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Overview of the forest vegetation of the Sierra Nevada Range (California, USA)

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Zusammenfassung

Die Sierra Nevada ist ein bedeutsamer 400 Kilometer langer und 60 Kilometer breiter Gebirgszug im Westen der Vereinigten Staaten von Amerika zwischen Kalifornien und Nevada. Der Mount Whithney erreicht hier mit 4421 Metern Meereshöhe die höchste Erhebung und die 100 Millionen Jahre alten Granite im Yosemite-Nationalpark bezeugen die alten Gesteinsformationen der Sierra.

Die Sierra Nevada ist in weiten Teilen der Hochlagen geprägt von verschiedenen Nadelholzformationen mit speziellen Waldgesellschaften, dominiert von *Tsuga mertensiana* oder von *Pinus albicaulis* bzw. *Pinus contorta* subsp. *murrayana* und dem Reliktendemiten *Sequoiadendron giganteum*. Im Osten der Sierra Nevada herrschen *Pinus jeffreyi*- und *Juniperus grandis*-Waldgesellschaften vor. Verschiedene Gehölzformationen mit diesen Nadelbaumarten werden hier nach verschiedenen Höhenstufen sowie nach Lee- und Luvlagen geordnet beschrieben.

Dazu kommen weitere Pflanzengesellschaften der potentiellen natürlichen Vegetation der Sierra Nevada, vor allem solche aus dem thermophilen Vegetationskreis, wie verschiedene immergrüne Wälder aus der Vegetationsklasse der *Heteromelo arbutifoliae-Quercetea agrifoliae* (z.B. *Quercion douglasio-wislizenii*- und *Quercion duratae*-Waldgesellschaften). Neu beschrieben wird hier als Associatio Nova das *Querco kelloggii-Pinetum pacificae* Rivas-Martínez & Sánchez-Mata 2012 und diese neue Assoziation wird entsprechend als Lectotypus validiert.

Abstract

The Sierra Nevada is an important mountain range in the western American states of California and Nevada. The Sierra runs 400 miles from north to south, and is approximately 60 miles across from east to west. Notable features of the Sierra include Lake Tahoe, the largest alpine lake in North America; Mount Whitney (4421 m), the highest point in the contiguous United States; and Yosemite Valley, which was sculpted by glaciers out of granite 100 million years old. Among other protected areas, the Sierra is home to three national parks: Yosemite, (Giant) Sequoia and Kings Canyon National Parks.

The main vegetation types covering the territories in the Sierra are conifer forests. The highest summits throughout the Sierra are non-forested cryoromediterranean areas, while pine-oak woodlands grow over broad areas in the foothills, in contact with California's adjacent Central Valley. The diversity of forest vegetation is higher on the western side of the Sierra than in the east, where the rainfall decreases dramatically; forest formations in the western side include diverse pine and fir forests, and the high mountain areas contain woodlands of mountain hemlock (*Tsuga mertensiana*), whitebark pine (*Pinus albicaulis*), and lodgepole pine (*Pinus contorta* subsp. *murrayana*); Sierra (giant) sequoia (*Sequoiadendron giganteum*) also grows in this mountain area, forming spectacular and localized old-growth forests. The

eastern side of the Sierra is covered mainly by open forests of Jeffrey pine (*Pinus jeffreyi*) and Sierra juniper (*Juniperus grandis*). All these forests are characterized by their bioclimatic features and particular floristic composition.

A pine-oak forest type – *Querco kelloggi-Pinetum pacificae* – is proposed for the first time as a new phytosociological association in the Sierra Nevada, in addition to three new nomenclatural taxonomic status: *Pinus ponderosa* subsp. *pacifica* for the California ponderosa pine; *Pinus austrina* for the southern Sierra foxtail pine; and *Abies critchfieldii* for the Critchfield fir.

1. Some historic, geographic and geological notes

The Sierra Nevada range is the largest physical geographic region in California, extending north-south throughout the eastern part of the state and evolving eastward into some areas of the adjacent state of Nevada.

The range was so named by early Spanish explorers who saw it from near the mouth of the Sacramento River and European to sight the range was Pedro Fages in 1772 during his explorations as military governor of New California (Alta California) in the period 1770-1774. The first description of the Sierra Nevada range appears in the field diaries (April, 1776) of the Franciscan friar and geographer Fray Pedro Font during Juan Bautista de Anza's second expedition to Alta California (TEGGART 1913; BOLTON 1930, 1933). These diaries include a useful map (John Carter Brown Library, Brown University, Providence, Rhode Island) dating from 1776 where for the first time this mountain range is clearly shown under the designation of *Sierra Nevada* (COUES 1900).

The physiographical features of the Sierra Nevada include a broad network of river basins that capture much of the water in the state flowing westward to the Central Valley and draining into the Bay Area (San Francisco Bay complex). The elevation increases gradually from west to east, from California's Central Valley to the summits, while the eastern slope forms the steep escarpment to the east (Sierra Escarpment) which helps create the more xeric regions eastward towards the state of Nevada within the biogeographical region of the Great Basin.

