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SEQUIADENDRON GIGANTEUM (CUPRESSACEAE) AT LAKE FULMOR, RIVERSIDE COUNTY, CALIFORNIA

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ABSTRACT

A GPS census made on 19 Jun 2012 of the Lake Fulmor area, northwestern San Jacinto Mountains, Riverside County, California, revealed seven trees of the Sierra Nevada endemic *Sequoiadendron giganteum* (Cupressaceae). The trees occur in a 234-meter-long narrow strip along the northwestern side of the lake. The population appears to be naturalizing. The largest tree (45 cm DBH, about 20 m tall), planted in 1980, is reproductively mature. Its six offspring to the northeast and southwest are 3–5 m tall and do not presently bear cones.

Key words: big tree, Cupressaceae, giant sequoia, Lake Fulmor, naturalized species, Riverside County, *Sequoiadendron*, *Sequoiadendron giganteum*, southern California.

INTRODUCTION

Schmid and Schmid (2011, 2012) documented by GPS census on 1 May 2009 a naturalized population of at least 157 individuals of *Sequoiadendron giganteum* (Lindl.) J.Buchholz at 2036–2236 m el. in the upper Hall Canyon area on the southwestern flank of Black Mountain (summit el. 2369 m) in the San Jacinto Mountains, Riverside Co., California. In 2009 this Sierra Nevada endemic was regenerating prolifically on Black Mountain, as revealed by multiple age classes, from juveniles (seedlings and saplings) about 20–60 cm tall to young adult trees over 6 m tall, up to about 40 years old, and reproductively mature. The naturalized population (<7 ha in 2009) is also spreading from its initial limited revegetation introduction (<2 ha in 1974) by the United States Forest Service after the 1974 Soboba fire.

Keeler-Wolf (1986, 1989 unpublished, but summarized in 1990, 2004) did the environmental analysis of Hall Canyon that resulted in its establishment in 1990 as a “Research Natural Area” (RNA; see Keeler-Wolf 1990, 2004) of the Forest Service. His 1990 and 2004 publications and, especially, the 1986 unpublished report (p. 59, quoted in full by Schmid and Schmid 2012: 31–32) mention *Sequoiadendron* J.Buchholz. Between 21 Nov 2009 and at least 21 Jun 2012 Calflora (2012) had been citing Keeler-Wolf (1986, 1989, 2004) for Riverside Co. for the Hall Canyon RNA as an unvouchered observation of *Sequoiadendron*, stating “Natural Status wild,” and giving without elevation a “Point Location 33.8064, –116.779[0].”

From 16–19 Jun 2012 we revisited the San Jacintos and stayed at the James Reserve at the base of Hall Canyon (Hamilton 1997; James San Jacinto Mountains Reserve 2012). One purpose of our revisit was to clarify the nature of the Keeler-Wolf reference by Calflora (2012).

METHODS

Schmid and Schmid (2012) give methodology, terminology, and criteria to characterize the naturalization of introduced plants. Our study site is shown in Fig. 1; for maps of this site

and the surrounding area see Hamilton (1997). We used a GPS receiver to create waypoints for individuals of *S. giganteum* encountered (“r” denotes a cone-bearing tree). Voucher collections will be deposited at RSA, UC, UCR, and the James Reserve.

OBSERVATIONS

Investigating the Calflora (2012) location of “33.8064, –116.779[0].” we found 35 m to the southwest at 33.8061, –116.7792, 1632 m el., a large tree of *S. giganteum* (Fig. 1, tree #2r) near the northeastern end of Lake Fulmor (1625 m el.). The tree, vouchered as *R. Schmid and M. Schmid 2012-4*, is about 20 m tall, 45 cm DBH, and reproductively mature (Fig. 2–3). Some unreachable lower branches bore unopened female cones. We collected from the ground shed, opened seed cones, some of which still contained a few seeds (for a comparable collection see Schmid and Schmid 2012: Fig. 7–8).

