

# 台灣。樹冠層的探索及頌讚

## Taiwan Explores and Celebrates Her Treetops

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在2009年，2位年輕的台灣生物學家拜訪我位於佛羅里達的辦公室，表明想要學習有關建造樹冠層吊橋的知識。這座樹冠層吊橋就位於我辦公室附近的瑪雅卡河州立公園，完工之後，不僅促進了許多科學上的新發現，更讓來訪的遊客加倍(甚至是3倍)的成長。2位國際訪客的夢想是在台灣也如法炮製建造一座樹冠層吊橋，以探索當地樹冠層生物多樣性的奧秘。於是儘管在燠熱潮濕的6月天，我們一行人在這座佛羅里達的樹冠層吊橋上，四處量測，拍攝每個螺栓、每條鋼纜，並討論樹冠層吊橋的建造及營運方式。

就在5年後，雪霸國家公園的處長邀請我去參加樹冠層吊橋的開幕式，這座吊橋在預定時程及預算內完工了！採用國際樹冠層吊橋的設計，雪霸的樹冠層吊橋耗資2萬4千美金，在2014年4月15正式開始營運。其實台灣早有一座觀光用的天空步道(編按：位於溪頭)，每年吸引數萬名遊客來訪。然而尚未有專為研究目的所設置的樹冠層吊橋。2位年輕的台灣科學家：藍永翔與傅國銘，無疑是催生此座研究設施的推手，而他們的研究生涯也因此台灣的樹冠層科學界啟動。某項令我激動的創新設計是，雪霸採用了電動的繩索式上升器，將訪客帶至樹冠層最高處的吊橋，可說是名符其實的“垂直”搭乘經驗！

我在此次的台灣參訪後，大量的書寫有關這個國家的令人驚嘆、美麗的森林樹冠層。過去人稱福爾摩沙，台灣是一個距離中國大陸

In 2009, two young Taiwanese biologists arrived at my doorstep in Sarasota, Florida, determined to learn everything about the canopy walkway built in nearby Myakka River State Park. This unique treetop walk has not only inspired research discoveries, but has also doubled (even tripled) visitors to this American park. The dream of my international visitors was to build one in Taiwan, and uncover the mysteries of biodiversity in their native treetops. Despite the sultry humidity of a blazing hot June day, we traipsed around the Florida walkway measuring and photographing every bolt and cable, and discussed how the walkway was constructed and operated.

Only five years later, Chiu-Fang Lee, the director of Taiwan's Shei-Pa National Park, invited me to the grand opening of their canopy walkway, constructed on schedule and under budget! Based on the design of other global walkways for canopy research, Shei-Pa National Park's walkway officially opened on April 15, 2014 and cost approximately \$24,000 US. The country already has a tourist skywalk, attracting hundreds of thousands of visitors per year. But there was no site dedicated to research. Two young Taiwanese scientists, Yung-Hsiang Lan and Kuo-Ming Fu, were the catalysts for this new research venture; and their scientific careers are now launched in the treetops of Taiwan. One thrilling innovation to our American canopy design was their addition of a small generator to literally propel up a rope and



圖1 筆者與台灣的女性科學家合影(Meg Lowman 攝)

160 km遠的島嶼，面積約等於麻塞諸塞州與康乃狄克州的總和，居民約2千3百萬。台灣有發達的國家公園系統來保護生態敏感區域，並提供遊樂的功能，藉以獲得經濟效益。台灣雖然是個小島，卻有超過200座以上的3000 m高山，所以事實上台灣的棲地總面積是島嶼面積的3倍之多。雪霸國家公園涵蓋了15萬英畝人跡罕至的山地區域，島嶼上，登山健行及賞鳥等自然生態愛好者的活動也日益普及。

為什麼台灣該提倡樹冠層研究？台灣引以自豪的是生態保育方面的成就，那些為下一代保護的原始林裡，孕育了許多精彩的物種，比如櫻花鉤吻鮭、台灣黑熊，以及超過100種以上的特有蝶類。此外超過1000種(編按：將近4000種)的高等維管束植物，遍布整個山區森林，那些令人驚嘆的巨大樹冠層，包括玉山圓柏、台灣紅檜，以及鐵杉等等。對比美國已經伐除了超過95%的原始森林，台灣島仍然保留著面積廣大的原始森林綠帶。這代表台灣的樹冠層生物學家可以研究天然林裡而非次生林的原生生物，揭開健康原始森林的秘密，以此觀點而言，台灣的樹冠層可說是全人類的瑰寶。

into the uppermost bridge of the Shei-Pa canopy, truly a great vertical ride!

