04

Performance in Environmental Sustainability (E)

▶ Highlights:

- UI GreenMetric World University Rankings No. 1 of Taiwan for nine consecutive years during 2014-2022; world's top 2%, No. 3 in Asia, and No. 27 in the world in 2022.
- Grew over 5, 000 seedings during 2020-2022, with over a survival rate of over 90%.
- The 2nd USR Awards 2021 by *Global Views Monthly*: No. 1 in "Ecology Co-Benefit".
- The 3rd USR Awards 2022 by *Global Views Monthly*: Model of "Ecology Co-Benefit".
- EUI 87.1 in 2021, below the EUI standard of 90.
- Total recycling with zero discharge for domestic sewage purification and recycling. Reduce second water consumption by about 180ML each year, and reduce BOD load by 1,461kg each year.
- Sheltered 105 species with over 1,400 heads in the IUCN Red List species and national conservation list species during 2020-2022.
- Green procurement rate over 99.53% from 100% local suppliers of Taiwan during 2020-2022.

■ Distinguished Research Fellow Cheh-Shyh Ting, a water conservation expert and winner of the Dayu Award, built the Greater Chaozhou Groundwater Recharge Lake Project in collaboration with the Pingtung County Government to direct rich rainwater during the flood period into the artificial lake for storage to recharge groundwater for the sustainable development and recycling of water.

4-1 Low-Carbon Campus

6.d 7.1 7.2 9.1 11.6 11.7 12.4 12.8 13.2 15.1

GRI 2-4, GRI 302-1 and 302-3, GRI 306-1 to 306-4 | Material Issue E03 and E04

We comply with the *Talloires Declaration* and practice the green campus based on the role of universities in environmental protection and the pursuit of environmental sustainability. By implementing GHG inventory, promoting sustainable commuting, installing renewables, saving energy, recycling and reusing waste, and offering environmental sustainability education, we reach the sustainable campus consensus among all teachers and students to achieve the goal of low-carbon campus.

Climate Change Governance and Action

In 2021 we joined the Green University Union of Taiwan (GUUT) and undertook to include “environmental sustainability” in institutional operations and comply with the relevant environmental laws and regulations. So far no non-compliance relating to environmental laws and regulations has been reported. Through the concerted efforts of all academic and administrative staff and students, we have earned recognitions for our performance in maintaining sustainable campus from home and abroad, including the excellence performance in the UI GreenMetric World University Rankings. Since 2014 we have been ranked No. 1 of Taiwan for nine consecutive years and the world’s top 2%, No. 3 in Asia, and No. 27 in the world in 2022. Particularly in categories including Settings and Infrastructure (SI), Water (WR), Transportation (TR), and Education and Research (ED), we have made brilliant performance in the UI GreenMetric World University Rankings. In response to climate change, we regulate climate through growing trees. In 2019 we began collaborating green business with Ching Jing Lin (CJL) Education Foundation. Every year we pull a crowd of over 100 volunteers to grow trees on our Daren and Baoli agricultural stations and have grown over 5,000 seedings so far, with a survival rate of over 90%. By growing these Earth-friendly seedlings, we aim to promote sustainable development for Taiwan and Earth.

Tree Growing Activities and Statistics in Past 3 Years

Year	Activity Name	Quantity (plants)
2020	Department for Forestry x CJL Education Foundation “Let’s go and grow some trees”	1,500
2021	Support Earth Day with Campus Plantation on April 22	26
	Beware of DoF and CJL! Department for Forestry x CJL Education Foundation grow thousands of trees for the future	1,500
2022	DoF and CJL Together Again! Department for Forestry x CJL Education Foundation rescue and restore rare species Hengchun camellia	1,000

▲◀ DoF and CJL call a crowd of over 100 people to rescue and restore the rare species Hengchun camellia (*Camellia hengchunensis*).

GHG Reduction and Management

We have established the campus energy audit and management mechanism to save energy and reduce GHG emissions. With 2019 as the base year, we independently inventory GHGs every year for the actual control over GHG emissions and disclose the GHG emission information, with indirect Scope 2 being the major scope of disclosure, so as to reduce GHG emissions by reducing energy consumption for the effective reduction of campus GHG emissions.