All the major rivers drain westward, and some have carved out fairly deep canyons separated by broad uplands. The whole range is drained on its northwest slopes by the Sacramento River (including its multiple branches) and to the west-southwest by the San Joaquin River, the two major central watercourses that run to the Pacific Ocean discharging in the Bay Area. Smaller rivers on the western slope include the Feather, Yuba, American, Mokelumne, Stanislaus and Tuolumne; the southern part of the range is drained by four rivers: Kings, Kaweah, Tule, and Kern. Lake Tahoe (known for its exceptionally clear water) is a down-faulted lake on the eastern side of the main Sierra crest. It is drained by the Truckee River, which flows east through the Reno area and ends in Pyramid Lake, in one of the interior drainage basins in central Nevada. South of Lake Tahoe, the rivers have not yet cut back all the way to the east, so the crest is high, relatively uniform and unbroken. To the east, there are numerous small rivers that flow out into the Great Basin of Nevada and eastern California. The geological history that created the Sierra Nevada began a little over 200 million years ago, when the granite rocks – formed during the Mesozoic Era – that make up most of the Sierra Nevada began to be embedded into the crust from below. The mountain range is a tilted, uplifted massive fault block with a gradually sloping western face and a very steep eastern one. Most of the uplift was produced by faulting along the eastern side, which has elevated the whole range and lowered the Owens Valley, producing a difference in elevation of over two miles.

The spectacular scenery in the modern Sierra Nevada was shaped by repeated glaciations during the Pleistocene ice ages. At the time of the last glacial maximum, about 20,000 years

ago, most of the Sierra crest from the Feather River drainage in the north to Mount Whitney was covered by glaciers. Glaciers flowed down river valleys forming the characteristic U-shape, with Yosemite Valley as a dramatic example of this process; glaciers have also produced other geomorphological forms throughout the range, which can be seen in today's panoramic views along the highlands.

Notable features of the Sierra Nevada range include, in addition to Lake Tahoe – the largest alpine lake in North America –: Mount Whitney (4421 m), the highest point in the contiguous United States; and the Yosemite Valley, sculpted by glaciers out of granite with an age of 100 million years. Among other protected areas the Sierra is home to three national parks: Yosemite, (Giant) Sequoia, and Kings Canyon National Parks.

2. Biogeography and Bioclimatology

Biogeography

Modern biogeographical approaches and the typology of the whole area of the state of California, mainly based on vegetation-series distribution, began to be published in the late 1990s (RIVAS-MARTÍNEZ 1997, RIVAS-MARTINEZ, SÁNCHEZ-MATA & COSTA 1999), and were later compiled (SÁNCHEZ-MATA 2007, Map 1). The typology is now being revisited and a new approach is under review. Basically, we consider four biogeographical regions throughout the territories of the state of California: three framed within the Holarctic kingdom: Californian, Great Basin and Rocky Mountains; and one within the Neotropical-Austroamerican kingdom: Mexican-Xerophytic region. Within the Californian region (mainly the territories with a pluviseasonal oceanic Mediterranean bioclimatic character) we will consider four biogeographical provinces: North Californian, Central Valley, Sierra Nevada, and South Californian. The Sierra Nevada province includes two biogeographical sectors: northern and southern.

Bioclimatology

The bioclimatic concepts and terminology follow the recent worldwide compendium published by RIVAS-MARTÍNEZ, RIVAS SÁENZ & PENAS (2011).

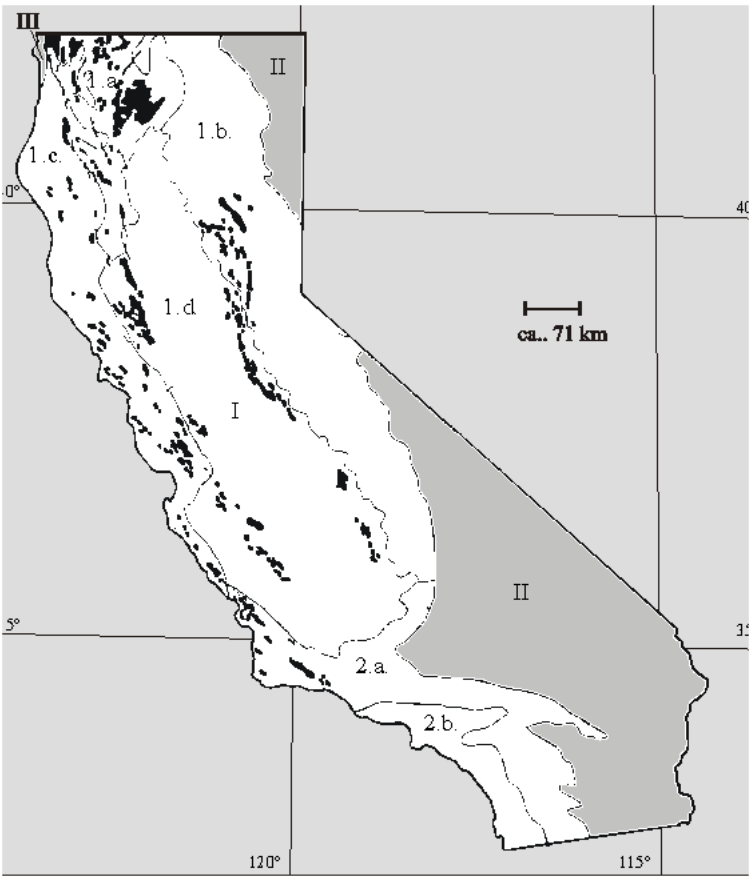
The Mediterranean type is the most broadly distributed macrobioclimate that can be recognized throughout the state of California. The temperate macrobioclimate only exists in the northwest corner of the state along the Pacific coast toward Oregon, and in the high mountains of the Klamath-Siskiyou ranges, including Mount Shasta and surrounding areas. The tropical macrobioclimate is restricted to some areas of the south-eastern corner of the state (SÁNCHEZ-MATA & RIVAS-MARTÍNEZ 2011).

