRAINAGE AND PERMEABILITY: Very poorly or poorly drained; slow to medium runoff; moderate permeability in the upper part of the solum, very slow in the cemented pan and moderately rapid in the underlying material.

USE AND VEGETATION: Most areas of this soil are in native shrubs and trees and are used for wildlife habitat. This soil has limited use for timber production. Intensive uses are for cranberry bogs, pasture, occasional homesites and recreation such as campgrounds and hunting. The native vegetation is shorepine, Sitka spruce, Port-Orford-cedar, western hemlock, evergreen huckleberry, rhododendron, salal, madrone, swordfern, azalea, spirea, sedges, rushes, and water-tolerant grasses. Gorse has invaded some cleared areas in southern Oregon.

DISTRIBUTION AND EXTENT: Coastal marine terraces of southern Oregon and northern California. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Portland, Oregon

SERIES ESTABLISHED: Marshfield Area, Coos County, Oregon, 1909.

REMARKS: Diagnostic horizons and features in this pedon:

Albic horizon - from 9 to 13 inches (E horizon).

Spodic horizon - from 13 to 52 inches (Bh, Bsm1, Bsm2, Bsm3 horizons).

Ortstein layer - from 15 to 52 inches (Bh, Bsm1, Bsm2, Bsm3 horizons).

This draft reflects a change in classification from sandy, mixed, mesic, ortstein Typic Tropaquods to sandy, mixed, isomesic, ortstein, and shallow Sideric Tropaquods. This classification is based on the addition of the Sideric subgroup to Tropaquads.

ADDITIONAL DATA: NSSL pedon S80CA-045-019 sampled as Blacklock taxadjunct, Mendocino County, CA.

Established Series
Rev. CAR-DJE-JJJ-ET
05/2011

CASABONNE SERIES

The Casabonne series consists of very deep, well drained soils formed in colluvium and residuum weathered from sandstone or shale. Casabonne soils are deep to lithic or paralithic material with spacing between cracks of less than 10 centimeters apart. Casabonne soils are on hills and mountains. Slopes range from 9 to 75 percent. The mean annual precipitation is about 1520 millimeters (60 inches) and the mean annual temperature is about 13 degrees C (55 degrees F).

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Ultic Haploxeralfs

TYPICAL PEDON: Casabonne gravelly loam - on a north-facing convex slope of 40 percent under Douglas-fir and tanoak at 575 meters (1,880 feet) elevation. (Colors are for dry soil unless otherwise stated. When described April 4, 1978, the soil was moist throughout.)

Oi--0 to 2 centimeters (0.0 to 1 inch); litter of Douglas-fir and tanoak leaves and twigs.

A1--2 to 10 centimeters (1 to 5 inches); brown (7.5YR 4/4) gravelly loam, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine tubular and interstitial pores; 20 percent gravel (2 to 50 millimeters); strongly acid (pH 5.4); clear wavy boundary. (5 to 15 centimeters thick)

A2--10 to 25 centimeters (5 to 12 inches); brown (7.5YR 4/4) gravelly loam, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine, and few medium and coarse roots; many very fine tubular and interstitial pores; 25 percent gravel (2 to 50 millimeters); strongly acid (pH 5.4); gradual wavy boundary. (13 to 23 centimeters thick)

Bt1--25 to 69 centimeters (12 to 27 inches); brown (7.5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; few very fine and fine and common medium and coarse roots; many very fine and few fine and medium tubular and interstitial pores; few faint clay films on faces of peds and lining pores; 10 percent gravel (2 to 50 millimeters); strongly acid (pH 5.2); gradual wavy boundary. (33 to 43 centimeters thick)

Bt2--69 to 94 centimeters (27 to 37 inches); brown (7.5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; few very fine, fine, medium and coarse roots; many very fine, and few fine, medium and coarse tubular and interstitial pores; common faint and distinct clay films on faces of peds and lining pores; 10 percent gravel (2 to 50 millimeters); strongly acid (pH 5.2); abrupt smooth boundary. (13 to 38 centimeters thick)

Bt3--94 to 127 centimeters (37 to 50 inches); reddish yellow (7.5YR 6/6) gravelly clay loam, brown (7.5YR 4/4) moist; moderate medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; common medium and coarse roots; many very fine and fine tubular and interstitial pores; many distinct clay films on faces of peds and lining pores; 20 percent gravel (2 to 70 millimeters); strongly acid (pH 5.2); abrupt irregular boundary. (25 to 38 centimeters thick)

Ct--127 to 200 centimeters (50 to 79 inches); gravel; strongly cemented, fractured sandstone; fractures are 2.5 to 10 centimeters apart and less than 1 millimeters wide; common medium and coarse roots follow fractures; continuous distinct clay films on fracture faces.

TYPE LOCATION: Mendocino County, California; about 9.15 miles west on Fish Rock Road from its intersection with Highway 128 to a north-facing meadow, then downslope 35 yards; about 3,750 feet west and 2,500 feet south of the northeast corner, section 14, T.12 N., R.14 W.; USGS Ornbaun Valley NW Quadrangle.

RANGE IN CHARACTERISTICS:

Soil moisture: The soil between the depths of 20 and 51 centimeters (8 to 20 inches) is dry in all parts from July 1 to October 1 (dry for 90 to 120 days) and is moist in all parts from November 1 to May 15 (moist for more than 180 days) in most years. The soil is in a xeric soil moisture regime.

Soil temperature: 12 to 15 degrees C(54 to 59 degrees F). The difference between mean summer and mean winter soil temperature is more than 6 degrees C. The soil has a mesic soil temperature regime.

The base saturation by sum of cations in the upper 75 cm of the argillic horizon ranges from 20 to 50 percent.

Particle size control section weighted average: Percent clay: 27 to 35 percent; Rock fragments: 5 to 25 percent; Reaction: strongly to slightly acid

A horizon: Hue: 5YR, 7.5YR or 10YR; Value: 4 through 7, 3 through 6 moist; Chroma: 3 through 6, dry or moist; Clay content: 15 to 27 percent; Rock fragments: 0 to 35 percent strongly cemented sandstone or shale gravel; Reaction: strongly to slightly acid

Upper Bt horizons: Hue: 5YR or 7.5YR; Value: 5 through 7 dry, 3 through 6 moist; Chroma: 3 through 6, dry or moist; Texture of fine earth: clay loam, sandy clay loam; Clay content: 27 to 35 percent; Rock fragments: 0 to 35 percent strongly cemented mudstone or shale gravel; Reaction: strongly to slightly acid

Lower Bt horizons: Hue: 5YR or 7.5YR; Value: 5 through 7 dry, 3 through 6 moist; Chroma: 3 through 6, dry or moist; Texture of fine earth: clay loam, sandy clay loam; Clay content: 27 to 40 percent; Rock fragments: 0 to 35 percent strongly cemented mudstone or shale gravel; Reaction: strongly to slightly acid

Ct horizon: Texture: gravel; Rock Fragments: 90 to 95 percent strongly cemented mudstone or sandstone

COMPETING SERIES: These are the Beal (CA), Boardburn (CA), Boomer (CA), Cherryhill (CA), Cle Elum (WA), Cohasset (CA), Crozier (CA), Dalig (WA), Fives (OR), Fong (CA), Fordcreek (ID)), Gunn (WA), Hood (OR), Katykat, Latourell (OR), Lettia (OR), Norling (OR), Para (T WA), Pishpishee (T CA), Rosehaven (OR), Sanhedrin (CA), Tigit (WA), Varelum (WA), and Wohly (CA) series. Beal, Dalig, Gunn, Hood, Latourell, Pishpishee, and Rosehaven soils are very deep and do not have lithic material within 100 to 150 centimeters. Boardburn, Boomer, Cherryhill, Cohasset, Crozier, Fives, Fong, Fordcreek, Lettia, Norling, Para, and Tigit soils formed from igneous materials. Cle Elum soils have a paralithic contact at depths within 50 to 100 centimeters. Varelum soils have a paralithic contact at depths within 100 to 150 centimeters. Wohly soils have paralithic materials between 50 and 100 centimeters. Sanhedrin soils have a mean January temperature less than 7 degrees C.

GEOGRAPHIC SETTING: Casabonne soils occur on the backslopes and summits of hills and mountains. Slopes range from 9 to 75 percent. Elevations are 150 to 1220 meters (500 to 4,000 feet). The soils formed in colluvium and residuum weathered from sandstone or shale. The climate is subhumid with hot dry summers and cool moist winters. Mean annual precipitation is 900 to 2030 millimeters (35 to 80 inches). Mean January temperature is 9 degrees C (48 degrees F), mean July temperature is 20 degrees C (68 degrees F), mean annual temperature is 13 degrees C (55 degrees F). The frost-free period is 150 to 290 days. Occasional snowfall occurs above 2,500 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: This is the competing Wohly soil and the Pardaloe and Woodin soils. Pardaloe and Woodin soils are loamy-skeletal. Wohly soils are moderately deep to paralithic material.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained; surface runoff under bare soil conditions is medium to high; moderately high saturated hydraulic conductivity.

USE AND VEGETATION: This soil is used for timber production, wildlife habitat and watershed. Vegetation consists of Douglas-fir, tanoak, Pacific madrone, and western bracken fern.

DISTRIBUTION AND EXTENT: Siskiyou-Trinity Area, MLRA 5. The series is moderately extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, Eastern Part, 1985.

REMARKS: Type location was moved to Western Mendocino soil survey in 1988. The activity class was added to the classification in January of 2003. – ET This soil was revised in February 2008 due to the presence of bedrock with cracks mostly closer together than 10 centimeters and coatings on the rock fragments. The soil lacks a lithic contact - ET.

Diagnostic horizons and features recognized in this pedon are:
Ochric epipedon -- the zone from 0 to 25 centimeters (O and A horizons)
Argillic horizon -- the zone from 25 to 127 centimeters (Bt1, Bt2, Bt3)

ADDITIONAL DATA: NSSL Pedon S80CA-045-020 (Type Location)Established Series
Rev. CAR-DJE-JJJ-ET 03/2023

LOCATION CLEAR LAKE CA

Established Series
Rev. GWH/CAF/JJJ/SBS/AEC
03/2018

CLEAR LAKE SERIES

The Clear Lake series consists of very deep, poorly drained soils that formed in fine textured alluvium derived from mixed rock sources. Clear Lake soils are in flood basins, flood plains and in swales of drainageways. Slopes are 0 to 5 percent. The mean annual precipitation is about 20 inches and the mean annual air temperature is about 60 degrees F.

TAXONOMIC CLASS: Fine, smectitic, thermic Xeric Endoaquerts

TYPICAL PEDON: Clear Lake clay, annual pasture. (Colors are for dry soil unless otherwise stated when described there was a water table at 48 inches).

Ag--0 to 13 inches; dark gray (N 4/0) clay, very dark gray (N 3/0) moist, few fine faint redoximorphic concentrations; strong medium granular structure at the surface and strong very coarse prismatic structure below when dry, massive when wet; very hard, firm, very sticky and very plastic; many fine roots; common very fine and fine pores; grass seeds, grass and burned plant remains in cracks and along cleavage planes; neutral (pH 7.0); gradual wavy boundary. (4 to 15 inches thick)

Bssg1--13 to 19 inches; dark gray (N 4/0) clay, very dark gray (N 3/0) moist; strong coarse prismatic structure when dry, massive when wet; extremely hard, very firm, very sticky and very plastic; many fine roots; many very fine and fine pores; many slickensides; grass remains in cracks and along cleavage planes; moderately alkaline (pH 8.0); clear wavy boundary. (5 to 10 inches thick)

Bssg2--19 to 45 inches; dark gray (N 4/0) clay, very dark gray (N 3/0) moist; strong coarse prismatic structure; extremely hard, very firm, very sticky and very plastic; few roots; few very fine and fine pores; many slickensides; few fine iron-manganese concretions; smooth pressure faces on peds; slightly calcareous; moderately alkaline (pH 8.0); diffuse irregular boundary. (10 to 35 inches thick)

Bssk--45 to 60 inches; grayish brown (2.5Y 5/2) clay, light olive brown (2.5Y 5/4) moist; tongues of very dark grayish brown (2.5Y 3/2) moist in the upper part; light yellowish brown (10YR 6/4) masses of iron accumulations; massive; very hard, very firm, very sticky and very plastic; few fine roots; very few very fine pores; few slickensides; few fine iron-manganese concretions; few soft lime masses; slightly calcareous; moderately alkaline (pH 8.0).