Increasing inventory items every year towards a carbon neutral university

Inventory shows that electricity use and transportation are the main sources of carbon emissions at NPUST. To immediately and effectively reduce GHG emissions, we have actively implemented electricity conservation plans and started the intelligent air-conditioning management system and intelligent energy conservation management system on all large buildings within NPUST.

On the main campus and student halls occupying an area of 298 hectares and about 30 hectares respectively, and in the Baoli and Daren (Taitung) agricultural stations occupying an area of 268 hectares and 576 hectares, we have grown about 1,382,778trees. Based on the statistics of the Forestry Bureau (now Forestry and Nature Conservation Agency) that each tree can reduce emissions by 12 kgCO2e/year on the Earth, the 2019 carbon removal of NPUST was up to 16,593.3 tCO2e/year. As the emissions from electricity use and transportation is 14,981.94 tCO2e/year, our carbon removal is greater than our carbon emissions. The 2019 scope of inventory covered electricity and transportation. In the future, we will increase more inventory items and continue to reduce carbon emissions through various energy-efficient facilities, green energy generation, and growing trees and greeneries, hoping to achieve 100% carbon neutral by 2049.

2019 Carbon Removal
Main campus about with 180,000 (plants) × 0.012t = 2,160 (t)
Two agricultural stations about with 1,202,778 (plants) × 0.012t = 14,433.3 (t)
Total:16,593.3 tCO2e.
2019 Emissions (electricity use + transportation exhaust)
Electricity = (Total consumption - Green energy)/1000 x 0.509 (2019 electricity emission factor announced by the Bureau of Energy, Ministry of Economic Affairs) = (30,667,579-1,616,850)/1000 × 0.509 = 14,786.82 (t)
Transportation (including: bus, private cars, and motorcycles) = 195.12 (t)
Total:14,981.94 (t)

*Data for calculating carbon emissions and carbon removal.
(1) 1Forestry Bureau (now Forestry and Nature Conservation Agency): The per tree carbon removal is 12 kg/year (average)
(2) The 2019 electricity emission factor announced by the Bureau of Energy, Ministry of Economic Affairs, was 0.509 (kgCO2e/kWh).
(3) UI Green Metric World University Rankings 2019 Guideline.
(4) Carbon emissions at NPUST are based on the total electricity consumption and transportation volume each year.

Indirect Scope 2 GHG Emissions in 2019 (base year)

Year	Electricity Consumption (GJ)	Carbon Emissions from Electricity Use (tCO2e/year)
2019	110,403.28	14,786.82
2020	109,600.67	12,824.63
2021	102,143.71	11,032.67
2022	105,146.03	11,088.49

*Calculations are based on the electricity emission factors announced by the Bureau of Energy, Ministry of Economic Affairs: 0.509 kgCO2e/kWh) for 2019, 0.502 kg/kWh for 2020, and 0.509 kg/kWh for 2021 and 2022.
(Information restatement: The 2020 carbon emission factor was 0.502 kg/kWh, thus updating the data of 2019 and 2020).

Agricultural net-zero and carbon sink towards net-zero emissions

We have established the College of Agriculture Tropic Organic Agricultural Net Zero & Carbon Sink Promotion Office" to help reduce carbon emissions and enhance carbon sink in agricultural production. The International Irrigation R&D Service Center earned the model prize for Ecology Co-Benefit at the 3rd USR Awards 2022 by *Global Views Monthly* with the eco-friendly farming method. Additionally, the Sustainable Circular Economy R&D Center also actively engages in research relating to green energy applications and won the gold medal at the 2021 AII American DAVINCI International Innovation and Invention Expo with the invention "Compound Generation System Using Compressed Air Energy Storage".

Carbon reduction for sustainable commuting

To reduce the number of motorcycles and scooters, improve air pollution, and reduce the number of traffic accidents to build a healthy and green campus, we established the Sustainable Commuting target in response to the Earth-friendly and campus green energy transportation policy.