We reconnoitered for additional individuals of *Sequoiadendron*: we walked around Lake Fulmor, thoroughly crisscrossed the narrow slope between the northwestern side of the lake and the access road to the gated James Reserve, and also transected the lower part of the large slope northwest of the access road. Our reconnoiter located six young adult trees of *Sequoiadendron*, 3–5 m tall, and all entirely vegetative, lacking both male and female cones:

- a tree 5 m tall (*R. Schmid and M. Schmid 2012-2*) at 33.8068, –116.7786, 1635 m el. (Fig. 1, tree #1; Fig. 4),
- a tree 3.5 m tall (12 cm DBH) (*R. Schmid and M. Schmid 2012-6*) at 33.8052, –116.7803, 1634 m el. (Fig. 1, tree #3; Fig. 5), and
- four trees 3–4 m tall (unvouchered) clustered at 33.8055, –116.7799, 1633 m el. (Fig. 1, trees #4–#7).

All seven trees of *Sequoiadendron* located in our GPS census of 19 Jun 2012 occur in a 234-meter-long narrow strip on the slope between the lake and the access road (Fig. 1). We did not see any seedlings or saplings of *Sequoiadendron*, that is, juveniles <1.4 m tall.

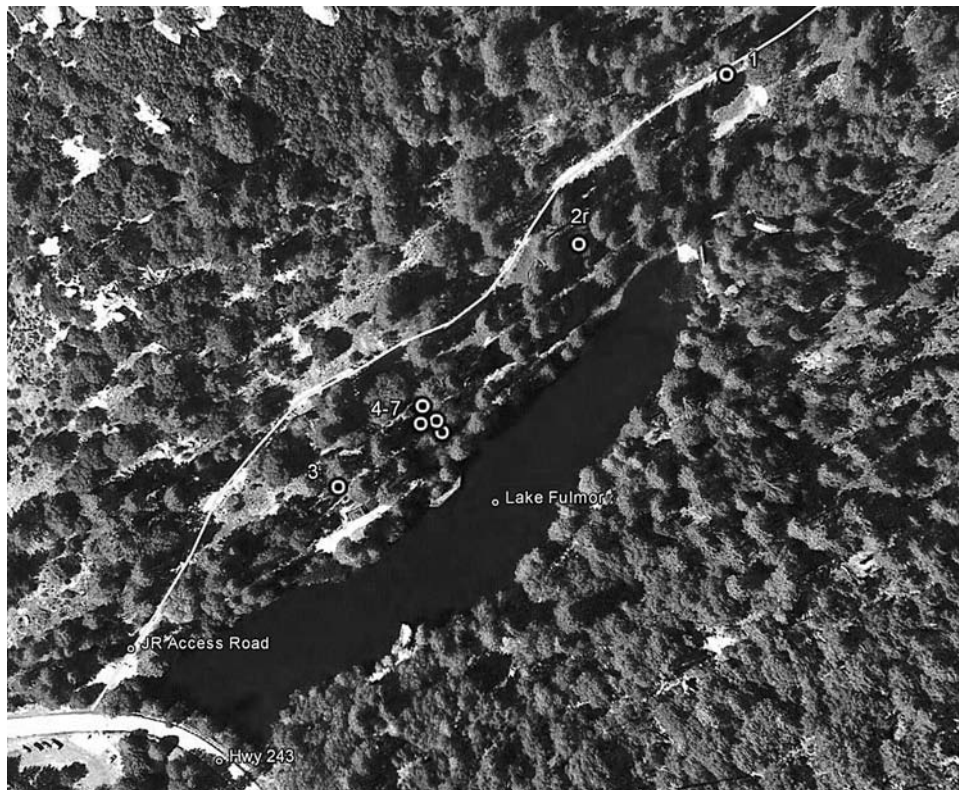


Fig. 1. Google-Earth image (16 Sep 2011) of Lake Fulmor (1625 m el.), northwestern San Jacinto Mountains, Riverside Co., California, showing GPS plots of seven trees of *Sequoiadendron giganteum* encountered on 19 Jun 2012.—The trees occur from 1631–1635 m el. in a 234-meter-long narrow strip along the lake. Tree #2r (“r” denotes reproductive) is large (45 cm DBH, ca. 20 m tall) and reproductively mature, whereas its six presumed offspring (#1, #3–#7) are 3–5 m tall and entirely vegetative (compare Fig. 2–3 with Fig. 4–5).—North is in standard vertical position. The James San Jacinto Mountains Reserve and the adjacent Hall Canyon Research Natural Area are just to the northeast (out of view). Highway 243 traversing the dam that created Lake Fulmor is at the lower left. Idyllwild is 16 highway km to the southeast. (In compliance with “Permission Guidelines for Google Maps and Google Earth”, www.google.com/permissions/geoguidelines.html).

