



老智慧 大地與人的新關係

Old Wisdom

New Human-Nature Relationship

陳其澎 談文化與生態工程

Chie-peng Chen on Culture and Ecological Engineering

採訪撰文 Interview & Text / 江明真 Ming-zhen Jiang 特別感謝 Special thanks to / 桃園縣環境景觀總顧問陳其澎教授 Prof. Chie-peng Chen, Chief Consultant for Environment & Landscape, Taoyuan County 圖片提供 Photo provided by / 陳其澎 Chie-peng Chen 翻譯 Translator / 蔡琇雯 Shio-wen Tsai

「生態工程」儼然是21世紀正夯的顯學。國際間，多層次多面向相關議題的研討、大型展覽、參訪等等活動之頻繁，天天可聞，這股熱潮正反映出全球對自然環境的永續存在有著普遍性的重視與急切，另外也反證：這是一條仍在探索、實驗、累積經驗的路。

拉近距離，縮小範圍，或許我們可以從身邊更具親和力與本土性的實作案例，重溯生態工程的初衷，同時也不忘在急著謀求人為環境與自然環境合諧共存的關係中，反覆提出大哉問：

「人」的位置？

百年傳承工法 沒有怪手只有人手

距今三百年前，我們的古老祖先已有了生態工程的施工智慧。在沒有怪手，只有人手的年代裡，他們從卵石及木料等自然材料的收集、揀選、加工、到疊砌，一路胼手胝足地完成真正最環保而原始的DIY生態工程。

直至今日，這些阿公阿嬤的智慧仍未被時代所淘汰，甚至在開發過度與自然環境警示的衝突下，這些原始智慧得以更被為所重視。

「講到生態，大部分人會想到自然環境、自然生態，而往往忘掉了『人』，人的生態。」中原大學室內設計學系陳其澎副教授緩緩說道。陳教授曾先後擔任國家公園的環境景觀總顧問，現任為桃園縣環境景觀總顧問。親力而為地參與了許多社區營造工程的陳教授認為，自然生態與人文生態兩者間，應更能尋其密切的互通關係，並從和諧的本源中領造出最符合生態環境的施作方式。



玉山國家公園梅山遊客服務中心的生態池 / 陳其澎提供
The ecological pond at Meishan Visitor Center in Yushan National Park. / Photo provided by Chie-peng Chen

Ecological engineering has well become one of the hottest topics in the 21st century.

Multi-level seminars, grand exhibitions, and site visits regarding ecological engineering have been constantly held internationally. This hot trend suggests widespread attention and urgency on the sustainability of natural environment. Yet, it is still a path that requires exploration, experiment, and experience.

By looking somewhere closer, one may revive the original purpose of ecological engineering from the more closely related local cases. In searching a harmonious coexistence between man and Nature, one must remember to ask the big question: what is the place for “humans” in all this?

Century-old Techniques by Hands

Ancestors in Taiwan had developed the wisdom of ecological engineering since 300 years ago, when they used only hands to collect, select, process and pile natural materials such as pebbles and logs, accomplishing the most primitive and environment-friendly ecological engineering.

Till this day these old wisdoms are still embraced by modern societies, and even more highly valued in a time of overexploitation and conflicts as Nature has started warning humans.

“Speaking of ecology, most people think of the natural one, but often forget about ‘people,’ the ecology of people,” said Asso. Prof. Chie-peng Chen of Dept. of Interior Design, CYCU, and chief consultant for Environment & Landscape at National Parks (formerly) and at Taoyuan County (currently). Having participated in cases of community development, Chen suggested that people find a closer relationship between natural and human ecologies, and initiate a most eco-friendly engineering from human-Nature harmony.



金門國家公園烈嶼自行車道。利用親近自然設計手法，使遊客能深曾感受列嶼之美，同時保護大地的滋養與當地特殊地形的保存。
Lieyu Biking Trail in Kinmen National Park. With a design that promotes closeness to the Nature, the Trail allows tourists to enjoy the beauty of Lieyu and at the same time protects the land and preserves the characteristic landform.