TYPE LOCATION: Solano County, California; 300 feet south, 300 feet east of northwest corner of sec. 25, T. 6 N., R. 2 E.; 38 degrees, 20 minutes, 35 seconds north latitude and 121 degrees, 42 minutes, 41.7 seconds west longitude; NAD83

RANGE IN CHARACTERISTICS: The combined thickness of the Ag, Bssg, and Bssk horizons is more than 60 inches. The mean annual soil temperature is 59 degrees to 65 degrees F. On drying, large cracks extend as deep as 48 inches and form large prisms. The cracks open and close at least once each year and are open by June or July and are closed by October or November. Various amounts of undecomposed plant material and surface soil are in these cracks. Common to many slickensides are in the zone from 12 to 48 inches. In some pedons moderate amounts of plant remains are in the lower part of the Ag horizon and the upper part of the Bssg horizon as well as in tongues of

the Ag horizon extending in to the Bssg horizon. These soils have a calcium to magnesium ratio of more than 2.

The Ag and Bssg horizons have 10YR, 2.5Y or 5Y hue or is of neutral hue; value ranges from 2 through 5. Chromas are 1 or 0 moist and dry. Moist values are 1 or 2 units darker. In some pedons, colors are mottled with hues of 7.5YR or 10YR, values of 3 to 5 and chromas of 2 to 6. In other pedons concretions of Fe and Mn are present. These horizons range from moderately acid to moderately alkaline (pH 5.6 to 8.4) in the upper part and from slightly alkaline to moderately alkaline and calcareous in the lower part. The more acid surfaces are probably the result of cultural practices, especially extensive use of fertilizers and other agricultural chemicals. In areas adjacent to streams or sloughs, there is an overwash of stratified fine sandy loam or silty clay loam. Texture is clay loam, silty clay or clay.

The Bssk horizon has 10YR, 2.5Y or 5Y hue or is neutral; value ranges from 3 through 6 and chroma from 1 through 6; colors are mottled with hues of 10YR, 7.5YR, 2.5Y and 5Y. This horizon ranges from slightly alkaline to strongly alkaline and is usually calcareous with segregations of accumulated lime in soft masses or seams. In some pedons the lower part is stratified and noncalcareous. Texture is silty clay or clay.

COMPETING SERIES: These are the Carhart, Copus, Dodgeland, and Hildreth series. Carhart soils are 20 to 40 inches to paralithic material. Hildreth soils overlie unrelated material and are somewhat poorly drained. Copus soils have neutral pH. Dodgeland soils have hue of 10YR and less than 40 percent clay in some horizons.

GEOGRAPHIC SETTING: Clear Lake soils are in flood basins, flood plains and in swales of drainageways. Slopes are 0 to 5 percent. Elevations are 5 to 2,000 feet. The soils formed in fine textured alluvium derived from igneous, metamorphic and sedimentary rocks. The soils are in a dry subhumid climate of relatively hot dry summers and cool moist winters. Mean annual precipitation ranges from 10 to 35 inches. Mean January temperature varies from 42 degrees to 47 degrees F., mean July temperature varies from 69 degrees to 72 degrees F., and mean annual temperature varies from 58 degrees to 62 degrees F. The frost-free season is 160 to 300 days. Cooler temperatures and a shorter frost-free season occurs in Lake County.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Cropley, Antioch, Capay, Pacheco, Salinas and San Ysidro soils. Antioch soils have natric horizons. Capay soils have a chroma of 2 or more throughout. Cropley soils have chromas of 1.5 or more within 40 inches. Pacheco and Salinas soils have a mollic epipedon and have less than 35 percent clay. San Ysidro soils have an ochric epipedon and lack cracks and slickensides.

DRAINAGE AND PERMEABILITY: Poorly drained; negligible to high runoff (if assumed concave runoff is always negligible); slow to very slow permeability. A water table is at depths of 4 to 10 feet in the late summer and in some areas is very near the surface during wet months of winter. Some areas are artificially drained.

USE AND VEGETATION: Used for growing many row crops such as tomatoes, beans and sugar beets, dry farmed to grain, or irrigated and dry farmed pasture. Also used for rangeland. Native vegetation is grasses and forbs.

DISTRIBUTION AND EXTENT: In central California coastal valleys, small valleys of the Coast Range and in the San Joaquin and Sacramento Valleys. The soils are moderately extensive in MLRA- 14, 15 and 17.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Lake County (Clear Lake Area), California, 1927.

REMARKS: Hildreth soils are currently listed in the same family. As currently described, Hildreth soils would not classify as Vertisols. A part of the Hildreth soils may belong to another series or different subgroup. More study of the Hildreth soils is needed to accurately classify these soils. In future MLRA updates Clear Lake mapped in MLRA 17 should be separated from acreage mapped in MLRA 14 (Coast Range Valleys). Differentia in this family is weak and has overlapping colors, plus marginal separations based on reaction classes, salinity and other factors.

Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon - 0 to 45 inches
Slickensides - 19 to 60 inches
Reduced matrix - 0 to 45 inches
Redox concentrations - 0 to 13 inches and 19 to 60 inches
Secondary carbonates - 45 to 60 inches
Aquic conditions - 0 to 60 inches

Series classification updated May 1996. Competing series not reviewed at that time.

ADDITIONAL DATA: Two pedons in Sonoma County, CA: S61CA-097-009 (40A-3087), at 38 degrees north latitude, 14 minutes, 54 seconds, 122 degrees West longitude, 36 minutes, 31 seconds; and S61CA-097-010 (40A-3088), at 38 degrees North latitude, 16 minutes, 14 seconds, 122 West longitude, 38 minutes, 38 seconds. Two pedons in Solano County: NSSL pedon S79CA-095-000-000 (type location) and S91CA-099-005 (partial pedon). One pedon in Colusa County: S89CA-011-005.

Runoff terminology adjusted 5/96 to the adjective criteria of the Soil Survey Manual, 10/93.
Edits made for SDJR projects 12/2014 - AEC

National Cooperative Soil Survey
U.S.A.

LOCATION COLE CA

Established Series
Rev. DWS-JMK-DJE-ET-AEC
03/2018

COLE SERIES

The Cole series consists of very deep, somewhat poorly drained soils that formed in alluvium from mixed sources. Cole soils are on stream terraces, flood-plain steps, and alluvial fans with slopes of 0 to 5 percent. The mean annual precipitation is about 40 inches and the mean annual air temperature is about 60 degrees F.

TAXONOMIC CLASS: Fine, mixed, superactive, thermic Pachic Argixerolls

TYPICAL PEDON: Cole clay loam - on a 1 percent slope in an irrigated walnut orchard at 1,360 feet. (Colors are for dry soil unless otherwise noted. When described on April 28, 1976, the soil was slightly moist throughout).

Ap--0 to 6 inches (0 to 15 cm); grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure parting to strong fine and medium granular; hard, firm, sticky and plastic; common very fine, fine and medium roots; common fine and medium tubular pores; few worm casts; slightly acid (pH 6.5); abrupt smooth boundary. (6 to 15 inches thick)

BAt--6 to 13 inches (15 to 33 cm); grayish brown (10YR 5/2) clay loam, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure parting to strong fine and medium granular; hard, firm, sticky and plastic; common very fine, fine and medium roots; many fine and medium tubular pores; common thin clay films on peds and in pores; few worm casts; slightly acid (pH 6.3); clear smooth boundary. (0 to 8 inches thick)

Bt1--13 to 35 inches (33 to 89 cm); gray (10YR 5/1) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse angular blocky structure; very hard, firm, sticky and plastic; common very fine, fine and medium roots; common very fine and fine and few medium tubular pores; many thin and common moderately thick clay films on peds and in pores; 2 percent gravel 5 to 15 mm in diameter; moderately alkaline (pH 8.0); clear wavy boundary. (10 to 22 inches thick)

Bt2--35 to 51 inches (89 to 130 cm); brownish yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/4) moist; grayish brown (10YR 5/2) clay films on peds and in pores; dark grayish brown (10YR 4/2) moist; weak medium prismatic structure; hard, firm, sticky and plastic; common medium coarse and few fine roots; common very fine, fine and few medium tubular pores; many thin clay films bridging mineral grains and common moderately thick clay films on peds and in pores; moderately alkaline (pH 8.0); clear wavy boundary. (6 to 17 inches thick).

Bt3--51 to 62 inches (130 to 157 cm); variegated brown (10YR 5/3) and pale brown (10YR 6/3) clay loam, yellowish brown (10YR 5/4) moist; grayish brown (10YR 5/2) clay films; weak medium prismatic structure; hard, firm, sticky and plastic; common medium, coarse and few fine roots; many very fine, fine and common medium tubular pores; few thin and moderately thick clay films bridging mineral grains, on peds, and in pores; moderately alkaline (pH 8.0); clear smooth boundary. (0 to 15 inches thick)

Bt4--62 to 71 inches (157 to 180 cm); variegated brown (10YR 5/3) and pale brown (10YR 6/3) clay loam, yellowish brown (10YR 5/4) moist; grayish brown (10YR 5/2) clay films; weak medium prismatic structure; hard, firm, sticky and plastic; few fine and medium roots; common very fine, fine and few medium tubular pores; common thin clay films on peds, bridging mineral grains and in pores; 4 percent gravel 2 to 20 mm in diameter; moderately alkaline (pH 8.0).

TYPE LOCATION: Lake County, California; about 5 miles southeast of Lakeport, 75 feet northwest of the junction of Argonaut Road and Thomas Drive; NE1/4 NE1/4, section 8, T.13 N., R.9 W. 38 degrees 59 minutes 36.8 seconds North, 122 degrees 52 minutes 32.5 seconds West, NAD83

RANGE IN CHARACTERISTICS: The mean annual soil temperature is 59 to 65 degrees F, and the soil temperature usually is not below 47 degrees at any time. The soil between depths of 4 and 12 inches is usually dry from July 1 to October 1 and is moist in all parts from December 1 to April 30. The soils usually increase in alkalinity with increasing depth but are noncalcareous. The particle-size control section has 35 to 45 percent clay. Organic carbon is 1 to 5 percent to a depth of 20 to 35 inches. Gravel content ranges from 0 to 15 percent throughout.

The A horizon dry color is 10YR 3/2, 4/1, 4/2, 4/3, 5/1, 5/2, 5/3; 2.5Y 4/1, 4/2, 5/1 or 5/2. Moist colors are 10YR 2/1, 2/2, 3/1, 3/2, 3/3; or 2.5Y 3/2. It is loam, silt loam, clay loam, or silty clay loam and has granular or subangular blocky structure. It is slightly hard to very hard and is neutral to moderately acid. Some pedons have AB or BA horizons.

The upper Bt horizon dry color is 10YR 2/1, 2/2, 3/1, 3/2, 4/1, 4/2, 4/3, 5/1, 5/2, 5/3, 5/4, 6/3; 2.5Y 3/2, 4/2, 5/2 N 3/0, or N 4/0. Moist colors are 10YR 2/1, 2/2, 3/1, 3/2, 3/3, 4/1, 4/2, 4/3 4/4; 2.5Y 3/2, 4/2 or 5/2. In some pedons the lower part has dry colors of 10YR 6/2, 6/3, 6/4 or 6/6. Moist colors are 4/4, 5/3 or 5/4 and some also have mottles. It is silty clay loam, clay loam, silty clay or clay and averages 35 to 50 percent clay in the upper 20 inches. It is slightly acid to moderately alkaline.

The lower Bt horizon dry color has hues of 10YR, 2.5Y or 5Y and values 3 through 6 dry and 2 through 6 moist. Chroma is 1 through 3 dry and 2 through 4 moist. It is clay loam, clay loam, silty clay loam or clay and is mildly or moderately alkaline. Some pedons are underlain by gravel.

COMPETING SERIES: There are no other series in this family.

