

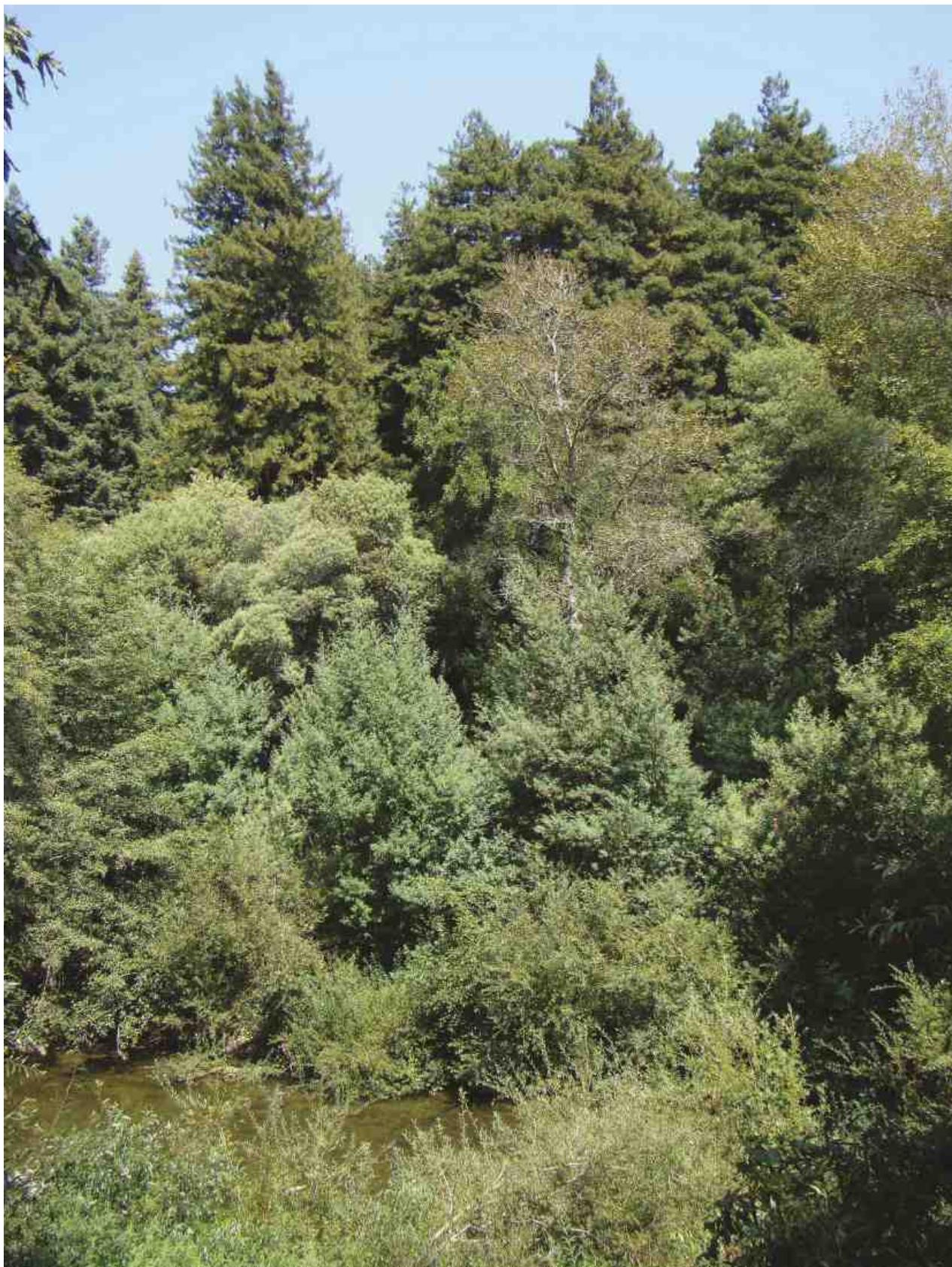
\$10.00 (Free to Members)

VOL. 40, NO. 1 AND VOL. 40, NO. 2 • JANUARY 2012 AND MAY 2012

FREMONTIA

JOURNAL OF THE CALIFORNIA NATIVE PLANT SOCIETY

THE NEW *JEPSON MANUAL*
THE FIRST FLORA OF CALIFORNIA
NAMING OF THE GENUS *SEQUOIA*
FENS: A REMARKABLE HABITAT
AND OTHER ARTICLES



In 1794, Archibald Menzies was the first botanist to collect specimens of coast redwood near the mouth of the canyon of the San Lorenzo river, less than a league above the Mission Santa Cruz. Photograph by Gary D. Lowe.

ENDLICHER'S SEQUENCE: THE NAMING OF THE GENUS *SEQUOIA*

by Gary D. Lowe

Austrian botanist Stephen Frierdrich Ladislaus Endlicher established the genus *Sequoia* in 1847. Endlicher's failure to record why he named the new genus *Sequoia* resulted in a significant body of literature speculative of his reasons. The genus *Sequoia* included two species for 85 years. In 1939 one of these, the giant sequoia of the Sierra Nevada, was separated into the genus *Sequoiadendron*, and the coast redwood was retained in the genus *Sequoia*. The history of the origin of the generic name *Sequoia* is a history shared by both of these two native California plants.

EUROPEANS' FIRST ENCOUNTER WITH CALIFORNIA'S GIANT TREES

Documentary mention of the coast redwood (*Sequoia sempervirens* [D. Don] Endl.) first appeared in Fray Juan Crespi's account of the overland expedition of Don Gaspar de Portola from San Diego to Monterey in his diary entry dated October 10, 1769. In September 1791, the first naturalist to encounter the coast redwood, also near Monterey, was Thaddeus Haenke, a member of the Spanish expedition of 1789–1794 headed by Alessandro Malaspina. This encounter resulted in seeds of the undescribed tree finding their way back to Spain.

Concurrently, the British expedition in the further quest for the Northwest Passage from 1790 to 1795, under George Vancouver, included Archibald Menzies as ship's surgeon and naturalist. Menzies collected specimens from near present day Santa Cruz. However, Menzies'

specimens were not described until 1824 by Scottish botanist David Don, working in London, and published in Aylmer Bourke Lambert's *A Description of the Genus Pinus* (Lambert was then vice-president of the Linnaean Society and Don was the Society's librarian). Don gave the coast redwood the Linnaean binomial name of *Taxodium sempervirens* (Beidleman 2006; Jepson 1910).

ENDLICHER'S RECLASSIFICATION OF *TAXODIUM SEMPERVIRENS*

In 1836 Endlicher was made curator of the botanical department of the Austrian Royal Natural History Museum. In 1840, he was named professor of botany at Austria's University of Vienna and director of the university's botanical garden. He published his monograph *Synopsis Coniferarum*, dated May 14, 1847. Though French was the most important language of science in the 17th through early 19th centuries, Latin still held dominance in Austria. So this volume, along with his other botanical works, was published in that language. In preparing *Synopsis Coniferarum* he undertook the reorganizing and reclassifying of the conifers and frequently included names, references, and passages in the language in which they were originally published or annotated on herbarium sheets: Latin, of course, but also Greek, English, Chinese, and Japanese, all languages with which he was familiar.