DISCUSSION

(1) Overview

We document a new grove of *S. giganteum* that appears to be naturalizing on the northwestern side of Lake Fulmor, Riverside Co., California (Fig. 1–5). We designate this lowland grove at 1631–1635 m el. as the “Lake Fulmor Grove” to distinguish it from the upland “Black Mountain Grove” at 2036–2236 m el. The latter, located 2.4 km upslope, was the subject of our previous reports (Schmid and Schmid 2011, 2012). The Lake Fulmor Grove consists of only seven trees occurring in a 234-meter-long narrow strip. For comparison, the Placer County Grove of *Sequoiadendron*, the northernmost of the 67 native groves of the taxon in the Sierra Nevada, is similarly small, consisting of only six living and two fallen trees occurring within a 120-m extent (Willard 1995, 2000).

(2) Historical Background

In 1933 and 1934 Riverside County Surveyor Alexander Chope Fulmor (1876–1965; see Rootswab 2012 for obituary) surveyed for a new mountain highway to connect Banning and Idyllwild and suggested that damming Indian Creek at Hall Canyon could not only form a road crossing but also impound a lake [Robinson and Risher’s (1993: 153) alternative “Hall

Creek” is not listed by USGS GNIS (2012)]. Lake Fulmor (1625 m el.) thus is an artificial lake (Fig. 1, 3). It was completed in spring 1947, opened in 1948 after being filled by Indian Creek draining spring runoff from Hall Canyon, and named in 1949 for A. C. Fulmor. The dam at the southwestern end of the lake allows crossing by Highway 243, “rather than contouring into the canyon as the old road did.” Lake Fulmor is 16 road km northwest of Idyllwild. The 40-km Banning-Idyllwild stretch of Highway 243 was “unofficially” opened on 11 May 1947. However, 19 km “remained unpaved until 1950, when the highway was officially dedicated” on 14 October (Robinson and Risher 1993: 151, for the first quotation; Smith 2009; Rootswab 2012; Robert B. Smith, pers. comm., 22 Jun 2012, for the subsequent quotations). Substantial woody alien species in this area must post-date these times of appreciable human disturbance.

The “Lake Fulmor Picnic Area” (USGS GNIS 2012) is a facility of the United States Forest Service. “Some of the picnic tables date to 1953/54 (the red concrete bases with wood tops)” (John C. Ladley, pers. comm., 18 Jul 2012). The site is heavily developed with an extensive, almost mazelike system of rock-lined paths (Fig. 2). “All the rock work and the non-native plantings were developed in 1980,” according to Michael P. Hamilton (pers. comm., 13 Jul 2012). From 1982 to 2008 Hamilton was director of the James Reserve, and from 1979 to 1982 he was a graduate student in residence there researching



Fig. 2–5. *Sequoiadendron giganteum* at Lake Fulmor (1625 m el.), northwestern San Jacinto Mountains, Riverside Co., California (see Fig. 1 for locations of trees).—2–3. Parent tree (#2r) 45 cm DBH, ca. 20 m tall, ca. 35 years old, with Rudolf Schmid. Arrows indicate top and bottom of tree; note the long leader.—4–5. Entirely vegetative offspring (#1, #3) 5 and 3.5 m tall, respectively. (Photos taken 19 Jun 2012 by M. Schmid).

the floristics of the San Jacinto Mountains for his Ph.D. thesis at Cornell University (Hamilton 1983).

After seeing our preliminary report (Schmid and Schmid 2011) about the naturalization of *S. giganteum* in southern California, Smith (2012) noted that the species can be found in several areas in and around the town of Idyllwild. Planting “started in the 1940s” due to the efforts of Marion Michael Null, a retired physician. By 1948 Null’s “horticultural hobby had become focused on growing sequoia trees from seed. He mounted a single-minded campaign to popularize them as ornamental additions to the village.” Null also urged “the Forest Service to include sequoias in its continual reforestation efforts.”