GEOGRAPHIC SETTING: Cole soils are on flood-plain steps, stream terraces and alluvial fans at elevations of 50 to 1,500 feet. Slopes are 0 to 5 percent. The soils formed in alluvium from mixed sources. The climate is subhumid with warm or hot dry summers and cool moist winters. Mean annual precipitation is 25 to 50 inches. Average January temperature is 55 to 61 degrees F. The frost-free period is 150 to 290 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Bale, Botella, Soquel, Clear Lake, Cortina, Pajaro, and Yolo soils. Clear Lake soils are clayey throughout and have intersecting slickensides. Cortina soils have an ochric epipedon and have a loamy-skeletal control section. Pajaro soils lack an argillic horizon, have a fine-loamy control section, and have an aquic moisture regime. Yolo soils have an ochric epipedon, lack an argillic horizon, and have a fine-silty control section.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; slow runoff; slow permeability. Many areas have been artificially drained or have drainage altered by gullying.

USE AND VEGETATION: Used mostly for production of orchards, vineyards, truck crops, and irrigated pasture. Uncultivated areas have oak-grass vegetation with some shrubs and forbs.

DISTRIBUTION AND EXTENT: North coastal counties, California. The soils are moderately extensive. MLRA is 14.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Lake County, California. Clear Lake Area 1927.

REMARKS: The activity class was added to the classification in February of 2003. Competing series were not checked at that time. - ET

Diagnostic horizons and features recognized in this pedon are:

Mollic Pachic epipedon -- the zone from 0 to 35 inches (Ap, BAt, Bt1)

Argillic horizon -- the zone from 6 to 62 inches (BAt, Bt1, Bt2, Bt3)

Edits made after sdjr projects-AEC

National Cooperative Soil Survey
U.S.A.

LOCATION FELIZ CA

Established Series
Rev. RFH-DJE-JJJ-ET
02/2003

FELIZ SERIES

The Feliz series consists of very deep, well drained soils on flood plains. These soils formed in alluvium derived from mixed sedimentary rocks and have slopes of 0 to 8 percent. Mean annual precipitation is about 37 inches and mean annual temperature is about 57 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, thermic Cumulic Haploxerolls

TYPICAL PEDON: Feliz loam - in an irrigated vineyard of 1 percent slope at 500 feet elevation. (Colors are for dry soil unless otherwise noted. When described July 13, 1977, the soil was dry to 20 inches and moist below.)

Ap--0 to 2 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine interstitial pores; slightly acid (pH 6.1); abrupt smooth boundary.

A--2 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate coarse and very coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine interstitial pores; 5 percent 2 to 15 mm pebbles; neutral (pH 7.0); abrupt wavy boundary.

AC--7 to 26 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine and fine roots; many very fine and common fine interstitial and few medium tubular pores; 5 percent 2 to 20 mm pebbles; slightly alkaline (pH 7.5); clear wavy boundary. (Combined thickness of the A horizon ranges from 20 to 46 inches)

C1--26 to 39 inches; dark grayish brown (10YR 4/2) clay loam, very dark gray (10YR 3/1) moist; moderate medium and coarse subangular blocky stricture; hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine interstitial pores; 3 percent 2 to 20 mm pebbles; slightly alkaline (pH 7.5); clear wavy boundary.

C2--39 to 55 inches; dark grayish brown (10YR 4/2) clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine interstitial pores; 5 percent 2 to 20 mm pebbles; slightly alkaline (pH 7.5); gradual wavy boundary.

C3--55 to 62 inches; dark grayish brown (10YR 4/2) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common fine interstitial pores; 13 percent 2 to 75 mm pebbles; slightly alkaline (pH 7.5). (Combined thickness of the C horizons ranges from 15 to over 60 inches)

TYPE LOCATION: Mendocino county, California; south of Hopland on Mountain House Road 1,700 feet south of Feliz Creek Bridge, then 700b feet west of road, on south side of vineyard avenue; 4,850 feet north and 700 feet east of the southwest corner of section 30, T.13 N., R.11 W., M.D.B.M. in the Sanel Land Grant, Hopland 7 1/2 minutes Quadrangle.

RANGE IN CHARACTERISTICS: The thickness of the solum ranges from 20 to 46 inches. The soil is more than 60 inches deep. Where not irrigated, the soil is dry in all parts between the depths of 6 and 18 inches from June to October and is moist in all parts from December to May. It is moist in some part from October to June. Mean annual

soil temperature varies from 59 to 62 degrees F and is less than 47 degrees F for 30 to 60 days in December and January. Rock fragment content ranges form 0 to 15 percent throughout the solum.

The A horizon is 10YR 4/2, 5/2 or 5/3. Moist color is 10YR 2/2, 3/2 or 3/3. It has 18 to 30 percent clay. Base saturation (sum) is 75 to 95 percent. Reaction is slightly acid through slightly alkaline.

The C horizon is 10YR 4/2, 4/3, 5/2, 5/3 or 6/3. Moist color is 10YR 3/1, 3/2, 3/3, 4/2 or 4/3. It is loam or clay loam with an average of 20 to 30 percent clay. Below 36 inches, some pedons have very gravelly loam, very gravelly clay loam or very gravelly sandy clay loam substrata. Reaction is neutral or slightly alkaline.

COMPETING SERIES: These are the Colpien (T CA), Marimel (CA) and Still (CA) series. Marimel soils have lime and mottles in the lower part of the control section. Still soils have moderately slow permeability and are dry for 120 days. Colpien soils are effervescent in some part of the series control section.

GEOGRAPHIC SETTING: Feliz soils are on flood plains and fans and have slopes of 0 to 8 percent. The soils formed in alluvium from sedimentary rocks. Elevations are 160 to 1,750 feet. The climate is subhumid with hot dry summers and cool moist winters. Mean annual precipitation ranges form 32 to 60 inches. Mean January temperature is 44 degrees F; mean July temperature is 72 degrees F; mean annual temperature varies from 54 to 59 degrees F. Frost-free period is 175 to 250 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Cole, Russian and Talmage soils. Cole soils are fine. Russian soils are coarse- loamy. Talmage soils are loamy-skeletal.

DRAINAGE AND PERMEABILITY: Well drained; slow to medium runoff; moderate permeability.

USE AND VEGETATION: Used for cropland growing walnuts, pears, prunes, grapes and irrigated pasture.

DISTRIBUTION AND EXTENT: Northern California in the valleys of the Coast Range. The soils are not extensive. MLRA is 14.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, Eastern Part, 1985.

REMARKS: The activity class was added to the classification in February of 2003. Competing series were not checked at that time. - ET

Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon: The zone from 0 to 26 inches (Ap, A, Ac)

National Cooperative Soil Survey
U.S.A.

LOCATION GIBNEY CA

Established Series
Rev. RJW,CAR,JJJ
05/2006

GIBNEY SERIES

The Gibney series consists of very deep, somewhat poorly drained soils formed in marine sediments. Gibney soils are on marine terraces and have slopes of 2 to 15 percent. The mean annual precipitation is about 50 inches and the mean annual temperature is about 53 degrees F.

TAXONOMIC CLASS: Fine, mixed, active, isomesic Typic Hapludults

TYPICAL PEDON: Gibney loam - on a southwest facing slope of 2 percent under Bishop pine at 520 feet elevation (colors are for dry soil unless otherwise stated. When described on August 14, 1984, the soil was dry to a depth of 4 inches, slightly moist between 4 and 9 inches, and moist from 9 to 63 inches).

Oi--3 inches to 0; litter of bishop pine and manzanita

A1--0 to 4 inches; pale yellow (2.5Y 7/4) loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, sticky and slightly plastic; many very fine and fine and common medium and coarse roots; common very fine and fine tubular and common very fine interstitial pores; 10 percent hard subrounded dark reddish brown (5YR 2.5/2)and black (5YR 2.5/1) nodules (2-30mm); moderately acid (pH 5.6); clear wavy boundary. (2 to 8 inches thick)

A2--4 to 9 inches; pale yellow (2.5Y 7/4) loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, sticky and plastic; common very fine,fine, medium and coarse roots; common very fine and fine tubular and common very fine interstitial pores; 5 percent hard, subrounded, dark reddish brown (5YR 2.5/2) and black (5YR 2.5/1) nodules (2-10mm); moderately acid (pH 5.9); clear wavy boundary. (0 to 6 inches thick)

Bt1--9 to 15 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; moderate very fine ,fine, medium and coarse subangular blocky structure; slightly hard, firm, sticky and plastic; common very fine and fine and few medium roots; common very fine tubular and interstitial pores; few thin clay films on faces of peds and bridging mineral grains; extremely acid (pH 4.3); gradual wavy boundary. (4 to 10 inches thick)

Bt2--15 to 29 inches; yellowish brown (10YR 5/8) clay loam, yellowish brown (10YR 5/6) moist; strong fine, medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; common very fine tubular and interstitial pores; common thin and moderately thick clay films on faces of peds and lining pores, and bridging mineral grains; extremely acid (pH 4.3); gradual wavy boundary. (6 to 18 inches thick)

Btv1--29 to 40 inches; yellowish brown (10YR 5/8) clay, yellowish brown (10YR 5/6) moist; common medium and coarse distinct strong brown (7.5YR 5/6) mottles, strong brown (7.5YR 5/6) moist, and common medium prominent red (2.5YR 4/8) mottles, red (2.5YR 4/6) moist; strong fine, medium and coarse angular blocky structure; hard, firm, very sticky and plastic; few very fine, fine and medium roots; few very fine tubular and interstitial pores; many thin and moderately thick clay films on faces of peds, lining pores and bridging mineral grains; most red color is the soft natural plinthite, that is firm when moist; 5 percent hard subrounded yellowish red (5YR 4/6) nodules, (20 to 60 mm); very strongly acid (pH 4.5); gradual wavy boundary. (0 to 15 inches thick)

Btv2--40 to 55 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; many medium and coarse distinct strong brown (7.5YR 5/6) mottles, strong brown (7.5YR 5/6) moist, common medium and coarse prominent red (2.5YR 4/8) mottles, red (2.5YR 4/8) moist, and common medium and coarse prominent light gray

(2.5Y 7/2) mottles, light yellowish brown (2.5Y 6/4) moist; strong fine, medium and coarse angular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; few very fine tubular and interstitial pores; many thin and moderately thick clay films on faces of peds, lining pores and bridging mineral grains; most red color is soft natural plinthite, that is firm when moist; 10 percent hard platelike yellowish red (5YR 4/6) nodules that are 5 to 10 mm thick, 20 to 100 mm long and 10 to 40 mm wide; extremely acid (pH 4.1); abrupt irregular boundary. (0 to 16 inches thick)

Btv3--55 to 63 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; common coarse prominent strong brown (7.5YR 5/8) mottles, strong brown (7.5YR 5/6) moist, and common medium prominent red (2.5YR 4/8) mottles, yellowish red (5YR 4/6) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few very fine roots; common very fine interstitial and few very fine tubular pores; few moderately thick clay films on nodules; most red color is soft natural plinthite that is firm when moist; 10 percent hard and very hard subangular yellowish red (5YR 4/6) nodules (50-200mm); very strongly acid (pH 4.5).

TYPE LOCATION: Mendocino County, California; about 400 feet north and 2600 feet east of the southwest corner of sec. 21,T.l7N., R.17W., MDBM, Mendocino quadrangle.

RANGE IN CHARACTERISTICS: Thickness of the solum is greater than 60 inches. Depth to bedrock is greater than 80 inches. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature varies from 6 to 9 degrees F. The soil between the depths of 9 and 21 inches is moist in all parts from November 1 to August 1 and is dry in some part from September 1 to October 1 in most years. The particle-size control section averages 35 to 45 percent clay. Hard iron nodule content ranges from 0 to 15 percent throughout.

The A horizon is 2.5Y 6/4, 7/2, 7/4; 10YR 6/2, 6/3, 6/4 or 7/2. Moist color is 2.5Y 5/2, 6/4; 10YR 4/3, 4/4, 5/2, 5/3, 5/4 or 6/3. The horizon may be smeary and may be brittle when moist. Clay content ranges from 7 to 15 percent. Subrounded nodules (2-30mm) range from 0 to 15 percent. Reaction is very strongly to moderately acid.