Endlicher had begun studying what he deemed "useful" languages in 1826, as part of his early theological education, especially Chinese, presumably in hopes of a missionary

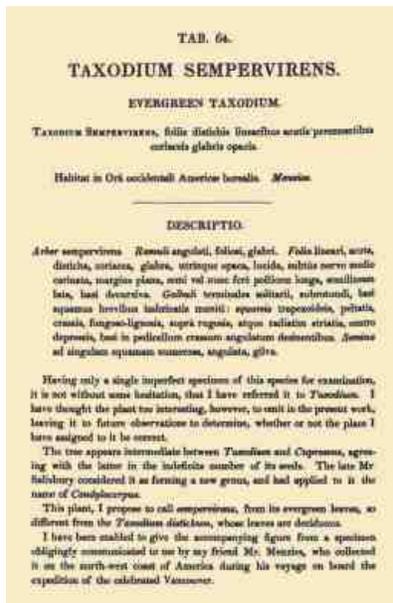
assignment. His final efforts along this line were published in 1844 as *Foundations of Chinese Grammar*, thereby formally establishing himself as a linguist (Rompel 1909). Stephen Endlicher died on March 28, 1849, less than two years after completing *Synopsis Coniferarum*.

In *Synopsis Coniferarum*, Endlicher incorporated 290 species among 31 genera as part of his reorganizations and reclassifications. He followed his own understanding of how plants should be described and named, as did all of the botanists of the time. By 1847, systematic botany was well along in breaking away from Linnaeus's artificial system of classification, and two *natural* systems of plant classification had risen to prominence: those of Jussieu and De Candolle.

Among the 31 genera described in *Synopsis Coniferarum*, Endlicher included, as his own, four genera and 28 species. His four genera are *Widdringtonia*, *Libocedrus*, *Glyptostrobus*, and *Sequoia*. He established



The Linnaean Society headquarters/library at 32 Soho Square, London, from 1822 through 1857, where David Don worked with Archibald Menzies' specimen, a small sprig, the only material of coast redwood available. Image courtesy of the Natural History Museum, London.



David Don's final description of *Taxodium sempervirens* in the 1833 edition of Lambert's *Description of the Genus Pinus*. He raises the possibility of the coast redwood forming a new genus and suggests a new name for it: *Condolcarpus*. Image courtesy of the Gray Herbarium, Harvard University.

the genus *Sequoia* by reclassifying *Taxodium sempervirens*. Endlicher generally did not explain why he chose the names he selected for any of the new genera and species listed in *Synopsis Coniferarum*. There was no convention requiring this at the time. Though custom and tradition had occasionally included recording such naming honors, rules to be followed were not available until 1867. That was the year Alphonse De Candolle published *Laws of Botanical Nomenclature*.

ENCOUNTER WITH A SECOND GIANT TREE IN CALIFORNIA

In 1833 a tree of the “Red-wood species” was mentioned in Zenas Leonard’s account of the overland expedition of the Joseph Rutherford Walker party during their arduous crossing of the Sierra Nevada. This account was serially published in a Pennsylvania newspaper and then

in book form in 1839 (Curry and Kruska 1991), but did not see a wide circulation or raise any interest.

The next published mention of Leonard’s “Red-wood species” in the Sierra Nevada did not appear until the spring of 1853 in the newspapers of the gold rush mining camps, from encounters in Calaveras County. The international population shift known as the California Gold Rush that had enabled the discovery of this tree also facilitated its being immediately and explosively brought to the attention of the world. Shortly thereafter it would popularly be known as the Mammoth Tree or Big Tree and botanically known as *Sequoia gigantea* from 1854 through 1939, and today as *Sequoiadendron giganteum*. (The history of the controversy over the naming of the giant sequoia is a subject unto itself, summarized by Saint John and Krause 1954.) Other historic matters aside, English botanist William Lobb delivered specimens of this tree to London—at that time the horticultural/botanical capital of the world—where John Lindley published the first botanical description of this tree as a new genus on December 24, 1853 in *The Gardener’s Chronicle and Agricultural Gazette*.

In 1854 reports of the sheer magnificence of the Mammoth Tree were establishing it firmly in the American conscience. The similarity of this inland species to the coastal species, combined with the simple fact that only one (William Lobb) of the botanists working in the early 1850s had actually seen mature living trees of both species, inevitably led to confusion. In May 1854, in sorting out some of the confusion, Harvard Professor Asa Gray stated, in referring to the 1847 generic name change of the coastal species, “. . . the Redwood of California, namely the *Taxodium sempervirens* of Don, of late very properly distinguished as a separate genus under the unmeaning and not euphonious name of *Sequoia*.” Gray

obviously accepted the basis for the name change, but thought the word senseless and not pleasing to the ear. Thus began the attempt to sort out the history of the origin of the generic name *Sequoia*. In June 1854, French botanist Joseph Decaisne corrected John Lindley’s assignment of the Mammoth Tree to a new genus, and placed the species in the genus *Sequoia*, consequently merging the social history of the two trees.

John Lindley, the original taxonomic describer of the Mammoth Tree, had entered the service of the Horticultural Society of London in 1823 as Secretary of the Garden at Cheswick. In 1827, Lindley also took on a professorship at London University. The following year, someone was needed at Cheswick Garden to perform those duties that Lindley no longer had time for, and the Society hired George Gordon as one of its gardeners, a prestigious position. Gordon stayed on at Cheswick until 1858, the year before the Society had to close Cheswick Garden (Fletcher 1969). That same year, Gordon issued the first edition of his monograph *The Pinetum*. In the 1858 edition, Gordon—to the extent that he could ascertain—gives the derivation of the

Sequoia sempervirens, the coast redwood, was first illustrated in the second edition of Lambert’s *Description of the Genus Pinus* in 1828. Image courtesy of Biodiversity Heritage Library and the Missouri Botanical Garden.



Taxodium Sempervirens.

names of the genera that he lists. He records the naming of Endlicher's four genera of 1847, as follows:

Widdringtonia.—The African Cypress.—“Named in compliment to Capitan Widdrington (formerly Cook) who traveled in Spain.” (Widdrington, born Cook, wrote extensively concerning Spain in the late 1830-1840s and probably provided Endlicher his study materials.)

Libocedrus.—The Incense Cedar.—“derived from ‘Libanos,’ incense and ‘Cedrus,’ the Cedar.

Glyptostrobus.—The Embossed Cypress.—“derived from ‘Glypho,’ embossed, and ‘strobus,’ a cone; scales of the cone embossed on the face.”

Sequoia.—The California Redwood.—“Name, not explained.”

