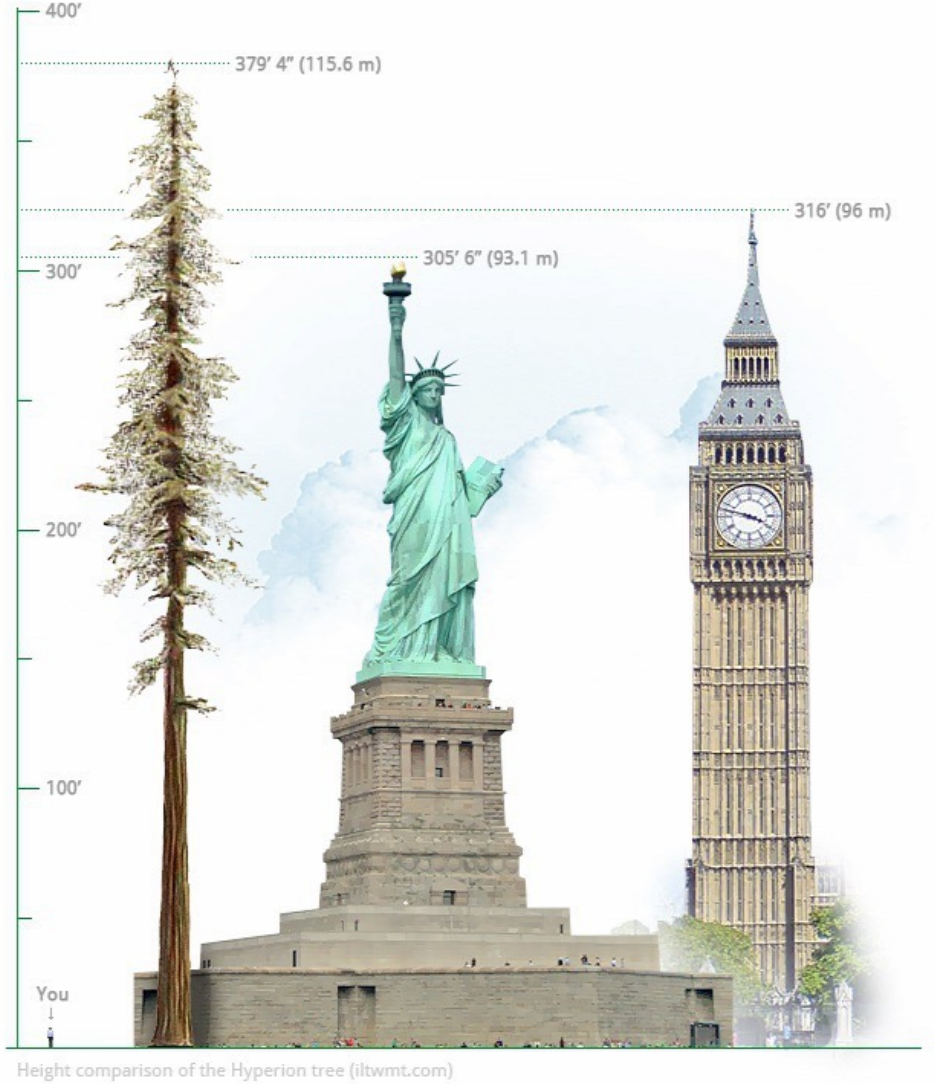
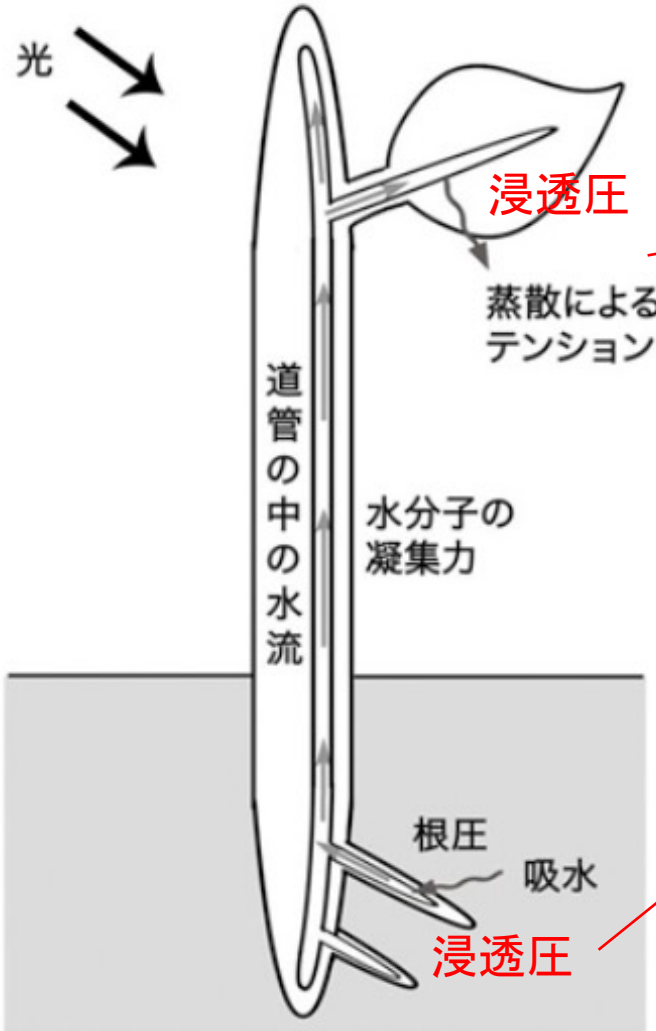
樹木はどこまで高く成長するか？