The Bt horizon is 5Y 7/2,; 2.5Y 7/2; 10YR 5/6, 5/8, 6/4, 6/6, 7/3 or N 7/0. Moist colors are 5Y 6/2, 6/3; 2.5Y 6/2; 10YR 4/6, 5/4, 5/6, 5/8 or N 5/0. Mottle colors are 2.5Y 7/2; 10YR 6/6, 7/1, 8/1; 7.5YR 5/6, 5/8 or 2.5YR 4/8. Moist mottle colors are 2.5Y 6/4; 10YR 5/4, 6/8, 7/2, 8/1; 7.5YR 5/6, 5/8; 5YR 4/6; 2.5YR 4/6 or 4/8. Low chroma grayish colors occur with higher chroma brownish colors and reddish colors in a regularly occurring reticulate pattern. This pattern occurs within a depth of 30 to 50 inches. It is clay, sandy clay, clay loam, or sandy clay loam. Clay content ranges from 30 to 60 percent. The horizon contains 0 to 20 percent soft plinthite. Hard iron nodules are commonly 2 to 30mm in diameter but may range to 200mm in the lowest part of the horizon. Base saturation (sum) ranges from 5 to 30 percent. Clay mineralogy is dominated by 1 to 1 lattice clays. Reaction is extremely or very strongly acid.

COMPETING SERIES: This is the Gibwell (CA) series. Gibwell soils lack mottling.

GEOGRAPHIC SETTING: The Gibney soils occur on marine terraces. Slopes are 2 to 15 percent. Elevations are 200 to 750 feet. The soils formed in marine sediments. The climate is humid with cool foggy summers and cool moist winters. A strong marine influence limits the diurnal and annual range of temperature. Mean annual precipitation varies from 40 to 65 inches. Mean January temperature is 48 degrees F., mean July temperature is 57 degrees F., and the mean annual temperature is 53 degrees F. The frost-free period is 270 to 330 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Gibwell soils and the Aborigine, Blacklock and Shinglemill soils. All are adjacent to Gibney soils on marine terraces. Aborigine and Blacklock soils support extreme pygmy vegetation. Aborigine soils are saturated with water above 10 inches for extended periods during the winter and are very poorly drained. Blacklock soils are shallow to an iron cemented hardpan. Shinglemill soils have low chroma mottles between 10 and 30 inches and are poorly drained.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; the soil is saturated with water for extended periods following episodes of heavy rain from December through April. The saturated zone starts between the depths of 30 and 50 inches and extends to greater than 60 inches. The soil is not saturated above 60 inches from summer through early fall. Surface runoff under bare soil conditions is slow or medium; slow permeability.

USE AND VEGETATION: This soil is used for wildlife habitat, watershed, recreation, and homesite development. Vegetation consists of Bishop pine, glossyleaf manzanita, California huckleberry, rhododendron, Mendocino cypress and bear grass.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is not extensive. MLRA 4.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, Western Part, 1993.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from 0 to 9 inches (A1, A2)

Argillic horizon - the zone from 9 to 63 inches (Bt1, Bt2,Btv1, Btv2, Btv3)

National Cooperative Soil Survey
U.S.A.

LOCATION GIELOW CA

Established Series
Rev: MJL/RFH/ET
03/2001

GIELOW SERIES

The Gielow series consists of deep, somewhat poorly drained soils formed in alluvium from sedimentary rocks. Gielow soils are on alluvial plains and fans and have slopes from 0 to 5 percent. The mean annual precipitation is about 44 inches and the mean annual temperature is about 56 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Cumulic Endoaquolls

TYPICAL PEDON: Gielow sandy loam - on a 2 percent slope in a grape vineyard at 590 feet elevation. (Colors are for dry soil unless otherwise stated. When described June 30, 1981, the soil was dry throughout.)

Ap1--0 to 4 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure parting to moderate very fine and fine subangular blocky; slightly hard, friable, nonsticky and nonplastic; many very fine roots; common very fine and fine and few coarse tubular pores; 5 percent 2 to 10 mm pebbles; moderately acid (pH 6.0); clear wavy boundary. (0 to 6 inches)

Ap2--4 to 8 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and very coarse subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine and common fine roots; common fine through coarse tubular pores; 5 percent 2 to 10 mm pebbles; moderately acid (pH 6.0); clear wavy boundary. (3 to 10 inches)

A1--8 to 11 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate very coarse subangular blocky structure parting to moderate coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine and coarse roots; common fine through coarse tubular pores; 5 percent 2 to 10 mm pebbles; moderately acid (pH 6.0); clear wavy boundary. (3 to 10 inches)

A2--11 to 18 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and very coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and coarse and few medium roots; common very fine and fine and few coarse tubular pores; 5 percent 2 to 10 mm pebbles; moderately acid (pH 6.0); gradual wavy boundary. (7 to 10 inches)

BAt--18 to 37 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; common fine distinct mottles of brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine and fine roots; common very fine and fine and few medium tubular pores; few thin and moderately thick clay films on peds and in pores; 5 percent 2 to 10 mm pebbles; slightly acid (pH 6.2); gradual wavy boundary. (11 to 20 inches)

Btg-37 to 48 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; common fine distinct mottles of brown (7.5YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine through coarse tubular pores; common moderately thick clay films in pores; 5 percent 2 to 10 mm pebbles; neutral (pH 6.8); abrupt wavy boundary. (10 to 20 inches)

C--48 to 65 inches; light yellowish brown (2.5Y 6/4) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine through coarse tubular pores; 5 percent 2 to 10 mm pebbles; neutral (pH 7.0). (10 to 25 inches)

TYPE LOCATION: Mendocino County, California; 0.3 mile west of Eastside Road and 150 feet south of Gielow Lane, Talmage, California; 530,800 feet north and 1,669,400 feet east, Zone 2, California coordinate system, Yokayo Rancheria, Elledge Peak 7 1/2 minute Quadrangle.

RANGE IN CHARACTERISTICS: Gielow soils are more than 60 inches deep. Mean annual soil temperature is 55 to 59 degrees F. The soil between the depths of 8 and 21 inches is dry in all parts from July 1 to October 15 and is moist the rest of the year. The particle-size control section is 18 to 27 percent clay. Base saturation is more than 50 percent throughout the profile. Organic carbon decreases irregularly with depth. Mollic epipedon is 24 inches thick or more and has mottles in the lower part. Reaction is medium acid to neutral. Gravel fragment content is 0 to 10 percent throughout the profile.

The A horizon is 10YR 5/2 or 5/3. Moist colors are 10YR 2/1, 3/1, or 3/2. It is sandy loam or loam.

The BAt and Btg horizons are; 2.5Y 6/2, 6/3 or 6/4. Moist colors are 2.5Y 4/2 or 4/4. It is stratified loam, fine sandy loam, sandy loam, or sandy clay loam with 15 to 27 percent clay.

COMPETING SERIES: These are the Coland, Comfrey, Delft, Glencoe, James Canyon, Keddie, Kimmerling, Konner, McClave, Peoh, Romnell, Shandep and Wenas series. All these soils except McClure have a mean annual soil temperature of less than 54 degrees F. McClure soils lack Bt horizons.

GEOGRAPHIC SETTING: Gielow soils are on alluvial plains and fans. Slopes are 0 to 5 percent. Elevations are 500 to 1,750 feet. The soils are formed in alluvium from sedimentary rocks. The climate is subhumid with hot dry summers and cool moist winters. Mean annual precipitation is 32 to 55 inches. Mean annual temperature is 54 to 57 degrees F. Frost-free season is 175 to 250 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are Cole, Russian, Feliz and Talmage soils. All these soils are xeric and thermic.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained, very slow to slow runoff, moderate permeability.

USE AND VEGETATION: This soil is used for vineyards, orchards, hay and pasture, wildlife and watershed, and limited homesite developments. Natural vegetation is annual and perennial grasses and forbs, occasional sedges and scattered oaks.

DISTRIBUTION AND EXTENT: Northern coastal California. The soils are not extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California 1985.

REMARKS: The classification was updated in February 2001 using the Eighth Edition to Soil Taxonomy. This series was formerly classified as fine-loamy, mixed, mesic Cumulic Haplaquolls. Competing series were not checked at that time.

National Cooperative Soil Survey
U.S.A.

Established Series
Rev. CAR-DJE-JJJ
07/98

HEESER SERIES

The Heeser series consists of very deep, somewhat excessively drained soils formed in eolian sands. Heeser soils are on marine terraces and have slopes of 0 to 15 percent. The mean annual precipitation is about 40 inches and the mean annual temperature is about 53 degrees F.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, isomesic Humic Dystrustepts

TYPICAL PEDON: Heeser sandy loam on a north facing slope of 4 percent under perennial grasses at 160 feet elevation. (Colors are for dry soil unless otherwise stated. When described on September 24, 1985, the soil was slightly moist to 13 inches and dry below 13 inches.)

A1--0 to 3 inches; very dark grayish brown (10YR 3/2) sandy loam, black (10YR 2/1) moist; moderate very fine, fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; many very fine roots; many very fine and fine interstitial and few fine tubular pores; strongly acid (pH 5.5); abrupt smooth boundary. (2 to 5 inches thick)

A2--3 to 7 inches; very dark grayish brown (10YR 3/2) sandy loam, black (10YR 2/1) moist; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial and few fine tubular pores; strongly acid (pH 5.5); clear wavy boundary. (3 to 6 inches thick)

A3--7 to 13 inches; dark brown (10YR 3/3) sandy loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine and few fine and medium roots; common very fine interstitial pores; strongly acid (pH 5.5); clear wavy boundary. (4 to 8 inches thick)

A4--13 to 23 inches; dark brown (10YR 3/3) sandy loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial pores; moderately acid (pH 6.0); gradual wavy boundary. (5 to 12 inches thick)

A5--23 to 34 inches; dark brown (10YR 3/3) sandy loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial pores; slightly acid (pH 6.2); clear wavy boundary. (0 to 12 inches thick)

AC--34 to 46 inches; brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine fine and medium roots; common very fine interstitial pores; slightly acid (pH 6.2); gradual wavy boundary. (5 to 16 inches thick)

C--46 to 65 inches; dark yellowish brown (10YR 4/6) sandy loam, dark yellowish brown (10YR 3/6) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial pores; slightly acid (pH 6.2).

TYPE LOCATION: Mendocino County, California; about 500 feet south and 2500 feet west of the northeast corner of sec. 30, T.17N., R.17W., MDBM, Mendocino quadrangle.

RANGE IN CHARACTERISTICS: Thickness of the solum is 20 to 50 inches and depth to bedrock is greater than 60 inches. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter soil temperature varies from 6 to 9 degrees F. The soil between the depths of 8 and 23 inches is moist in all parts from November 1 to June 1 and is dry in some or all parts from July 1 to October 15 in most years. The particle-size control section is dominated by sandy loam textures. Gravel content ranges from 0 to 5 percent throughout. Base saturation (ammonium acetate) ranges from 10 to 45 percent throughout. Organic carbon content is 30 kg in upper cubic meter.

The A horizon is 10YR 3/2, 3/3, 4/2 or 4/3. Moist color is 10YR 2/1, 2/2, 3/2, or 3/3. It is sandy loam but may be loamy sand in the lower part. Clay content ranges from 6 to 12 percent and organic carbon content ranges from 2 to 5 percent. Reaction is strongly through slightly acid.

The C horizon is 10YR 4/4, 4/6, 5/4 or 5/6. Moist color is 10YR 3/4, 3/6, 4/4 or 4/6. It is sandy loam, loamy sand or sand. Clay content ranges from 4 to 10 percent. Hard, subrounded nodules, 2 to 20mm, range from 0 to 15 percent. The horizon may be weakly cemented. Reaction is moderately or slightly acid.

COMPETING SERIES: There are no competing series.

GEOGRAPHIC SETTING: The Heeser soils occur on marine terraces. Slopes are 0 to 15 percent. Elevations are 20 to 240 feet. The soils formed in eolian sands. The climate is characterized by cool foggy summers and cool moist winters. A strong marine influence limits the diurnal and annual range of temperature. Mean annual precipitation varies from 35 to 45 inches. Mean January temperature is 49 degrees F., mean July temperature is 57 degrees F., and the mean annual temperature is 53 degrees F. The frost-free period is 250 to 330 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Biaggi, Cabrillo, Mackerricher and Sirdrak soils. Biaggi soils are on slightly higher landscape positions and are moderately deep to lithic contact. Cabrillo soils are on similar landscape positions and have a fine-loamy particle-size class. Mackerricher and Sirdrak soils have sandy particle-size control sections.

DRAINAGE AND PERMEABILITY: Somewhat excessively drained; surface runoff under bare soil conditions is very slow through medium. Permeability is moderately rapid to a depth of about 34 inches and rapid below this depth.