After visiting Taiwan, I have written extensively about the wonders of this extraordinary country, and her gorgeous forest canopies. Formerly called Formosa, Taiwan is an island located 160 kilometers off the coast of mainland China, almost the same size as Massachusetts and Connecticut combined, and home to 23 million people. Taiwan has an extensive national park system that protects the country's ecologically significant regions, provides recreational opportunities, and stimulates economic growth through tourism. Despite its relatively small size as an island, Taiwan has over 200 mountain peaks above 9,000 feet, so it actually boasts over triple the land surface than if it were flat. Shei-Pa National Park embraces approximately 150,000 acres of high mountain landscapes in the remote interior of Taiwan. The country is increasingly popular for hikers, bird-watchers, and nature-lovers.

Why canopy research and why Taiwan? Taiwan prides herself on extraordinary conservation. Expansive tracts of primary forest have been carefully conserved for future generations, and their biodiversity includes such amazing creatures as Formosan landlocked salmon, Formosan black bears, and over 100 species of native butterflies. Over 1000 species of plants dominate their montane forests including enormous canopies of Yushan juniper, Taiwan red cypress, and Chinese hemlock. Whereas Americans originally cut down over 95% of our own primary (or original) forests, Taiwan has retained enormous swathes of original, old-



圖2 筆者受邀於樹冠層研討會開幕演講(Meg Lowman 攝)



圖3 筆者於雪見的樹冠層吊橋(Meg Lowman 攝)

此外以科學上的重要性而言，台灣的島嶼隔離作用，造就了許多台灣特有種(編按：只有台灣有分布的物種)。有幸來到台灣的訪客，可能見到櫻花鉤吻鮭、山豬、帝雉、水鹿，這些全都是台灣特有種。而我印象最深刻的就是櫻花鉤吻鮭了，這種陸封性的鮭魚，已經完全適應了淡水的溪流環境，不需要週期洄游至海洋，了解魚類如何適應這種巨大的轉變機制，可能可以解決近年來因為海洋酸化及棲地惡化而頗受衝擊的漁業問題。

台灣邁入了日益興起的樹冠層研究領域，嘗試了解森林樹冠層的奧秘，所謂的樹冠層可說是大氣與陸地的交界，全世界預估有超過一半的陸地生物棲息於此，也因此健康森林對健全地球生物至為關鍵。因此我頌讚台灣，期待雪霸國家公園的樹冠層吊橋，能訓練更多新世代的台灣樹冠層生物學家。

growth trees. One of the country's six major national parks, Shei-Pa is a wonderland of unique biodiversity. This means that forest scientists can determine what lives in the original forest canopies, not just the secondary regrowth; such discovery may shed light on the true nature of healthy forests. Taiwan's canopies are a treasure for the entire planet, not just for Taiwan.

Also of great scientific importance, Taiwan's isolation as an island has resulted in many endemic species (translation: species native only to this single place). Anyone who is fortunate to visit Taiwan might see the Formosan rock-monkey, the Taiwan wild boar, Mikado pheasant, or the Formosan sambar – all unique to this island nation. Perhaps the most incredible creature to me was the Formosan landlocked salmon, which has adapted to living entirely in fresh-water lakes and streams without the conventional migration to the ocean and back. Understanding how fish adapt to such significant changes in their movements may provide critical knowledge in dealing with the future of fisheries that are currently threatened by ocean acidification or other environmental degradation.

Taiwan now joins a growing number of countries who are trying to understand the scientific secrets of forest canopies. The treetops is the interface between land and atmosphere, and is home to an estimated 50% of our terrestrial biodiversity. Healthy forests are critical to the health of all life on earth. So I celebrate Taiwan, and I look forward to seeing the next generation of forest scientists who will train in the canopy walkway of Shei-Pa National Park. 🌳