The diversity of Mediterranean thermotypes in the Sierra Nevada includes mesomediterranean throughout the foothills in contact with the lands in the Great Valley; supramediterranean at higher altitudes (starting at an altitude of 750-800 m up to 1750-1800 m approx.); oromediterranean (high mountain areas); and cryoromediterranean only in the highest summits. The ombrotypes range from dry to hyperhumid.

Figures 1 and 2 show some bioclimatic diagrams from selected climatic stations located throughout the Sierra Nevada range, with particular reference to recognized thermotypes and ombrotypes. There is a close relationship with the bioclimatic features and existing forest vegetation as natural potential vegetation:

West side of the Sierra upward from the Great Valley to Lake Tahoe

– Auburn (394 m): low mesomediterranean, upper subhumid (Fig. 1). Forest vegetation: foothill (gray) pine-blue oak woodlands (*Pino sabinianae-Quercetum douglasii*, *Heteromelo arbutifoliae-Quercetea agrifoliae* class).



Map 1: Biogeographical map of the Californian Region (I) with the distribution of the main ultramafic (serpentine) outcrops (black areas). The biogeographical limits follow the proposals of RIVAS-MARTÍNEZ, SÁNCHEZ-MATA & COSTA (1999) and the geological information is from KRUCKEBERG (1984) (II. Great Basin Region; III. Rocky Mountain Region) North California Province: I.1.a. Klamath-Ciscascadian Sector; I.1.b. Sierra Nevada-Transcascadian Sector; I.1.c. North Californian Coastal Sector; I.1.d. California Great Valley Sector. South California Province: I.2.a. South Californian Ranges Sector; I.2.b. South California Coast & Channel Islands Sector. The present map was adapted from SÁNCHEZ-MATA (2007).

– Grass Valley (732 m): upper mesomediterranean, low humid (Fig. 1). Forest vegetation: California ponderosa pine-California black oak forests (*Querco kellogii-Pinetum pacificae*, *Calocedro decurrentis-Pinetea jeffreyi* class).

– Calaveras Big Trees (1431 m): upper supramediterranean, low hyperhumid (Fig. 1). Forest vegetation: Sierra Sequoia (California Big Tree, Giant Sequoia) forests (*Corno nuttallii-Sequoiadendretum gigantei*, *Calocedro decurrentis-Pinetea jeffreyi* class).

– Blue Canyon (1609 m): low supramediterranean, low hyperhumid (Fig. 2). Forest vegetation: Sierra white fir forests (*Castanopsio sempervirentis-Abietetum lowianae*, *Calocedro decurrentis-Pinetea jeffreyi* class).

– Truckee RS (1835 m): low oromediterranean, low subhumid (Fig. 2). Forest vegetation: California red fir forests (*Abietetum magnificae*, *Calocedro decurrentis-Pinetea jeffreyi* class).