領先關懷 生態工程在國家公園

「使用符合『原生』、『自然』的材料，以堆疊的方式創造多孔性空間，有利植生復育，快速融入地景，且避免造成大片混凝土的構造，阻礙生態系的平衡。」早在2000年時，生態工程已是國家公園貼近土地關懷、為所重視的施工原則。

以墾丁國家公園的石牛溪整治工程為例，由於其邊坡多處係砂質土壤，為免危害鄰近農牧場之安全性，又必須兼顧護岸功能及生態保育，除了在河岸上採取分段式蛇籠、植生護坡與採砌石塊等護岸工法；引進當地原生的喬木、灌木林帶以減緩洪水流速，防止砂石大量流出總體施作上的總體考量與檢測都較一般工程來得繁雜，每個環節亦須更為審慎。

雪霸國家公園的湧泉池，則設置為台灣櫻花鉤吻鮭的生態避難河道。將深潭淤沙清除，同時再將引水道與七家灣溪流匯口處加強護岸，並在引水道內以石頭堆砌成階梯狀和複式斷面水路，如此便可讓鮭魚能順利洄游避難。

Eco-engineering Pioneer: National Parks

“Using native and natural materials with the technique of stone-piling to create porous space is helpful for botanic restoration and its rapid integration into the landscape, and prevents large areas of concrete structures from breaking the balance of eco-system.” This principle of ecological engineering has been the major concern and emphasis of national parks since 2000.

In regulating Shihniu River in Kenting National Park, in order to protect its banks' sandy soil and the nearby farms and ranches, eco-engineering techniques such as multi-section gabions, bank-protective vegetation, stone-piling, etc. were applied while local native arbors and shrubs were introduced to lessen the torrent speed and prevent large amounts of sand and stones from being washed away. All the considerations and inspections of the entire project were much more complicated and required more caution than usual.

In setting up Yongchuan Pond in Shei-Pa National Park as the conservation watercourse for Formosan Landlocked Salmon, silt in the Pond was cleaned up and riverbanks at the convergence of the canal and Cijiawan Creek were strengthened. Ladder-like multi-section watercourse made by piled stones would allow the salmon to retreat for shelter.



太魯閣國家公園著名的景觀地點砂卡礑步道，在不破壞原始地景與生態環境，甚至是避車區的道路容許強度等施作原則下，除了材料及人員運輸皆須以人工或小型農用運載車搬運，在山壁側預留集水溝，並在步道低凹處設置導水明溝，將雨水導入溪谷等，都是包含在生態工程內的技術環節。

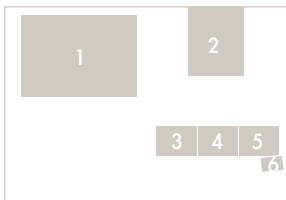
生態工程 好近好近

若再拉近一些，其實如此的生態工程，也能在與民親近的厝邊巷道裡見到。

In renovating the famous attraction Shakadang Trail in Taroko National Park, the project did not cause damage to the original landscape and eco-environment, and took the road allowance of intensity into account, requiring all the materials and staff must be transported by men or small light trucks. Gutters and ditches were carefully designed and built to protect the mountain walls and direct the rain water into the valleys. All these are part of ecological engineering.

Up-close Manifestation of Eco-engineering

Such ecological engineering, in fact, can be found right around the corner and in nearby lanes and alleys.



