Cupressus revealiana (Silba) Bisbee, *comb. nova* validation as a new *Cupressus* species

with notes on identification and distribution of other nearby cypress species.

The range of *Cupressus stephensonii* is limited to the slopes of Cuyamaca Peak

Several authors (Farjon, 2005 ; Eckenwalder, 2009 ; Debreczy & Rácz, 2011) consider the cypress of northern Baja California (Mexico) to be the same taxon as the one growing on the slopes of the Cuyamaca Peak in San Diego County, in southern California, *Cupressus stephensonii* C.B.Wolf. Several visits by Jeff Bisbee to both places as well as observations of both taxa in cultivation in southern France lead to the conclusion they are separate species, morphologically distinct and unable to hybridise naturally.

Morphology

Jeff Bisbee visited the Cuyamaca Cypress and the cypress near Rincón in Baja California in July 2004. He took photos and made the following observations. Several morphological characters distinguish these two taxa in the field.

- Young trees :

  The colour of the foliage and form of young trees differs considerably. The Cuyamaca trees have darker, greener foliage, and long branches forming a more open, irregular crown. The Rincón trees have more blue-glaucous foliage and a dense bushy crown, in some ways looking more similar to *Cupressus glabra* Sudw.

Figure 1 : Rincón, Baja California. Cuyamaca Peak, San Diego County.

- Trunk :

After the Cedar Fire in October 2003, which destroyed most of the stand (J. B., *pers. obs.*), the Cuyamaca tree represented here is the oldest remaining tree. The difference between the bark colours is very obvious.

Figure 2 : Rincón, Baja California. Cuyamaca Peak, San Diego County.

- Bark :

Side by side comparison of bark, both taken in late July 2004.

Figure 3 : Rincón, Baja California. Cuyamaca Peak, San Diego County.

- First year cones:

Several interesting differences were noted between the Cuyamaca population and the one in Rincón. One of the most striking is the colour of the first year cones. Of hundreds of trees Jeff Bisbee observed before the fire at Cuyamaca, none had the blue cones observed in the Rincón trees. The Cuyamaca trees all have brown first year cones. The two photos below were both taken in late July. Current DNA studies point to the fact that the Rincón population is a different species. The studies by Bartel (2003) suggested that the Rincón trees were *Cupressus montana* Wiggins. We do not agree with this suggestion. They are not only very distinct from the Cuyamaca trees, but also from the San Pedro Martir Cypress (see Appendix 3: *Cupressus montana*, for further comparison).

Figure 4 : Rincón, Baja California. Cuyamaca Peak, San Diego County.

- Mature cones:

Another difference noted is that the Cuyamaca Peak stand usually has cones in dense clusters, on short stems, where the Rincón trees had cones with long stems, generally hanging from the branch similar to *Cupressus bakeri* Jeps., not in large clusters.

Figure 5 : Rincón, Baja California. Cuyamaca Peak, San Diego County.

For a further comparison between these two taxa, see Appendix 2: Photos, page 9.

From seeds of *Cupressus stephensonii* obtained before 2003 from an US seed merchant and from material collected by Jeff Bisbee near Rincón, seeds were germinated and the following cotyledon statistics were established.

Table I

	Cuyamaca Cypress						El Rincón Cypress				
Cotyledons	3	4	5	6	7	Total	3	4	5	6	Total
Seedlings	34	250	109	23	1	417	20	13	1	0	34
%	8.15	59.95	26.14	5.52	0.24	100.00%	58.82	38.24	2.94	0.00	100.00%

The differences in cotyledon numbers are obvious. Although there were only a few germinations of the El Rincón Cypress, if they were similar, one would have been expecting at least one seedling with 6 cotyledons and eight with 5 cotyledons. Also striking is the very small number of seedlings of *Cupressus stephensonii* with 3 cotyledons, while they represent more than half of the El Rincón Cypress. This very low number of 3-cotyledon seedlings is a characteristic also encountered in *Cupressus macnabiana* A.Murray (article in preparation).

