Overview Governance Carbon Reduction Energy Transition Nature Inclusion Appendix

## chapter 4

# **Nature**

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4.1

# TCC Nature Action

TCC places nature at the heart of its business philosophy, integrating natural carbon sinks into its 2050 net-zero strategy. In line with the Kunming-Montreal Global Biodiversity Framework adopted at COP15, TCC aligns its nature-related actions with global targets for 2030 and goals for 2050, aiming to live in harmony with nature and achieve positive outcomes for biodiversity.

Nature is the foundation of the global economy with over half of global GDP (over 44 trillion USD) depending on natural resources and ecosystems.

According to Swiss wealth manager Lombard Odier, 33% of global soil is moderately to severely degraded, and around 5 million hectares of forest—1.4 times Taiwan's area—are lost annually. As extreme weather worsens, sustainable investments must go beyond net zero and prioritize nature-positive growth.

#### **3**

"TCC remains committed to exploring ways for civilization and nature to coexist in harmony, serving life, always in service of life."

--Chairman Nelson An-ping Chang



By 2040

Net Positive Impact (NPI)
No Net Deforestation



Biodiversity Policy

No Deforestation Commitment

#### TCC's Terrestrial and Marine Nature and Biodiversity Programs Mapped to 23 GBF Targets



Fulfilling Human Needs through Sustainable Utilization and Benefit Sharing



Promote Hoping EcoPort as OECMs

6,8

3

NbS Project: White popinac Removal

4

Ex-situ Conservation Plan for Botanic Conservation Center 2,11

Formulate and Implement
Quarry Rehabilitation Plan (QRP)

Ho-Ping Ark Ecological Program

9

Plan

(BMP)

Biodiversity

Management

8

NbS Project: Aquavoltaics

Low-carbon Construction Materials Development 12

Kaohsiung Shoushan Land Transformation to Detention Basin Park

13

Dr. Cecilia Koo Botanic Conservation Center (Conservation Center)'s Plant Gene Bank Assists Pharmaceutical Development Implementation tools and mainstreaming solutions

Ho-Ping Power Plant: Little Tern Environmental Education

Hoping EcoPort: Harbor-type Environmental Education Site

TCC DAKA Environmental Education 19

Long-term
Investment in
Botanic
Conservation
Center and
Forest, Soil,
Marine
Restoration and
Research
Projects

22

Implementation of Consultation and Consent Rights for Indigenous Peoples

23

Nature-related Project Team is Led by a Woman (the Chief Sustainability Officer)

15

14

Regular Monitoring of Quarry and Marine Ecosystems

Release of Task Force on Nature-related Financial Disclosures (TNFD) Report

Kunming-Montreal Global Biodiversity Framework available on CBD website

# TCC Nature Management

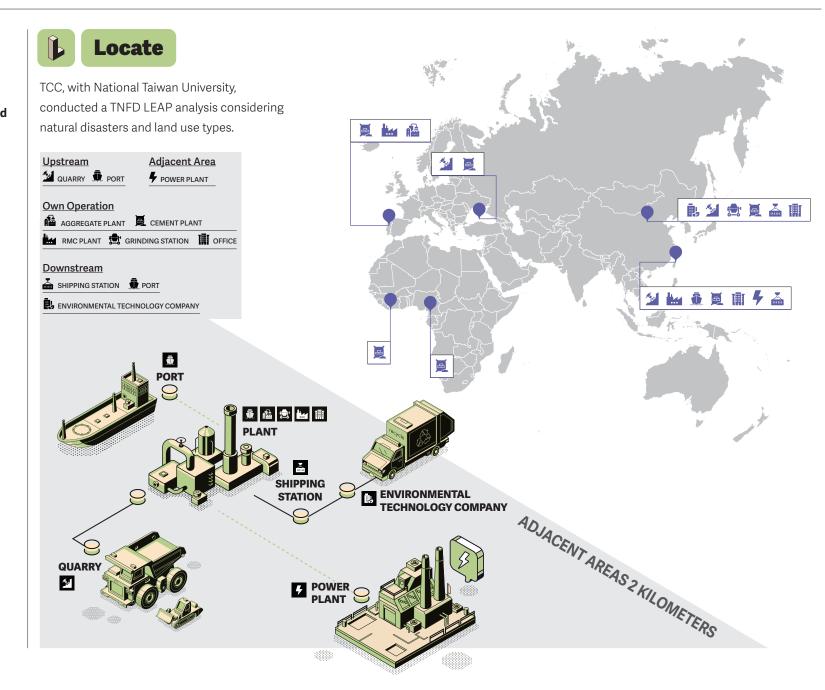
Assessment and Management Conducted in Accordance with International Standards, the Task Force on Nature-related Financial Disclosures (TNFD), and SBTN





# Scope

TCC's cement operations in Taiwan, Mainland China, Türkiye, Portugal, West Africa, and its suppliers in Taiwan and Mainland China.



#### TCC Locate Methodology Description

Sites are evaluated based on two major criteria: Criterion I - Natural Sensitivity and Criterion II - Operational Impact.

- Criterion I Natural Sensitivity: Composed of ecosystem sensitivity and species sensitivity
- Criterion II Operational Impact: Taiwan sites add operational impact analysis according to actual conditions

Taiwan	Mainland China	Overseas locations						
Criterion I-1 - Ecosystem Sensitivity								
100% of TCC's operational sites are not situated within Category I-IV protected areas	n World Heritage areas or International Union f	or Conservation of Nature (IUCN)						
<ul> <li>Ministry of the Interior's National Land Function Zones</li> <li>Ministry of the Interior's Marine Resource Areas</li> <li>TCC's Dependency on Disaster Resilience</li> </ul>	<ul> <li>National Protected Areas</li> <li>World Database on Protected Areas (WDPA)</li> <li>Key Biodiversity Areas (KBA) Database</li> </ul>	<ul> <li>World Database on Protected Areas (WDPA)</li> <li>Key Biodiversity Areas (KBA) Database</li> </ul>						
Criterion I-2-Species Sensitivity: Assess the number	of potentially threatened species around the si	te						
Taiwan Biodiversity Network Data	<ul> <li>→ China Natural Observation Species         Distribution Database     </li> <li>→ IUCN Species Distribution Database</li> </ul>	Mean Species Abundance (MSA						
Criterion II-Operational Impact: Calculate the vegetation naturalness of the site based on current land use to determine the degree of operational impact on the environment								
Methodology for Assessing Plant Naturalness in Environmental Impact Assessments	_	_						

Contains important ecosystems, hosts multiple threatened species, and is located in areas with high naturalness; operations may have negative impacts on nature.

Contains important ecosystems, hosts multiple threatened species, and is located in areas with high

Contains relatively important ecosystems, hosts a few threatened species, and is located in areas with relatively low naturalness.

M

Does not contain important ecosystems, has no distribution of threatened species, and is located in areas with low naturalness.

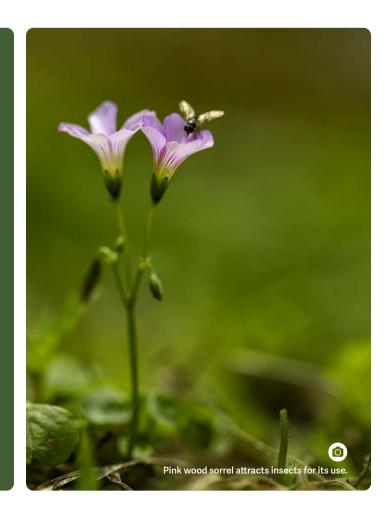
Definition of Priority / Nature Sensitivity

Inclusion

Appendix

TCC Nature Action — Forest & Soil - TCC Restoration Map — Marine Rehabilitation — OECMs (Other Effective Area-Based Conservation Measures) — Nature-based Solutions (NbS) — Natural Benefit Sharing — Environmental Education

Locate Analysis Results					
Value Chain Stage	<b>Business Activities</b>	VH	н		
Own Operations	Taiwan Cement Plant	0	0	1	2
	Mainland China Cement Plant	1	0	1	13
	Taiwan RMC Plant	1	0	20	15
	Mainland China Grinding Station	0	0	1	2
	Office	0	0	1	2
Upstream	Taiwan Quarry	3	0	0	0
	Mainland China Quarry	3	2	3	16
Upstream/Downstream	Hoping EcoPort	0	0	0	1
Downstream	Taiwan Shipping Station	0	0	0	5
	Hong Kong Cement Shipping Station	0	1	0	0
	Mainland China Environmental Technology Company	0	0	0	2
Surrounding Areas	Ho-Ping Power Plant	0	0	0	1



**=** 129

Note 1: Analysis of own operations in Europe and Africa, as well as suppliers in Taiwan and Mainland China, is still in progress.



