

期望有一天我們能看到每株台灣油杉皆能成長茁壯，迎向美麗的藍天 / 賴宛靖攝
Hopefully one day we will see Taiwan Cow-tail Fir flourish and stand strong reaching to the beautiful sky./ by Wan-ching Lai

Vanishing Taiwan Cow-tail Fir 消失中的台灣油杉

專訪台大森林環境暨資源學系羅漢強教授 An Interview with Prof. Hann-chung Lo of School of Forestry and Resource Conservation, NTU.

採訪撰文 Interview and Text / 藍嘉俊 Jia-jun Lan 特別感謝 Special thanks to / 宜蘭大學森林系王兆桓教授 Prof. Chao-huan Wang, Department of Forestry and Natural Resources, National Ilan Univ. 圖片提供 Photos provided by / 羅漢強 Hann-chung Lo、王兆桓 Chao-huan Wang
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如果沿著台大運動場跑步，接近升旗台時，你或許不知，擦身而過的樹叢中，竟藏有一棵身世非凡的針葉木。樹皮呈灰褐色、鱗片狀斑剝，在路旁整排的黃果垂葉榕林中並不突出，卻是保育界頂頂有名的台灣油杉。它和台東蘇鐵、台灣穗花杉都是冰河期孑遺植物，可說是這塊土地的老祖先，與台灣海棗，併稱「台灣四大奇木」。

微弱的兩處紅點

然而，就像它孤伶伶的立在校園一角，即便以台灣整個族群來說，台灣油杉也是孤伶伶的。扣除礁溪的人工林，天然林地只分佈在北部的坪林和南部的大武，總面積也小的可憐（農委會的資料顯示，受保護的面積不及50公頃）。若你手上有張A4的台灣地圖，按照比例，它們主要的區位，用兩個小紅點就標完了。一南一北微弱的閃著，猶如兩盞等待救援的紅燈。

數字會說話。長期關心台灣鄉土植物與保育生物學的臺大羅漢強教授表示，台灣油杉現在的數量大概不到500株。因此，在農委會稀有及瀕危植物資料庫中，台灣油杉屬於嚴重瀕臨滅絕（CR）等級；在文建會文化資產體系裡，它也是公告保護的十一種珍貴稀有植物之一。

在分類上，台灣油杉為松科、油杉屬，屬於常綠大喬木，毬花單性，雌雄同株，葉互生，通常三月開花，十月種子成熟；樹幹筆直、樹冠成圓錐形，高度可達35公尺，木材含油量高，故名之。台灣油杉的木材質地細密、紋理漂亮，為林業的二級木，可用於建材，曾在1900年代遭到大量砍伐。

同樣都是珍稀生物，但比起聞名全球的大貓熊與北極熊，或是澎湖的綠蠵龜、七家灣溪的櫻花鉤吻鮭，一般民眾對植物的認知與關注，顯然相對的少。那麼，台灣油杉有何特殊之處呢？首先以生長位置而言，就值得一提。它屬低海拔的針葉樹，也就是500公尺上下的高度即可見其蹤跡，這和大多數的針葉林分佈在中、高海拔不同。台灣油杉群如此平易近人，卻帶來致命危機。對伐木業者來說，可及性高代表開發成本低，所以，早期的大面積純樹林幾乎就被掠奪一空了。

稀有植物的美麗與哀愁

台灣油杉的珍貴之處，在於其不但是台灣的特有種，且數量又少，兼具特殊性與稀少性雙重意義。羅教授進一步指出，熱帶島嶼有一共同現象：單位面積擁有較高比率的特有物種。這是因為熱帶地區生物的演化速率較快，增加了多樣性的機會，因而相對容易出現特有種。至於島嶼，則是提供了地理上的隔絕條件，劃定了獨立演化範圍，生物無法和外界親緣種行基因交流，時間久了，成為當地特產的機會就增加。

Among the trees along the tracks circling the Athletic field of National Taiwan Univ. hides an extraordinary conifer. With its dull brown scaly bark, it may not be particularly eye-catching compared to the nearby *Ficus benjamina* L. var. *comosa* King, but it's the celebrated Taiwan Cow-tail Fir (*Keteleeria davidiana* var. *formosana* Hayata). Along with *Cycas taitungensis*, *Amentotaxus formosana* Li, and Taiwan Date Palm, it is called one of the four wonder trees in Taiwan.

Two Feeble Red Dots

It stands solitarily not just on NTU campus but across the land of Taiwan. Except the artificially grown ones in Jiaosi, its natural forests can only be found in Pinglin and Tawu, with a total area of less than 50 hectares. They may be pinpointed on an A4-size map of Taiwan with two tiny red dots, like two feeble red lights signaling for help.