(3) *Sequoiadendron giganteum* at Lake Fulmor

The large tree of *S. giganteum* (Fig. 2–3) in the seven-tree Lake Fulmor Grove (Fig. 1) was planted in 1980 (see above), contrary to the “natural status wild” indication of Calflora (2012). The tree is nicely positioned in an “island” surrounded by rock-lined paths (Fig. 2) and would be about 35 years old, assuming that a 3-year- or 4-year-old seedling had been planted in 1980 (the tree naturally would be older had a sapling been planted). At about 20 m in height the tree is appreciably taller than the approximately 6-m-tall, 40-year-old trees of *Sequoiadendron* that Schmid and Schmid (2012: 26) saw in 2009 in the upper Hall Canyon area. The considerably greater height of the Lake Fulmor tree is to be expected given its occurrence in a mesic, rather open area close to Lake Fulmor (Fig. 1, 3). “Giant sequoia seedlings in the open grow rapidly and, given an even start, can outgrow any associated tree species Height growth up to 60 cm (24 in) per year is not uncommon” (Weatherspoon 1990: 557). At this rate of growth, and given its amenable location, the Lake Fulmor *Sequoiadendron* could have achieved its 2012 stature of about 20 m (65 ft.) in just 35 years. We note that besides *Sequoiadendron* the lakeside is decorated with other woody aliens such as *Juniperus* L., *Cotoneaster* Medik., and *Pyracantha* M.Roemer that date to 1980 (see Hamilton’s quote above).

The population of six young, entirely vegetative adults of *S. giganteum* at Lake Fulmor raises several questions: How old are the six trees? Why are juveniles (seedlings and saplings, that is, trees <1.4 m tall) absent? Why is reproductivity so low? To what degree, if any, is the parent selfing?

The six young adults (trees #1 and #3 shown in Fig. 4–5) of *Sequoiadendron* are presumably offspring of the reproductive giant (Fig. 2–3) because their locations (Fig. 1) appear random, as due to seed dispersal, rather than planned, as due to systematic landscaping. It seems significant that establishment was on the narrow slope between the lake and the access road because here there is less duff from the local native conifers and black oak (*Quercus kelloggii* Newb.). Duff is inimical to seedling establishment of *Sequoiadendron* (see Schmid and Schmid 2012). The appreciable litter produced by the black oak at Lake Fulmor would disfavor seedling establishment of the redwood. Perhaps significantly, the Black Mountain Grove—regenerating prolifically nearby at 2036–2236 m el. in the upper Hall Canyon area—is above the heavy litter zone of black oak that locally occurs below 1874 m el. (Keeler-Wolf 1986, 1989, 1990, 1994; Schmid and Schmid 2012).

The six offspring vary in height from 3–5 m and thus probably are of different ages. We estimate that the oldest offspring could be as old as 15 years. Trees as young as 10 years may produce seed, but abundant seed production usually occurs after 150 or 200 years (Weatherspoon 1990). The taller and presumably older young adults may be on the verge of producing male and female cones.

Conifers are wind pollinated and generally outcrossing; selfing may occur but can be avoided by various means (Williams 2009). *Sequoiadendron giganteum* probably fits this model, but we have been unable to find specific information in the literature (Weatherspoon 1990; Williams 2009; citations in Schmid and Schmid 2012). The parent redwood at Lake Fulmor has sparse cone production. In June 2012 it bore very few cones and its litter was markedly devoid of cones (the opposite situation characterizes both wild and most cultivated trees of the species that we have seen elsewhere). An extended search yielded only five old cones in the litter. The closest reproductively mature individuals available for outcrossing occur in the Black Mountain Grove 2.4 km upslope at the head of Hall Canyon. It seems that the parent tree at Lake Fulmor is selfing. Rare selfing could explain the small number (six) of adult trees as well as the absence of juveniles.

Sequoiadendron giganteum is a species favored by mesic conditions such as those found immediately adjacent to Lake Fulmor or, as shown by Schmid and Schmid (2012), in the Black Mountain Grove at the head of Hall Canyon. Compared to the larger Black Mountain Grove containing at least 157 individuals, the Lake Fulmor Grove has only 7 (Fig. 1): the 6 entirely vegetative offspring (Fig. 4–5) plus their handsome parent (Fig. 2–3).

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