Thus, in naming his genera, Endlicher, to Gordon's reckoning, named one for a colleague, one from a property, and one for a form, leaving one unknown, or, in Gray's initial assessment, meaningless—*Sequoia*. None of Endlicher's five species and one genus occurring in China were named after a Chinese linguist, as would have been consistent with his earlier interests.

HISTORICAL DERIVATION OF THE NAME SEQUOIA

Endlicher did not explain his choice of a name for his genus *Sequoia*, and died before he could subsequently do so. Therefore, any explanation of the name *Sequoia* entails examining the history of how others perceived the derivation of the word. Before reevaluating what Endlicher may have had in mind in choosing the name *Sequoia*, it is first necessary to thoroughly understand the accepted history of the word. In presenting this history, the original spelling of names as used by the various authors is retained, since the



Stephan Endlicher

Portrait of Stephen Endlicher, who established the genus *Sequoia* in 1847. From Haberlandt 1899 (correspondence between Franz Unger and Stephan Endlicher).

confusion resulting from the variability of the spelling is also an essential part of the history.

Popularization of Endlicher's possible derivation of the name *Sequoia* began in 1868 with publication of *The Yosemite Book* by the Geological Survey of California, authored by Josiah Dwight Whitney, California state geologist and professor in the Mining School at Harvard. In his chapter on “The Big Trees,” Whitney states, “The genus was named in honor of *Sequoia** or *Sequoyah*, a Cherokee Indian of mixed blood, better known by his English name of George Guess . . . known to the world by his invention of an alphabet and written language for his tribe.” For the asterisked “*Sequoia*,” Whitney footnoted:

This is the way the name was spelt in an article published in the ‘Country Gentleman’ which attracted Endlicher's attention, and led him to adopt this name for the genus. It is also more generally spelt ‘*Sequoyah*,’ which is the English way of writing it, while the other is what it would naturally and properly be in Latin.

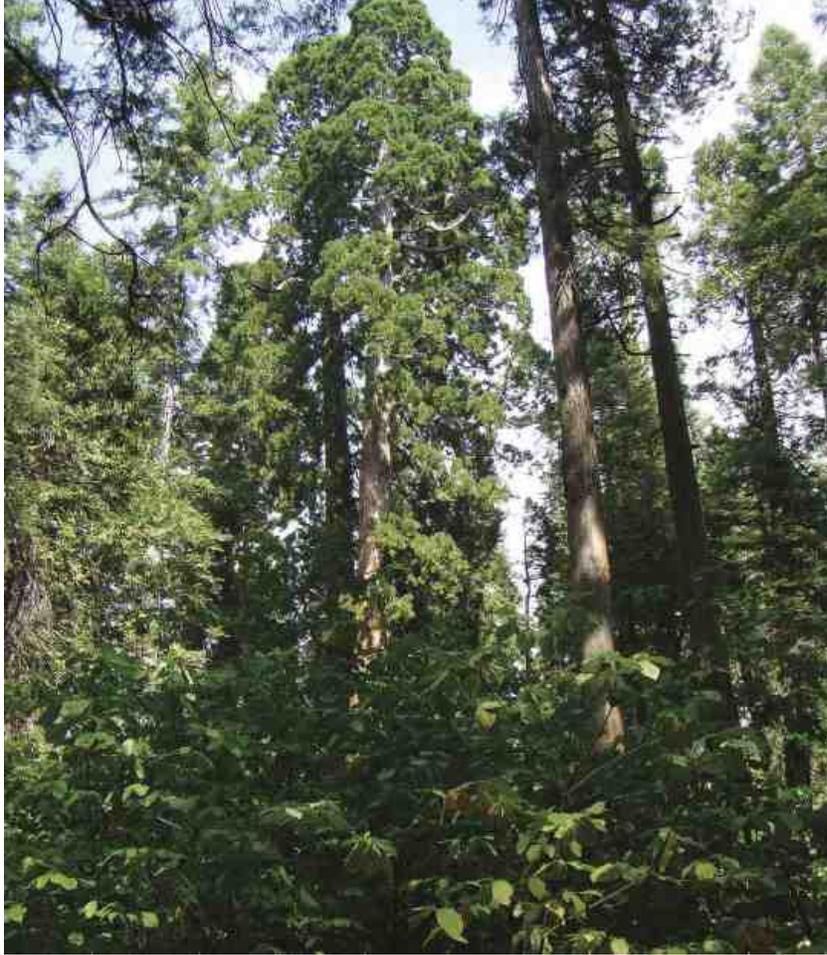
Furthermore, to his summary of George Guess/*Sequoyah*'s career, Whitney added the footnote, “For

the above particulars of *Sequoyah*'s history . . . we are indebted to Professor Brewer.”

William H. Brewer, principal assistant in charge of the botanical department in the California State Geological Survey (1860–1864) and professor of agriculture in the Sheffield Scientific School at Yale (1864–1903), would have been familiar with the scientific literature when Whitney was preparing *The Yosemite Book*. Later, revised editions (renamed *The Yosemite Guide-Book*)—the ones that most people had access to—appeared in 1869 and 1870. It was undoubtedly due to Brewer's editorial assistance that Whitney's reference to Endlicher having been “attracted” to the name *Sequoia* in an issue of the *Country Gentleman* was removed from these later editions and replaced with “Endlicher, who named the genus, was not only a learned botanist, but was eminent in ethnological research, and was undoubtedly well acquainted with *Sequoia*'s career.” The first issue of *The Country Gentleman* was published on November 4, 1852 (Mott 1938), three-and-a-half years after Endlicher's death!

There were no specialized scientific journals in the United States in the middle of the nineteenth century. One of the few broad-based magazines that provided an outlet for both casual observations and some research was *The Gardener's Monthly, Devoted to Horticulture, Arboriculture, Botany & Rural Affairs*. This journal was owned, edited, and published by Thomas Meehan in Philadelphia. Characteristic of the times, contributors generally signed their submittals, either by their name, their initials, or under a penname. While this journal did not serve as the publication of choice for the mainstream botanists Torrey and Gray, or even Brewer, it did publish accounts by others.

One of the names advocated in 1854 for the giant sequoia had been *Washingtonia*. In the March 1860



Giant sequoias in the North Grove, Calaveras Big Trees State Park, September 2011. English botanist William Lobb was familiar with all but one of the mixed conifer forest species at the headwaters of San Antonio creek in Calaveras County. There he noticed a splendid, unidentified cedar-like tree—what we now call the giant sequoia. He collected herbarium specimens, live saplings, and thousands of seeds in late July or August of 1853, and personally escorted them to London. Photograph by Gary D. Lowe.

issue of *The Gardener's Monthly* an article appeared with the title “Sequoia versus Washingtonia” signed simply “L.” Of course “L.” is not to be confused with Linnaeus. This article and its title show that the genus name *Sequoia* was culturally more associated with the giant sequoia than with the coast redwood.