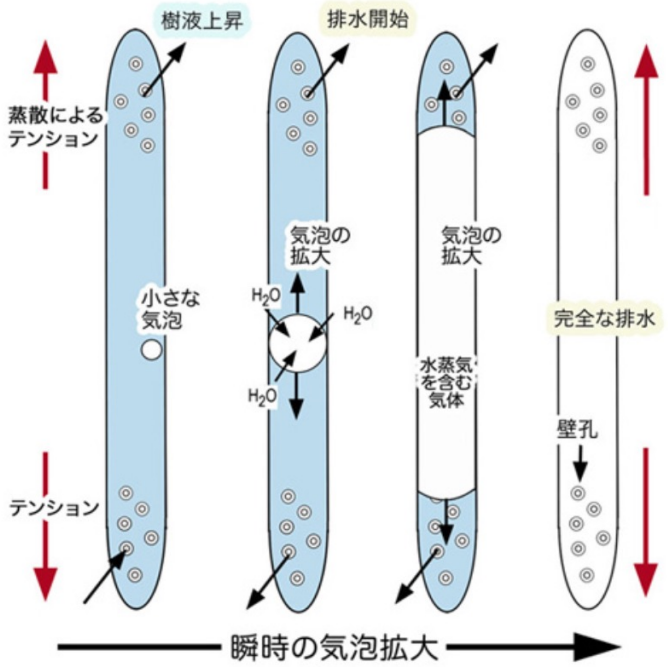
現在　高さ：115.61 m、直径：4.84 m、場所：アメリカ合衆国カリフォルニア州、
レッドウッド国立公園　樹齢：約600年

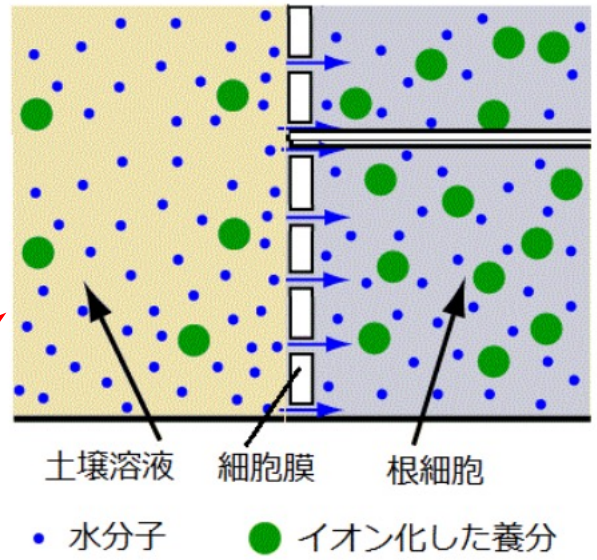


Height comparison of the Hyperion tree (iltwmt.com)

水を吸い上げる力＝浸透圧＋凝集力＋蒸散







・根内のイオン濃度が高い方へ土の水が移動する
・イオン濃度を薄める方向に移動する
・土から根の方向に圧力がかかる（浸透圧）

根圧は0.1～0.3MPa　→　10～30mまで水柱を押し上げる力

出典： https://science.howstuffworks.com/life/botany/tree-grow.htm

In 2008, a study proposed that the maximum height for a Douglas fir -- one of the world's tallest trees -- is about 453 feet (138 meters) [source: Kinver]. But why is there a limit? Trees are supposed to be nature's skyscrapers, impossible to hem in. This cap exists because trees can only pull water so far up their trunks.