▲ Green e-bus


▲ Campus pavement

Performance in Sustainable Commuting in Past 3 Years

Transportation Strategy	Quantitative Performance	Description
NPUST shuttle bus	298,558 persons 54 buses daily	In addition to traveling across all buildings on campus and the student halls off campus, and school bus also offers services between the campus and Pingtung city center, Shuimen, Wutai, and Fengshen outbound bus in collaboration with the Ministry of Transportation and Communications and Ping Tung Bus.
Green e-Bus	4 units	Collaborating with the green e-bus plan of transportation companies, we have established e-bus charging stations on campus to provide eco-friendly, low-carbon transportation on campus.
DRTS Smart NPUST shuttle bus Booking	19,590 persons	We offer the Demand Responsive Transit Service (DRTS) in collaboration with the Highway Bureau and Ping Tung Bus for students to book the bus and destination over the app to save waiting time and encourage carpool.
e-Bicycle and e-Scooter	2,247 units	We promote campus green transport using e-bicycles and e-scooters and establish numbers of free charging stations on campus in collaboration with China Motor Corporation (CMC).
Recycled bicycles	200 units	We apply for the C-Bike to the Kaohsiung Environmental Protection Bureau for free use by NPUST students.
e-Trolleys For school affairs	4 units	We team up with the departments and institutes to build e-trolleys to transport equipment for campus activities.
Campus Pavement	Total length 1,512.95m.	We began progressively building shaded pavement in all areas across the campus in 2019 to enhance road safety.

Energy Management

We have formed the Energy Conservation Promotion Team chaired by the vice president for administrative affairs to draw up the targets and working plan for energy conservation each year so as to implement energy conservation and realize the consensus on energy conservation between all NPUST teachers and students without affecting teaching, research, and institutional development.

Due to the spacious campus, our electricity demand is high. To reduce electricity consumption and effectively capture the energy-consuming areas on the campus, we have built the smart energy monitoring system and smart air-conditioning management system in all large campus buildings to monitor the electricity and air-condition consumption of all campus buildings. After energy inventory, we can accurately locate campus buildings with higher electricity consumption, investigate the causes immediately, and make timely improvement to save energy.

We also progressively replace aged air-conditioners with the inverter models and install inverter air-conditioner smart meters to control electricity use; replace aged power transformers with amorphous metal transformers to reduce power loss; replace all lighting fixtures with the LED models; install heat pump water heaters, water-efficient taps, water-efficient flush, and other water-efficient equipment in student halls; and implement periodic maintenance to ensure normal equipment operation. In 2022 MOEA commissioned the Taiwan Green Productivity Foundation to audit this university. We have already promoted and implemented energy conservation management in accordance with the regulations relating to the *Energy Administration Act*, replaced the air-conditioners of all student halls and all campus buildings with the inverter models, and replaced all street lamps with the LED models. During 2015-2021 the annual average energy conservation rate was 1.62%, meeting the requirements of the energy conservation targets.

▲ Campus Smart Energy Management System

▲ Smart Electricity Control System

Based on the “Government Agencies and Schools Electricity Efficiency Rate (EER) Management Plan” of the Executive Yuan, we fall in Category 1 of UST in the categorization and grouping. The baseline values of the energy usage index (EUI) for 2019 (the base year) was 90 kWh/m2/year. Through active energy conservation, our electricity consumption in both 2021 and 2022 was below the EUI baseline value, demonstrating a great show in energy conservation and carbon reduction.

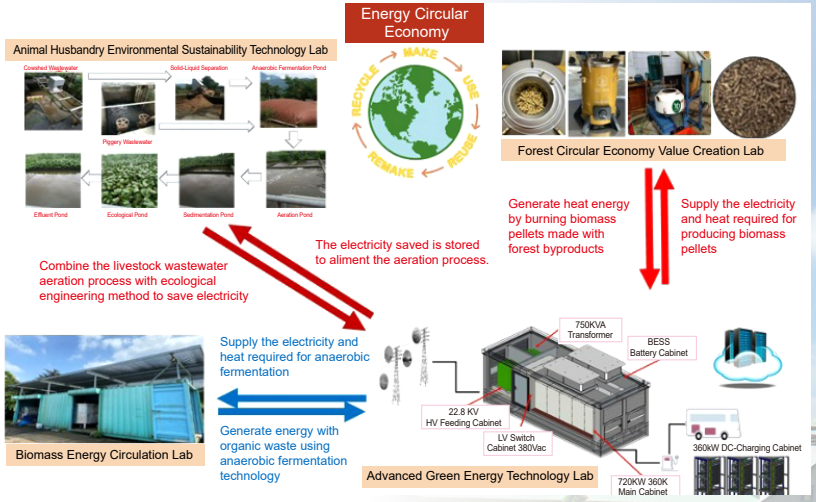
Statistics on Electricity Use in Past 3 Years