1. 國家公園的生態工程都是典型的運用，有些活動能讓民眾親近、體驗生態工程的精神 / 陳德鴻攝
The practice of ecotechnology in National Park, regenerated human ecological interaction through the maintenance and management of communities./by De-hong Chen
2. 雪霸國家公園中的湧泉池，是台灣櫻花鉤吻鮭的護育避難所 / 雪管處提供，俞錚攝
Yongchuan Pond in Shei-Pa National Park serves as the conservation shelter for Formosan Landlocked Salmon. / Photo provided by SPNP; taken by Cheng-hao Yu
- 3-4. 太魯閣國家公園砂卡礑步道施工前後照片。(左) 舊有步道沖刷嚴重。(右) 完成後步道俱排水生態功能老少皆宜。
Views before and after the renovation of Shakadang Trail in Taroko National Park. The old trail was seriously washed off. (left) After renovation, the Trail serves both drainage and ecological functions and is suitable for tourists of all ages. (right)
- 5-6 墾丁國家公園龍鑾潭特別景觀區。(左) 水管露出部分可做適當材質遮掩。(右) 以竹筒固定池底泥沙。 / 陳其澎提供
Longluan Lake Landscape Protected Area in Kenting National Park. The extruding part of pipes may be covered by some proper materials. (Left) Silt at the bottom of the Lake is held in place by bamboo tubes. (right)

從先民智慧看生態工程——壘石工法

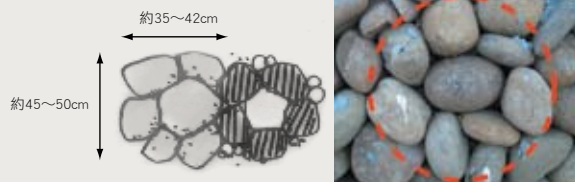
A Look at Ecological Engineering from Ancestors' Wisdom The Cobbl. laging Technique

台灣先民從卵石的材料收集、加工、撿選、到壘砌的過程，必有一套固定的方法，這些固定的方法是聚集當地族群的智慧，歷經無數次的「嘗試」、「錯誤」與「改善」才漸漸形成的。

The Hakka ancestors employed a fixed set of methods for the collection, processing, selection and piling of pebbles. These methods represent the wisdom of the local community and were formed through numerous trials and errors and improvements.



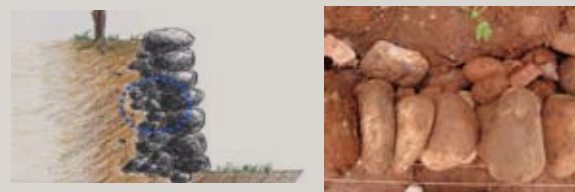
取大顆完整礫石安放疊置平整，是為第一層，上方疊放較細小的礫石，以填補不平整之處。
Large gravels are laid flat as the first layer, on which smaller ones are placed to fill up vacancies.



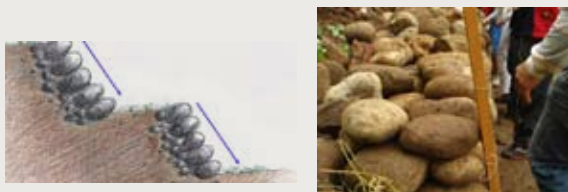
表層壘石以一顆圓石為中心，周圍一個單位的壘石排列擺放五至七顆壘石，互相咬合，為且石頭間的縫隙需呈三角形，如此石頭間才會有咬合力，此種排列工法稱為「五圓砌」。
At the center of the surface layer is a round pebble, which is surrounded by 5-7 joining-up pebbles. The gaps between pebbles have to be triangles so that there is enough snap-in force between pebbles. This technique is known as the five-circle pitching.



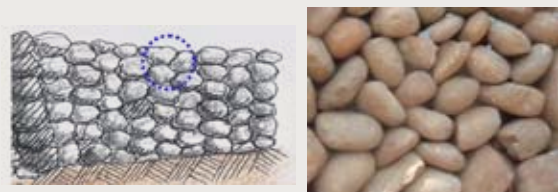
堆疊卵石的面要平整，才能使得整個壘石牆面穩固，不會輕易的倒塌。
The surface of the pebble pile has to be even so the entire layer can be firm and stable.