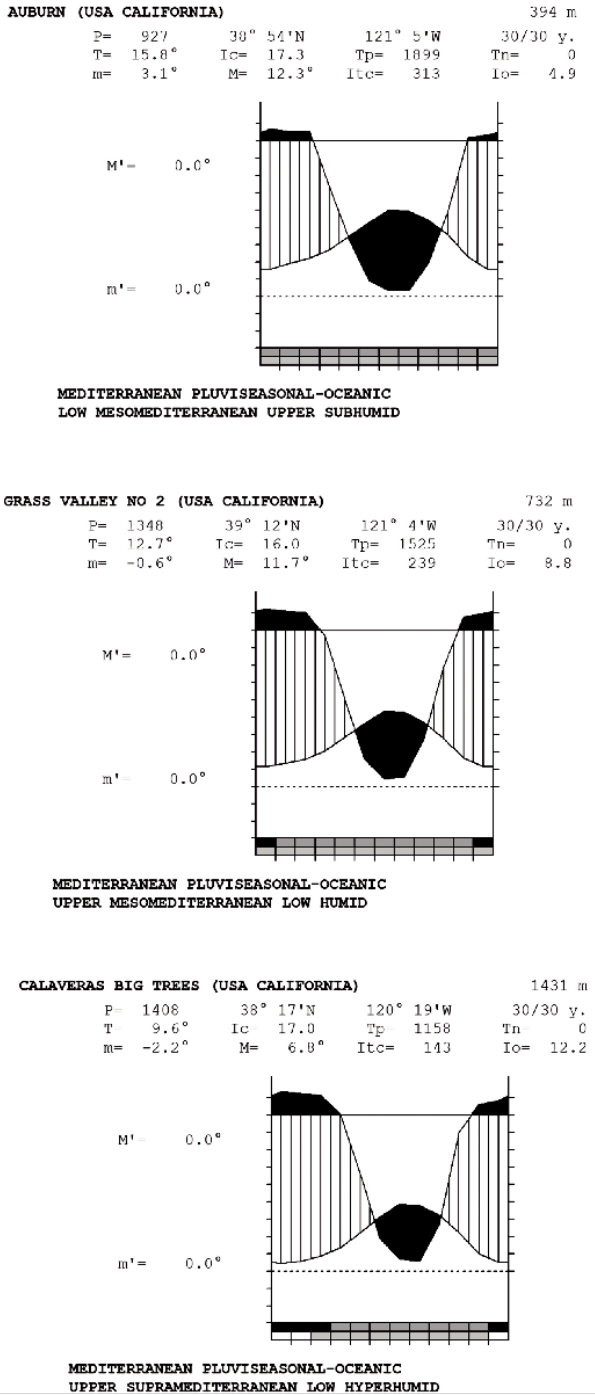


Fig. 1: Bioclimatic diagrams from selected California climatic stations located in northern Sierra Nevada: Auburn (Placer County), Grass Valley (Nevada County) and Calaveras Big Trees State Park (Calaveras County).

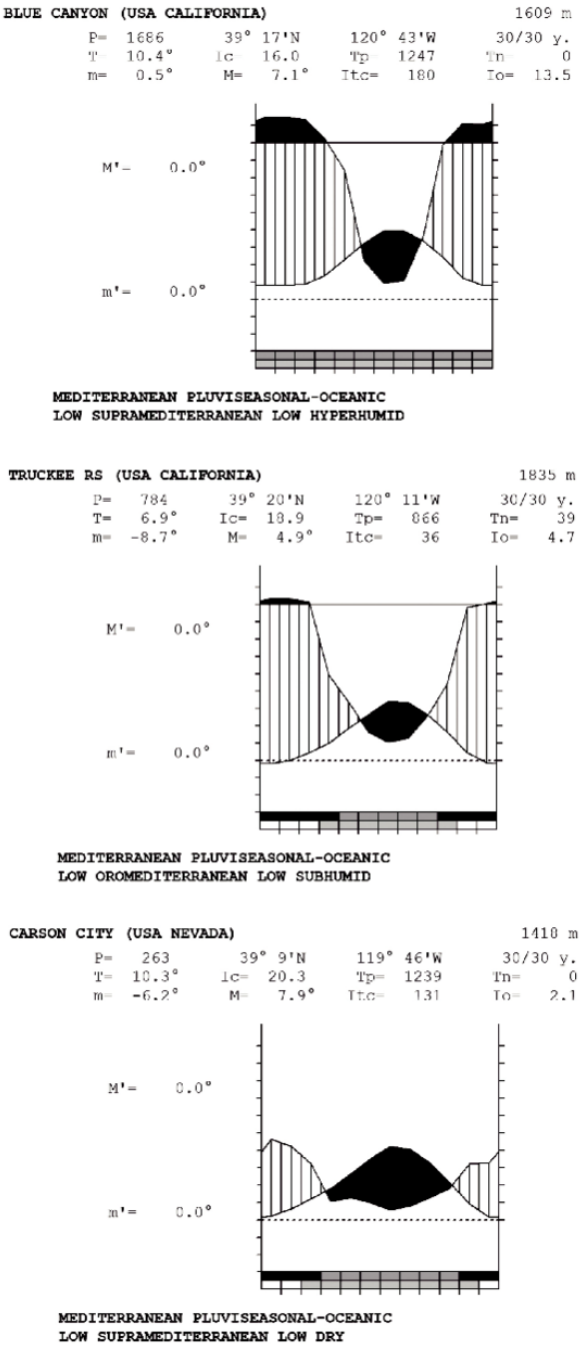


Fig. 2: Bioclimatic diagrams from selected California climatic stations located in northern Sierra Nevada Range: Blue Canyon (Placer County), and Truckee (Nevada County). The station of Carson City is located in the state of Nevada eastward of Lake Tahoe (Consolidated Municipality of Carson City).

Eastern side of the Sierra

– Carson City (1418 m): low supramediterranean, low dry (Fig. 2). Forest vegetation: Sierra juniper-Jeffrey pine forests (*Junipero australis-Pinetum jeffreyi*, *Calocedro decurrentis-Pinetea jeffreyi* class).

Snow is frequent in the landscapes of the Sierra in winter above areas with supramediterranean thermotypes. Precipitation – mostly snow – falling in the Sierra Nevada provides most of the water that is delivered around California for agricultural and urban uses. Snow pack is a relatively efficient way of storing water. As a result, the water in the winter snow pack is stored for several months before it melts, delaying peak runoff and keeping more water available through the summer dry season.