Numbers talk. Prof. Hann-chung Lo of NTU reveals that the current number of Taiwan Cow-tail Fir is less than 500. The tree, therefore, is categorized as "critically endangered" (CR) by Council of Agriculture, and is announced as one of the 11 rare and precious plants by Council for Cultural Affairs.

As a member of Pinaceae family and *Keteleeria* genus, Taiwan Cow-tail Fir is an evergreen giant arbor. It is monoecious, and flowers in March while its seeds mature in October. The tree may reach up to 30 m in height with an oblate crown. Its oily fine wood had led to the massive logging of the tree in the 1900s.

Compared to other endangered species that have received great attention, Taiwan Cow-tail Fir is much lesser known to and cared about by the public. What makes the tree so special is that it is a low-altitude type of conifer, which can grow at as low as 500 m above the sea level. But this closeness to humans also meant high accessibility and low costs to the logging industry, and resulted in extensive exploitation of the tree.

Beauty and Sorrow of Rare Plants

The value of Taiwan Cow-tail Fir lies in its uniqueness (because it's native to Taiwan) and scarcity. As Lo explains, native species are more and the level of biodiversity is higher in tropical islands due to the climate that facilitates the evolution of life forms and the geographical isolation that hinders genetic exchanges between local and outside species.



成年的台灣油杉高度可達 35 公尺 / 王兆桓提供
A grown-up Taiwan Cow-tail Fir can grow to a height of 35 meters. /
Photo provided by Chao-huan Wang



台灣油杉的分布圖。(繪圖參考來源：林務局網站)
The distribution of Taiwan Cow-tail Fir. (Reference &
Resource: the website of the Forestry Bureau)

分布于北部與南部的低海拔區。
It is distributed over low altitude areas in northern and southern Taiwan.

這麼說來，台灣還真是特有種的天堂（約佔四分之一）。可惜，這不意味人類會善待它們。除了前人大量砍伐造成數量遽減，台灣油杉也有自己的問題要面對。它的另一個危機，就是繁殖力不旺盛。其種子多為受精不成功的空粒，受精成功的種子發芽率也低，因此雖然人為威脅已減輕，但自身的族群數量仍無法提升。羅教授補充，一些珍貴的裸子植物也有遺傳衰弱的課題，如台東蘇鐵、紅豆杉、台灣穗花杉、叢花百日青等。

好在，情況也不全然那麼悲觀。針對台灣油杉的生育地，羅教授曾以其土壤理化特性與植群為題進行分析，初步結論算是好消息。研究團隊發現，在生存環境方面，台灣油杉並不侷限於特定土壤與氣候條件，這對於其族群擴展是有利的；在植物社群方面，它能與不同的植物相處而不退讓，因此，也不太有競爭上的問題。此外，其族群中不乏小苗、幼木，整體更新有望。

拉它們一把

然而，台灣油杉族群稀少終究是事實，亟需人類積極地拉它們一把。坪林早在 1975 年即設立保護區，1986 年再依據文化資產保存法，成為台灣油杉自然保留區。保留區比保護區的層級高，受到的維護更嚴格，目前台灣共有 19 處自然保留區。此外，林務局依森林法，也先後在大武（1981）、礁溪（1992）劃設台灣油杉自然保護區。

幾十年過去了，情況沒有好轉嗎？對此，羅教授解釋，要根本拯救台灣油杉，詳細的基礎資料不可少，但植物個體生老病死的紀錄，需要很長的時間觀察。所以要看到成效，急不得。不過，除了劃設保留區／保護區之外，還有擴大族群與基因庫交流兩項工作可以加強。

In such a sense, Taiwan is a paradise for native species, which account for one quarter of all species found in Taiwan. But this doesn't mean people would treasure them. Besides the harm done by humans, Taiwan Cow-tail Fir faces another crisis from within: its low fertility. Frequent failed fertilization and a low germination rate have prohibited the increase in the number of the tree, a similar problem faced by some gymnosperms such as *Cycas taitungensis*, *Taxus sumatrana* (Miq.) de Laub., *Amentotaxus formosana* Li, and *Podocarpus fasciculus* de Laubenfels.

Fortunately, the situation is not all that hopeless as Lo has found in his research that Taiwan Cow-tail Fir grows not just in certain types of soil and climate, and is able to live with other plants without compromising itself. These are good news and hopeful signs of potential revitalization of the tree.

Give Them a Hand

As current scarcity of Taiwan Cow-tail Fir is still truth, more help from humans is desperately needed. A conservation area has been established in Pinglin in 1975, and has later become a natural reserve in 1986 and enjoyed greater protection. Two other natural reserves of the tree have been set up in Tawu in 1981 and Jiaosi in 1992.

Has the situation turned better after dozens of years of such work? Lo explains that to fully conserve Taiwan Cow-tail Fir requires detailed data of the entire life process of the species, which takes a very long time, so we must not expect quick results. But we do need to do better in two things: increasing the number of the tree and exchanging its gene pool.