Phenology

Seedlings were planted in southern France at about 600 metres altitude, some of them in the same field and not far from each other, to observe and compare their physiology and phenology with the same edaphic and climatic conditions. The first Cuyamaca Cypresses were planted in July 2000. It took 9 years for them to produce the first pollen cones and one more year for the seed cones to appear. Observed during three successive summers, the pollen is released in July. The seed cones do not enlarge during the following months, but only after the next winter.

The first Rincón Cypress was planted in October 2007. Only four years were necessary for the first pollen cones and one more year for the seed cones. This taxon releases its pollen at the beginning of spring, later than most other cypress species, but several months earlier than Cuyamaca Cypress. The time gap observed between when these two taxa are pollinating excludes any possible natural hybridisation between them (see figures 12 to 16).

Physiology

These two cypresses were already showing an obvious colour difference as saplings, as noticed by Jeff Bisbee on young trees growing in their natural habitat. It is possible to distinguish them easily after only a few years once the intermediate foliage has developed. The Cuyamaca Cypress keeps its intermediate foliage for a longer time.

Both taxa are hardy to at least -13°Celsius. At the beginning of February 2012, there was a two weeks frost period when the thermometer never went above 0°C and with several lows below -10°C. The seedlings (both in the nursery and in the field) and trees experienced strong winds and direct sunlight. A slight difference in hardiness was observed. The Rincón Cypress showed no damage at all, while the Cuyamaca Cypress had some shoots burned and more branches changed colour on the side exposed to the sun and wind. In the nursery in containers above soil, some Cuyamaca Cypresses died. It is a well known fact that roots in Cupressaceae are less hardy than foliage.

Conclusions

Considering all these observations, we conclude that these two taxa form two different species. The phenology of *Cupressus stephensonii* places this species distant from any member of the *Cupressus arizonica* Greene group and thus it should not be considered as a variety or

even as a synonym [1] of *C. arizonica*, but as a distinct species. *Cupressus stephensonii* was first described by C.B.Wolf in 1948 [2]. Molecular analysis by Bartel *et al.* (2003; see figure 2, p. 700) shows that *Cupressus stephensonii* clusters with *Cupressus macnabiana*. It is to be noted that while *Cupressus stephensonii* releases its pollen in July, *Cupressus macnabiana* does so even later, in August (in cultivation, southern France).

The Cuyamaca Cypress range is thus limited to only one population on the western slopes of the Cuyamaca Peak and it should be considered as critically endangered after the Cedar Fire in October 2003. This fire went right through the stand sparing only a few trees. Regeneration is occurring, but is less extensive than would be expected compared to the recruitment of other fire adapted cypresses in California after similar destruction of mature trees. A new fire before a full seed load can be produced (considering the late coning of this species) would put this species in danger of extinction in its natural range.

The northern Baja California Cypress was first described in 1981 by J. Silba as a variety of *Cupressus arizonica* under the name *C. a.* var. *revealiana*. Later, Silba (2009) treated it as a species but in the segregate genus *Hesperocyparis*, publishing the combination *Hesperocyparis revealiana*. With the recent conclusion of monophyly of the genus *Cupressus* sensu lato (Mao *et al*. 2009 ; Christenhusz *et al*. 2011), it is necessary to make the following new combination :

Cupressus revealiana (Silba) Bisbee, *comb. nova*
Basionym : *Cupressus arizonica* Greene var. *revealiana* Silba, Revised Generic Concepts of *Cupressus* L. (Cupressaceae). *Phytologia* 49 (4): 393 (1981).
Synonyms :
≡ *Cupressus arizonica* Greene subsp. *revealiana* (Silba) Silba, A Monograph of the Genus *Cupressus* L. in the Twenty-First Century. *Journal of the International Conifer Preservation Society* 12 (2): 51 (2005).
≡ *Hesperocyparis revealiana* (Silba) Silba, The Taxonomy of the Genus *Hesperocyparis* Bartel et Price in Mexico and Honduras (Cupressaceae). *Journal of the International Conifer Preservation Society* 16 (2): 67 (2009).
Type : Mexico, Baja California Norte, Sierra Juarez, near El Rincón, *R. Moran 21251* (holo-: SD).