3. Nomenclature

Taxonomic nomenclature

Throughout this brief contribution the taxonomic criteria and nomenclature follow the proposals of the recently published second edition of *The Jepson Manual* (BALDWIN et al. 2012), except for the genus *Abies* Miller (Pinaceae), with the California white fir *Abies lowiana* (Gordon) A. Murray bis and the Shasta red fir *Abies shastensis* (Lemmon) Lemmon given the consideration of species; we consider the taxonomic rank of subspecies for the grass *Elymus elymoides* subsp. *californicus* (J.G.Sm.) Barkworth. Furthermore, the following new nomenclatural taxonomic status is proposed for California ponderosa pine, southern Sierra foxtail pine, and Critchfield fir:

– *Pinus ponderosa* subsp. *pacifica* (J.R. Haller & N.J. Vivrette) Rivas-Martínez & Sánchez-Mata, stat. nov. Bas.: *Pinus ponderosa* var. *pacifica* J.R. Haller & N.J. Vivrette in Aliso 29(1): 55. 2011.

– *Pinus austrina* (R.J. Mastrog. & J.D. Mastrog.) Rivas-Martínez & Sánchez-Mata, stat. nov. Bas.: *Pinus balfouriana* subsp. *austrina* R.J. Mastrog. & J.D. Mastrog. in Syst. Bot. 5(1): 102. 1980.

– *Abies critchfieldii* (Lanner) Rivas-Martínez & Sánchez-Mat, stat. nov. Bas.: *Abies magnifica* var. *critchfieldii* Lanner in Madroño 57(2): 143. 2010.

Syntaxonomical nomenclature

For the vegetation syntaxonomy we follow the basic contribution and proposals of RIVAS-MARTÍNEZ (1997) and RIVAS-MARTINEZ & SÁNCHEZ-MATA (1997) for Californian potential natural vegetation with regard to forests and woodlands. The phytosociological nomenclatural aspects strictly follow the current issue of the International Code of Phytosociological Nomenclature (ICPN; WEBER et al. 2000).

4. Main forest phytosociological units and vegetation series

There is a strong elevation zonation of forest vegetation communities in the landscapes of the Sierra Nevada. The sequences and elevation distribution differ on the western and eastern slopes as a consequence of bioclimatic features and topography, as do those of the northern and southern Sierra territories.

The vegetational (natural potential vegetation) and altitudinal schemes of the forests and woodlands in the Sierra Nevada range are the following:

West side of the Sierra Nevada

– Mesomediterranean thermotype areas (Sierra foothills)

– Oak woodlands (*Quercion douglasio-wislizenii* alliance, *Heteromelo arbutifoliae-Quercetea agrifoliae* class) on different kind of soils (including some ultramafic soils).

– Leather oak chaparrals (*Quercion duratae* alliance, *Heteromelo arbutifoliae-Quercetea agrifoliae* class) on ultramafic soils derived from strongly serpetinized rocks.

– Upper mesomediterranean-supramediterranean thermotype areas

– Conifer forests (*Querco kelloggii-Abietion lowianae* alliance, *Calocedro decurrentis-Pinetea jeffreyi* class) on different kind of soils (including some ultramafic soils).

– Upper supramediterranean-oromediterranean thermotype areas

– Conifer forests: *Abietion magnificae* and *Querco vaccinifoliae-Pinion jeffreyi* alliances (ultramafic rocks), both framed within the *Calocedro decurrentis-Pinetea jeffreyi* class. This forest territory on the western slopes covers the elevation ranges where snowfall is generally highest, so the trees have had to adapt to heavy snow and deep, long-lasting snow packs mainly in the summit areas.

Two new trees have recently been described from territories with an oromediterranean thermotype throughout the highest mountains in the southern Sierra Nevada: *Pinus austrina* (sub *Pinus balfouriana* subsp. *austrina*) and *Abies critchfieldii* (sub *Abies magnifica* var. *critchfieldii*), which structure particular forest communities that we provisionally frame within the alliance *Abietion magnificae*. It is worth noting that –like the Shasta red fir (*Abies shastensis*) which is distributed throughout high mountain areas of the Shasta-Klamath-Siskiyou mountains in California – the Critchfield fir (*Abies critchfieldii*) has exserted cone bracts.

– Cryoromediterranean thermotype areas: plant communities structured by perennial herbs (potential natural vegetation) and azonal communities (permanent plant communities).

East side of the Sierra Nevada

– Oro-supramediterranean thermotype areas

– Jeffrey pine forests *(Arctostaphylo patulae-Pinion jeffreyi alliance, Calocedro decurrentis-Pinetea jeffreyi class)*

The main forest types of secondary forest vegetation throughout the Sierra landscapes comprise quaking aspen forests (*Populus tremuloides*). Groves of quaking aspens are found scattered throughout the high mountain conifer forests, and add bright touches of fall color.