L.’s main thrust in his article was supporting a tribute to the Cherokee “See-quah-yah” (L.’s spelling) as the origin of the genus name *Sequoia*. He stated that, “Surely if the genus were not named in his honor, it should be now.” To this article, editor Meehan appended a note that included the statement that Endlicher, “as he was no less noted for his philological knowledge than his botanical, it is not at all unlikely that he knew Sequoia’s history, and that L. has hit on the secret.” And

then, he added, “Our intelligent correspondent, himself having family relationship with the Cherokees, renders the history the more reliable.”

The following May, Meehan published a clarification that L. “does not assume, as implied in our note, to have been the first to suggest that the name Sequoia was derived from See-quah-yah,” but that he (Mr. L.) ‘failed to detect any clue to any other origin’ in the libraries, and among the botanists of Philadelphia or New York.” Author “L.” and editor Meehan did not have any evidence to support the conclusion that Endlicher derived the name of the genus *Sequoia* from that of the Cherokee linguist Sequoyah.

Meehan’s note published in May 1860 also made reference to an earlier statement of the origin of the name Sequoia:

. . . the strong presumptive evidence drawn from the extensive philological attainments of the late distinguished Endlicher, warrant us in believing that the suspicion first awakened in the columns of the *Country Gentleman*, a few years since is correct.

This is the article that Whitney had originally referenced, which had appeared in the column “The Fireside” of *The Country Gentleman* for January 24, 1856.

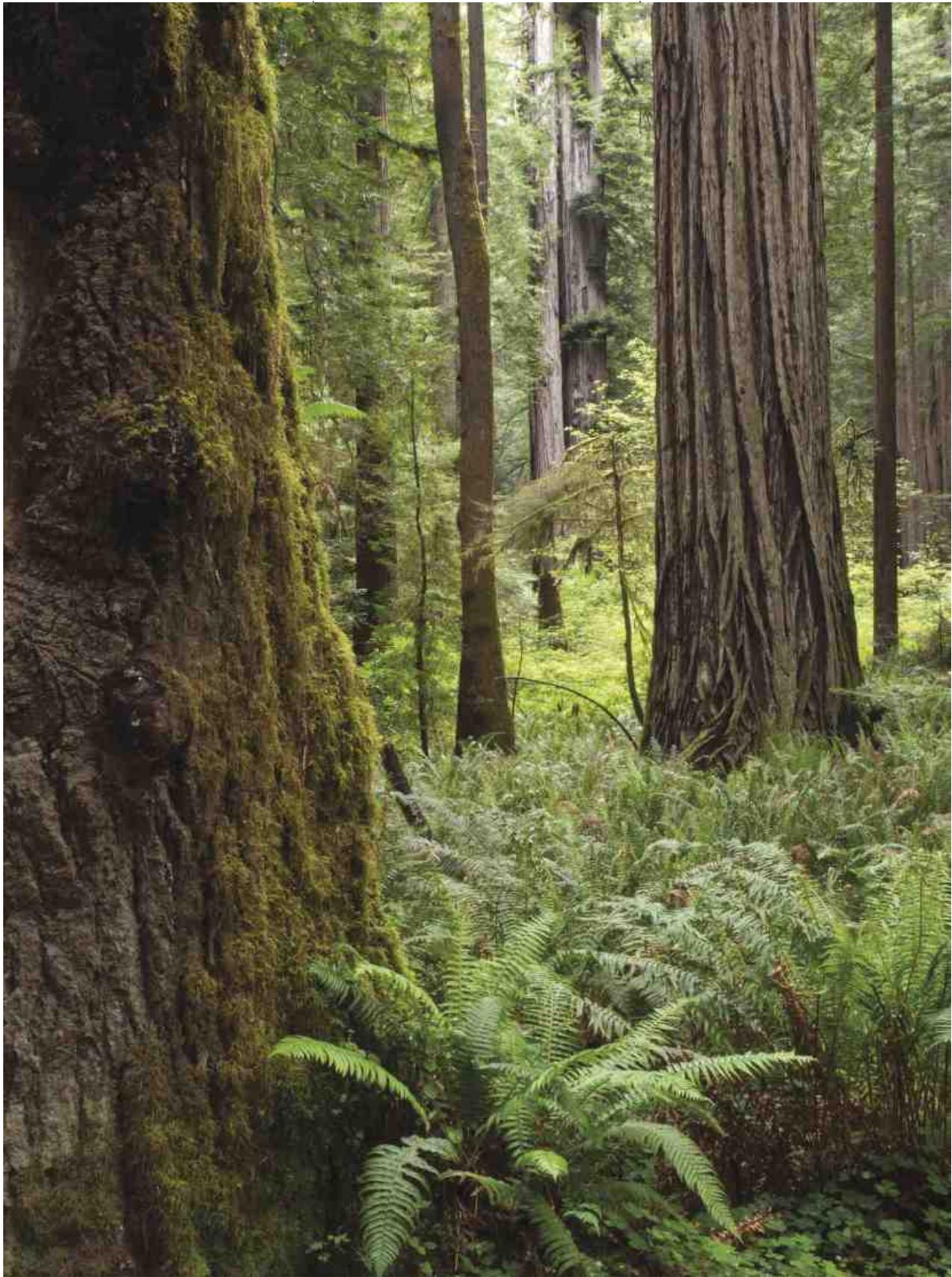
The *Country Gentleman* article bore the title, “The American Cadmus: The *Sequoia gigantea*—The Great American Tree and the Great American Genius for Whom it is Named.” The article was anonymous, attributed “to an esteemed correspondent in Maryland.” In the article the association of the name of the genus *Sequoia* with the originator of the written Cherokee language is expressed with a noticeable measure of uncertainty:

Pray, Messrs. Editors, where does the name come from? Is it an intentional thing, or is it an accident, that the American tree should bear the name of an American who deserves any such honor. . . . The honor must be intentional; but if not, the accident is most gratifying.

The article then closed with the following statement: “If the huge monuments erected by Nature—the *Sequoia gigantea*, are dedicated to his name, it is a thing well done.” It appears that the historical basis for the name of the genus *Sequoia* has heretofore been due to the fact that an anonymous writer merely wanted it that way.

ACCEPTED DERIVATION OF THE NAME SEQUOIA PERSISTS

The documentary sources of the origin of the name Sequoia presented above has shown that derivation of the name from that of the Cherokee



Moss growing on the side of a redwood trunk at Prairie Creek Redwoods State Park, Humboldt County. Photograph by Chris Johnson.

linguist Sequoyah was merely the desire of three authors (Anonymous 1856, "L." 1860, and Meehan 1860). Consequently, it becomes necessary to explore why an unsubstantiated conclusion has persisted into the present century.

In 1890, 30 years after Thomas Meehan published the article by "L." in *The Gardener's Monthly*, the topic of the origin of the name Sequoia was still a contentious subject, particularly among California botanists, dendrologists, and foresters, and particularly for John Gill Lemmon.