Item/Year	2020	2021	2022
Non-renewables (GJ)	91,969.4	78,030.6	78,425.5
Renewables (GJ)	17,631.2	24,113.1	26,720.6
Total Electricity Use (GJ)	109,600.7	102,143.7	105,146.0
Floor Area (m2)	323,551	325,890	325,890
EUI	94.1	87.1	89.6

Renewables

By cooperating with the government's energy policy, we hope to raise the proportion of renewables use to 20% in 2025 through self-generation for self-use. The variety of renewables on campus include solar energy, wind power, biodiesel energy, and biomass energy. In 2022 we established the Sustainability R&D Center to continuously research, develop, and integrate resources to develop the collection, storage, and use of renewables.

The major sources of our renewables include the agro-photovoltaics of the Smart Agriculture Center, the fish and electricity symbiosis of fish farms and fishmeal factories, and the solar panels of the mushroom factories, fruit and vegetable greenhouses, the eight student halls, the new library and exhibition hall completed in 2021, and the common building. Based on the daily average sunshine duration in Taiwan, the daily average sunshine hours in specific areas on Neipu Campus are up to 4.5 hours, allowing PV systems to generate electricity of 7,173.5 (GJ) in 2020 and 13,215.5 (GJ) on average during 2021-2022. A small number of wind turbines installed at the plant factory and Sustainability R&D Center supply electricity for the plant factory. The biomass energy developed by the Biodiesel Energy Laboratory of the Department of Biomechanical Engineering supplies fuels for use by agricultural machinery. The Agricultural and Forestry Byproduct Recycling and Value Creation Development Center develops agricultural and forestry byproducts into various biomass pellets or biocarbon pellets to create higher value.



▲ The team of the NPUST Sustainability R&D Center develops the renewables circular economy map through mutual support.

Green Building

All new buildings are green buildings using natural lighting and equipped with related energy conservation equipment to meet the sustainability requirements. Currently, we have obtained five green building certificates, including the Tropical Agriculture Research Building, Working Dog Breeding Farm, Immunity Horse Breeding Farm, and the Intelligent Agricultural Machinery Center II (2020) of the College of Agriculture and the Sustainability R&D Center. All these buildings comply with the following four indicators: greening capacity, basic water conservation capacity, daily energy conservation, and water.

Additionally, our application for the Green Building Label Candidate Certificate has been approved for the following buildings under construction and about to be completed, including the Innovation and R&D Building of the Department of Wood Science and Design, the Scientific Agriculture Promotion Building, and Aquaculture and Conservation Center, also passed the candidate green building application, and eight buildings have passed the Green Building Label Candidate Label.

▲ Intelligent Agricultural Machinery Center II

▲ Sustainability R&D Center

▲ Tropical Agriculture Research Building of the College of Agriculture

▲ Working Dog Breeding Farm

◀ Immunity Horse Breeding Farm

Waste Management

The Environment, Safety, and Health (ESH) Center plans and implements the campus environmental maintenance, promotes the ESH management system, and establishes the campus waste management policy to realize campus waste reduction and resource recycling and reuse.

At NPUST, waste is divided into to categories: non-hazardous waste and hazardous waste. Hazardous waste is mainly produced by the medical consumables from teaching and research and waste chemical liquids from laboratories. The Center for Environmental Protection, Safety, and Health gathers them every week for temporary storage before hiring legal transporters to transport them to qualified disposal sites for disposal to prevent environmental pollution. The whole disposal process complies with the sorting, storage, and clean-up processes as stipulated in the *Waste Disposal Act*.