#### **Evaluate**

In alignment with the TNFD methodology and Sector Guidance, TCC uses the ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure) tool, jointly developed by the UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and Finance Initiative (UNEP FI), to analyze the potential dependencies and impacts of operational sites on nature at a global scale.

The degree of impact and dependency is classified on a scale from 1 to 5, from low to high.

Using various scientific literature and databases-such as IPCC and UNEP-industries are assessed for their levels of impact and dependency on nature.

Definition of ENCORE

ENC	ORE Analysis for Own Operations, Upstream, Down	stream, a	ind Surrour	nding Are	as				Environment	
		Quarry	Cement Plant	RMC Plants	Grinding Station	Office	Port Area	Shipping Station	Technology Company	Powe Plant
	Flood mitigation services	4	3	3	3	1	4	1	1	3
	Global climate regulation services	4	1	1	1	1	1	1	1	3
	Dilution by atmosphere and ecosystems	3	2	2	2				3	
	Rainfall pattern regulation services	5	2	2	2	1	1	1	3	
De	Soil and sediment retention services	4	2	2	2	1	2	3	1	3
Dependency	Solid waste remediation		3	3	3				5 <sup>3</sup>	3
nde	Storm mitigation services	3	3	3	3	1	3	2	2	2
ncy	Water flow regulation services	4	3	3	3	1	3	1	3	4
	Water purification services	5 <sup>2</sup>	3	3	3				3	3
	Water supply	4	3	3	3	1	2	1	3	4
	Natural disaster protection	5	5	5	5	5	5	5	5	5
	Area of freshwater use	4	3	3	3		1			3
	Area of land use	3	2	2	2	3	2	2	3	3
	Area of seabed use	44					3			
	Disturbances (e.g, noise, light)	4	3	3	3	1	1	1	4	5
	Emissions of GHG	4	4	4	4	1	3	3	4	5
	Emissions of non-GHG air pollutants	4	4	4	4	1	2	2	3	5
	Emissions of nutrient pollutants to water and soil		3	3	3	1	3	1	4	
Impact	Emissions of toxic pollutants to water and soil	4	5	5	5	1	2	1	4	5
act	Generation and release of solid waste	2	3	3	3	1	2	2	3	4
	Introduction of invasive species	1						1	3	
	Other abiotic resource extraction	5								
	Volume of water use	3	3	3	3	2	2	2	3	3

For supply Chain Analysis and more, please refer to the ESG section of TCC's official website.

Note 2: TCC quarries only require water quality standards for plant restoration and have relatively low dependence on water quality.

Note 3: TCC Environment Technology Company uses high-temperature co-processing to treat industrial waste and household garbage, rather than relying on microbial or ecosystem functions through landfill. Therefore, this item is not applicable to TCC's operational model.

Note 4: All of TCC's quarries are located on land and do not affect seabed usage.

#### **Comprehensive Analysis**

Nature is both a fundamental prerequisite and the core spirit of TCC's development.

TCC has designated VH sites as top-priority management areas due to their high ecological vulnerability. Compared to H, M, and L sites, VH sites are located in close proximity to sensitive ecosystems such as nationally important wetlands, nature parks, and first-class coastal protection zones, and are potentially home to multiple threatened species. Maintaining a balance between operations and nature is one of TCC's core values. Failure to protect healthy ecosystems and threatened species may degrade ecosystem functions and reduce natural resilience, increasing the risk of disasters like landslides, floods, and extreme heat, leading to higher costs, production disruptions, and business losses.

Locate results show that VH sites are mainly within TCC's own operations and upstream value chain, especially six quarries. For cement plants, concrete plants, quarries, and suppliers in VH areas, TCC cross-assessed operations with ENCORE items rated 5 in dependency or impact to understand how each type of operation relies on and affects natural resources. Based on this, strategies and monitoring procedures were developed to reduce potential impacts, including informing suppliers of nearby protected areas, cautioning relevant activities, and engaging them in identifying feasible mitigation actions to reduce environmental impacts and promote biodiversity restoration around facilities.



#### Own operational sites in **Taiwan**

#### Location of VH Sites



**Hoping Quarry Taibaishan Quarry Shoushan Land** 

#### **Locate & Evaluate Comprehensive Analysis Results**

#### Locate

Hoping and Taibaishan Quarry are adjacent to a first-class coastal protection zone and a land protected area; Shoushan Land is adjacent to Shoushan National Park, with the potential distribution of Pangolin, Fairy Pitta, Brown Wood Owl, and Yellow-margined box turtle.

#### Encore

Quarry depends on rainfall pattern regulation services to prevent severe damage from floods or landslides, while extraction activities alter land use and impact biodiversity.

#### **Comprehensive Analysis Results**

Cross-analysis shows that extraction leads to ecological degradation, not only increasing the risk of landslides but also shortening the operational lifespan of the quarry.

For detailed results, please refer to the TCC 2023 TNFD Report.

#### **Adaptation Methods**

All quarries have established Biodiversity Management Plans to mitigate impacts on biodiversity and collaborate with academia to carry out scientifically based plant restoration efforts, to mitigate environmental impact, and ensure the sustainable use of quarry resources. For detailed information, please refer to 4.2 Forest and Soil Restoration Map.



**RMC Zhongli Plant**  The plant is located 740 meters from the Taoyuan Reservoir and Canal National Important Wetland, where protected species such as the black kite, gray water snake, and Taiwan red-legged frog may be present. The surrounding area is characterized by relatively low development and a higher proportion of natural forest distribution.

The operation of RMC Plants may cause greenhouse gas emissions and water pollution.

Through cross-analysis, we know that the plant's operations will result in the long-term discharge of highly alkaline wastewater with high concentrations of suspended solids into ecologically sensitive areas. Not only leads to soil alkalization and water pollution, exacerbating the difficulty of accessing water resources and increasing the maintenance costs of water infrastructure, but also disrupts ecological balance and weakens the plant's resilience to natural disasters.

The Zhongli Plant has zero process wastewater discharge and is equipped with a rainwater collection system to reduce dependence on water resources. Additionally, dust self-monitoring is conducted daily, and third-party dust and noise monitoring is conducted every six months to ensure that operational activities minimize impacts on surrounding biodiversity as much as possible.







# Own operational sites in Mainland China

# Location of VH Sites



Yingde Plant

#### **Locate & Evaluate Comprehensive Analysis Results**

#### Locate Encore

Adjacent to the Qingyuan

Yingde Black Tea Valley

Local Forest Nature Park,
with the potential presence
of endangered species such
as the Chinese giant

Cement plant
operations may
cause air and
water pollution.

+

#### Comprehensive Analysis Results

The outcome of the cross-analysis for Yingde Plant show consistency with those observed in RMC Zhongli Plant.

# Adaptation Methods

The Yingde Cement Plant has zero process water discharge and is equipped with a rainwater recycling system. It also utilizes multi-stage combustion equipment to reduce air pollution. Through continuous automatic air pollution monitoring and water pollution management mechanisms, the plant ensures all emission indicators remain below regulatory requirements.



Dapashan,
Houyan Xishan
and Qingshuijing, and
Jingkoumianshan Quarry
Shaoguan

Beihushan

Quarry

Two quarries in Yingde are adjacent to the Qingyuan Yingde Black Tea Valley Local Forest Nature Park, while the Shaoguan Quarry borders the Qingyuan Yingde Huashui Mountain Local Nature Reserve.

These areas potentially host endangered species such as the Chinese giant salamander, three-lined box turtle, tokay gecko, pangolin, and black-headed ibis.

salamander, three-lined box

turtle, tokay gecko, pango-

lin, and black-headed ibis.

Quarry depends
on rainfall
pattern regulation services to
prevent severe
damage from
floods or
landslides,
while extraction

activities alter

land use and

biodiversity.

impact

The outcome of the cross-analysis for quarries in Mainland China show consistency with those observed in Taiwan's quarries.

The quarries carry out revegetation and rehabilitation in accordance with the Biodiversity Management Plan, meeting the requirements of the National Green Mine assessment. Planning to launch flora and fauna monitoring and rehabilitation programs in 2025, collaborating with local universities to restore biodiversity in quarry through long-term systematic surveys and rehabilitation effort.



#### Assess

Please refer to
TCC 2023 TNFD Report



#### **Prepare**

Please refer to TCC 2023 TNFD Report









#### **Action Spotlight**

# TCC's four natural strategies recognized by Business for Nature – Sole construction materials company invited to share

TCC was invited by Business for Nature (BfN), supported by the United Nations, to speak at the 2025 Asia Nature Conference. BfN described TCC as a practitioner of natural and sustainable development within the construction materials industry, stating it

is, "Championing nature and sustainability in the cement and materials sector." TCC aims to prove through practical action that working in harmony with nature is not only achievable, but also a catalyst for new value and opportunities.