Lemmon came to California in 1869, still recovering from the effects of imprisonment during the Civil War. While recovering he took up botanizing. In 1874 he had his first paid assignment working with plants (Beidleman 2006). By 1876 he was a contributing correspondent to the *Pacific Rural Press* in a series titled "Botanical Excursions." In 1879 he contributed a six-part article titled "The Cone-bearers, or Evergreen Trees of California." Portions of this article eventually became part of his *Handbook of West-American Cone-Bearers* (Lemmon 1892), that followed Lemmon's own system of classification for the conifers.

In the 1879 article, Lemmon expressed the opinion that the name of the genus *Sequoia* was "said to be derived from Sequoia, the celebrated Cherokee Indian; but this is no doubt an afterthought and unworthy to be kept up." He then methodically set about finding out more. In 1888, following the death of Albert Kellogg, Lemmon received the assignment of "botanist for the California State Board of Forestry." As part of his duties to this state Board, Lemmon conducted an opinion poll concerning the origin of the name Sequoia by collecting published statements and by sending out letters of inquiry to the "principal dendrologists of the East and Europe." His report was published in 1890 in the forestry board's Third Biennial Report.

In his report concerning the

"Origin of the Name Sequoia," Lemmon included one published statement and the five letters he received in response to his inquiry. Two of these letters clearly did not even pretend to answer the question that Lemmon had posed.

From a statement published by George Engelmann in 1873 in a St. Louis, Missouri journal, Lemmon concluded that Engelmann "evidently believed in the origin of the name as derived from the Cherokee, Sequoyah." The letter from Joseph D. Hooker stated, "My impression is very strong that Dr. Gray accepted the view of Sequoia being named in honor of the American who invented the alphabet for his tribe language." Thomas Meehan, in his letter, revealed the identity of "L." as being J.H. Lippincott, with whom he had close personal ties. Meehan wrote Lemmon that Lippincott was "a very learned and careful critic," who "was personally acquainted with De Candolle, and possibly with some of the immediate associates of Endlicher." Alphonse De Candolle wrote that the "supposed origin of the word Sequoia is entirely fanciful, having no basis." De Candolle closed his letter by stating "After all, it matters little, a name is a name."

Lemmon placed considerable emphasis on Meehan's statement that Lippincott "was personally acquainted with De Candolle, and possibly with some of the immediate associates of Endlicher." With regards to De Candolle, Lemmon merely stated that he "is eighty-four years of age, and was contemporary with Endlicher, so is enabled to know as much about the origin of the word as any one."

From his review of the opinions of his contemporaries, Lemmon concluded, "So the name is still a myth." However, the strong weight of opinion of most others who have investigated the derivation was that the name was derived from the name of the Cherokee linguist. Lemmon's report on the naming of the genus



Sequoiadendron giganteum was first botanically illustrated as *Wellingtonia gigantea* in W.J. Hooker's April 1, 1854 issue of *Curtis's Botanical Magazine* (Vol. 10, 3rd Series, Vol. 80). The history of the naming of this tree is a story unto itself.

Sequoia ended by acceding that "we will be consoled by the last closing words of De Candolle, philosophical, terse, and clearly restating the scientific requisites of a good name," words that De Candolle had included in the *Laws of Botanical Nomenclature*: "The essential things are: first, that it be the expression of a natural genus; second, that it has not yet been employed before; and third, that the genus had not previously received another name."

The historical understanding of the origin of the name Sequoia has persisted into the present century based on learned opinion, not fact.

HISTORICAL EVIDENCE OF A LATIN DERIVATION

Another possible derivation of the name Sequoia that has historically been offered is that the name Sequoia came directly from the Latin for "sequence," with no connection to the Cherokee linguist Sequoyah. Two possible explanations have appeared in the literature.

In the 1858 edition of *The Pinetum*, George Gordon had indicated that he could find no explanation for the name Sequoia. In the 1862 *Supplement to Gordon's Pinetum*, and again in the second edition of *The Pinetum*, in 1875, Gordon added an etymology for the genus *Sequoia*. He wrote: "The name *Sequoia* is prob-

ably derived from 'Sequence,' separated, or following in order of succession, after *Taxodium*; from which Genus Professor Endlicher separated it." While this sounds plausible, it somewhat forces a sequential relationship, and fails to mention that Endlicher had also named *Glyptostrobus*, which was also "separated, or following in order of succession, after *Taxodium*." Lemmon (1890) quoted Gordon's possible sequence but did not explore it any further. Instead, he reiterated his preference first published in 1879.

In the aforementioned 1879 article, Lemmon emphatically stated, "The generic name *Sequoia* was given by Endlicher because this genus is a lone follower ('sequi,' to follow) of vast colossal forests." No authority was provided for this statement in 1879. In the 1890 report Lemmon added:

In 1877 Hooker and Gray made a journey to the Pacific Coast and in conversation with them, I asked which was the true origin of *Sequoia*? Dr. Gray quickly replied that . . . undoubtedly Endlicher derived his name from sequi or sequor, alluding to the well known fact that our Redwoods are followers or remnants of several colossal extinct species.

However, both the letters from Thomas Meehan and J.D. Hooker questioned this as Gray's interpretation, suggesting that Lemmon had misunderstood Gray.

In 1872, Gray had published the statement that "I, for one, cannot doubt that the present existing species are the lineal successors of those that garnished the earth in the old time before man." Gray (1872) had based his interpretation on paleobotanical publications that appeared after 1854 by Heer, Lesquereux, and Newberry. Studies of these fossil floras were, of course, unavailable to Endlicher in 1847. Though Endlicher could know nothing of his genus following in sequence after

UNDERSTANDING THE CLASSIFICATION OF SPECIES

All societies have given a name to each kind of living thing and have observed that living things fall naturally into groups, which in turn form parts of larger groups. The act of arranging or classifying living things into their several groups and naming them accordingly, colloquially referred to as pigeonholing, is known as taxonomy. Our name for a kind of living thing is from the Latin species and is called "species," e.g., *Sequoia sempervirens*, in the genus *Sequoia*. The full name includes the name of the genus because many living things may be given the same specific name; there are several evergreen plants that have been named *sempervirens*. Thus, classification is an exercise in organizing a comparison of a single species to all other species, or in Asa Gray's (1872) terms, determining "their place in the ranks."