Total Weight of Campus Non-Hazardous Waste and Hazardous Waste in Past 3 Years (unit: t/year)

	Disposal Method	Waste Category	2020	2021	2022
Non-Hazardous Waste	Incineration	General Waste	334.2	362.5	310.4
	Recycling Reuse	Paper	75.5	84.9	80.6
		Metal Can	1.2	1.4	1.7
		Other Metals	13.4	76.6	18.1
		Aluminum Can	0.4	0.7	0.9
		PE Bottle	2.3	4.4	1.5
		Plastics	7.3	14.7	10.5
		Waste Batteries and Waste Fluorescent Tubes	0.7	0.5	0.2
		Waste DVDs and Waste Cells	0.3	0.8	0.3
		Waste Home Appliances/Waste Computers/Waste Toner Cartridges/Waste Bicycles	12.3	0.4	2.8
		Kitchen Leftover	30.0	17.7	18.0
Total			477.5	564.5	444.9
Hazardous Waste	Incineration	Corrosive Mixed Waste	0.3	0.5	0.3
		Hexavalent Chromium	0.6	0.3	0.5
		Mixed Waste Containing Toxic Metals and Exceeding the Leaching Limit	1.0	0.6	1.0
		Waste Liquids with pH ≥12.5	1.5	1.6	2.0
		Waste Liquids with pH ≤2	2.6	2.7	3.2
	Chemical Treatment	Mixed Waste Containing Organic Pollutants and Exceeding the Leaching Limit	1.0	1.1	1.3
		Mixed Waste Containing Organic Chemicals and Exceeding the Leaching Limit	5.9	5.7	7.6
		Scrapped Oil Mixtures	1.6	0.3	2.7
		Flammable Mixed Waste	1.1	1.2	1.3
Total			15.5	13.8	19.7

Waste Reduction and Waste Recycling and Disposal Practices

Item	Description
Sorting and Recycling	Each building is equipped with litter boxes for general waste, paper, and resource recycling. The student hall area is also equipped with the clothing donation dropbox. The campus restaurants are equipped with the kitchen leftover box. All these are meant to practice waste sorting.
Paper Reduction	1. Reduction of unnecessary packages. 2. Using the e-document system; printing conference data on both sides of the paper or used paper; displaying conference data with electronic devices.
Plastics Reduction	1. Use reusable foodware and ban single-use foodware. 2. Use reusable cups in conferences. 3. Currently there are 381 water dispensers on the campus to supply free drinking water for teachers, students, and visitors. 4. Replace large bin liners with reusable plastic mesh bags for collecting fallen leaves.
Donation	Donate reusable scrap equipment to social groups or elementary schools in remote townships for reuse. During 2020-2022, a total of 61 computers and 1,026 reusable tables, chairs, and cabinets were donated.
Exchange	Waste dry cell and DVD recycling redemption and pre-owned item exchange and marketplace are organized to reduce waste production.
Resale	Reusable scrap equipment is resold according to the relevant procedures for resource reuse. The income from scrap resale in the past three years was NT$6,516,093.

▲ Clothing donation dropbox and litter boxes for waste sorting

▲ Publicity event for waste sorting and recycling

Waste Recycling and Reuse

We recycle organic waste by nature for reuse. Through interdisciplinary research, we gather, transport, store, and reuse organic waste. Through technology innovation and R&D, we create new value for green gold.

Category	Recycling and Reuse
Kitchen Leftover	1. Add 5% of enzymes to liquid kitchen leftovers to enhance fermentation efficiency to transform them into odorless liquid fertilizers. 2. Mix solid cooked kitchen leftovers, unprocessed kitchen leftovers, and tree leaves for composting into plant fertilizers. 3. Transform kitchen leftovers into biomass energy to generate electricity. 4. Produce safe and non-toxic carbonated organic fertilizers with silicon-containing agricultural waste through hydrothermal carbonization.
Fallen Leaves	Crush fallen leaves for composting to solve the fallen leaf problem and improve soil.
Wood Waste	1. The Department of Wood Science and Design produces BBQ pellets, charcoals, and cat litters with tree leaves and other wood waste using the granulation machine and carbonization machine. 2. Establish the reusable waste exchange platform to manage the reuse and reduction of campus organic waste. 3. Wood waste can become the ingredient for biomass energy on campus.
Livestock Waste	1. After separating the urine from manure of animals on the livestock farm with the solid-liquid separator, biogas (propane and CH4) is generated with the the organic waste water of cow dung for use as green biomass energy. In addition to increasing its added value, this also prevent direct discharge of animal excretions from eutrophicating and contaminating the waterbody of rivers and near waters. 2. After treating livestock waste with the activated sludge process, the leachate can be used for irrigation to nourish crops, and the solid waste can be used as fertilizers are drying.
Others	Lemon peels, waste from the local lemon processing industry, are developed into the additive that is beneficial to the intestinal track function of groupers. Cocoa fruit pods, waste from the local cocoa processing industry, are developed into the immunity stimulant for aquaculture animals.