#### **TCC's Four Major Natural Strategy Features**

- → Formed a dedicated Biodiversity Group to identify and manage 10 nature-related risks and 12 nature-related opportunities, promoting corresponding initiatives .
- Uses alternative raw materials and renewable energy to cut emissions and reduce resource use, including repurposing invasive White popinac as biofuel.
- Collaborating with National Taiwan University and National Ilan University to conduct in-depth analysis of biodiversity in quarries, set 2040 nature net positive impact goals, and promote soil restoration projects.
- Sharing natural strategy with the goal of becoming a partner in the international It's Now for Nature initiative, engaging stakeholders in the issue through multiple channels, and promoting biodiversity mainstreaming.



## Participation in the Pilot Group for Science Based Targets Network (SBTN)

TCC joined the SBTN Pilot Group promoted by BCSD Taiwan and ERM. Using Geographic Information Systems (GIS), the group assessed key environmental indicators like biodiversity sensitivity and water stress at plant sites. Following the steps of Scope, Locate, Evaluate, and Access, the group explored SBTN standards and identified challenges in meeting disclosure requirements. Cross-sector collaboration provided insights into biodiversity impacts across industries, supporting the development of targeted, forward-looking nature goals and interdisciplinary strategies.

The SBTN, built on the Science Based Targets initiative (SBTi), is a network of 80+ NGOs and business groups—including CDP, WRI, WWF, and IUCN—working with companies to drive positive outcomes for nature through alignment with global ecosystem initiatives.

## **SBTN AR3T**



#### **REGENERATE/RESTORE**

- Quarry rehabilitation in Taiwan and Mainland China prioritizes native species and site-appropriate planting.
- Topsoil is collected at the Suao Plant and is mixed with spent mushroom substrate to restore plants.
- Hoping EcoPort established artificial wetlands, and nest boxes were installed in the quarries to provide ecological habitats and enhance urban resilience.
- → TCC's restoration program promotes plant growth in quarries, while also restoring soil health and gradually increasing soil carbon sequestration.

#### REDUCE

- Remove invasive White popinac and repurpose it as biofuel.
- Time-controlled streetlights to reduce light pollution; sound-proofing reduces noise.
- → Hoping Plant uses Membrane Bioreactor (MBR) technology to achieve 100% domestic wastewater-recycling and reuse, reducing environmental pollution.
- Hoping Quarry installed a vertical shaft transport system to reduce environmental dust.

#### **AVOID**

- TCC does not conduct extraction in any nationally designated protected areas.
- → The quarries in Taiwan and Mainland China 100% passed environmental impact assessments.
- Cement plants in Taiwan and Mainland China, as well as RMC plants in Taiwan, have rainwater harvesting systems to reduce freshwater extraction.
- To avoid using herbicides, manual mowing or solar-grazing are used for weed control.
   To prevent the spread of invasive species, implement vehicle washing control.
- Use sustainable self-evaluate questionnaires to avoid suppliers with significant biodiversity impacts.

#### **TRANSFORM**

Shoushan Land transformed into a hiking area and detention pond park, serving as a recreational area and a flood prevention system.

Hoping EcoPort is planning to apply for recognition as OECMs.

Reuse wastes as alternative raw materials and fuels, cutting waste and emissions.

TCC offers scholarships, home repairs, emergency funds to cooperate with local communities.

## Forest & Soil -Biodiversity Management Plan **TCC Restoration Map** coverage rate BMP 100% TCC KEY FACTS | Taiwan and Mainland China Quarry Rehabilitation Plan coverage rate **QRP 100%** Taiwan, Mainland China, CIMPOR, and OYAK CEMENT **HOPING QUARRY** 88% **Native Species Preservation Ratio ANTALYA PLANT, TÜRKIYE**

12,000

restored

23 QUARRIES IN MAINLAND CHINA

2,726,317

plants restored

30% restoration and

revegetation rate

**TAIBAISHAN QUARRY** 

**Native Species** Preservation Ratio

restoration and revegetation rate

#### **Forest** Restoration

TCC follows the principle of simultaneous quarrying and rehabilitation. All quarries in Taiwan and Mainland China have established Biodiversity Management Plans (BMP) and Quarry Rehabilitation Plans (QRP) tailored to local requirements, which aims to restore ecosystem, accelerate ecological succession, and achieve Nature Positive. To rehabilitate native species in quarries, TCC has adopted two approaches. One is establishing nurseries and conduct hardening in collaboration with experts like Conservation Center and Professors. The other is promoting natural succession to enhance plant diversity. CIMPOR and OYAK CEMENT also advance biodiversity efforts beyond compliance.



Hoping Quarry, Hualien

#### **Native Plant Restoration**

**Timeline:** Environmental and ecological surveys since 2003 |

Conducted long-term restoration projects since 2016 Team: Hoping Cement Plant and Ho Sheng Mining Co., Ltd.

**Rehabilitation Method:** Assisted natural regeneration, accelerating

rehabilitation progress with minimal intervention

To enhance rehabilitation success, Hoping Quarry rehabilitation team has established nurseries in lower-altitude areas with stable environmental conditions. Seedlings are only transplanted to the quarry once they adapt and grow steadily, improving survival rates. The team also collects seeds to cultivate seedlings, which are then replanted in the quarry to preserve the genetic diversity of local native plants. After ten years of rehabilitation, the native species preservation ratio reached 88%. The restoration and reforestation rate has reached 52.39%, an increase of 3.29% compared to last year.





Taibaishan Quarry, Suao

#### Wind-Resistant, Drought-Tolerant, and Site-Specific Rehabilitation

**Timeline:** in 2017, Dedicated Ecological Restoration Project Launched

Team: Professor Ji-Wei Huang, Sustainable Landscape Laboratory,

National Ilan University

Rehabilitation Method: Miyawaki method, achieving environmental protection through high-density planting of multiple species

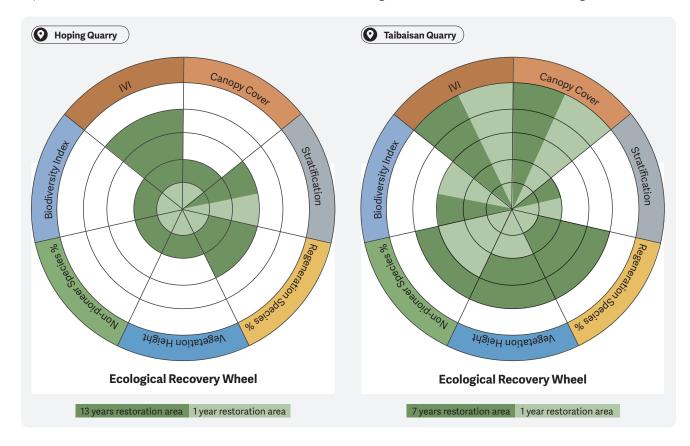
The Taibaishan Quarry's karst terrain poses challenges for water retention. To address this issue, solar-powered drip irrigation system, windbreak nets, and rainwater harvesting have been implemented. Poor soil is enriched with chicken manure, spent mushroom substrate, and other organic matter to improve soil quality. Increased planting density reduces wind gaps, improving resilience. Under the guidance of Professor Ji-Wei Huang, rehabilitation methods have steadily advanced, achieving 81% vegetation coverage within one year.



#### **Ecological Recovery Wheel:**

#### Seven Major Indicators to Evaluate Rehabilitation Progress

To assess quarry rehabilitation effectiveness, TCC introduced the Ecological Recovery Wheel based on the methodology of the Society of Ecological Restoration. It evaluates biodiversity using six major factors including ecosystem function, species composition, invasive species, and pollution. TCC applies key indicators related to quarry restoration to assess the progress of ecosystem rehabilitation. By 2025, the Ecological Recovery Wheel extended to Taibaisan Quarry. As Hoping Quarry adopts a semi-natural succession and Taibaishan Quarry prioritizes the restoration of non-pioneer species, separate wheels are used for each site. TCC will continue monitoring to ensure the effectiveness of ecological restoration.