New syntaxonomical proposal

Querco kelloggii-Pinetum pacificae Rivas-Martínez & Sánchez-Mata ass. nova hoc loco

(*Querco kelloggii-Abietion lowianae*, *Abietetalia magnifico-lowianae*, *Calocedro decurrentis-Pinetea jeffreyi*)

This newly proposed association includes the forest formations structured by California ponderosa pine (*Pinus ponderosa* subsp. *pacifica*) and California black oak (*Quercus kelloggii*) found throughout the areas of upper mesomediterranean to lower supramediterranean thermotype in the northern Sierra Nevada range reaching the landscapes of Yosemite National Park (Plate 1).

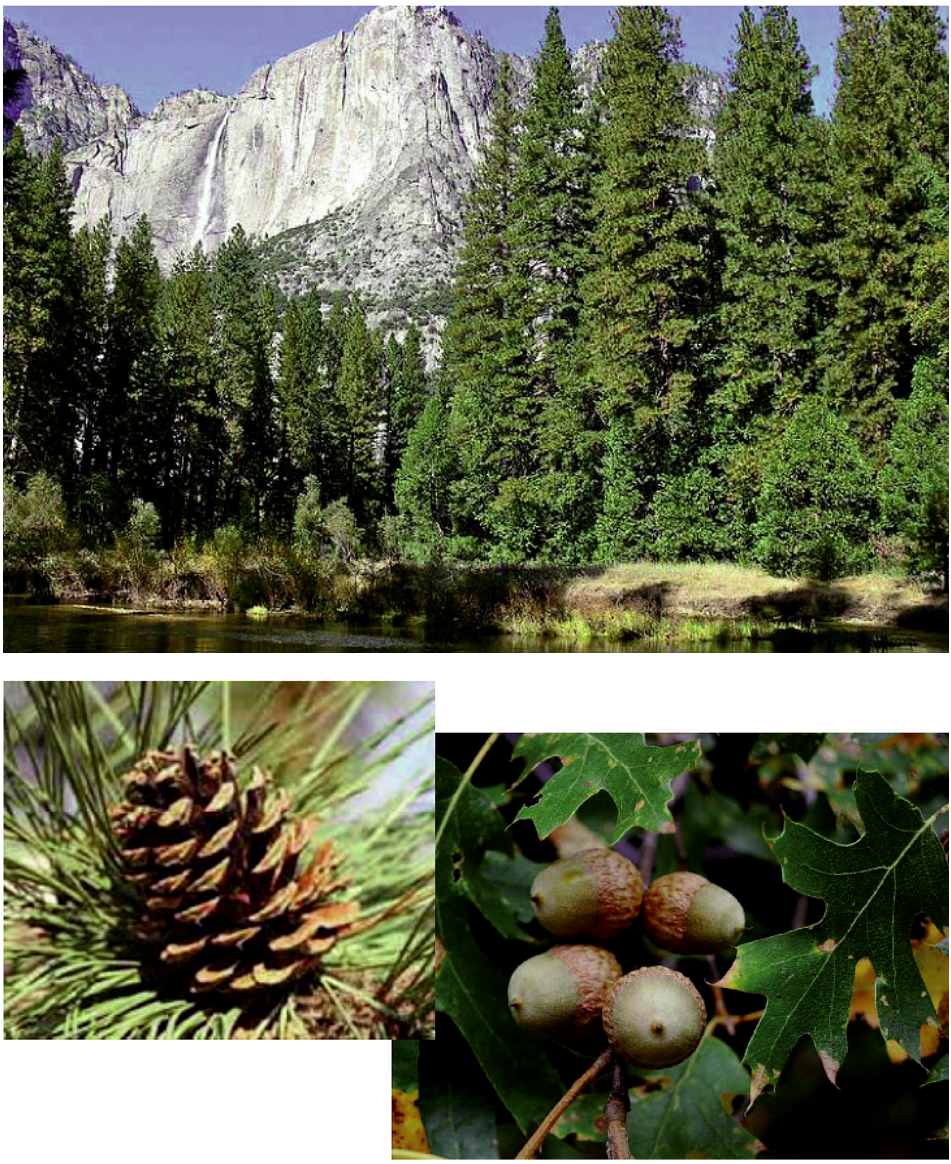


Plate 1: Above: California ponderosa pine forests (*Querco kelloggii-Pinetum pacificae*) in Yosemite Valley, Yosemite National Park (Mariposa County, California). Below, left: cone branch of California ponderos pine (*Pinus ponderosa* subsp. *pacifica*), and right: small branch of California black oak (*Quercus kelloggii*) with mature acorns.

These forests grow under subhumid (low humid) ombrotype conditions and are vegetationally located between the gray pine-blue oak woodlands toward the foothills of the mountain range (*Pino sabinianae-Quercetum douglasii*, *Quercion douglasio-wislizenii*), and the California white fir forests toward the mountain highlands (*Castanopsio sempervirentis-Abietetum lowianae*, *Querco kelloggii-Abietion lowianae*).