Example 1 Fallen Leaves Composting

We have a spacious campus with over 180,000 trees. Fallen leaves are crushed for composting and reuse.

Example 2 Circular Economy in Agriculture

To promote the circular economy in agriculture, the Department of Wood Science and Design has established the “Agricultural and Forestry Byproduct Recycling and Reuse and Value Creation Development Center” to develop wooden agricultural waste into biomass pellets or biocarbon pellets. The department has also established the “Southern Taiwan Agricultural and Forestry Residual Materials Industry Platform” to coordinate the academia with the industry. Currently, factories have been built in Pingtung, Yunlin, and Nantou to help farmers engage in recycling and reuse to transform large amounts of fruit tree waste branches into valuable products. Further reading

Source: China Times Online/Photo by Hsiu-Fan Liu

4-2 Water Sustainable Management 6.3 GRI 303-1 to 303-3 | Material Issue E06

The Department of Civil Engineering and Water Resources Education and Research Center develop water resource diversity in southern Taiwan to contribute to technology development research of water resources through interdisciplinary collaboration better teachers and students from related areas of specialization. Our water sustainable development policy mainly includes the promotion of water conservation facilities, education, and research, and enhance water conservation and domestic sewage recycling and reuse.

Water Sources and Consumption Estimation

Pingtung has abundant groundwater which is the major source of public water supply. As there is no public tap water pipeline passing through the main campus, groundwater pumping wells with legal water rights are the campus' only water sources. The daily average groundwater withdraw is 209,988m3 (approx. 210ML), and no seawater or other third-party water is withdrawn.

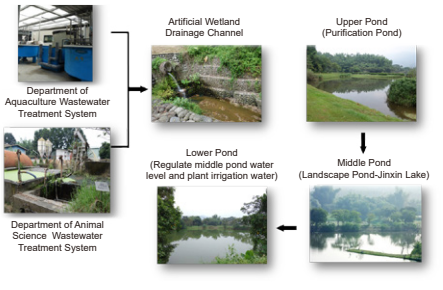
Drinking water (eight student halls, two restaurants, and campus activities of academic and administrative staff) and water used by the culture practice factory, practice farm, and irrigation roadside trees are the major waster demand at NPUST, with drinking water demand being the highest.

Zero Discharge of Sewage

At NPUST, sewage management is implement in terms of flood control, water facilitation, water conservation, water cherishment, and water revitalization to achieve the goals of consumption and "total reclamation and zero discharge". We build artificial wetlands and grow vegetation on campus for water purification, sewage treatment and recycling for reuse. The related facilities include the Life Garden sewage treatment plant, Chingshih Lake, environmental protection park, and Yinghsia Lake. Ecological engineering methods are applied to achieve water purification, water storage, water reuse, and ecological conservation.

Life Garden sewage treatment plant treats about 600CMD of sewage from the student halls, restaurants, and campus buildings. Then, treated water is purified with the ecological engineering method to become effluents for reuse by the toilet flush in the Shalin Center for Life Education, landscape water in the Yinghsia Lake Park, and irrigation at the practice workshop in the botanical garden. Campus sewage is fully recycled for reuse to ensure zero discharge to reduce secondary (irrigation) water use by about 180Ml/year. Apart from causing no impact on receiving water bodies, this practice also reduces BOD discharge by about 1,4612 kg/year in the pollution burden of off-campus receiving water bodies.