USE AND VEGETATION: This soil is used for homesites, livestock grazing, recreation, and as wildlife habitat. A few areas are used for bulb and vegetable production. Vegetation consists of perennial and annual grasses and forbs.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is not extensive. MLRA 4.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, Western part, 1993.

REMARKS: Diagnostic horizons and features recognized recognized in this pedon are:

Umbric epipedon -- the zone from 0 to 46 inches (A1, A2, A3, A4, A5, AC)

Established Series
Rev. RHB-CEJ-JJJ-KP
12/2022

HOPLAND SERIES

The Hopland series consists of very deep, well drained soils formed in colluvium and residuum weathered from sandstone or shale. Hopland soils are moderately deep to paralithic material with spacing between cracks less than 10 centimeters apart. Hopland soils are on hills and mountains and have slopes of 9 to 75 percent. The mean annual precipitation is 1070 millimeters (42 inches) and the mean annual temperature is 14 degrees C (57 degrees F).

TAXONOMIC CLASS: Fine-loamy, mixed, active, mesic Typic Haploxeralfs

TYPICAL PEDON: Hopland loam--on an east facing convex slope of 57 percent under black oak and Pacific madrone at 183 meters (600 feet) elevation. (Colors are for dry soil unless otherwise noted. When described on November 23, 1976, the soil was moist to a depth of 36 centimeters (14 inches) and dry below).

A--0 to 13 centimeters (0 to 5 inches); yellowish red (5YR 5/6) loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine and medium tubular pores; neutral (pH 7.0); clear wavy boundary. (8 to 18 centimeters thick)

AB--13 to 31 centimeters (5 to 12 inches); yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine, and common medium and coarse roots; many fine and medium tubular pores; moderately acid (pH 6.0); clear wavy boundary. (0 to 23 centimeters thick)

Bt1--31 to 61 centimeters (12 to 24 inches); yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and plastic; common fine, medium, and coarse roots; many very fine, fine, and medium tubular pores; common thin clay films in pores and as bridges between mineral grains; 5 percent 2 to 50 millimeters gravel; slightly acid (pH 6.2); clear wavy boundary. (28 to 38 centimeters thick)

Bt2--61 to 79 centimeters (24 to 31 inches); yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common fine and medium roots; many very fine, and fine, and common medium tubular pores; many thin clay films in pores and few thin clay films on peds; 12 percent 2 to 50 millimeters gravel; slightly acid (pH 6.5); abrupt wavy boundary. (15 to 23 centimeters thick)

C--79 to 200 centimeters (31 to 79 inches); paragravel; light yellowish brown soft fractured sandstone and shale, fractures are 2 to 8 centimeters (1 to 3 inches) apart.

TYPE LOCATION: Mendocino County, California; 0.9 mile from Mountain House Road along the Bradford Ranch Road past the Fountain Ranch Headquarters, and old dump to a small interior live oak hanging over the road. The pit is about 50 feet up the hill from this tree; 950 feet north and 2,750 feet east of the southwest corner of section 33, T.13 N., R.11 W., MDBM.

RANGE IN CHARACTERISTICS:

Soil moisture: The soil is dry between a depth of 18 to 48 centimeters from June to October and moist in all parts from November to May. The soils have a xeric moisture regime.

Soil Temperature: 12 to 15 degrees C (54 to 59 degrees F). The difference between mean summer and mean winter soil temperature is 6 degrees C or greater. The soils have a mesic temperature regime.

Depth to paralithic material with fractures less than 10 centimeters apart: 50 to 100 centimeters (20 to 40 inches)

Particle size control section (weighted average):
Rock fragments: 0 to 15 gravel
Clay content: 25 to 35 percent
Base saturation (sum): 75 to 95 percent

A Horizon:
Hue: 7.5YR, 10YR, 5YR
Value: 5 or 6, 3 or 4 moist
Chroma: 3 through 6 dry or moist
Clay content: 15 to 25 percent
Organic matter content: 1 to 5 percent
Reaction: moderately acid to neutral

B Horizon:
Hue: 5YR, 7.5YR
Value: 5 or 6, 3 or 4 moist
Chroma: 3 through 6 dry or moist
Texture of fine earth: loam, clay loam
Clay content: 20 to 35 percent
Rock fragments: 0 to 15 gravel
Reaction: moderately to slightly acid

Ct horizon:
Hue: 10YR
Texture: paragravel

COMPETING SERIES: There are no competing series in this family

GEOGRAPHIC SETTING: Hopland soils are on sideslopes of hills and mountains. Slopes are 9 to 75 percent. The soils formed in colluvium and residuum weathered from sandstone and shale at elevations of 660 to 1070 meters (200 to 3,500 feet). The climate is subhumid with hot dry summers and cool moist winters. Mean annual precipitation varies from 760 to 1520 millimeters (30 to 60 inches). Mean January temperature is about 7 degrees C (44 degrees F); mean July temperature is 22 degrees C (72 degrees F); mean annual temperature is 12 to 15 degrees C (53 to 59 degrees F). Frost-free period ranges from 140 to 250 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Etsel, Kekawaka, Mayacama, Maymen, Sanhedrin, Frogwoman, Witherell, Woodin, Yorktree, and Yorkville soils. Etsel and Maymen soils are less than 50 centimeters to fractured bedrock. Witherell soils are shallow to lithic material. Kekawaka, Yorktree, and Yorkville soils are fine. Mayacama, Frogwoman, and Woodin soils have more than 35 percent rock fragments. Sanhedrin soils are more than 100 centimeters to lithic material.

DRAINAGE AND PERMEABILITY: Well drained; medium to very high runoff; moderately slow permeability.

USE AND VEGETATION: Used for watershed, wildlife habitat, recreation, and limited firewood production. Vegetation is black oak, Oregon white oak, interior live oak, blue oak, canyon live oak, Pacific madrone, common manzanita, buckeye, poison oak, annual grasses and forbs.

DISTRIBUTION AND EXTENT: Siskiyou-Trinity Area, MLRA 5. The soils are moderately extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Lake County, California, 1983

REMARKS: The depth class was changed to reflect the fracture spacing in the paralithic material in January 2008. - ET.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - zone from 0 to 13 centimeters (A horizon)

Argillic horizon - zone from 31 to 79 centimeters (Bt1 and Bt2 horizon)

Paralithic material - C horizon 79 to 200 centimeters

ADDITIONAL DATA: NSSL Pedon S76CA-045-117 was sampled as the type location and is the OSED. However, based on lab data the pedon is a Xerept not a Haploxeralf.

Established Series
Rev. CAR-DJE-JJJ-ET
03/2023

IRMULCO SERIES

The Irmulco series consists of deep or very deep well drained soils formed in material weathered from sandstone. Irmulco soils are on hills and have slopes of 9 to 75 percent. The mean annual precipitation is about 55 inches and the mean annual air temperature is about 53 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, isomesic Ultic Hapludalfs

TYPICAL PEDON: Irmulco loam - on a west facing concave slope of 28 percent under redwood, Douglas-fir, tanoak, swordfern and oxalis at 650 feet elevation. (Colors are for dry soil unless otherwise stated. When described on July 12, 1979 the soil was slightly moist throughout.)

Oi--0 to 1 inch; litter of redwood and tanoak.

A--1 to 7 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3 and 7.5YR 3/4) moist; strong very fine and fine granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots; common fine interstitial pores; 10 percent hard subangular pebbles (2-20mm); moderately acid (pH 5.8); clear wavy boundary. (5 to 9 inches thick)

Bt1--7 to 27 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and common medium roots; few fine and common very fine tubular and few very fine interstitial pores; common thin clay films on faces of peds and lining pores; 10 percent hard subangular pebbles (2-20mm), moderately acid (pH 5.6); gradual wavy boundary. (10 to 30 inches thick)

Bt2--27 to 42 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common medium and coarse and few fine roots; common very fine and few fine tubular and few very fine interstitial pores; common thin clay films on faces of peds and lining pores; many thin very pale brown (10YR 7/3) coatings, yellowish brown (10YR 5/4) moist, on faces of peds and lining pores; 4 percent hard subangular pebbles (2-20mm), strongly acid (pH 5.2); gradual wavy boundary. (10 to 20 inches thick)

Bt3--42 to 57 inches; variegated light brown (7.5YR 6/4) and pink (7.5YR 7/4) clay loam, brown (7.5YR 4/4) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and plastic; common medium and coarse and few fine roots; common very fine tubular and few very fine interstitial pores; common thin clay films on faces of peds and lining pores; 9 percent hard subangular pebbles (2-20mm); strongly acid (pH 5.4); gradual wavy boundary. (10 to 20 inches thick)

Bt4--57 to 62 inches; variegated light brown (7.5YR 6/4), reddish yellow (7.5YR 6/6)and pink (7.5YR 7/4) clay loam, brown (7.5YR 4/4) and dark yellowish brown (10YR 4/4) moist; weak medium and coarse angular blocky structure; hard, firm, sticky and plastic; common medium and few fine roots; few very fine tubular and common very fine interstitial pores; many moderately thick clay films on faces of peds and common thin clay films lining pores; 2 percent hard subangular pebbles (2-20mm); strongly acid (pH 5.4); gradual wavy boundary. (0 to 10 inches thick)

Crt--62 to 73 inches; light brown (7.5YR 6/4) highly weathered sandstone; few fine and medium roots following fracture faces; continuous moderately thick clay films on fracture faces; rock slakes in water.

TYPE LOCATION: Mendocino County, California; about 3 miles south on G-P road "4000" from its intersection with Usal road; uphill 200 feet on road cut face; about 150 feet south and 2720 feet east of the northwest corner of sec. 23, T.23N., R.18W., MDBM, Hales Grove quadrangle.

RANGE IN CHARACTERISTICS: Depth to a paralithic contact and thickness of the solum is 60 to 80 inches The mean annual soil temperature ranges from 50 to 56 degrees F. The difference between mean summer and mean winter soil temperature varies from 3 to 6 degrees F. The soil between the depths of 6 and 17 inches is moist in all parts from November 1 to August 15 and is dry in some part from September 1 to October 1 in most years.

The A horizon is 10YR 3/3, 4/2, 4/3, 5/3 or 6/3. Moist color is 10YR 2/2, 3/2, 3/3, 4/3, 4/4 or 7.5YR 3/4. Gravel content is 0 to 10 percent. Reaction is moderately acid or slightly acid. Thickness for a mollic epipedon is not met.

The Bt horizon is 10YR 4/3, 4/4, 5/3, 5/4, 6/3, 6/4, 7/4; 7.5YR 6/4, 6/6 or 7/4. Moist color is 10YR 4/2, 4/3, 4/4, 5/3, 5/4, 5/6; 7.5YR 3/4, 4/4, 4/6 or 5/6. It is loam, clay loam, gravelly loam or gravelly clay loam. Clay content ranges from 20 to 40 percent. Textures with more than 35 percent clay occur below 30 inches. Gravel content is 0 to 25 percent. Reaction is very strongly through moderately acid. Base saturation (sum) is 30 to 60 percent and is greater than 35 percent in the lower part of the argillic horizon.

COMPETING SERIES: These are the Carlain (CA) and Tramway (CA) series. Carlain soils are very deep and have a very gravelly lithological discontinuity in the lower Bt horizon. The Tramway series is 20 to 40 inches deep to a paralithic contact.

GEOGRAPHIC SETTING: The Irmulco soils occur on mountains. Slopes are 9 to 75 percent. Elevation is 10 to 800 feet. The soils formed in material weathered from sandstone. The climate is humid with cool foggy summers and cool moist winters. A strong coastal marine influence limits the diurnal and annual range of temperature. Mean annual precipitation ranges from 40 to 70 inches. Mean January temperature is 50 degrees F.; mean July temperature is 55 degrees F.; and mean annual temperature is 53 degrees F. The frost-free season is 290 to 365 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Carlain and Tramway soils and the Dehaven, Kibesillah, Ornbaun, Usal, Vandamme, Yellowhound and Zeni soils. All occur on hills and mountains. Kibesillah, Ornbaun, Yellowhound and Zeni soils have ustic soil moisture regimes. Dehaven, Kibesillah and Yellowhound soils are loamy-skeletal. Usal soils are mollisols. Vandamme soils have a clayey particle-size control section.