#### **Canopy Cover**

The vegetation coverage in the sample plot

#### **Non-pioneer Species**

Species are ranked by shade tolerance from levels I to V. Those at level III or above are non-pioneer species. Higher percentage suggests a more advanced forest succession stage

#### Stratification

Vegetation composition is visually assessed to evaluate stratification structure. More stratification support species coexistence, enhancing biodiversity

#### **Vegetation Height**

The average height of vegetation with a DBH  $\geq$ 5 cm

#### **Regeneration Species**

Calculated as the percentage of species with DBH  $\leq 5$  cm relative to the total. A higher value indicates dominance by seedlings and fewer mature trees. The closer it is to a natural forest, the higher the score

#### **Biodiversity Index**

Shannon-Weiner Species Diversity Index adopted

#### IVI

Average coverage and frequency of native species are used to calculate IVI. A higher IVI indicates more native species in the plot

#### **Definition**

**Taibaishan Quarry** 

Items

IVI

81%

52.4%

2.6 meters

98.18%

92.25%

Canopy Cover

Stratification

Vegetation Height

Biodiversity Index

Non-pioneer Species

Regeneration Species

1st Year of Restoration (830m)

Two layers (ground cover and shrubs)

7th Year of Restoration (860m)

Two layers (ground cover and shrubs)

TCC Nature Action — Forest & Soil - TCC Restoration Map — Marine Rehabilitation — OECMs (Other Effective Area-Based Conservation Measures) — Nature-based Solutions (NbS) — Natural Benefit Sharing — Environmental Education

	Hoping Quarry	
Items	1st Year of Restoration (1020m)	13th Year of Restoration (1160m)
Canopy Cover	37%	83%
Non-pioneer Species	10%	29%
Stratification	Two layers (ground cover and shrubs)	Two layers (ground cover and shrubs)
Vegetation Height	1.87 meters	6 meters
Regeneration Species	100%	71%
Biodiversity Index	0.93	1.75
IVI	65%	98.7%

# Hoping Quarry, with a larger rehabilitation area, uses assisted natural regeneration.

Initially the restoration areas were mainly composed of pioneer species that can tolerate harsh conditions like intense sunlight and wind. As soil conditions gradually improve and vegetation becomes more established, shade-tolerant plants begin to take root. Therefore, it takes a longer time to see improvements in indicators such as coverage and the proportion of non-pioneer species.

## Taibaishan Quarry, with a smaller rehabilitation area, adopts the Miyawaki method Miyawaki method featuring multi-species,

multi-layered, dense planting and mixed-species planting strategies. This enables higher coverage and a greater proportion of non-pioneer species in the initial stage. After just one year, Taibaishan Quarry reached 52.4% non-pioneer species rate, while Hoping Quarry maintained only 29% after 13 years

These results indicate that long-term restoration at the Hoping Quarry has led to strong outcomes in forest stand height, biodiversity index, and IVI. In contrast, Taibaishan Quarry, through more intensive intervention, rapidly improved coverage, non-pioneer species proportion, and biodiversity. Although the two quarries adopt different restoration strategies, both show significant progress in enhancing biodiversity.

Comprehensive analysis: Due to different geographical conditions in each quarry, TCC adopts site-specific approaches.

93%

70.0%

4.5 meters

26.67%

95.72%

1.73 (Note: Because the restoration zone is small, monitoring data from the entire area is used)

#### Seven National-level Green Quarries - Mainland China

All plants in Mainland China have developed quarry geological environment protection and land reclamation plans, strictly following regulations and the principle of "restoring farmland to farmland, forest to forest". These efforts aim to create green quarries where humans and nature coexist in harmony. A stepped quarrying approach is adopted to minimize environmental impact. After extraction, limestone is transported using

unmanned electric mining trucks and enclosed corridors to reduce air pollution and dust. In closed quarry, vegetation restoration is actively promoted through slope adjustment, topsoil preparation, soil covering, and tree planting.

Biodegradable vegetation bags are used to protect slopes, and a nutrient-rich mixture is sprayed to complete the greening project.





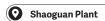
#### Creates an Ecological Farm

The slope platforms are covered with soil for planting trees and shrubs, while the slopes are sprayed with seeds through netting. In the quarry, fruit trees and vegetable gardens are replanted to create a garden-like environment, and employees are encouraged to grow vegetables on the ecological farm.



#### **Carries out Timely Seeding and Restoration**

The soil is relocated to the restoration area to support plant restoration, with shrubs and herbaceous plants seeded seasonally according to appropriate timing. The gently sloping quarry floor is designated as a crop cultivation area and orchard to stabilize soil and reduce dust.



#### **Improves Slope Restoration Methods**

Multiple engineering methods are adopted to maintain the quarry environment. Ecological growth bags are placed on the slopes, followed by spraying topsoil and soil coverage on the slope surface to create a suitable environment for plant growth.

Additionally, a 1.2 mu watermelon garden has been designated, making effective use of idle land.

#### **CIMPOR & OYAK CEMENT**

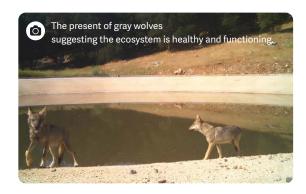
#### Aligns with the European Cement Association (CEMBUREAU)



Starting in 2025, CIMPOR is aligning its Biodiversity Policy in the next decade with the CEMBUREAU Biodiversity Roadmap, which it has already subscribed to. This new roadmap defines measures and goals by 2030, grouped into four focus areas: 1) ecosystem rehabilitation and services, 2) the EU Pollinators Initiative, 3) invasive species and 4) protected species.

In addition, CIMPOR will also consider the Sustainability Guidelines for Quarry Rehabilitation and Biodiversity Management, published by the GCCA and will comply with the Nature Restoration Regulation, which is aimed at establishing measures and goals for restoring land and sea areas for 2030 and 2050.

After the OYAK CEMENT Antalya plant ceased operations in 2017, it immediately began a three-year rehabilitation plan, replanting over 12,000 plants and establishing a drip irrigation system and water reservoir for wildlife use, aiming to restore the natural state of flora and fauna in the area.



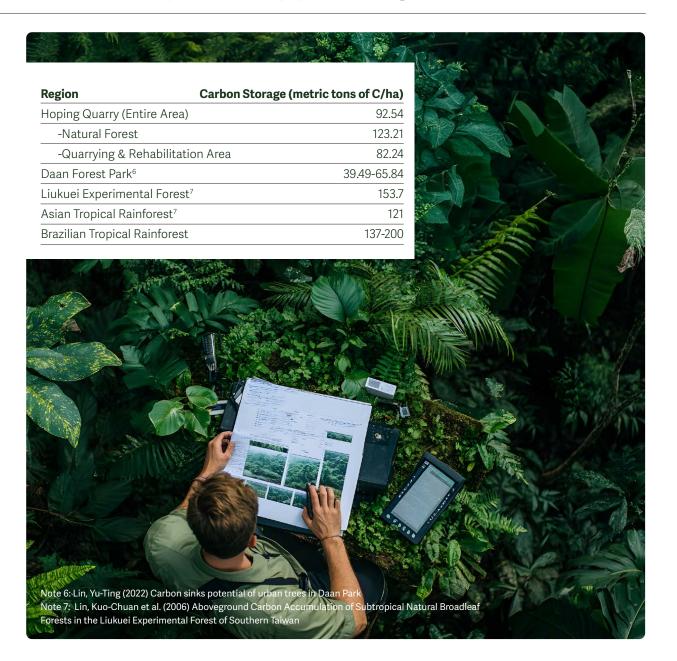


#### **Forest Carbon Sink Research**

At the end of 2023, we collaborated with Associate Professor Chyi-Rong Chiou's team from the Department of Forestry at National Taiwan University. Due to the April 3rd earthquake, the project was not completed until the end of 2024. First, the historical land use types, areas, and their changes over time at the quarry were analyzed. Findings showed high-density forest occupies the largest proportion of area, increasing from 63.08% in 2002 to 76.92% in 2022. Medium- and low-density forests have also shown a trend of transitioning into high-density forests, clearly indicating the effectiveness of the rehabilitation plan.

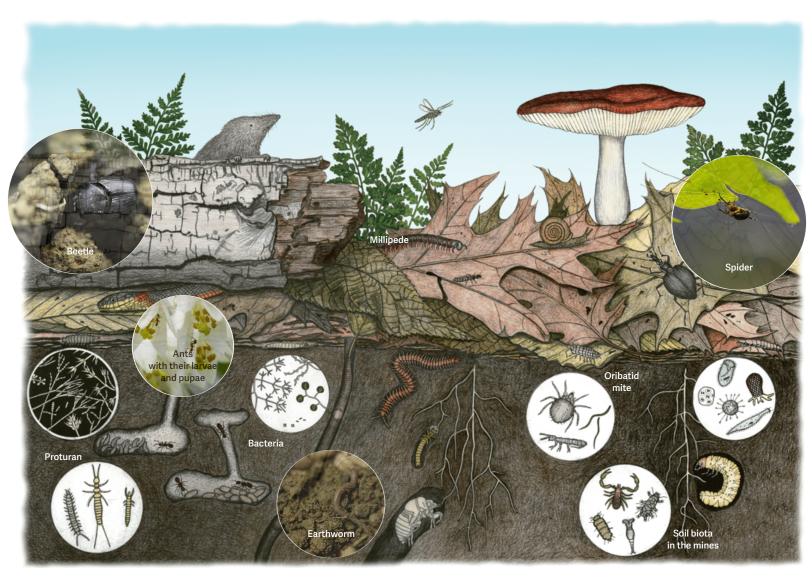
#### **Hoping Quarry Carbon Sink Report**

Sample sites at different altitudes were randomly selected for carbon sink surveys. The results show that the carbon storage in the Jinchang Quarry (natural forest area) was 123.21 metric tons per hectare, nearly double that of Daan Forest Park. In 2024, the survey area expanded to include both quarry and rehabilitation areas, with carbon storage capacity of 82.24 metric tons per hectare. Through restoration, the carbon storage capacity of the developed areas remains approximately 1.5 times higher than that of Daan Forest Park. When integrating natural forests with quarry and rehabilitation areas, the overall carbon storage capacity of the entire Hoping quarry reaches approximately 92.54 metric ton per hectare.