▲ Sewage Treatment Flowchart



▲ Livestock Wastewater Treatment Flowchart

Water Sustainability Management Approaches

Groundwater is the main water source for the main campus, Daren Agricultural Station, and Baoli Agricultural Station. For the sustainable use of valuable water resource, the following management approaches are implemented:

Water Conservation	• Recharging groundwater by means of water infiltration through permeable paving surfaces: Permeable paving surfaces are installed in the car parks, pavements, and roads on the campus to increase rainwater infiltration to recharge groundwater. • Groundwater conservation and rainwater reuse with artificial lakes: The two campus artificial lakes: Chingshih Lake and Yinghsia Lake and the rainwater storage lake at the Daren Agricultural Station in Taitung County are used for water purification, vegetation irrigation, and groundwater recharge.
Water Saving	• Drought-tolerant trees are used for campus greening and beautification to save irrigation water consumption. • Water storage tanks are washed and water quality are checked periodically, water-saving concept is promoted, and water-efficient devices are used. • Smart farms are developed and drip irrigation is applied to save water.
Reuse	• Campus sewage is purified and reclaimed for use in tree irrigation and toilet flush. • Water discharged from swimming pools is purified and reclaimed for irrigation use of the practice orchards. • Rainwater harvesting and recycling systems are installed for green-wall irrigation.

▶ Rainwater Harvesting System

4-3 Biodiversity Protection and Restoration

14.1 14.2 15.1 15.5 GRI 304-1 to GRI 304-4 | Material Issue E07

The Department of Plant Medicine, Department of Aquaculture, and Taiwan's unique Institute of Wildlife Conservation and Pingtung Rescue Center spare no efforts in the protection and restoration of terrestrial and aquatic ecology.

Aquatic Ecology Protection and Restoration

In view of the decreasing population of the wild mutated red swamp crawfish, (*Procambarus clarkii*) and Australian freshwater crayfish (*Cherax quadricarinatus*) due to overfishing, to protect the species' population and maintain the resources of freshwater ecosystems, we study and culture the mutated red swamp crawfish and develop the seed production of the Australian freshwater crayfish, with an incubation rate of over 70%.

Academic staff of the Department of Aquaculture assist Southeast Asian countries in developing skin saver cream, skin relief cream, massage cream, and personal cleaning products with economic seaweed in their near waters. Apart from facilitating the reasonable development and use of marine resources, this can also help protecting marine resources towards sustainable use.

We co-organized the "In-Depth Exploration of Taiwan Aquaculture" special exhibition with the National Museum of Marine Biology and Aquarium to promote the sustainable development of Taiwan aquaculture. We also organized aquaculture exploration and experiential TVET courses and offered educational courses on water resource protection and aquaculture sustainable operations to elementary, junior high, and senior high schools and vocational high schools to advocate the concepts including no overfishing; no Illegal, unreported and unregulated (IUU) fishing; and no destructive fishing to ingrain sustainable marine ecology protection.

▲ Mutated red swamp crawfish

▲ Developing skin saver cream and personal cleaning products with economic seaweed.

▲ Opening of the "In-Depth Exploration of Taiwan Aquaculture" permanent exhibition.

▲ Poster of the "In-Depth Exploration of Taiwan Aquaculture".

▼ Exploration and experiential TVET courses for aquaculture.

Terrestrial Ecology Protection and Restoration

The NPUST Pingtung Rescue Center (the "Center") is an important shelter and rescue center for endangered species at home and abroad. In addition to sheltering international indicative endangered species, it also provides rescue, recovery, release, and population rebuilding of domestic native protected species over time. The center engages in active international cooperation to build the extraterritorial conservation and propagation population for endangered species and establish the regional contact network. In 1995 the center began to establish exchange channels with national wildlife conservation or shelter organizations in Australia, Cambodia, France, Hong Kong, India, Indonesia, South Korean, Malaysia, the Netherlands, Pakistan, the Philippines, Singapore, Thailand, the UK, and the USA. We also established subsequent cooperation mechanisms with eight related organizations.

Currently, we have sheltered 105 IUCN Red List species and national conservation list species (critically endangered (CR), endangered (EN), vulnerable (VU), and near threatened (NT)) with over 140 heads. In the past three years, the center has rescued domestic endangered and protected species, rare and valuable species, other conservation-deserving species, and general wildlife with a population under 992 heads. Up to 371 heads have been released after recovery.