DRAINAGE AND PERMEABILITY: Well drained; surface runoff under bare soil conditions is medium to very rapid; moderate permeability.

USE AND VEGETATION: This soil is used for commercial timber, wildlife and watershed. Natural vegetation consists of redwood, Douglas-fir, tanoak, California red huckleberry, California huckleberry, swordfern, oxalis, trillium and rhododendron.

DISTRIBUTION AND EXTENT: Northern Coastal California. The series is moderately extensive. MLRA 4.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, Western Part, 1993.

REMARKS: Diagnostic features and horizons recognized in this pedon are:

Ochric epipedon -- 0 to 6 inches (A)

Argillic horizon -- 6 to 61 inches (Bt1, Bt2, Bt3, Bt4)

Particle-size control section -- 6 to 26 inches = 20 percent clay.

Base saturation (sum) Bt4 = 36 percent.

The classification was changed in 1993 from an Ultic Tropudalf to Ultic Hapludalf. Soil Taxonomy Notice 8 deletes Tropudalfs and reclassifies them as Hapludalfs.

The activity class was added to the classification in February of 2003. Competing series were not checked at that time. - ET

Many areas mapped as Irmulco soils were mapped as Josephine soils by the California Soil Vegetation Survey 1947-1950.

ADDITIONAL DATA: NSSL number S80CA-045-008-(1-7). The Bt1 horizon was sampled as two subhorizons (6 to 15 inches and 15 to 26 inches).

Established Series
Rev. CAR-CEJ-JJJ-ET
02/2003

ORNBAUN SERIES

The Ornbaun series consists of deep, well drained soils formed in material weathered from sandstone and mudstone. Ornbaun soils are on hills and mountains and have slopes of 9 to 75 percent. The mean annual precipitation is about 60 inches and the mean annual temperature is about 53 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, isomesic Ultic Haplustalfs

TYPICAL PEDON: Ornbaun loam - on a west facing convex slope of 50 percent under redwood and Douglas fir at 800 feet elevation. (Colors are for dry soil unless otherwise stated. When described May 8, 1978, the soil was moist throughout.)

Oi--0.5 inch to 0; litter of redwood and Douglas fir.

A--0 to 3 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky and weak medium granular structure; hard, friable, slightly sticky and slightly plastic; common fine and few very fine and coarse roots; few very fine and fine interstitial and few fine tubular pores; 5 percent soft subangular pebbles (2 to 20 mm); moderately acid (pH 5.6); clear wavy boundary. (2 to 5 inches thick)

BAt--3 to 9 inches; light brown (7.5YR 6/4) loam, dark yellowish brown (7.5YR 4/4) moist; weak fine angular blocky structure; hard, firm, sticky and plastic; common fine, and few very fine, medium and coarse roots; few very fine interstitial and common fine tubular and interstitial pores; few thin clay films bridging mineral grains; 2 percent soft subangular pebbles (2 to 20 mm); strongly acid (pH 5.5); clear wavy boundary. (4 to 7 inches thick)

Bt1--9 to 25 inches; variegated reddish yellow (7.5YR 7/6)and light brown (7.5YR 6/4) loam, strong brown (7.5YR 5/6) moist; moderate fine and medium angular blocky structure; hard, firm, sticky and plastic, common fine and few very fine, medium and coarse roots; few very fine interstitial and common fine tubular and interstitial pores; common moderately thick clay films on faces of peds and lining pores; moderately acid (pH 5.6); gradual wavy boundary. (10 to 20 inches thick)

Bt2--25 to 40 inches; variegated light brown (7.5YR 6/4) and yellowish red (5YR 5/6) gravelly loam, strong brown (7.5YR 5/6) moist; weak fine and medium angular blocky structure; hard, firm, sticky and plastic; common fine, few very fine, coarse and very coarse roots; few very fine and fine interstitial pores; common moderately thick clay films on peds and in pores; 16 percent soft subangular pebbles (2 to 75 mm); strongly acid (pH 5.5); gradual wavy boundary. (10 to 20 inches thick)

Bt3--40 to 50 inches; variegated reddish yellow (5YR 6/6) and pink (7.5YR 7/4) clay loam, yellowish red (5YR 4/6) and strong brown (7.5YR 5/6) moist; weak fine angular blocky structure; very hard, very firm, sticky and very plastic; few fine, medium, and coarse roots; few very fine tubular pores; many moderately thick clay films on faces of peds; 14 percent soft subangular pebbles (2 to 75 mm); strongly acid (pH 5.4); clear irregular boundary. (5 to 10 inches thick)

Bt4--50 to 59 inches; variegated reddish yellow (5YR 6/6) and pink (7.5YR 7/4) clay loam, yellowish red (5YR 4/6) and strong brown (7.5YR 5/6) moist; weak fine angular blocky structure; very hard, very firm, sticky and very plastic; few fine, medium and coarse roots; few very fine tubular pores; many moderately thick clay films on faces of peds; 10 percent soft subangular pebbles (2 to 75 mm); strongly acid (pH 5.2); abrupt irregular boundary. (5 to 10 inches thick)

Cr--59 to 61 inches; soft, fractured sandstone; fractures are about 1 to 3 mm wide and about 10 cm apart.

TYPE LOCATION: Mendocino County, California; about 1 mile south of the town of Boonville; 1,800 feet east and 1900 feet south of the northwest corner of section 14, T.13 N., R.14 W.; Ornbaun Valley Quandrangle.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to a lithic or paralithic contact is 40 to 60 inches. The mean annual soil temperature ranges from 50 to 56 degrees F. The difference between mean summer and mean winter temperature ranges from 5 to 9 degrees F. The soil between depths of 6 and 17 inches is moist in all parts from November 1 to June 1 and is dry in some or all parts from July 1 to October 1 in most years. The particle-size control section averages from 25 to 35 percent clay and from 15 to 35 percent soft fragments of sandstone. Base saturation ranges from 40 to 75 percent throughout the soil.

The A horizon is 10YR 5/2, 5/4, 6/2, 6/3 or 6/4. Moist color is 10YR 2/2, 3/3, 3/4, 4/3, 4/4, 5/3, 5/4, or 7.5YR 3/2. Soft sandstone fragments content ranges from 0 to 10 percent. Where mollic colors occur, the layer is too thin to meet the requirements for a mollic epipedon. Reaction ranges from strongly acid through slightly acid.

The Bt horizon is 10YR 6/4, 6/6, 7/3, 7/4; 7.5YR 6/4, 6/6 7/4, 7/6; 5YR 5/6 or 6/6. Moist color is 10YR 4/6, 6/4; 7.5YR 4/4, 4/6, 5/6, 6/4, 6/6, 7/6; 5YR 4/6 or 5/6. It is loam or clay loam. Clay textures are below the particle-size control section. Clay content ranges from 20 to 50 percent (increasing with increasing depth). Soft sandstone fragment content ranges from 0 to 35 percent. Fragments slake in water. Reaction ranges from very strongly acid through moderately acid.

COMPETING SERIES: These are the Cabrillo (CA), Crispin (CA), Inverness (CA) and Zeni (CA) soils. Inverness soils have C horizons above a paralithic contact and contain 5 to 20 percent mica flakes. Crispin and Zeni soils are 20 to 40 inches deep to a paralithic contact. Cabrillo soils are very deep.

GEOGRAPHIC SETTING: The Ornbaun soils occur on hills and mountains. Slopes are 9 to 75 percent. Elevations range from 200 to 2,500 feet. The soils formed in material weathered from feldspathic or micaceous sandstone and mudstone. The climate is subhumid with cool foggy summers and cool moist winters. A moderate coastal fog influence limits the diurnal and annual range of temperature. Mean annual precipitation ranges from 40 to 70 inches. Mean January temperature is about 50 degrees F; mean July temperature is about 60 degrees F; and the mean annual temperature is about 53 degrees F. The frost-free period is 220 to 320 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Zeni and the Casabonne, Dehaven, Hotel, Irmulco, Kibesillah, Pardaloe, Tramway, Woodin, Wohly and Yellowhound soils. The Hotel, Kibesillah, Tramway, Woodin, Wohly and Zeni soils are moderately deep. Casabonne, Pardaloe, Woodin and Wohly have a xeric mesic moisture temperature regime. Dehaven, Hotel, Irmulco and Tramway soils have a udic moisture regime. Dehaven, Hotel, Kibesillah, Pardaloe, Woodin and Yellowhound soils have a loamy-skeletal particle-size control section.

DRAINAGE AND PERMEABILITY: Well drained; surface runoff under bare soil conditions is medium to very rapid; moderate permeability.

USE AND VEGETATION: This soil is used for timber production, wildlife habitat and watershed. Vegetation consists of Douglas-fir, redwood, tanoak, madrone and California huckleberry.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is moderately extensive. MLRA 4.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, Eastern Part 1985.

REMARKS:

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the surface layer from 0 to 3 inches.

Argillic horizon - the zone from 9 to 59 inches (Bt1, Bt2, Bt3, Bt4 horizons)

Paralithic material, when present, has a similar available water capacity and bulk density to the overlying B horizon. Soft sandstone fragments in the Bt horizon are not recognized in the textural class as they do not affect engineering properties in the same manner as hard gravels.

The activity class was added to the classification in February of 2003. Competing series were not checked at that time. - ET

ADDITIONAL DATA: Complete lab characterization of typical pedon: NSSL Lab Sample Nos. - 80P2469-2475.

LOCATION PINOLE CA

Established Series
Rev. SJB-RFH-JJJ-ET
03/2003

PINOLE SERIES

The Pinole series consists of very deep, well drained soils formed in alluvium weathered from sedimentary and other rock sources. Pinole soils are on terraces and have slopes of 0 to 30 percent. The mean annual precipitation is about 37 inches and the mean annual temperature is about 57 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, active, thermic Ultic Argixerolls

TYPICAL PEDON: Pinole gravelly loam; in an open field on an east-facing slope of 7 percent at 920 feet elevation. (Colors are for dry soil unless otherwise noted. When described July 13, 1983, the soil was moist below a depth of 15 inches).

Oi--0.5 inch to 0; roots and decomposed grass material.

A--0 to 10 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure breaking to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; common very fine, fine, medium and coarse tubular and interstitial pores; 15 percent 2 to 25mm pebbles; neutral (pH 6.8); clear wavy boundary. (10 to 16 inches thick)

Bt1--10 to 15 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many very fine and common fine, medium and coarse tubular and interstitial pores; few thin clay films on peds and in pores; 10 percent 2 to 25mm pebbles; neutral (pH 6.8); gradual wavy boundary. (9 to 14 inches thick)

Bt2--15 to 37 inches; variegated strong brown and yellow (7.5YR 5/6, 10YR 7/6) clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure parting to strong fine subangular blocky; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and common fine and medium interstitial and tubular pores; many moderately thick clay films on peds and in pores; 10 percent 2 to 25mm pebbles; slightly acid (pH 6.5); gradual wavy boundary. (10 to 14 inches thick)

Bt3--37 to 61 inches; variegated strong brown and brownish yellow (7.5YR 5/8, 10YR 6/6) sandy clay loam, variegated dark brown and brown (7.5YR 3/4, 7.5YR 4/4) moist; strong fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular and interstitial pores; common moderately thick clay films on peds and in pores; 5 percent 2 to 25mm pebbles; few black (N 3/0) manganese stains; slightly acid (pH 6.2).

TYPE LOCATION: Mendocino County, California; 1 mile north on Tomki road from intersection with Eastside-Westside Road, Redwood Valley, California, 0.4 mile northwest on dirt farm road, 0.3 mile east on side road to vineyards, 150 feet east of road in open field; 1650 feet south and 750 feet east of the northeast corner of section 18, T.17 N., R.12 W., M.D.B.M., Redwood Valley Quadrangle.

RANGE IN CHARACTERISTICS: Depth of solum is greater than 60 inches. Where not irrigated, the soil between a depth of 8 to 23 inches is dry in all parts from June to October and is moist in all parts from November to May. The mean annual soil temperature varies from 59 to 62 degrees F. Mean January soil temperature is 46 degrees F and mean July temperature is 72 degrees F. Organic matter content to a depth of 10 inches is 1 to 5 percent. Coarse fragment content in the particle-size control section averages 10 to 35 percent.