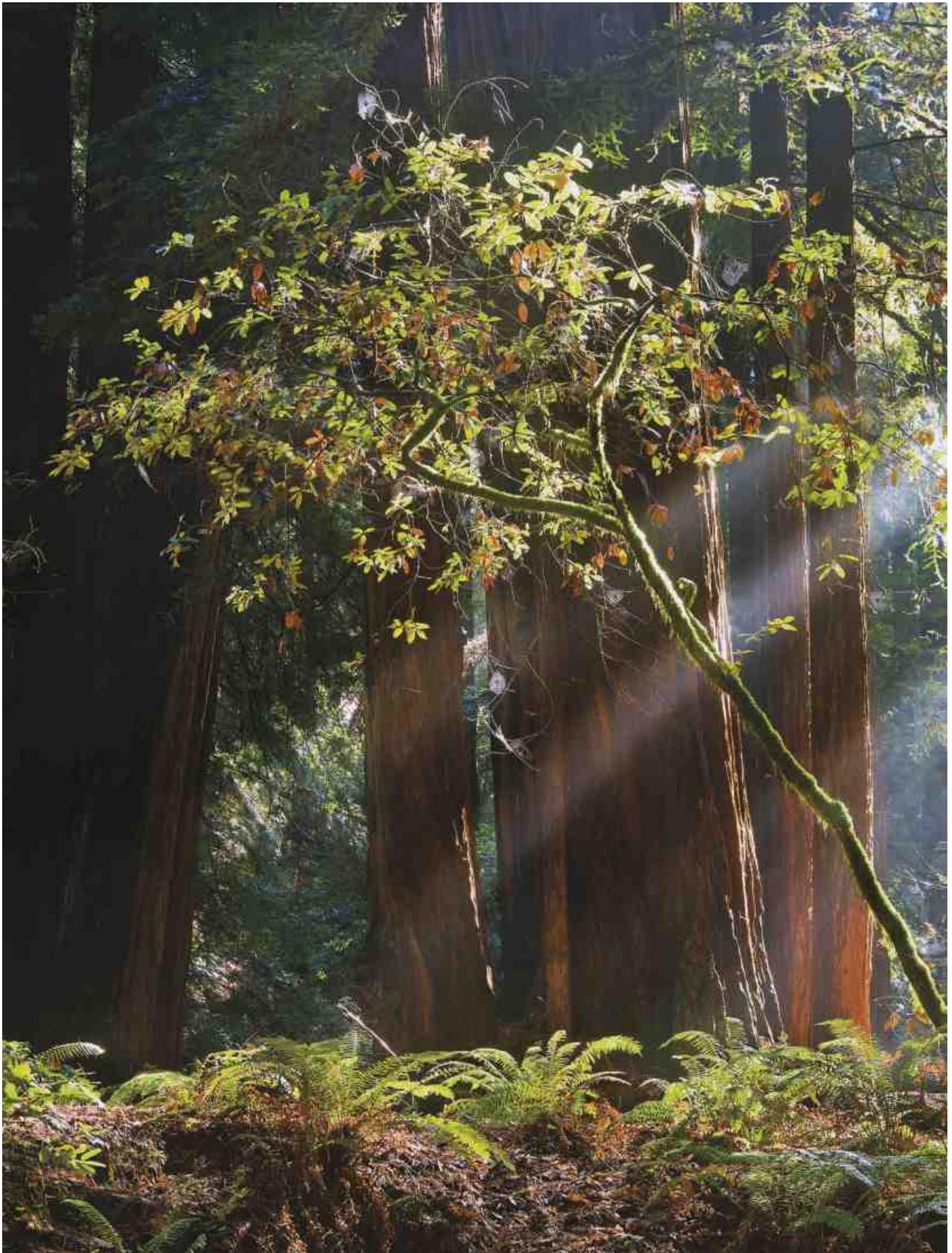
Each level in the ranks is given a name. For example, the highest level is named "kingdom," thus the "Vegetable or Plant Kingdom." Lower levels of classification have sequentially been named Subkingdom, Division, Class, Subclass, Order, Family (Endlicher's level of Suborder), Genus, and Species. Early plant, animal, and mineral systematics, or classification systems, were based on the selection of a single arbitrary characteristic as an aid to classification, much like identification keys in modern popular guides, where flowers are arranged by color or trees by leaf features. Linnaeus's system was considered artificial because it was based on a single characteristic, the reproductive organs of plants. This limitation resulted in about a quarter of the British genera containing species at variance with the characteristics of the *Classes and Orders*, the classification system developed by the father of systematics, Swedish botanist Carl Linnaeus.

To many, the use of multiple characteristics seemed more natural. Thus, natural systems of classification were developed that considered as many plant characteristics as possible, organized either from simple to complex forms (followers of Jussieu) or from complex to simple forms (followers of A.P. De Candolle). Each of these two schools of thought had many adherents, each with their own natural system of classification within the overall context. Lindley (1853) summarized 29 natural systems of plant classification that had been published by that date. Each of these natural systems was independent of the others. A researcher classified (i.e., organized) a genera and/or its species as to where he felt it should be placed among the several higher ranks, to suit his latest findings and opinions. Thus a species can be assigned to a genus by one investigator and then be reassigned to a completely different, or new genus, by a later researcher. All species are subject to later revisions since the process of classification is at once very subjective and very precise.

"vast colossal forests," what about following in sequence after "several colossal extinct (fossil) species?"

Ralph W. Chaney (1951) revised the assignment of fossil sequoias following the discovery of the genus *Metasequoia* in Szechuan Province,

China. Chaney noted that the last 50 pages of Endlicher's *Synopsis Coniferarum* are devoted to fossil conifers, and that Endlicher did not identify any of his fossil conifers as members of the genus *Sequoia*. Concerning one fossil form (*Taxites*



Filtered light sometimes creates a magical feeling in redwood groves, as here in Muir Woods National Monument, Marin County. Photograph by Stephen Joseph, www.stephenjosephphoto.com.

langsdorfii Brongn.), Chaney stated that, "Endlicher failed to recognize the resemblance of these leafy shoots to those of *Sequoia sempervirens* which he had described for the first time on a preceding page." This further discredits Lemmon's idea that the generic name *Sequoia* was given by Endlicher because the genus is a follower or remnant of vast colossal forests, which would have been composed of extinct (i.e., fossil) species. This understanding came long after Endlicher's time.

SUMMARY OF HISTORIC DERIVATION THEORY

In summary, the foregoing has shown that the name of the genus *Sequoia* as a tribute to the Cherokee linguist Sequoyah is an unsubstantiated opinion, and that its derivation from the Latin because the species followed from a sequence of fossil forms, or paleoforests, also does not withstand scrutiny. Lemmon expressed his preference for a sequence and then conceded to the learned opinion of his correspondents. The historic record supports Lemmon's conclusion—the origin of the name of the genus *Sequoia* is an American myth.

ENDLICHER'S SEQUENCE

Clearly, Endlicher had to have had something in mind when he named the genus *Sequoia*. Careful examination of his writings indicates that the name *Sequoia* indeed was derived from the Latin for sequence, although this documentation has inexplicably not been thoroughly examined previously.

Endlicher published his description of the genus *Sequoia* twice. It first appears in his monograph on the conifers (*Synopsis Coniferarum*) that bears the printed date May 14, 1847 (Endlicher 1847a). It then appears again in the fourth supplement to his larger work (published sequen-

TABLE 1. ENDLICHER'S SEQUENCE EXPLAINED.