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Silba, J. (1981). Revised Generic Concepts of *Cupressus* L. (Cupressaceae). *Phytologia* 49 (4): 390-399.

Silba, J. (2005). A Monograph of the Genus *Cupressus* L. in the Twenty-First Century. *Journal of the International Conifer Preservation Society* 12 (2): 31-103.

[1] See the Jepson Manual, 2012, as *Cupressus arizonica* subsp. *arizonica*, available on the 17.4.2012 at: http://ucjeps.berkeley.edu/cgi-bin/get_JM_treatment.pl?157,160,162,163

[2] Wolf is certainly the botanist who studied the Californian Cypresses most thoroughly.

Silba, J. (2009). The Taxonomy of the Genus *Hesperocyparis* Bartel et Price in Mexico and Honduras (Cupressaceae). *Journal of the International Conifer Preservation Society* 16 (2): 65-67.
Wolf, C.B. (1948). Taxonomic and distributional studies of the New World cypresses. *El Aliso* 1: 1-250.

Appendix 1 : Diagnosis of *Cupressus stephensonii*. In Farjon (2005), the author, while considering this species as a variety of *arizonica*, is proposing the following diagnosis (Key to varieties, page 180) :

> Leaves eglandular or inconspicuouly [sic] glandular, rarely with resin drops.

In fact the resin drops are a very variable character, likely depending on weather conditions. If such is the case, this character cannot be used to distinguish a *Cupressus stephensonii* specimen from other Cypresses. A further study is under way.

Figure 6 : *Cupressus stephensonii* leaves with abundant resin dots, Cuyamaca Peak.

Figure 7 : *Cupressus stephensonii*, leaves with abundant resin dots, cultivated.

Appendix 2 : Photos

Figure 8 : *Cupressus revealiana* in its natural habitat, March 2011.

Figure 9 : *Cupressus stephensonii* in its natural habitat, with *Pinus coulteri* in the background.

Figure 10 : Mature cones of *Cupressus revealiana*, near El Rincón, March 2011. Notice the abundance of the resin dots.

Figure 11 : *Cupressus stephensonii*, immature cones, Cuyamaca Peak. The variability of these cones (size, shape, scales, umboes, colour) is still to be studied.

Figure 12 : *Cupressus stephensonii*, cultivated, 25 June 2011, pollen cones before pollination.

Figure 13 : *Cupressus stephensonii*, cultivated, 6 August 2011, pollen cones after pollination with one year-old cone.

Figure 14 : *Cupressus revealiana*, cultivated, 18 February 2012, seed cones before pollination.

Figure 15 : *Cupressus revealiana*, cultivated, 12 April 2012, seed cones at pollination time or soon after.

Appendix 3 : Summary table : comparison of the 3 *Cupressus* species.

Characters	*Cupressus stephensonii*	*Cupressus revealiana*	*Cupressus montana*
Height [1]	Below 15 m.	15 - 20 m.	To 30 m.
Crown	Irregular, open	Dense, bushy	Regular, narrow conical
Foliage	Dark green	Light blue-glaucous	Green [3]
Bark (old trunk)	Smooth, whitish/gray	Smooth, reddish	Fibrous, reddish-brown
1st year cones	Brown	Pruinose blue	Pruinose grey-blue (or green)
Mature cones	Large clusters, serotinous	Not in large clusters, serotinous	Clusters, not serotinous
Peduncles	Short	Long	Very short
Cotyledons	(3-)4-5(-6-7)	3-4(-5)	— [4]
Pollination	Summer	End of Winter	Summer
First cones [2]	At least 9 - 10 years	4 - 5 years	None before 6 years
Cone scales	6 [32.3%]-8 [66.2%] (-10 [1.5%]) [5]	6-8	10-12

[1] Field estimated height. — The fire intervals shall be taken into account.
[2] Cultivated — After plantation in the field + 2-3 years in the nursery.
[3] Can be yellowish in the wild due to edaphic conditions.
[4] Still under study. [5] 65 cones.