卵石堆砌時，將緊密堆疊的小石頭填滿於大石頭後方，而後大石頭疊上壓實砌之，增加穩固。
When piling pebbles, smaller ones that are densely piled should be placed behind large ones. After that, large pebbles are placed on top of the pile to increase firmness and stability.



卵石的堆疊面要略微向後傾斜，避免成為垂直面，才能保持牆面不會向前坍塌。
The pebble pile should lean backwards instead of standing straight, so that it won't collapse.



利用「人字型」疊砌的方式使石頭與石頭之間彼此能咬合住，增加摩擦力。放置卵石時，需不停的以各個角度調整卵石的位置，務求與四周的卵石都有接觸。
The herringbone technique allows for greater adhesion and increases friction. When placing the pebbles, one must constantly adjust the position of each pebble to make sure that it is somewhat attached to other pebbles.



從國家公園常需實踐生態工程。圖為雪霸國家公園之大鹿林道維持原有的碎石路面供遊客通行 / 賴宛靖攝

Dalu Forest Road in SPNP is being repaired as efficiently as possible by maintaining the original gravel surface that allows tourist to pass./by Wan-ching Lai



大汗淋漓跟著老師傅學習壘石工法，「身體記憶」有了傳承

Students are sweating while learning with master craftsman the Lei Stone technique, thus passing on the "body memories."

陳教授茲舉「水巷桃園」的水巷生態環境建構來說明，沿桃園「大圳第」十二支圳，將部分已被覆蓋的水圳重新掀蓋，重塑一條親水的水圳步道，連串水圳、埤塘等，使其成為更優質的生活環境，實現生活、生產、生態兼顧的社區願景。「同樣是堤岸，在水泥圍砌的隔絕工程下，水是水，岸是岸；壘石多孔性工法則讓兩者空間可互相穿透，植物根菌微生物可滋養小蟲小魚，而其排泄物與在土裡的翻動也能適切釋放養分，讓植物長得更好，形成可互通互惠的生態體系。」

原來，人與人之間原本的疏離與隔絕，也能如同國家公園為生態旅遊所肩負的保育責任、或是水巷在民里社區間的成功搭建，讓「人」這角色，成為了生態工程正面效益上的永續條件；原來，與自然環境親近的生態工程，也可以很近很近。🌱

The ecological construction of "water alleys in Taoyuan" is a great example. The project uncovered some of the 12 waterways and rebuilt a canal trail that connected waterways, low-wall ponds, etc. to fulfill a vision of a community balanced in life, production, and ecology. "Under the method of concrete construction, the water and the banks are two individual things. The technique of porous-space stone-piling allows the two to access each other's space. Root fungus and microbes can nourish insects and fish, and their feces, with the flip in the earth, may release nutrients to help plants grow, and hence form a mutually beneficial ecosystem."

Through this kind of eco-engineering, people have renounced the alienation that used to exist among them and become a positive factor in the sustainability of eco-engineering, just as effectively as ecotourism designed by national parks and water alley constructions in neighborhoods. It turns out that such Nature-friendly ecological engineering can be so up close to everyone's life. 🌱

陳其澎教授簡介 Profile of Prof. Chie-peng Chen

中原大學室內設計學系副教授：曾任內政部國家公園計畫委員、桃園縣文化資產審議委員。曾以「水巷桃園」概念，規劃新屋鄉巷弄空間及埤圳文化再造計畫，引領團隊獲營建署城鄉風貌計畫首獎。

Asso. Prof., Department of Interior Design, Chung-Yuan Christian University; Member of National Park Committee, Ministry of the Interior; Member of the Cultural Heritage Committee, Taoyuan County. Under Chen's leadership, the space reconstruction project in Xinwu Township, Taoyuan County, was recently awarded the first prize in Creating Urban and Rural Landscape Plan by Construction and Planning Agency, Ministry of the Interior (CPAMI).