The sequence used in the Diagnosis Generum of the Suborder Cunninghamieae of Endlicher's *Synopsis Coniferarum* (1847, page 80).

Genera	Observed Number of Seeds per Cone Scale	Median (of range) Number of Seeds per Cone Scale	Given N=0; Nval=0		Given N=1; Nval=1		Given N=2; Nval=3			N=5
			N=0	N=1	N=2	N=3	N=4	N=5		
0 Nonentity			0							5
1 <i>Dammara</i> (Agathis) monospermae = 1		1		1						
2 <i>Cunninghamia</i> trispermae = 3		3			3					
3 <i>Arthrotaxis</i> (Athrotaxis) tri-pentaspermae = 3 to 5		4	(Val of N-3) 0	(Val of N-2) 1	(Val of N-1) 3	Calculated SEQval N=3 4				
4 <i>Sequoia</i>* penta-heptaspermae = 5 to 7		6	(Val of N-3) 1	(Val of N-2) 3	(Val of N-1) 4	Calculated SEQval N=4 6			Sequoia, from sequer - to follow. (Follows in the sequence.)	
5 <i>Sciadopitys</i> penta-enneaspermae = 5 to 9 (DG) DG = From the "Diagnosis Generum" (In Endlicher's text this was revised and became 7 to 8)		7	(Val of N-3) 3	(Val of N-2) 4	(Val of N-1) 6	Calculated SEQval N=5 7				
6 <i>Ekasiadopitys</i> (Hypothetical undiscovered genus "assumed to stand next in order beyond" <i>Sciadopitys</i> .)			(Val of N-3) 4	(Val of N-2) 6	(Val of N-1) 7	Calculated SEQval N=6 9				

Or, simply:

Given	Given	3+1-0 =	4+3-1 =	6+4-3 =	7+6-4 =
0	1	4	7	9	

Endlicher's Sequence in the Suborder Cunninghamieae

Gary D. Lowe

tially between 1836 and 1850) on all the genera of plants (*Generum Plantarum*). The supplement (*Gen. Pl. Suppl. IV*) bears the printed date December 1847 (Endlicher 1847b). He inadvertently enhanced later confusion on the subject by referencing his second publication of the description as an unpublished manuscript in his monograph.

Endlicher's unstated explanation for the name he chose, *Sequoia*, for the generic reassignment of Don's *Taxodium sempervirens* is couched in the science of his day. His explanation is most readily apparent, through proximity, in *Generum Plantarum*. The explanation can be found on page 5, two pages ahead of the description of the genus *Sequoia*. The explanation is also present in *Synopsis Coniferarum* on page 80, at a considerable separation of 118 pages ahead of the description of the genus *Sequoia*.

Plant classification is considerably different now compared to what it was in the middle of the nine-

teenth century. In dealing with the conifers (Endlicher's Class Coniferae), he chose morphological features common to larger groupings of plants to define his categories. Endlicher divided his conifers into five Orders, not all of which need concern us. His Orders were divided into suborders, which were populated with the genera. Assigning a specific plant within this hierarchy is what Asa Gray (1872) called determining "their place in the ranks."

In studying the California tree that David Don had named *Taxodium sempervirens*, Endlicher decided that it was more like those he had placed in his pine-like Order Abietineae than like those in his cypress-like Order Cupressineae, where he had assigned the swamp cypress of the southeastern United States (*Taxodium distichum*). This reassignment stripped Don's California tree of its generic affiliation, necessitating that it be reassigned.

Endlicher had divided his Order Abietineae into three Sub-Orders.



TOP: Title page of *The Country Gentleman* (January 24, 1856) where an anonymous resident of Maryland published his opinion as to the origin of the genus name *Sequoia*.
 • BOTTOM: Title page of *The Gardener's Monthly* (March 1860) where "L." published his opinion as to the origin of the genus name *Sequoia*. Image courtesy of Biodiversity Heritage Library and the University of Massachusetts, Amherst Libraries.

When Endlicher reached this level of his classification system, he provided a table showing the diagnostic features of the suborders and of the genera assigned to the Suborders. The table was headed, in Latin, "Diagnosis Generum." Endlicher assigned Don's California tree to the Suborder Cunninghamieae.

As listed in Endlicher's *Diagnosis Generum*, exclusive of the genus *Sequoia*, Endlicher's Suborder Cunninghamieae comprised four previously established and acceptable genera—*Dammara*, with 1 seed per cone scale; *Cunninghamia*, with 3 seeds; *Arthrotaxis*, with 3 to 5 seeds; and *Sciadopitys*, with 5 to 9 seeds. These four genera have median numbers of seeds per cone scale of 1, 3,

4, and 7 (see page 33). In 1830, Alexander Braun had previously found this sequence of numbers in the arrangement of the leaves and cones of conifers. In his investigation Braun had also found the arrangement of plant parts to follow in the sequence 1, 1, 2, 3, 5, and 8 (Braun 1831). Braun had discovered that the growth patterns of plants frequently occur in one of two recursive numerical sequences. Over four decades later, these two recursive sequences were respectively named the Lucas sequence and the Fibonacci sequence.

A close friend and colleague of Endlicher's was fellow Austrian, Franz Unger. In 1832 Endlicher and Unger were exchanging letters discussing floral diagrams using Braun's mathematical methods in the context of plant systematics (Haberlandt 1899). He retained these mathematical concepts of plant systematics when working on *Synopsis Coniferarum*. When he recognized Don's California tree as a new genus with 5 to 7 seeds per cone scale he had to place it somewhere in the hierarchy of his classification system. He opened a gap in the sequence of genera in his Suborder Cunninghamieae, between *Arthrotaxis*, with 3 to 5 seeds, and *Sciadopitys*, with 5 to 9 seeds, to allow placement of the new genus with 5 to 7 seeds per cone scale. With the addition of the new genus, the arrangement of the genera in his Suborder Cunninghamieae no longer followed the se-

quence 1, 3, 4, and 7 in the median number of seeds per cone scale. Instead, a new recursive sequence was formed—1, 3, 4, 6, and 7, Endlicher's sequence.

Endlicher named the genus for the operation that he had conducted. The new genus fell in sequence with the other four genera in his suborder. For Stephan Endlicher to have developed his systematics of the conifers at least partially on anatomically based mathematical patterns is in complete holding with the science of his times in the Austrian Empire.

ENDLICHER'S SEQUENCE ESCAPES NOTICE

Endlicher's sequence has lain hidden for the last 160 years. Botanists and others in America had little or no access to either of Endlicher's publications, and would hardly have sought out Endlicher's second publication since he had indicated that it was unpublished. The availability of reference works was always a problem in mid-nineteenth century America. In 1851, American botanist John Torrey wrote to an associate that "in this place (Princeton) I labor under many disadvantages—chiefly from the want of books." In 1853 Louis Agassiz, world-renowned geologist and zoologist, wrote that certain German works "are hardly to be seen in any American library." In 1855 he again lamented that "No one has felt more keenly the want of

TABLE 2. ENDLICHER'S SEQUENCE IN HIS SUBORDER CUNNINGHAMEAE: THE NUMBER OF SEEDS PER CONE SCALE.