Appendix 4 : *Cupressus montana* Wiggins

Compared to *Cupressus revealiana* and *Cupressus stephensonii*, this species grows at higher elevations in a much cooler and moister environment (between 2200 and 3000 m altitude), within the montane forest, where winter snow is frequent, while *Cupressus revealiana* grows in the dryer pinyon-juniper belt (between 1200 and 1500 m). The cone shapes are quite different and cannot be mistaken; *Cupressus montana* cones open at maturity and mostly have 10–12 scales, while *Cupressus revealiana* cones do not open without fire and have 6–8 scales.

Figures 16 & 17 : *Cupressus montana* in its natural habitat, March 2011, large specimen and young one.

Figure 18 : *Cupressus montana* crown shape.

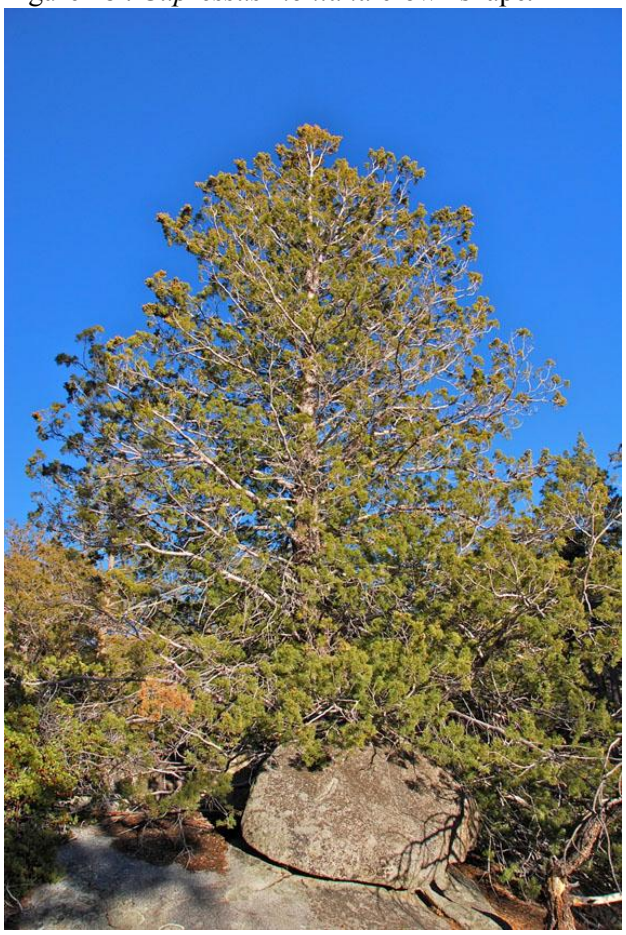

Figure 19 : *Cupressus revealiana* crown shape.

Figure 20 : *Cupressus montana* bark, March 2011.

Figure 21 : *Cupressus revealiana* bark, March 2011.

Figure 22 : *Cupressus montana* mature cones.

Figure 23 : *Cupressus revealiana* mature cones

Figure 24: *Cupressus montana* in its native habitat growing with *P.lambertiana*, *P.jeffrey* and *A.concolor*.

Photo credit : Jeff Bisbee : figures 1 to 5, 8, 10, 16 to 24 – Joey Malone : figures 6, 9 and 11 – *Cupressus* Conservation Project : figures 7, 12 to 15.