Table 1: ***Querco kelloggii-Pinetum pacificae*** Rivas-Martínez & Sánchez-Mata ass. nova (*Querco kelloggii-Abietion lowianae*, *Abietetalia magnifico-lowianae*, *Calocedro decurrentis-Pinetea jeffreyi*)

Altitude m 1 = 10	59	84	78	66	74	72	78	75	70	76	130	115	
Ordinal number	1	2	3	4	5*	6	7	8	9	10	11	12	S
Trees													
Pinus ponderosa subsp. *pacifica*	4	4	3	4	5	3	4	3	3	3	4	4	V
Quercus kelloggii	3	3	2	3	4	2	3	2	2	3	2	2	V
Quercus chrysolepis	.	1	+	1	+	2	+	1	1	1	1	.	V
Calocedrus decurrens	.	.	1	+	+	1	2	2	3	.	3	2	IV
Pseudotsuga menziesii	.	.	1	1	.	1	1	+	+	1	.	1	IV
Pinus lambertiana	.	+	.	.	.	1	+	.	+	+	1	1	III
Abies lowiana	.	+	+	.	.	.	.	.	.	.	1	1	II
Acer macrophyllum	.	.	.	1	.	+	.	+	+	.	.	.	II
Arbutus menziesii	.	.	.	.	.	.	1	+	1	.	.	+	I
Umbellularia californica	+	.			.	.	+	.	.	.	.	.	I
Characteristics													
Ceanothus integerrimus	1	2	.	1	2	1	1	.	.	1	1	1	IV
Polygala cornuta	.	.	+	2	.	2	+	+	.	.	2	1	III
Chamaebatia foliolosa	.	.	.	.	3	.	1	1	2	.	3	2	III
Hieracium albiflorum	.	.	.	1	+	1	.	.	.	1	2	.	III
Chimaphila menziesii	.	.	1	.	.	.	1	.	.	+	1	.	II
Ribes roezlii	.	.	.	.	+	.	.	.	+	+	.	1	II
Rosa woodsii subsp. *ultramontana*	.	.	.	.	.	.	1	1	1	.	.	1	II
Arctostaphylos patula	.	.	+	.	.	.	.	.	.	.	+	1	II
Lonicera hispidula	.	2	.	.	.	.	1	1	2	1	.	.	III
Arctostaphylos viscida	1	.	.	.	1	.	+		.	.	.	+	II
Heteromeles arbutifolia	1	.	.	.	.	.	+	1	1	.	.	.	II
Osmorhiza berteroi	.	.	.	1	.	.	.	.	.	+	1	1	II
Stipa lemmonii	.	1	.	.	.	.	.	.	.	1	+	.	I
Galium triflorum	.	.	.	.	1	.	.	.	.	1	1	.	I
Elymus elymoides subsp. *californicus*	+	.	.	.	.	.	.	.	.	1	.	.	I

Others: **Trees***: Quercus douglasii* +, *Quercus wislizeni* +, and *Pinus sabiniana* 1 in 12. **Characteristics**: *Melica harfordii* 2 in 1; *Apocynum androsaemifolium* 2 in 1, and 1 in 2; *Wyethia mollis* 1 in 2; *Dicentra formosa* 1 in 5; *Platanthera dilatata* var. *leucostachys* + and *Symphoricarpos mollis* 1 in 8; *Phoradendron juniperinum* 1 in 10; *Corylus cornuta* subsp. *californica* 2 in 12. **Companion species**: *Asarum hartwegii* 1 in 1; *Whipplea modesta* 2, *Ceanothus tomentosus* 1, *Comandra umbellata* subsp. *californica* 1, and *Prunus emarginata* + in 3; *Elymus glaucus* 1 in 5; *Arctostaphylos viscida* subsp. *mariposa* 1 in 7; *Dryopteris arguta*, *Quercus durata*, and *Rhamnus ilicifolia* + in 8; *Melica torreyana*, *Bromus laevipes*, *Melica californica*, *Eriophyllum lanatum* var. *grandiflorum*, *Galium porrigens*, and *Calochortus monophyllus* 1 in 8; *Frangula californica* subsp. *tomentella* and *Ribes cereum* + in 9; *Aristolochia californica* 1 in 11; *Ceanothus leucodermis*, *Arctostaphylos manzanita*,

Silene lemmonii, and *Keckiella lemmonii* 2 in 11; *Notholithocarpus densiflorus* var. *echinoides* 2, *Polystichum imbricans* 2, and *Goodyera oblongifolia* 1 in 12.

Localities -including relevé area (m^2), orientation, slope (%), average height of trees (m), and average diameter of trees (cm)-

1. Placer Co.: Forest Hill Divide, Forest Hill Road, Tahoe National Forest, 38°59'N-120°56'W, 400 m^2, S, 5% slope, 3 cm, 50 cm.
2. Amador Co.: Between Mokelumne Hill and Rich Gulch, East Clinton Road, Stanislaus National Forest, 38°21'N- 120°38'W, 400 m^2, SW, 30% slope, 30 m, 50 cm.
3. Calaveras Co.: Between San Andreas and Mountain Ranch, Murray Creek Road, Stanislaus National Forest, 38°13'N – 120°35'W, 500 m^2, S, 0% slope, 40 m, 50 cm.
4. Tuolumne Co.: Twain Harte, Confidence Road to Confidence, Stanislaus National Forest. 38°00'N - 120°12'W, 500 m^2, E, 30% slope, 30 m, 70 cm.