擴大族群，才能降低滅絕的機率。人為砍伐、颱風、森林大火，可能只是大型喬木基本的生存挑戰，但對稀少的台灣油杉而言，卻是難以承受的風險，何況還有全球氣候變遷加劇的新挑戰。唯有增加個體數量，才有足夠本錢面對各種衝擊，造林，就是擴大族群最直接有效的方式。另針對現有管制區外圍，亦可考量劃設緩衝區，一來隔絕干擾、得到更完善的維護，二來預留林木擴展腹地。

至於基因庫交流，則是為了增加遺傳的變異性，讓後代更有能力適應環境的變化。又因台灣油杉族群分處南北兩端，距離太遠，不可能靠自然的力量傳遞花粉或種子，故需藉助人力，以種苗、扦插苗在兩處相互栽植。如此，不但符合擴大族群的需求，不同林地也都各自注入了新血，增加基因多樣性，利於繁衍。

珍惜老天賦予的資源

台灣油杉雖然嬌貴，卻非與世隔絕。事實上，低海拔的生育地反而讓它易於被親近、被觀察。除了族群聚集的保留區／保護區外，如開頭提到的台大校園，以及坪林國小、附近的農家，甚至位於台北金山南路錦安里的社區內，平地裡也能驚見其零星的身影。若有適當的管理，羅教授認為，台灣油杉是可以廣為栽種的。它樹型優美，具有觀賞價值，更重要的，它是本土的原生特有物種，有教育意義。只是，現在的園藝選擇，僅偏重觀賞層面，大量引用外來種也不在乎，令保育人員頗為擔憂。

而不只台灣油杉，許多珍稀植物的保育，也要更積極。羅教授以台灣島槐為例，它也是瀕臨滅絕的特有種，大多分布於山腰上，但也有少數分布於遊客人數較多的陽明山國家公園的二子坪一帶。羅教授提醒，進入此區內須更注意腳下的一花一草，不只是為了尊重生命，同時也能為物種保育多盡一份心力。

台灣雖小，卻擁有多樣的地形地貌、豐富的動、植物生態，走在其中，不只是享受，更有深刻的感動。對於這些上天賦予的資源，本應珍惜、維護，何況是原生瀕危的物種。台灣油杉保育的方向已經很清楚了，且確實可行，期盼政府與民間多加把勁，未來，得以解除它的紅色警戒，讓一株株台灣油杉都能順利茁壯，看到台灣美麗的藍天。

Increasing the number of the tree lowers the risk of extinction, and helps the species deal with the challenge of logging, typhoons, fires, and climate change. We may also build a buffer zone at the skirt of the restricted area to ensure a full protection and room for forest expansion.

Exchanging the gene pool of the tree may increase its genetic variety and help the tree develop greater adaptability to environmental changes. The clusters of Taiwan Cow-tail Fir, located far apart in the northern and southern parts of Taiwan, heavily rely on planting seedlings and rooting cuttings by humans instead of transmitting pollens and seeds on their own, in order to facilitate the propagation.

Cherish the Natural Gift

Precious as Taiwan Cow-tail Fir is, it can be easily accessed and observed due to its low-altitude habitats, which are scattered in places like NTU, Pinglin Elementary School, Jin-an Li neighborhood, in addition to its reserves. Lo thinks that the tree should be widely planted because it's elegant in shape and native to Taiwan. But nowadays people strongly prefer those plants that look pretty, especially many foreign species, when making choices in gardening. This has truly worried local conservationists.

Besides Taiwan Cow-tail Fir, many precious plants should be better conserved, too, such as the endangered *Maackia taiwaniana* Hoshi et Ohashi. Most of them are located at the hillside while some grow at Erzhiping, where only a few tourists frequent. Tourists must pay more attention to the flowers and the grass beneath themselves, so as to respect lives and contribute to protecting the species.

Living in such a tiny island as Taiwan with a great variety of landscapes and flora and fauna, we feel privileged and touched, and should cherish and conserve these natural gifts. Hopefully one day we will see Taiwan Cow-tail Fir flourish and stand strong reaching to the beautiful sky.

羅漢強教授簡介 Profile of Prof. Hann-chung Lo

羅漢強，國立臺灣大學農學博士，現任該校森林環境暨資源學系教授兼系主任。主持樹木解剖學研究室，探討本省珍稀鄉土樹種之分類地位、有性或無性繁殖、生命史、族群構造等主題，以供保育之參考。

With a Ph.D. in Forestry at National Taiwan University, Lo is currently a professor and the chairman of School of Forestry and Resource Conservation, NTU. He also hosts the Lab of Tree Anatomy, exploring the categorization, a/sexual propagation, life history, population structure of precious native trees in Taiwan.