Another tree height study, published four years prior, posited the maximum height of a tree at 426.5 feet (130 meters)

Study limits maximum tree height

By Jonathan Amos
BBC News Online science staff

The tallest any tree could grow would be about 130m (426ft), say US scientists.

Even the biggest things have their limits

George Koch and colleagues climbed five of the eight tallest trees in the world - including the biggest at 112.7m - and examined their physiology in detail.

The researchers found these massive Californian redwoods pushed the limits to which water could be raised from the ground to support further growth.

The team tells the journal Nature that under present conditions, the trees are unlikely to gain more than a further 5-15m in height.

出典：http://news.bbc.co.uk/2/hi/science/nature/3643899.stm

Abstract

Trees grow tall where resources are abundant, stresses are minor, and competition for light places a premium on height growth. The height to which trees can grow and the biophysical determinants of maximum height are poorly understood. Some models predict heights of up to 120 m in the absence of mechanical damage, but there are historical accounts of taller trees. Current hypotheses of height limitation focus on increasing water transport constraints in taller trees and the resulting reductions in leaf photosynthesis. We studied redwoods (Sequoia sempervirens), including the tallest known tree on Earth (112.7 m), in wet temperate forests of northern California. Our regression analyses of height gradients in leaf functional characteristics estimate a maximum tree height of 122-130 m barring mechanical damage, similar to the tallest recorded trees of the past. As trees grow taller, increasing leaf water stress due to gravity and path length resistance may ultimately limit leaf expansion and photosynthesis for further height growth, even with ample soil moisture.

最大樹高122～130 mを推定

出典：**The limits to tree height**

George W Koch[1], Stephen C Sillett, Gregory M Jennings, Stephen D Davis

蒸散による
圧力低下

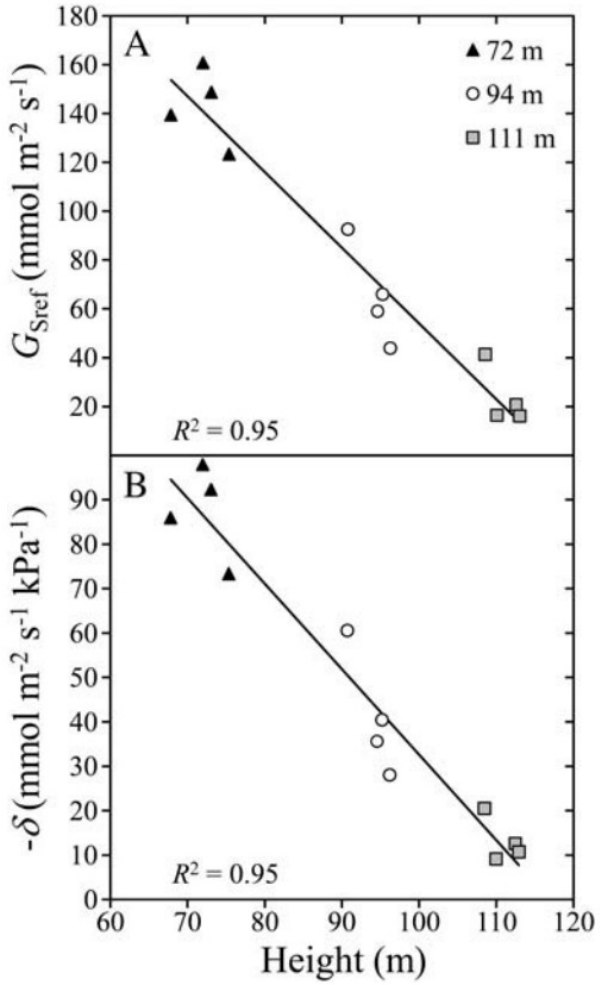


Figure 7. (A) Decline in average treetop stomatal conductance at a reference vapor pressure deficit (G_{Sref}; D = 1 kPa) with increasing *S. sempervirens* tree height. (B) Decline in sensitivity of average treetop stomatal conductance to vapor pressure deficit ($-\delta$; dG_S/dln$D$) with increasing *S. sempervirens* tree height.

出典：**Effects of height on treetop transpiration and stomatal conductance in coast redwood (*Sequoia sempervirens*)**

Anthony R. Ambrose, Stephen C. Sillett, George W. Koch, Robert Van Pelt, Marie E. Antoine, Todd E. Dawson