5*. Nevada Co.: Between Grass Valley and Colfax, Peardale, Tahoe National Forest, 39°11'N-120°8'W, 1000 m^2, NW, 10% slope, 30 m, 100 cm. * *Holotypus* ass.

6. El Dorado Co.: Between Placerville and Coloma, Coloma Road, El Dorado National Forest, 38°46'N - 120°22'W,1000 m^2, NE, 25% slope, 35 m, 100 cm.
7. Placer Co.: Forest Hill Road near Forest Hill (Todd Valley-Forest Hill), Tahoe National Forest, 39°01'N-120°48'W, 400 m^2, W, 10% slope, 40 m. 50 cm.

8 and 9. El Dorado Co.: Between Placerville and Georgetown, Spanish Flat, Traverse Creek Road - Bear Creek Road.; inv. 9: 38°50'N-120°47'W. 400 m^2, E, 5% slope, 30 m, 50 cm; inv. 10: 38°03'N-120°48'W. 400 m^2, E, 5% slope, 40 m, 50 cm.

10. Mariposa Co.: Coulterville, Old Yosemite Road to Yosemite National Park, Stanislaus National Forest, 37°44'N – 120°00'W, 400 m^2, S, 20% slope, 30 m, 50 cm
11. Tuolumne Co.: Sugar Pine-Miwuk Village, Stanislaus National Forest, 38°02'N-120°10'W. 400 m^2, 5% slope, 30 m, 130 cm.
12. Placer Co.: Finning Mill Road, Tahoe National Forest, 39°03'N-120°46'W, 400 m^2, W, 10% slope, 30 m, 50 cm.

Remarks

– *Querco-Pinetum ponderosae* Rivas-Martínez & Sánchez-Mata 1997 [in Itinera Geobotanica 10: 75 and 76] is not a validly published name, ICPN, art. 2b.

– *Ceanotho velutini-Pinetum ponderosae* Rivas-Martínez & Sánchez-Mata 1997 [in Itinera Geobotanica 10: 58] is an association described from Klamath County (Oregon) in Deschutes National Forest (near Crescent Lake); these ponderosa pine forests as mature vegetation grow on basaltic-derived soils throughout territories with an upper supramediterranean to lower oromediterranean thermotype. This association should be placed within the alliance *Arctostaphylo patulae-Pinion jeffreyi* Rivas-Martínez & Sánchez-Mata 1997 (*Arctostaphylo patulae-Pinetalia jeffreyi* Rivas-Martínez & Sánchez-Mata 1997, *Calocedro decurrentis-Pinetea jeffreyi* Rivas-Martínez & Sánchez-Mata 1997. The name of this association should be corrected to *Ceanotho velutini-Pinetum pacificae* Rivas-Martínez & Sánchez-Mata 1997 corr. hoc loco.

5. Syntaxonomical Appendix

The following is a compilation of the syntaxonomical checklist of the phytosociological classes mentioned in the text:

I. HETEROMELO ARBUTIFOLIAE-QUERCETEA AGRIFOLIAE Rivas-Martínez 1997

Quercetalia agrifolio-wislizenii Rivas-Martínez 1997

Quercion douglasio-wislizenii Rivas-Martínez 1997
– *Pino sabinianae-Quercetum douglasii* Rivas-Martínez 1997
Adenostomo fasciculati-Rhamnetalia croceae Rivas-Martínez 1997
Quercion duratae Sánchez-Mata, Barbour R Rodríguez-Rojo in Rivas-Martínez 1997

II. CALOCEDRO DECURRENTIS-PINETEA JEFFREYI Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez] 1997

Arctostaphylo patulae-Pinetalia jeffreyi Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez] 1997
Arctostaphylo patulae-Pinion jeffreyi Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez] 1997
– *Junipero australis-Pinetum jeffreyi* Rivas-Martínez & Sánchez-Mata [in Rivas Martínez] 1997
– *Ceanotho velutini-Pinetum pacificae* Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez] 1997 corr. Rivas-Martínez- Sánchez-Mata hoc loco
Querco vaccinifoliae-Pinion jeffreyi Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez] 1997

Abietetalia magnifico-lowianae Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez] 1997

Querco kelloggii-Abietion lowianae Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez] 1997
– *Querco kelloggii-Pinetum pacificae* Rivas-Martínez & Sánchez-Mata ass. nova hoc loco
– *Corno nuttallii-Sequoiadendretum gigantei* Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez] 1997
– *Castanopsio sempervirentis-Abiteteum lowianae* Rivas-Martínez & Sánchez-Mata
[in Rivas-Martínez] 1997
Abietion magnificae Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez] 1997
– *Abietetum magnificae* Oosting & Billings ex Rivas-Martínez & Sánchez-Mata [in Rivas-Martínez]1997

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