The A horizon is 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/3, 5/2 or 5/3. Moist colors are 10YR 3/2, 3/3, 7.5YR 3/2 or 3/3. It is loam, gravelly loam or very gravelly loam with 15 to 27 percent clay, and 2 to 40 percent gravel. Base saturation is 50 to 75 percent. It is moderately acid through neutral.

The Bt horizon is 10YR 4/4, 5/4, 6/4, 6/6, 7/6; 7.5YR 4/4, 5/4, 4/6, 5/6 or 5/8. Moist colors are 10YR 3/4, 4/3, 4/4 5/6; 7.5YR 3/4, 4/3, 4/4 or 4/6. It is sandy clay loam or clay loam or gravelly or very gravelly sandy clay loam or clay loam. It has 20 to 35 percent clay and 2 to 50 percent gravel. Base saturation is 50 to 75 percent in the upper part and ranges to 90 percent in the lower part. Gravel often occurs in lenses 3 to 6 inches thick below 30 inches. It is strongly acid through neutral.

COMPETING SERIES: This is the Boontling (CA) series. The Boontling soils has low chroma mottles in the lower Bt horizon and are somewhat poorly drained.

GEOGRAPHIC SETTING: The Pinole soils are on terraces and have slopes of 0 to 30 percent. The formed in alluvium from sedimentary and other rock sources at elevations of 200 to 1500 feet. The climate is subhumid with hot dry summers and cool moist winters. Mean annual precipitation varies from 32 to 50 inches. Mean January temperature is about 46 degrees F; mean July temperature is about 72 degrees F; mean annual temperature varies from 56 degrees to 59 degrees F. Frost-free period is 175 to 250 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Pinnobie, Redvine, and Yokayo soils. Redvine and Yokayo soils have ochric epipedons and are fine. Pinnobie soils do not have an argillic horizon.

DRAINAGE AND PERMEABILITY: Well drained; slow to rapid runoff; moderately slow permeability.

USE AND VEGETATION: Used for vineyards, orchards and urban development. Vegetation was annual grasses, manzanita, liveoak, white oak, black oak, madrone, blue oak poison-oak, and ponderosa pine. Most areas of this soil are cleared and cultivated.

DISTRIBUTION AND EXTENT: Northern California in the Coast Range. The soils are not extensive. MLRA 14.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, 1914.

REMARKS: The activity class was added to the classification in February of 2003. Competing series were not checked at that time. - ET

Diagnostic features and horizons recognized in this pedon are:

Mollic epipedon -- the zone from 0 to 10 inches (A)

Argillic Horizon - the zone from 10 to 60 inches (Bt)

National Cooperative Soil Survey
U.S.A.

LOCATION SHINGLEMILL CA

Established Series
Rev. CAR-CEJ-JJJ-ET
03/2003

SHINGLEMILL SERIES

The Shinglemill Series consists of very deep, poorly drained soils formed in marine sediments. Shinglemill soils are on marine terraces and have slopes of 2 to 15 percent. The mean annual precipitation is about 50 inches and the mean annual temperature is about 53 degrees F.

TAXONOMIC CLASS: Fine, mixed, semiactive, isomesic Aquic Hapludults

TYPICAL PEDON: Shinglemill loam - on a northeast facing slope of 2 percent under Bishop pine and Mendocino cypress at 570 feet elevation. (Colors are for dry soil unless otherwise noted. When described on October 23, 1984, the soil was moist throughout.)

Oi--2 inches to 0; litter of bishop pine and manzanita.

E--0 to 3 inches; variegated light gray, (10YR 7/2) light brownish gray (10YR 6/2) and very pale brown (10YR 7/4) loam, grayish brown (10YR 5/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine and few medium roots; common very fine interstitial and tubular pores; 10 percent hard subrounded yellowish red (5YR 5/6) nodules (2-30mm); very strongly acid (pH4.5); clear wavy boundary. (2 to 9 inches thick)

1 E--3 to 8 inches; variegated very pale brown (10YR 7/4) and reddish yellow (7.5YR 6/6) loam, yellowish brown (10YR 5/4) moist; moderate fine medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; common very fine interstitial and tubular pores; very strongly acid (pH 4.9); clear wavy boundary. (0 to 6 inches thick)

1 2B--8 to 15 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/6) moist; moderate fine, medium and coarse subangular blocky structure; hard, friable, sticky and plastic; few very fine, medium and coarse and common fine roots; common very fine interstitial and tubular pores; few thin clay films on faces of peds and lining pores; very strongly acid (pH 4.6); clear wavy boundary. (4 to 10 inches thick)

1 2t --15 to 25 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/6) moist; moderate fine through coarse subangular blocky structure; hard, friable, sticky and plastic; few fine and medium roots; few very fine interstitial and common very fine tubular pores; many moderately thick and thick clay films on faces of peds and lining pores; extremely acid (pH 4.2); gradual wavy boundary. (6 to 15 inches thick)

1 2vB-25 to 31 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/6) moist; common fine prominent light gray (2.5Y 7/2) redox depletions, light gray (2.5Y 7/2) moist, and common fine and medium prominent red (10YR 4/6) redox concentrations, red (10YR 4/6) moist; strong very fine, fine and medium angular blocky structure; hard, firm, sticky and plastic; few fine roots; few very fine interstitial pores; continuous moderately thick and thick clay films on faces of peds and lining pores; red mottles are mainly soft plinthite with a firm moist consistence; very strongly acid (pH 4.6); gradual wavy boundary. (5 to 15 inches thick)

1 2vt --31 to 50 inches; yellow (10YR 7/6) clay, brownish yellow (10YR 6/6) moist; common fine and medium prominent white (10YR 8/1) redox depletions, white (10YR 8/2) moist, and common fine and medium prominent red (10R 4/6) redox concentrations, red (10Y 4/6) moist; strong medium and coarse angular blocky structure; few fine roots; few very fine interstitial pores; continuous moderately thick and thick clay films on faces of peds and lining pores; red mottles are mainly soft plinthite with a firm moist consistence; extremely acid (pH 4.1); diffuse wavy boundary. (5 to 20 inches thick)

t 1 23--50 to 63 inches; brownish yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; common fine and medium prominent white (10YR 8/2) mottles, light gray (10YR 7/2) moist; strong medium and coarse angular blocky structure; hard, firm, sticky and plastic; few fine roots; common very fine interstitial pores; continuous moderately thick and thick clay films on faces of peds and lining pores; 10 percent very hard red (2.5YR 4/6) nodules (5-60mm); very strongly acid (pH 4.5).

TYPE LOCATION: Mendocino County, California; about 1,900 feet north and 400 feet west of the southeast corner of section 21, T.17 N., R.17 W., MDBM, Mendocino quadrangle.

RANGE IN CHARACTERISTICS: Depth of solum is greater than 60 inches. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter soil temperature varies from 6 to 9 degrees F. The soil between the depths of 7 and 21 inches is moist in all parts from November 1 to August 15 and is dry in some part from September 1 to October 1 in most years. The particle-size control section averages 35 to 45 percent clay. Reaction is extremely or very strongly acid (pH 4.1 to 5.0).

The E horizon is 10YR 5/1, 6/1, 6/2, 7/2, 7/3 or 7/4. Moist color is 10YR 5/1, 5/2, 5/3, 6/1, 6/2 or 6/3. Clay content ranges from 7 to 15 percent. The horizon may be slightly smeary and may be slightly brittle when moist. Iron nodules range from 2 to 15 percent and are 2 to 30 mm in diameter.

The BE horizon is 10YR 6/4, 6/6, 7/1, 7/4; 7.5YR 5/8 or 6/6. Moist colors are 10YR 5/4, 6/2, 6/6 or 6/8. The horizon is often variegated. It is loam or sandy clay loam. Clay content ranges from 10 to 27 percent. The horizon may be slightly smeary and may be slightly brittle when moist. Iron nodules range from 0 to 15 percent and are 2 to 40mm wide.

The Bt horizon is 5Y 6/1,7/1; 2.5Y 6/1, 7/1; 10YR 6/4, 6/6, 7/1, 7/2, 7/4 or 7/6. Moist color is 5Y 5/1, 6/1, 7/1; 2.5Y 5/2, 5/4, 6/2; 10YR 5/4, 5/6, 6/4, 6/6, 6/8 or 7.5YR 5/8. Mottle colors are 2.5Y 7/2; 10YR 8/1, 8/2; 7.5YR 4/6, 5/6, 5/8; 5YR 5/8 or 10R 4/6, 4/8. Moist mottle colors are 2.5Y 6/2, 7/2; 10YR 5/8, 6/4, 7/2, 8/2; 7.5YR5/8; 10R 4/6, or 4/8. Redox depletions (grayish colors) occur with redox concentrations (reddish colors) in a regularly occurring reticulate pattern. This pattern occurs within a depth of 15 to 30 inches and continues to 60 inches or more. It is loam, clay loam, clay, or sandy clay. Clay content ranges from 20 to 60 percent. The horizon contains 0 to 20 percent soft plinthite. Iron nodules ranges from 0 to 15 percent and are 2 to 60 mm in size. Base saturation (sum) ranges from 10 to 35 percent.

COMPETING SERIES: This is the Vondergreen series. Vondergreen soils are 40 to 60 inches to a paralithic contact and have values of 2 to 4 in the A horizon..

GEOGRAPHIC SETTING: The Shinglemill soils occur on marine terraces. Slopes are 2 to 15 percent. Elevations are 200 to 750 feet. The soils formed in marine sediments. The climate is humid with cool foggy summers and cool moist winters. A strong marine influence limits the diurnal and annual range of temperature. Mean annual precipitation varies from 40 to 65 inches. Mean January temperature is 48 degrees F., mean July temperature is 57 degrees F., and mean annual temperature is 53 degrees F. The frost-free period is 270 to 330 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Aborigine, Blacklock, Gibney and Gibwell soils. All occur on marine terraces. Aborigine soils have colors with chromas of 2 or less between the surface and depth of 10 inches. Blacklock soils are shallow to an iron cemented hardpan. Gibney soils have mottles with chromas of 2 or less between a depth of 30 and 50 inches. Gibwell soils lack mottling.

DRAINAGE AND PERMEA1 ILITY: Poorly drained. The soil is saturated with water for extended periods following episodes of heavy rain from December through April. The saturated zone starts between the depths of 10 and 30 inches and extends to greater than 60 inches from summer through early fall. Surface runoff under bare soil conditions is slow or medium; slow permeability.

USE AND VEGETATION: This soil is used for wildlife habitat, watershed, recreation and homesite development. Vegetation consists of Bishop pine, Mendocino cypress, California huckleberry, glossyleaf manzanita, rhododendron

and bear grass.

DISTRI1 UTION AND EXTENT: Northern coastal California. The series is not extensive. MLRA 4.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSI1 LE: Davis, California

SERIES ESTA1 LISHED: Mendocino County, California, Western part, 1993.

REMARKS:

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - zone from 0 to 3 inches - (E horizon)

Argillic horizon - zone from 8 to 63 inches (Bt1, Bt2, Btv1, Btv2, Btv3)

Aquic feature - saturation and redox depletions in the upper part of the Bt horizon.

The activity class was added to the classification in February of 2003. Competing series were not checked at that time. - ET

National Cooperative Soil Survey
U.S.A.

Established Series
Rev. CAR-CEJ-JJJ-ET
03/2003

VANDAMME SERIES

The Vandamme series consists of deep, well drained soils formed in material weathered from sandstone or mudstone. Vandamme soils are on marine terraces and upper sideslopes of hills and have slopes of 2 to 75 percent. The mean annual precipitation is about 55 inches and the mean annual air temperature is about 53 degrees F.

TAXONOMIC CLASS: Fine, mixed, active, isomesic Typic Haplohumults

TYPICAL PEDON: Vandamme loam - on an east facing convex slope of 9 percent under redwood, Douglas-fir, huckleberry and swordfern at 860 feet elevation. (Colors are for dry soil unless otherwise stated. When described on July 29, 1980 the soil was moist below 8 inches).

0i--1 inch to 0; litter of redwood and tanoak leaves and twigs.