#### Soil Research

TCC began forest ecosystem restoration at its core industrial sites - Taibaishan Quarry and Hoping Quarry. However, past experience shows that even when excavated soil is returned shortly after quarrying, natural organic fertilizers are still needed to improve its physical and chemical properties. Quarrying disrupts soil biodiversity, prompting us to explore the vast subterranean ecosystem more deeply.



TCC KEY FACTS

#### 1.3 times

Organic carbon ratio | 2021-2023

#### 3l.2 metric tons

Total Organic Carbon Storage (TOCS) in soil per hectare 12023

by 2035 Goal to Increase 60%

Reference: Life in the Soil: A Guide for Naturalists and Gardeners. By James B. Nardi.

Soil teems with life—from ants and earthworms to springtails, pseudoscorpions, and countless microbes essential to soil health.



#### Soil Carbon Sequestration Survey Report

Preliminary 2024 results showed that soil in restored areas of the Hoping Quarry over the past 16 years consistently holds more organic carbon than that in urban parks. Notably, a site at 1,060 meters elevation-restored for three years-shows a 1.3-fold increase in total organic carbon compared to a site at 1,020 meters, following topsoil coverage and vegetation restoration. This highlights the effectiveness of restoration in boosting soil carbon sequestration.

To assess the impact of new restoration methods, further soil analysis is planned for 2025, with survey results expected to be published in August 2025 on the ESG section of TCC's official website. In 2025, restoration strategies will also focus on improving seedling survival rates and accelerate biodiversity recovery.



#### **Action Spotlight**

# Hoping Quarry's New Restoration Area at 1,015 meters — Skill Improvement Program for

# Restoration Personnel

#### Implementation Team:

Ho Sheng Mining Co., Ltd. Restoration Group, comprising two Truku and two Atayal colleagues

#### **Purpose:**

Soil expert was hired to assess the soil health conditions on-site in the quarry and conduct team training, to accelerate the process of ecosystem restoration in the quarry.



#### **Improved Restoration Methods:**

- Enhanced soil covering method: Adding stones of varying sizes to planting areas to improve soil porosity and prevent compaction that can hinder root development
- 2. Site-specific planting and seedling management: Moving up the planting schedule to reduce the physical burden on restoration staff and helping plants establish before their roots extend beyond the containers, thus minimizing the risk of root damage
- 3. Increase planting density: Raising the density from one plant every 3 meters to one plant every 1 meter

#### Follow-up Plans:

- Establish a restoration manual and provide recommendations for species selection, soil improvement, and nursery management
- Continue to improve professional capabilities in seedling cultivation and plant care
- 3. Regularly inspect and analyze seedling growth conditions
- 4. Conduct soil organic carbon surveys every five years to evaluate restoration effectiveness



#### **Areas for Improvement:**

Quarry rehabilitation now goes beyond regulatory compliance, aiming to restore full ecosystem functionality. However, harsh conditions and poor soils often lead to high plant mortality, requiring enhanced expertise from restoration teams. Through this training course, the expert identified issues in the planting process and offer practical solutions to ease staff workload. In the future, we will lead restoration team members in training, aiming to comprehensively improve the efficiency and quality of restoration work, from seed collection and seedling cultivation to tree planting.

#### **Soil Talent Development**

In 2024, TCC organized the Soil Award and Soil Camp to encourage younger generations to explore soil-related issues in depth. TCC plans to host the second Soil Award at the end of 2025, expanding its scope to include fundamental research, applied technology, and educational promotion. Through this ongoing initiative, we aim to strengthen academic focus and investment in soil research in Taiwan, continue to nurture outstanding talent, and inject fresh innovative ideas into land sustainability and environmental development.





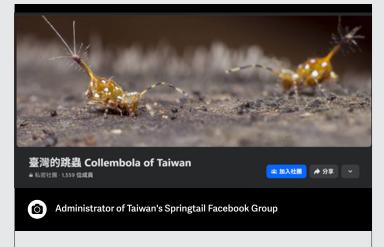
Hsiang-Yun LIN as instructor in 2025 Soil Camp

2024 Gold Award Winner. also 2025 Soil Camp Instructor

**Hsiang-Yun LIN** 

Master's degree from Institute of Ecology and Evolutionary Biology, NTU/Student Teacher at Sacred Heart High School

Pseudoscorpions are carnivorous soil animals. No new species had been discovered in Taiwan for over 80 years until Hsiang-Yun LIN discovered two species and proposed the phoretic relationships between pseudoscorpions and other insects. Starting in 2025, she began serving as a student teacher at Sacred Heart Girls High School, actively promoting science education and dedicating herself to inspiring students' interest and passion for the environment and land, giving back to society with her knowledge.



#### 2024 Gold Award Winner

#### Hsin-Ju CHENG

Pursuing a doctoral degree at the University of Cologne, Germany

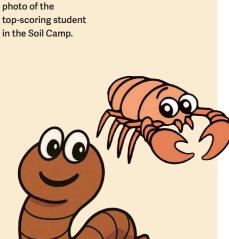
Springtails play important roles in both the food chain and nutrient cycling of soil ecosystems. Hsin-Ju CHENG updated Taiwan's springtail inventory from 26 to 58 recorded species, increasing species richness by 123%. Starting in 2024, she began pursuing her doctoral degree at the University of Cologne, Germany, focusing on taxonomic research of soil animals, specifically springtails, demonstrating her strong commitment and professional dedication to soil conservation.



Field practice from the Soil Camp: measuring soil moisture outdoors.

The 2025 Soil Camp, aimed at high school students, covers topics ranging from basic soil properties and soil ecology to hands-on observation of soil invertebrates and practical applications of AI monitoring. The program is designed to guide students in developing a clear and accessible understanding of soil ecosystems and raise awareness about the urgency of soil degradation. Through professional courses and engaging experiments, the camp hopes to inspire students' interest in soil research and cultivate future talent in the field.





## **Hoping Ark Ecological Program 2.0**



The most important foundation for humanity's future is a balanced and orderly natural world. Nature is humanity's Sine Qua Non, an essential condition.

--Chairman Nelson An-ping Chang

In 2022, TCC launched the Hoping Ark Ecological Program conducting its first survey of total soil organic carbon content at the Hoping Quarry. The findings revealed that areas rehabilitated for over a decade now host typical soil animals, such as earthworms and native nematodes. This indicates that TCC's long-term efforts have successfully restored certain soil ecosystem services, turning the land into an effective carbon sink and revitalizing soil quality. TCC deeply understands that maintaining Earth's biodiversity requires a more comprehensive perspective - beyond focusing on the visible greenery, we must also pay attention to the soil beneath our feet that nurtures all life. The Hoping Ark Ecological Program is TCC's experimental field for in-depth soil research. Through establishing the Soil Ecology Research Award to encourage research, and summer camps to inspire high school students to understand soil ecology, TCC aims to sow the seeds of stewardship and care for the land. TCC plans to launch a plant conservation project with the Hoping Ark Ecological Program in collaboration with the Conservation Center. The project will involve planting species from the Orchidaceae, Lauraceae, Bromeliaceae families, as well as ferns, making it an important ex-situ conservation site. Prior to planting, risk assessments will be conducted to prevent the spread of non-native species. Additionally, TCC is collaborating with Chung Yuan Christian University on a construction surplus soil reuse project, attempting to increase the reuse ratio of construction surplus soil through innovative technologies, reduce waste treatment costs, and provide new possibilities for quarry soil improvement.



