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Abstract. In the Cascade and Coast Ranges of Oregon and Washington *Abies amabilis*, *A. lasiocarpa*, *A. magnifica* var. *shastensis*, *A. procera*, *Picea engelmannii*, *Pinus monticola*, *Pseudotsuga menziesii*, and *Tsuga mertensiana* can produce immature cones either red (or purple) or green in color. Abundance and distribution of the color varies in each species. Variation in cone coloration on individual trees is related to exposure of the cones to sunlight.

Observations throughout the Cascade and Coast Ranges of Oregon and Washington indicate that the immature cones of many conifers are either red (purple) or green, or some intergrade between. For many years European foresters have recognized two different forms of *Picea abies* which bear either red cones (variety "*erythrocarpa*") or green cones (variety '*chlorocarpa*") during their lifetime. *Picea glauca* is also known to produce either green or reddish-brown immature cones.[2]

Color variation in immature or mature cones has not been studied for western conifers but has incidentally been noted for *Pinus ponderosa*,[3] *P. monticola*[4] *Abies concolor*[4,5], *Abies grandis*,[5] and *Tsuga mertensiana*.[3,5] The species upon which

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TABLE 1. Notes on color of immature cones.

Species	*Color*	*Remarks*
Abies amabilis (Pacific silver fir)	Red or green	Red form more abundant, green form rare and observed only in central Oregon Cascade Range.
Abies lasiocarpa (subalpine fir)	Purple or green	Red form more abundant, green form rare and observed only in central Oregon Cascade Range.
Abies magnifica var. *shastensis* (Shasta red fir)	Green or red	Both forms found in southern Oregon Cascade Range.
Abies procera (noble fir)	Green or red	Green form more abundant, but red form frequent in Oregon and Washington Cascade Range and Oregon Coast Ranges.
Picea engelmannii (Engelmann spruce)	Green or red	Green form more abundant, but red form frequent in Oregon and Washington Cascade Range.
Pinus monticola (western white pine)	Green or red	Green form more abundant, but red form frequent in Oregon and Washington Cascade Range.
Pseudotsuga menziesii[1] (Douglas-fir)	Green or red	Green form appears to be more common.
Tsuga mertensiana (mountain hemlock)	Purple or green	Purple form more abundant, green form observed in the Oregon and Washington Cascade Range.

[1] Personal communication from Roy R. Silen, Pacific Northwest Forest & Range Expt. Sta. Color dimorphism in Douglas-fir was not observed by the author.

two color forms have been observed by the author are listed in Table 1, with notes on colors observed and their relative abundance and distribution.

In *Abies* species, color variation of immature cones is generally expressed on the bracts. Thus, on *A. amabilis* and *A. lasiocarpa*, variation can be observed on immature cones for only a short time as cone scales soon overgrow bracts. *A. procera* and *A. magnifica* var. *shastensis*, on the other hand, have exserted bracts, and color variation can be observed at later stages in cone development. Coloration of scales on mature cones of *Abies concolor* and *Abies grandis* may vary from purplish to yellow green, however.[3,4] Cone scales of *Picea engelmannii*, *Pinus monticola*, *Pseudotsuga menziesii*, and *Tsuga mertensiana* vary in color. Differences in color can sometimes be detected on mature cones, particularly in the case of mountain hemlock.

Expression of red or purple cone coloration on individual trees and between adjacent trees is variable. On individual trees, red or purple coloration is most pronounced on portions of cones exposed to direct sunlight; however, the capacity of cones to turn red when exposed to sunlight seems inherent. Heavily shaded cones or parts of cones are usually green or very light red. Cones on adjacent trees often redden to a different degree, and there may be a gradation from trees exhibiting strictly green cones to trees with dark-red cones, even within a small area.

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