A1--0 to 2 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; strong fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine and common fine and medium roots; many fine interstitial and few fine tubular pores; moderately acid (pH 5.7); clear smooth boundary. (2 to 4 inches thick)

A2--2 to 4 inches; light yellowish brown (10YR 6/4) loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and common fine and medium roots; many fine interstitial and few fine tubular pores; strongly acid (pH 5.2); clear wavy boundary. (2 to 4 inches thick)

ABt--4 to 9 inches; brownish yellow (10YR 6/6) loam, dark yellowish brown (10YR 4/6) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; many fine interstitial and few fine tubular pores; very few thin clay films on peds and in pores; very strongly acid (pH 5.0); gradual wavy boundary. (5 to 7 inches thick)

Bt1--9 to 14 inches; light brown (7.5YR 6/4) clay loam, strong brown (7.5YR 4/6) moist; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine interstitial and few fine and medium tubular pores; common thin clay films on peds and in pores; very strongly acid (pH 5.0); gradual wavy boundary. (5 to 10 inches thick)

Bt2--14 to 20 inches; reddish yellow (7.5YR 6/6) clay, strong brown (7.5YR 4/6) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; common fine interstitial and few fine and medium tubular pores; many thin and common moderately thick clay films on peds and in pores; very strongly acid (pH 5.0); gradual wavy boundary. (5 to 10 inches thick)

Bt3--20 to 25 inches; strong brown (7.5YR 5/6) clay, strong brown (7.5YR 4/6); moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and plastic; common fine and medium and few coarse roots; common fine interstitial and common fine and medium tubular pores; many thin clay films on peds and common moderately thick clay films on peds and in pores; strongly acid (pH 5.1); gradual wavy boundary. (5 to 16 inches thick)

Bt4--25 to 42 inches; variegated brownish yellow (10YR 6/8) and strong brown (7.5YR 5/6) clay loam, yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few coarse roots; common fine interstitial and common fine and medium tubular pores; many moderately thick clay films on peds and common thick clay films in pores; very strongly acid (pH 4.9); gradual irregular boundary. (15 to 20 inches thick)

Crt--42 to 59 inches; variegated brownish yellow (10YR 6/8) and strong brown (7.5YR 5/6) soft sandstone, yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) moist; few very fine roots along fracture planes; many thick and common moderately thick clay films along fracture planes; rock slakes in water.

TYPE LOCATION: Mendocino County, California; about 8 miles east of Fort Bragg on Highway 20; about 500 feet south and 1200 feet east of the northwest corner of sec. 6, T.17N., R.16W.; Comptche, SW quadrangle.

RANGE IN CHARACTERISTICS: Depth to a paralithic contact is 40 to 60 inches. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter soil temperature is 3 to 6 degrees F. The soil between the

depths of 6 to 19 inches is moist in all parts from November 1 to August 15 and is dry in some part from September 1 to October 1 in most years. The particle-size control section averages from 35 to 45 percent clay. Gravel content ranges from 0 to 10 percent.

The A horizon is 10YR 6/2, 6/3, 6/4, 6/6, 7/3, 7/4. Moist color is 10YR 3/2, 3/3 4/6. It is loam or sandy loam with 10 to 27 percent clay. Organic carbon content ranges from 2 to 5 percent. Base saturation (sum) ranges from 25 to 45 percent. Reaction is strongly or medium acid.

An E horizon is present at the surface in some pedons. It is 10YR 7/1, 7/2 or 8/1. Moist color is 10YR 6/1, 6/2 or 7/2. It is sandy loam with 10 to 20 percent clay. Reaction is strongly or moderately acid.

The Bt horizon is 10YR 6/8; 7.5YR 5/6, 6/4, 6/6, 6/8, 7/6, 7/8; 5YR 5/6, 6/6. Moist color is 10YR 5/8; 7.5YR 4/4, 4/6, 5/6, 5/8; 5YR 4/8, 5/6, 5/8. It is clay or clay loam with 35 to 50 percent clay. Organic carbon content ranges from 0.9 to 2 percent in the upper 16 inches of the Bt horizon. Base saturation (sum) ranges from 5 to 35 percent. Reaction is very strongly acid or strongly acid.

The Cr horizon is highly weathered saprolitic sandstone or mudstone that slakes in water.

COMPETING SERIES: These are the Bullgulch (T OR), Hunterscove (T OR), Loeb (T OR), Macklyn (T OR), Quinliven (CA) Wadecreek (OR) and Winchuck (OR) series. Bullgulch, Wadecreek and Winchuck soils are very deep and have an umbric epipedon, in addition Winchuck soils have gravelly or very gravelly C horizons. Hunterscove and Macklyn soils are 20 to 40 inches to paralithic contact. Loeb soils have an umbric epipedon and have more rock fragments in the control section. Quinliven soils are very deep.

GEOGRAPHIC SETTING: The Vandamme soils occur on broad ridges and upper sideslopes of hills. Slopes are 2 to 75 percent. Elevations are 80 to 1000 feet. The soils formed in material weathered from soft sandstone. The climate is humid with cool foggy summers and cool moist winters. A strong marine influence limits the annual and diurnal range in temperature. Mean annual precipitation ranges from 40 to 70 inches. Mean January temperature is about 50 degrees F.; mean July temperature is about 55 degrees F.; and the mean annual temperature is about 53 degrees F. The frost-free season is 290 to 365 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Dehaven, Hotel, Irmulco, Tramway and Threechop soils. Dehaven, Hotel, Irmulco and Tramway soils occur on mountain sideslopes. Dehaven and Hotel soils formed from hard sandstone and have loamy-skeletal particle-size control sections. Irmulco and Tramway soils have fine-loamy particle-size control sections. Threechop soils occur in similar landscape positions as Vandamme but are farther from the ocean and have an ustic soil moisture regime.

DRAINAGE AND PERMEABILITY: Well drained; surface runoff under bare soil conditions is slow through very rapid. Slow permeability.

USE AND VEGETATION: This soil is used for commercial timber production and as wildlife and watershed. Natural vegetation consists of redwood, Douglas-fir, grand fir, tanoak, huckleberry, swordfern, and oxalis.

DISTRIBUTION AND EXTENT: Northern coastal California. Soil occurs in the zone of strong marine influence. The series is not extensive. MLRA 4.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, Western Part, 1993.

REMARKS:

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon -- 0 to 4 inches (A1, A2) Clay content by field texture was estimated to be about 30 percent.
Argillic horizon -- 9 to 42 inches (Bt1, Bt2, Bt3, Bt4).

Many areas mapped as Vandamme soils were mapped as Mendocino or Josephine soils by the California Soil-Vegetation survey 1947-1950.

The activity class was added to the classification in February of 2003. Competing series were not checked at that time. - ET
ADDITIONAL DATA: NSSL pedon S80CA-045-013. (type location)

Established Series
Rev. CAR-JWH-ET-KP
12/2022

WITHERELL SERIES

The Witherell series consists of very deep, somewhat excessively drained soils formed in material weathered from sandstone. Witherell soils are loamy in the upper part of the profile with fragmental gravel in the lower. These soils are on hills and mountains and have slopes of 5 to 75 percent. The mean annual precipitation is about 1500 millimeters (50 inches) and the mean annual temperature is about 14 degrees C (57 degrees F.).

TAXONOMIC CLASS: Fragmental, mixed, thermic Typic Haploxerepts

TYPICAL PEDON: Witherell loam - on a south facing convex slope of 30 percent under annual grasses at 550 feet elevation. (Colors are for dry soil unless otherwise noted. When described June 14, 1978, the soil was dry throughout.)

A--0 to 3 centimeters (0 to 1 inch); brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, nonsticky and nonplastic; many very fine and common fine roots throughout; common very fine and fine interstitial pores; 5 percent gravel (2 to 5 millimeters); strongly acid (pH 5.2); clear wavy boundary. (3 to 8 centimeters thick)

Bw--3 to 18 centimeters (1 to 7 inches); light yellowish brown (10YR 6/4) loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine and common fine roots; few very fine and fine interstitial pores; 5 percent gravel (2 to 5 millimeters); very strongly acid (pH 4.9); clear wavy boundary. (10 to 20 centimeters thick)

Bt--18 to 30 centimeters (7 to 12 inches); light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and common fine roots; few very fine and fine interstitial pores; few faint clay films bridging mineral grains; 5 percent gravel (2 to 10 millimeters); many faint silt coatings lining pores; very strongly acid (pH 4.8); clear wavy boundary. (10 to 20 centimeters thick)

C--30 to 200 centimeters (12 to 79 inches); gray (10YR 5/1) gravel, strongly cemented fractured sandstone; fractures are 0.5 centimeters to 10 centimeters apart and are less than 1 millimeters wide; many faint silt coatings lining fracture faces; few very fine roots in fractures; 95 percent angular gravel, rock is mostly fractured in place.

TYPE LOCATION: Mendocino County, California; about 1 mile south of Boonville; about 1/2 mile west on Hutsell Road from the intersection of Hutsell Road and Highway 128, about 1,000 feet southwest from feeder barn; 500 feet north and 200 feet west of the southeast corner of section 11, T.13 N., R.14 W.; Ornbaun Valley Northeast Quadrangle; 38.994385 latitude and -123.3651116lonitude, 468381.8mE, 4316216.9mN, zone 10 NAD 83.

RANGE IN CHARACTERISTICS:

Soil moisture: The soil from a depth of 18 centimeters (7 inches) to lithic material is moist in all parts from November 1 to May 1 and is dry in all parts from June 1 to October 15 in most years.

Soil temperature: 15 to 19 degrees C.

Depth to fragmental material with fractures less than 10 centimeters apart is 25 to 36 centimeters.

A horizon:
Hue: 10YR or 7.5YR
Value: 5 or 6 dry, 3 or 4 moist
Chroma: 3 through 6 dry, 3 or 4 moist
Reaction: strongly acid through neutral.
Clay content: 12 to 27 percent
Texture of the fine earth: sandy loam or loam
Coarse fragment content: 0 to 15 percent gravel

B horizons
Hue: 10YR or 7.5YR
Value: 5 through 7 dry, 3 or 4 moist
Chroma: 3 through 6, dry or moist

Clay content: 12 to 30 percent
Texture of the fine earth: sandy loam, clay loam, or loam
Rock fragment content: 0 to 25 percent gravel
Reaction: very strongly through slightly acid

C horizon
Texture: gravel
Clay content: 12 to 27 percent in the fine earth fraction. Texture of the fine earth: sandy loam or loam
Rock fragment content: 91 to 95 percent gravel

COMPETING SERIES: There are no other series in the family.

GEOGRAPHIC SETTING: Witherell soils occur on hills and mountains. Slopes are 5 to 75 percent. Elevations are 90 to 1220 meters (300 to 4,000 feet). The soils formed in material weathered from sandstone. The climate is subhumid with hot dry summers and cool moist winters. Mean annual precipitation varies from 900 to 1780 millimeters (35 to 70 inches). Occasional snow occurs above 3,000 feet. Mean January temperature is 7 degrees C. (44 degrees F); mean July temperature is 22 degrees C. (72 degrees F); and mean annual temperature is 14 degrees C. (57 degrees F). The frost-free period is 125 to 280 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Bearwallow, Hellman, Hopland, and Frogwoman soils. All of these soils are over 50 centimeters deep to a paralithic or lithic contact.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Somewhat excessively drained; surface runoff under bare soil conditions is moderate to high; moderately high to high saturated hydraulic conductivity.

USE AND VEGETATION: This soil is used for livestock grazing and wildlife habitat. Vegetation is annual grasses and forbs.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is not extensive. MLRA 5 and 15.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Mendocino County, California, Eastern Part, 1985.

REMARKS: This soil was reclassified in January 2008 due to the presence of bedrock with cracks mostly closer together than 10 centimeters and coatings on the rock fragments. The soil lacks a lithic contact but has material weathered from residuum. The original concept had fractured bedrock within 25 to 50 centimeters. In order to not have a contrasting particle size control section, depth to the fragmental material is restricted to 25 to 36 centimeters.

Diagnostic horizons and features recognized in this pedon are:

1. Ochric epipedon: the zone from 0 to 3 centimeters. (A horizon)
2. Cambic horizon: the zone from 3 to 30 centimeters (Bw, Bt horizons) There is a slight increase in clay content over the A horizon, but it is not enough to meet the requirements of an argillic horizon.
3. Particle-size control section - the zone from 25 to 100 centimeters centimeters has 1 percent clay by weight, and 89 percent gravel by volume. (Bt and C horizons)
4. Fragmental material - the zone from 30 to 200 centimeters (C horizon)

Where Witherell is used in MLRA 15, it needs to be re-examined.