TCC Nature Action — Forest & Soil - TCC Restoration Map — Marine Rehabilitation — OECMs (Other Effective Area-Based Conservation Measures) — Nature based Solutions (Mrs) — Natural Re-

4.3

# Marine Rehabilitation



**Coral Rehabilitation Plan** 

2024 Planting

155 coral individuals

2021/4-2024/7

80% coral survival rate

3 times growth area

**Giant Clams Survey** 

 $3_{\text{species}}$ 

98 individuals

**Artificial Wetland** 

**2025** Used by

14 species

Fish and Clams Survey

 $217_{\text{species}}$   $11,091_{\text{individuals}}$ 

**Little Tern Conservation Plan** 

TARGET

0/ reproductive rate
0 in 3 years

**Chinese Spiranthes Survey** 

1,943 individua in 1.3 hec

OYAK CEMENT

placed artificial reefs in the Marmara Sea



#### **Hoping EcoPort**

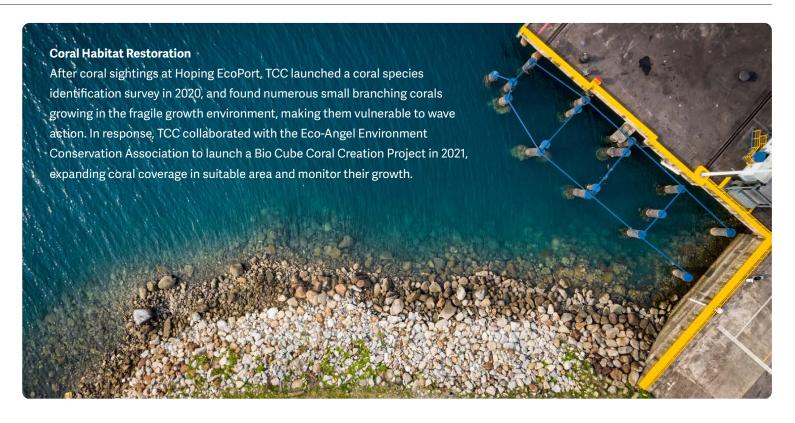
Hoping EcoPort is the only inward-dredged port in Taiwan. It was certified to APSN Green Port Award System (GPAS) in 2021, and in 2023, it renewed the PERS certification in 2023. Hoping EcoPort strives to minimize the environmental impact of its operations to the greatest extent possible and actively undertakes conservation efforts. This enables Hoping EcoPort to become an oasis within the marine ecosystem, providing diverse habitats for marine life to thrive.







The second phase of the coral restoration project at Hoping EcoPort has shown successful coral propagation, contributing significantly to the enhancement of marine biodiversity.



# First Phase of the Bio Cubes Construction Project

In 2021, the team installed Bio cubes in calmer areas of the port. Leveraging TCC's core business, they used TCC's low-carbon cement as the base to attach coral fragments, broken due to natural factors or port waves, onto these ecological blocks, giving the corals a chance to grow. 2024 surveys found that earthquakes and typhoons had damaged some of the Bio cubes, affecting coral survival rates.

#### Second Phase of the Coral Planting Project with Grating Plates

In January 2024, the team expanded construction areas including all coral habitats with grating plates, transplanting 713 coral colonies from 66 species in 16 genera. This project is Taiwan's first successful coral restoration project in an industrial port. Future plans include, public coral planting to promote marine conservation.

In mid to late 2024, typhoons Gaemi, Krathon and Kong-rey severely impacted Hoping EcoPort, causing 143 coral colonies lost in total. However, the coverage area decreased by only 4%, and the coral health score reached 4.9 out of 6, indicating the corals remain in a healthy condition.





#### **Giant Clam Survey**



#### Hoping EcoPort Has the Highest Density of Giant Clams in Taiwan

Giant clams, the world's largest protected bivalve, play a vital role in coral ecosystem by providing surfaces for coral, algae, and other marine organisms attachment and releasing nutrients that support marine life. However, their populations have declined due to climate change, hunting, and human interference. Hoping EcoPort's clear waters offer ideal habitat for these giant clams. In 2022, this rare species was accidentally discovered during a coral survey and the annual records have become valuable information on the growth of giant clams. In 2025, TCC commissioned Eco-Angel Environment Conservation Association to conduct an annual giant clam survey, and found 3 giant clam species, including 60 individuals of Tridacninae squamosa, 24 individuals of T. maxima and 14 individuals of T. noae – a total of 98 individuals. Notably, 88% of T. maxima and 55% of T. squamosa were mature, contrasting with the low maturity rates typically observed across Taiwan. This suggests Hoping EcoPort's stable environment supports successful growth. The port will continue exploring conservation strategies and monitor changes in clam size and health over time.

#### **Surveys of Fish and Mollusks**

Hoping EcoPort commissioned Taipei University of Marine Technology to conduct fish and mollusks surveys using Underwater Visual Census and underwater cameras for species identification. In 2024, across all four seasons, the survey recorded 10,431 individual fish from 207 species and 39 families, along with 660 individual mollusks from 10 species and 8 families.





Heniochus chrysostomus



The results showed that fish biodiversity was highest around the Bio cubes, suggesting that the cubes and the corals growing on them enhance environmental heterogeneity, allowing more species to coexist. Algae and other organisms attached to the corals and cubes also provide food, making the area more attractive to fish. Long-term monitoring will be conducted in the future to determine whether the biodiversity of fish and mollusks around the bio cubes increases over time.



Action Spotlight

# **OYAK CEMENT** Launches Artificial Reef Project

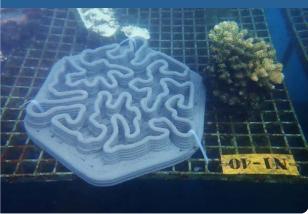
In 2025, OYAK CEMENT collaborated with Kocaeli University to construct artificial reefs using Duracem + CEM III/B (S) 32.5N-SR cement, the lowest carbon product in their series8. These reefs were deployed in Izmit Bay on International Biodiversity Day. Subsequently, they will assess the effectiveness in enhancing marine biodiversity and supporting small-scale fisheries.

Note 8: 294 kg carbon emission intensity per ton of cement



#### **Optimization Directions for TCC's 3D Printed UHPC Restoration Bases**

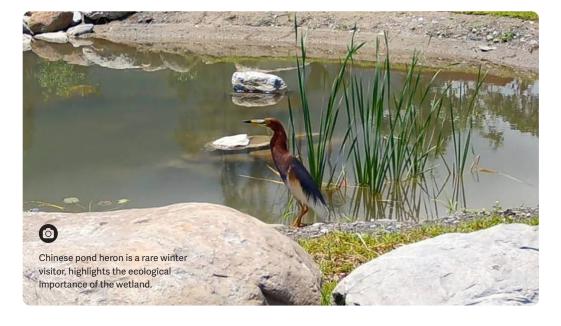
To further optimize the restoration efforts, TCC developed 3D-printed UHPC artificial bases with natural-like folds, cracks and porous structures that mimic coral reefs. These features promote coral and algae attachment. The project aims to compare algae and coral attachment to surfaces with varying degrees of roughness, as well as the impact of base shapes on fish hiding behavior and study the durability of UHPC in marine environments. In October 2024, three bases were installed on the grating plates at Hoping EcoPort.



#### **Ecological Environment Protection Around the Port Area**

#### **Artificial Wetland and Bird Survey**

In 2024, Hoping EcoPort expanded its ecological restoration efforts to land areas, transforming idle spaces into artificial wetlands designed to enhance urban climate resilience. These wetlands help regulate water resources and microclimates under extreme weather conditions, thereby strengthening overall environmental resilience. To improve the ecological integrity of the wetland system, native species such as the endemic Aphyocypris kikuchii were introduced, along with plantings of Oenanthe pterocaulon and Nuphar shimadai. As the ecosystem gradually stabilized, amphibians like the Ornate narrow-mouthed toad and the Rice field frog began to inhabit the area. The wetlands also naturally evolved into feeding and resting grounds for birds, reflecting the multifunctional environmental benefits of the artificial wetland. Hoping EcoPort collaborated with Associate Professor Xu-Yu Cheng from National Dong Hwa University to conduct bird surveys within and around the port. Infrared automatic cameras were installed to monitor bird activity. As of June 2025, 11 bird species have been recorded visiting the wetland, with further optimization measures to follow based on detailed survey results.



#### **Chinese Spiranthes Survey**

Chinese spiranthes, a terrestrial orchid listed in Appendix II of the Convention on International Trade in **Endangered Species of Wild Fauna** and Flora (CITES) due to over-collection for traditional medicine and its anti-cancer properties, is thriving at Hoping EcoPort. The port's eco-friendly management-prohibiting herbicides and pesticides – supports the growth of native Taiwanese flora. A 2025 survey by Professor Yu-Yun Chen's team from National Dong Hwa University recorded 1,943 Chinese spiranthes in a 1.3 hectares area. The professor expressed surprise at this density, stating, "Even the Chinese spiranthes restoration area at Dong Hwa University doesn't have such a high density." During the blooming season, the area becomes a stunning landscape of flowers. Other rare species found include Ophioglossum thermale (Near Threatened in Taiwan),





Professor Yu-Yun Chen's team from National Dong Hwa University conducted Chinese spiranthes survey at Hoping EcoPort.

and Eulophia dentata (Endangered on the IUCN Red List). Hoping EcoPort's eco-friendly management system has effectively established it as an alternative sanctuary for these endangered plants. Ongoing monitoring will track changes in population size and fruiting success over time.