<i>Dammara</i>		<i>Cunninghamia</i>		<i>Arthrotaxis</i>		<i>Sequoia</i>		<i>Sciadopitys</i>
Monospermae		trispermae		tri-pentaspermae		penta-heptaspermae		penta-enneaspermae
1	:	3	:	3-5	:	5-7	:	5-9(DG) / 7-8 (Txt)

Dammara is now known as *Agathis*. DG = From the "Diagnosis Generum." Txt = From the description in Endlicher's text. In later manuals (e.g., Bailey 1949), the number of seeds per cone scale of *Sciadopitys* is 7-9.

an extensive scientific library than I have since I have been in the United States" (Bruce 1987).

Those who concerned themselves most with the derivation of the name *Sequoia* were not necessarily mainstream scientists and would have had limited access to the libraries that were available. No one needs to be reminded that science and technology were immeasurably different in the third quarter of the nineteenth century compared to the present. When a researcher needed a reference, he had to first locate a copy. Once a reference work was located, the researcher either had to transcribe the text, or hire the services of a copyist. Making a manuscript copy of Endlicher's description of *Sequoia* would inevitably separate it from the whole of Endlicher's *Synopsis Coniferarum*. Consequently, Endlicher's sequence was probably not available to be studied by those interested in the origin of the name *Sequoia*.

Furthermore, a uniform system of plant classification was not yet available. Each plant systematist had his own hierarchy of the ranks of plants. By July 21, 1853, six months before the description of the giant sequoia was published, Lindley had restudied the genera of Endlicher's *Synopsis Coniferarum*. Lindley disagreed with Endlicher and rearranged the conifers. Lindley thought that *Sequoia sempervirens* was more cypress-like and less pine-like than Endlicher had indicated, and so re-assigned the genus *Sequoia* to the Cupresseae, thus breaking Endlicher's sequence of five genera arranged by the number of seeds per cone scale. Lindley also did away with Endlicher's classification level (his suborders) that held the other four genera of the sequence (including Endlicher's suborder Cunninghamieae). Lindley placed these four genera together with all of the other pine-like species in the Abietae. This last revision totally eliminated Endlicher's sequence from the ma-

ior classification system in use at the time the description of the giant sequoia was published on December 24, 1853. The giant sequoia subsequently inspired numerous speculations as to the origin of the name *Sequoia*.

REFERENCES

- Anonymous. 1856. The American Cadmus. The *Sequoia Gigantea*—The Great American Tree and the Great American Genius for Whom it is Named. *The Country Gentleman* 7(4): 65.
- Bailey, L.H. 1949. *Manual of Cultivated Plants*. The Macmillan Company, Toronto Canada.
- Beidleman, R.G. 2006. *California's Frontier Naturalists*. University of California Press, Berkeley, CA.
- Braun, A., 1830. Vergleichende Untersuchung über die Ordnung der Schuppen an den Tannenzapfen als einleitung zur Unterscheidung der blattstellung überhaupt: Nova Acta Physico-Medica, Academiae Caesareae Leopoldino-Carolinae Naturae Curiosorum, Vol. 25, 1831 (submitted 16 Jul. 1830).
- Bruce, R.V. 1987. *The Launching of Modern American Science: 1846-1876*. Alfred A Knopf, New York, NY.
- Currey, L.W., and D.G. Kruska. 1992. *Bibliography of Yosemite, the Central and the Southern High Sierra, and the Big Trees: 1839-1900*. Dawson's Book Shop, Los Angeles and William P. Wreden, Palo Alto, California.
- Endlicher, S. 1847a. *Synopsis Coniferarum*. Apud Scheitlin & Zollikofer, Sangalli, Österreich.
- . 1847b. *Generum Plantarum Supplementum Quartum*. Apud Fridericum Beck, Universitatis Bibliopolam, Vondobonae, Österreich.
- Fletcher, H.R. 1969. *The Story of the Royal Horticultural Society, 1804-1968*. Oxford University Press, London.
- Gordon, G. 1858. *The Pinetum*. Henry G. Bohn, London.
- . 1862. *A Supplement to Gordon's Pinetum*. Henry G. Bohn, London.
- . 1875. *The Pinetum*. 2d ed. Henry G. Bohn, London.
- Gray, A. 1854. On the Age of the large tree recently felled in California. *American Journal of Science Series 2*, 17(51): 440-443.

- . 1872. *Sequoia and its history*. *The American Naturalist* 6(10): 577-596.
- Haberlandt, B., 1899. Briefwechsel zwischen Franz Unger und Stephan Endlicher, Verlag von Gebrüder Borntraeger, Berlin.
- Jepson, W.J. 1910. The *Silva of California*. *Memoirs of the University of California* 2: 480.
- Lemmon, J.G. 1879. The Cone-Bearers, or Evergreen Trees of California.—No. 5; Cypress, Arbor-Vitae, Redwood, and Big Tree. *The Pacific Rural Press* 17(7): 107.
- . 1890. Redwoods. *Report of the Botanist of the California State Board of Forestry, Third Biennial Report of California State Board of Forestry for the Years 1889-1890*. State Office, Sacramento: 157-168 and 208-10.
- Lindley, J. 1853, 3d ed. *The Vegetable Kingdom; or, The Structure, Classification, and Uses of Plants, Illustrated Upon the Natural System*. Bradbury & Evans, London.
- "L." (Lippincott, J.H.). 1860. *Sequoia versus Washingtonia*. *The Gardener's Monthly, Devoted to Horticulture, Arboriculture, Botany & Rural Affairs* 2(3): 75-77.
- Meehan, T. 1860. *Sequoia*. *The Gardener's Monthly, Devoted to Horticulture, Arboriculture, Botany & Rural Affairs* 2(5): 148.
- . 1879. Derivation of *Sequoia*. *The Gardener's Monthly and Horticulturist* 21(6): 189.
- Mott, F.L. 1938. *A History of American Magazines, 1850-1865*. The Balknap Press of Harvard University, Cambridge, MA.
- Rompel, J. 1909, 421. Stephan Ladislaus Endlicher. *The Catholic Encyclopedia*. Robert Appleton Company, New York, NY.
- Saint John, H. and R.W. Krauss. 1954. The Taxonomic Position and the Scientific Name of the Big Tree Known as *Sequoia gigantea*. *Pacific Science* 8(3): 341-358.
- Whitney, J.D. 1868. *The Yosemite Book*. Geological Survey of California. Published by Authority of the Legislature. Julius Bein, New York, NY.
- . 1869, 1870. *The Yosemite Guide-Book*. Geological Survey of California. Published by Authority of the Legislature. University Press, Cambridge, MA.

Gary D. Lowe, P.O. Box 2165, Livermore, CA 94551-2165; h2ogeol@comcast.net