4.4

## **OECMs**

# Other Effective Area-based Conservation Measures



#### What are OECMs?

An Other Effective Area-based Conservation Measures (OECMs), is a geographically defined area other than a Protected Area. Through effective governance and management, deliver long-term positive outcomes on ecosystem services. OECMs also incorporate cultural, spiritual, socio-economic, and other values relevant to local communities. According to the CBD, OECMs can be counted as conservation area and included in the scope of the 30x30 target. Therefore, the inventory and certification of OECMs have become key efforts pursued by countries worldwide.

#### **OECMs Assessment Criteria:**

Not an official or traditional protected area established for ecological conservation purposes

Has effective governance and management systems

Provides in-situ biodiversity conservation functions

Ensures the effectiveness of long-term protection

#### **Experts and Scholars Visited Hoping Quarry and Hoping EcoPort**

A team of experts and scholars from the Forestry and Nature Conservation Agency

#### 2024/1

#### **Preliminary Assessment**

Hoping Quarry: Complies with the principle of long-term protection Hoping EcoPort: Complies with the principle of in-situ restoration Deputy Minister of Ocean Affairs Council Hsiang-wen Huang, along with authoritative coral expert Chang-feng Dai

#### 2025/6

#### **Assessment Result**

Hoping EcoPort: Conducted an on-site ecological assessment and recommended applying for OECMs



#### **OECMs Opportunities for TCC:**

- Strengthen TCC commitments, and advance its sustainability influence through proactive ecological protection
- Support environmental education and tourism
   while creating employment opportunities
- → Multi-stakeholder collaboration:
  - **Environmental groups:** Enable teaching and demonstration partnerships on OECMs
- **Suppliers and partners:** Promoting cooperation as a best practice model
- Government departments: Co-invest in marine ecological conservation
- **Local residents:** Increasing educational resources

#### TCC Quarries and Hoping EcoPort Response Strategies:

- Restoring native species in Quarry: Implement long-term surveys and apply quantitative indicators to assess restoration results.
- Establishing tourism and education parks: Promote OECMs by creating education parks that generate local employment and tourism opportunities, foster knowledge exchange with government and academia.
- Developing a Taiwan marine education platform: Create a centralized platform to consolidate marine education resources related to OECMs.
- Planning historical and cultural tours of quarries: Preserve former production facilities and historic structures to support cultural tours that highlight its historical development.



4.5

# **Nature-based Solutions (NbS)**

Ovais Sarmad, former Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC), stated, "We face a double crisis of climate change and nature. The two are inextricably linked. The mutual, intertwined destruction grows worse by the day. If nature and climate change are linked, it only stands to reason that Nature-based Solutions lie at the heart of addressing both." A joint IUCN and UNEP report estimates that NbS could reduce or remove at lease five billion metric tons of CO2e by 2030, increasing to ten billion metric tons by 2050, which is crucial for achieving the Paris Agreement's 1.5°C target. Guided by the NbS approach, TCC manages environmental impacts of its operating sites, restores local ecosystems, and protects rare and endangered species, thereby contributing to climate change mitigation and creating positive impacts for nature. NbS reflects TCC's carbon reduction and green enhancement operational model.



#### What is NbS?

The International Union for Conservation of Nature (IUCN) defines Nature-based Solutions (NbS) as actions that protect, sustainably manage, and restore natural or modified ecosystems to address societal challenges, while delivering benefits for both human well-being and biodiversity.

Source: IUCN Nature-based Solutions

NbS have prime potential to help address global challenges such as:







and socia development





reduction



degradation





security

NbS can provide long-term environmental. societal and economic benefits:



to climate



iobs



health community



benefits



clean air accessible and water



reduction





biodiversity net gain

Reference: IUCN Nature-based Solutions

#### **Remove White Popinac**

#### **Addressing Challenges:**

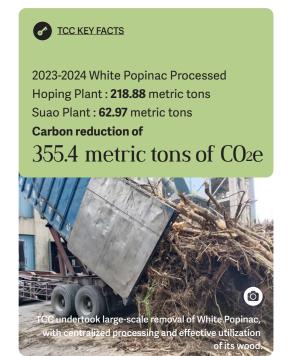
Environmental Degradation and Biodiversity Loss

| Climate Change Mitigation and Adaptation

#### **Creating Opportunities:**

#### Becoming Zero-carbon Biomass Energy

White popinac, an invasive alien species that releases toxins to inhibit other plant growth. Originally introduced to Taiwan for pulp and timber production, its limited utility and poor management led to its spreading. Since 2023, Suao and Hoping Plants have partnered with the Industrial Development Bureau and local governments to mechanically remove White popinac from riverbanks and industrial areas. Then it is converted into zero-carbon energy via co-processing, addressing both ecological threats and reducing coal use. TCC will continue the invasive species removal and replant native species to safeguard biodiversity.



#### **TO BE Marine Guardian:**

#### **Hoping EcoPort Ecological Restoration Project**

#### **Addressing Challenges:**

**Environmental Degradation and Biodiversity Loss** 

#### **Creating Opportunities:**

Increasing Habitat Richness and Enhancing Biodiversity

Ports often generate jetty effects that alter coastlines and disrupt ecosystems, while industrial structures can further threaten marine life. Designed with ecological considerations, Hoping EcoPort is the only inward-excavated port in Taiwan and features gentle slope revetments to enhance habitat use by wildlife. It also employs low-impact dredging and continuous water quality monitoring. Since 2021, a coral creation project has been in place. In 2023, the project expanded to include coral planting using Grating Plates and UHPC restoration bases, along with indicator species surveys, such as giant clams. Comprehensive marine ecosystem monitoring is conducted through multi-taxa biological surveys.

#### **Solar Grazing:**

#### **Balancing Green Energy and Ecology**

#### Addressing Challenges:

**Environmental Degradation and Biodiversity Loss** 

#### **Creating Opportunities:**

Grazing for Weed Control and Soil Fertility

#### Enhancement

Solar sites often used herbicides for weed control, harming ecosystems. TCC Green Energy and the Yingde Plant adopted solar grazing--using goats to manage weeds, cut coasts, and provide free feed. After ensuring equipment safety, TCC began goat grazing at the Changbin Solar and Wind Power Plant in 2024; added a maternity area, rain shelters and raised floors in 2025.

Yingde plant also started solar grazing in 2024, working with local farmers to ease land pressure and support elderly shepherds. This pesticide-free method produces healthier, leaner goats, with lambs selling up to 1.6 times the market average. Goat numbers ad kept within the land's capacity to avoid overgrazing. Their manure improves soil, creating a cycle of free feed and fertilizer, promoting sustainable land use.

## **Generating Green Power While Farming Fish and Shrimp**

#### **Addressing Challenges:**

Climate Change Mitigation and Adaptation

#### **Creating Opportunities:**

Combining Renewable Energy Generation with Fishery Production



As demand raises, aquaculture is set to replace ocean fishing, requiring industry upgrades. Simultaneously, green energy is growing to combat climate change. Aquavoltaics--combining aquaculture and solar power--reflects both trends. At its Chiayi site, TCC Green Energy partners with local fish farmers to build ponds, with a professional team researching shrimp farming, beneficial bacterial, and water purification systems. By blending traditional know-how with modern tech, TCC aims to create a sustainable aquaculture model that drives industry change and boosts the local economy. See CH3.5 Energy Generation for details.



TCC KEY FACTS

Produced 217 metric tons of fishery products

| 2024/1-2024/11

Generated 137 million kWh of electricity Equivalent to

66.000 metric tons of CO<sub>2</sub>e



Yingde Plant

2023/5-2024/12

6.5 hectares goat grazing area

NT\$1 million labor cost savings

#### 1.423 metric tons CO2e carbon reduction

(estimated based on carbon emissions from mowing equipment)

Changbin Solar and Wind Power Plant

2024/10-12

#### 0.95 hectares goat grazing area

NT \$320,000 labor cost savings

# CO2e carbon reduction

(based on estimated carbon emissions from mowing equipment)

4.6

# **Natural Benefit Sharing**

The three objectives of CBD are: 'The conservation of Biological diversity', 'The sustainable use of the components of biological diversity' and 'The fair and equitable sharing of the benefits arising out of the utilization of genetic resources'. Among these, GBF and the CBD COP 16 both emphasize the importance of benefit sharing, the fair and equitable use and sharing of genetic resources globally. TCC has long supported the Dr. Cecilia Koo Botanic Conservation Center in preserving genetic diversity, which has become the world's largest tropical and subtropical plant conservation base.

Plant collections are primarily cultivated in greenhouses 17 greenhouses & 2 temperature-controlled rooms

 $35\overline{,}398\mathrm{m}^2$  (approximately 3.5 hectares)



Conservation of Plants (Including Endangered Species) 34,714 taxa

#### Plants frozen in liquid nitrogen

8,709 species / 62,037 frozen specimens Accumulated

6,500 samples for medical use



Dr. Cecilia Koo Botanic Conservation Center



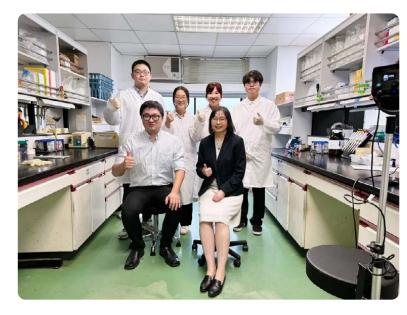
Since 2007, TCC has provided long-term support to the Dr. Cecilia Koo Botanic Conservation Center (the Conservation Center), currently led by Executive Director Chia-Wei Ll, Chin-Tui Hou Chair Professor at National Tsing Hua University. The Conservation Center is located in Gaoshu Township, Pingtung County, the Conservation Center is dedicated to the global conservation of tropical and subtropical plants through ex-situ living preservation and academic research. Each plant is managed using scientific methods, including unique barcode labeling to each plant. It designs appropriate temperature, humidity, and sunlight conditions based on each plant's native habitat, with isolation greenhouses. The Center actively engages in international collaboration and conservation initiatives, such as a joint effort with National Taiwan University's Xitou Experimental Forest to preserve 1,385 cloud forest species. It has also partnered with the Southern Institute of Ecology (Vietnam Academy of Science and Technology) and Bidoup Nui Ba National Park, resulting in the discovery and publication of new fern species in the journal of the American Society of Plant Taxonomists<sup>9</sup>.

Note 9: A New Species and a New Record of Stegnogramma (Thelypteridaceae; Polypodiales) from Southern Vietnam Chen, Cheng-wei & Kuo, Li-Yaung & Huang, Yu-hsuan & Hsu, Tian-Chuan & Dang, Tri & Luu, Hong Truong & Wei, Shuo & Huang, Yao. (2019)

# Helping to Develop Anti-cancer, COVID-19 Formulations and Patented New Drugs for Brain Injury

Plants have long been a vital foundation for drug development. Their secondary metabolites - alkaloids, flavonoids, and terpenoids - possess various pharmacological properties including antibacterial, antiviral, and anticancer properties, offering crucial clues for new medicines development. These natural compound libraries not only directly shape modern drug design but also inspire the development of synthetic medicines, underscoring nature's vast medical potential.

The Conservation Center places great emphasis on the application potential of genetic resources in medical development and offering them free of charge to research institution. In 2014, the Center collaborated with Kaohsiung Medical University to establish a medicinal library, which by the end of 2024 housed at least 83 families, 920 plant species, with 2,874 crude and fractionated extracts available for application, including drug formulations that can be used against influenza, cancer, and COVID-19. In 2024, the Center collaborated with National Tsing Hua University to successfully develop a patented new drug for brain injury treatment. The Institute of Molecular Medicine team conducted large-scale screening from over two thousand plant extracts and ultimately identified Rhaphidophora hongkongensis, a native Taiwanese plant from the Araceae family, as highly promising. With assistance from the Department of Chemistry for organic synthesis, they synthesized a novel small molecule compound. This innovative compound has obtained invention patent No. 1823110 and international patent priority rights.





Monstera epipremnoides was found to have the ability of promoting nerve regeneration.

# Supporting the Sustainable Preservation of Taiwanese Millet Entering the Agricultural Noah's Ark

In 2024, the Conservation Center partnered with National Central University's Taiwan Polar Research Center and the Agricultural Research Institute to jointly send millet seeds, which symbolize Taiwan's agricultural culture, to the Global Seed Vault located in Svalbard, Norway. Utilizing the stable low-temperature environment of permafrost and modern freezing preservation technology, the initiatives ensure that

plant germplasm can be preserved and rehabilitated in the face of extreme disasters, thus safeguarding agricultural biodiversity. Millet is an important traditional crop of Indigenous peoples. Preserving more than 400 varieties of millet seeds in an international-level seed bank reflects a deep respect for Taiwan's Indigenous knowledge and native species, and a pledge to sustainability.

4.7

# **Environmental Education**





Cumulative to 2024



A total of 2,056 participants in ecological guided tours

#### 8.77 million

visitors exceeding



39 sessions of environmental education courses
A total of

2,043 participants



#### TCC DAKA Ecological Guided Tours

From its inception, TCC DAKA integrated environmental education, establishing a Bromeliad Garden showcasing a thousand plants from 147 different species. Exhibits range from the world's second-largest Giant Bromeliad on limestone cliffs to the smallest Spanish Moss Tillandsia growing on trees. Its intimate viewing design and guided tours offer visitors deeper insights into plant conservation and restoration. Additionally, following several bird-window collision incidents, the garden optimized its design in 2025 by incorporating bird-visible patterns, integrating bird-window collision prevention into its environmental education efforts.



#### **Action Spotlight**

## Little Tern Conservation Project-Hoping Welcomes You

The Little Tern, a migratory bird, is the only Category II marine protected species that breeds on Taiwan's main island. In 2024, it was first recorded nesting and raising chicks near the Ho-Ping Power Plant's sea outlet. In response, the plant partnered with the Wild Bird Society of Hualien and initiating a three-year monitoring plan. The ten key suppliers of Ho-Ping Power Plant joined these efforts through the 2024 Supplier Convention.



#### TARGET

Increase the reproductive rate of Little Terns by 10% within three years





#### Join us in protecting the Little tern through these actions:

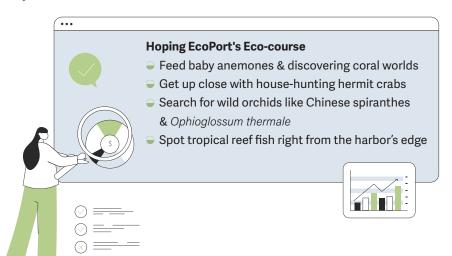
- Environmental Education Courses: Ho-Ping Power Plant and Hoping EcoPort jointly developed 'Soaring with Nature Little Tern' and designed the board game 'Little Tern The Great Adventure Back to Hoping', allowing participants to learn about the ecological challenges faced by Little terns through courses and games.
- Patrol Team protects habitats: A 24-person team from the plant, port and suppliers patrols April-August to protect nesting sites, advise anglers, and deter stray animals to support the reproduction and growth of Little terns.
- Ecological observations led by the Taiwan Wild Bird Federation: Expert-guided observation using binoculars.
- Install beach information signs to remind anglers and local residents to reduce disturbances.

# Hoping EcoPort Receives Highest Honor First Prize in the Corporate Category

of the National Environmental Education Awards

In 2022, Hoping EcoPort earned environmental education certification to promote the ethos of "understanding, loving, and connecting with the sea." It established a "near marine" learning center, established Taiwan's first port-based environmental education facility. In 2024, a "Net-Zero Green Living" course was added to promote resource recycling awareness in local communities, connecting daily actions with ecological conservation. Hoping EcoPort believes that while one person may walk fast, a group walks far. Hoping EcoPort extends environmental education to employees and contractors, requiring at least one hour of training annually. In 2024, 30 employees and 14 contractors participated in this training.

Hoping EcoPort practices eco-friendly grassland management, avoiding chemical herbicides for weed control. This has allowed native wild orchids, like Chinese spiranthes and *Ophioglossum thermale* to thrive. Their abundance has prompted voluntary field surveys by professors and students from National Dong Hwa University. On Earth Day 2025, Hoping EcoPort held a parent-child eco-trip for environmental education, helping children reconnect with the land's natural vitality.





"Before joining Hoping EcoPort in 2022, I served on the Hualien County Environmental Protection Bureau's counseling committee for environmental education facilities. At that time, the Bureau invited me to assist with the certification for Hoping EcoPort. As a Hualien native, my impression of an industrial port was of gray skies and an oily sea. However, I instead saw a blue sea with coral clusters and schools of tropical fish, completely subverting my expectations. At that moment, I foresaw that Hoping EcoPort would become a leading model for environmental education."

by Sam Yu,

Environmental Education Manager at Hoping EcoPort

# Taiwan Science Train: Advancing Marine Conservation and Energy Education Ho-Ping Power Plant: Pursuing Environmental Education Facility Certification

Dong Hwa University and the National Science and Technology Council invited Hoping EcoPort and Ho-Ping Power Plant to join the 2024 Taiwan Science Train Activity, engaging 699 participants. Besides, Hoping EcoPort partnered with Yilan's Aohua Elementary School, teaching marine conservation through picture book storytelling. The Ho-Ping Power Plant plans to integrate its resources in renewable energy, circular economy, and marine conservation to create a learning environment that merges education with conservation. It aims to apply for Environmental Education Facility certification in 2025.

# Guigang Ecological Environmental Education Practice Base

The Guigang Plant actively promotes the cement industry's green transformation. The plant earned the "Guangxi Ecological Environmental Education Practice Base" designation in 2023. Each year, the plant invites employees and local communities to the base to promote the harmonious coexistence of industry and nature, showcased the modern factory, and highlighted the importance of daily environmental protection efforts.