In addition to the annual operating fund subsidization of the Forestry Bureau (now Forestry and Nature Conservation Agency), Council of Agriculture (now Ministry of Agriculture), Executive Yuan, other fund sources included the university endowment fund and small-amount donation from the public.

Total Number of IUCN Red List Species and National Conservation List Species Sheltered by NPUST

Risk of Extinction	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)	Near Threatened (NT)	Least Concern (LC)	Total
Total Number of Species	9	15	21	10	50	105

Statistics on Domestic Wildlife Rescued by the Center in Past 3 Years

Domestic Wildlife/ Year	Endangered and Protected Species		Rare and Valuable Species		Other Conservation-Deserving Species		General Wildlife		Release after Recovery
	Species	Quantity (head)	Species	Quantity (head)	Species	Quantity (head)	Species	Quantity (head)	Quantity (head)
2020	3	12	14	87	3	7	16	35	60
2021	4	569	17	70	3	9	22	54	52
2022	4	11	16	78	4	4	21	59	259

Example

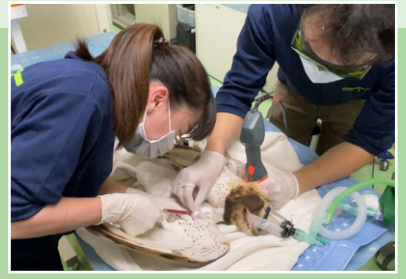
International Orangutan Day: The center prepared the fruit tapioca ball as the dessert for the orangutan to ease heat in summer to express care for animals. Further reading

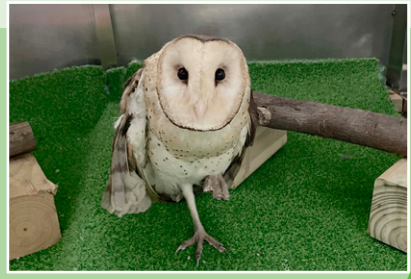
The center celebrated the 12th birthday for Bill, a liger sheltered by the center. Further reading

The center also organized the "Xmas Present Pack" event to publicize the animal protection concept to practice its education mission. Further reading: Pingtung Rescue Center Facebook

Center staff also build more comfortable activity space for sheltered animals during the free time. Further reading: Pingtung Rescue Center Facebook

A wounded eastern grass owl (*Tyto longimembris*), endangered and protected species, was transferred to the center, and center veterinarians treated this lovely apple-faced eastern grass owl . The eastern grass owl recovered well and was released to the wild. Further reading





The snake-eating turtle (*Cuora flavomarginata*) and the yellow pond turtle (*Mauremys mutica*) have been IUCN-listed as EN and CR species respectively. The research team of Director Tien-Hsi Chen of the center has been studying both species in Feicui Reservoir Snake-Eating Turtle Protected Area for over one decade. The the study included ecological study, population monitoring and fortification, habitat improvement and building, protect area patrol and conservation. The center also collaborated with the competent authorities, local communities, and tribal communities for the ex situ release, reconstruction, and fortification of the endangered freshwater turtle wild population.

Related report: Subsistence: Dangers in the wild of endangered snake-eating turtle and yellow pond turtle

Assistant Processor Ching-Min Sun of the Institute of Wildlife Preservation has been studying and promoting the preservation of the endangered Chinese pangolin (*Manis pentadactyla*) for a dozen years. In 2022 he became the chair of the IUCN Pangolin Expert Group in East Asia Region and has developed numbers of pangolin research and technology patents for use by worldwide pangolin preservation organizations. The team led by Dr. Sun and teachers and students of National Heng-Chun Industrial & Commercial Vocational High School implemented the education and promotion of “End Ants, Protect Crabs, and Feed Chinese Pangolin” to ingrain animal preservation in children. The project was funded by the Ecological Preservation Program at the “7Th UMC Eco Echo Award”

Related report: Pangolin expert Dr. Ching-Min Sun’s latest preservation program “End Ants, Protect Crabs, and Feed Pangolin” exposed

The NPUST Veterinary Teaching Hospital and Kaohsiung City Shoushan Zoo engage in long-term collaborative education. Veterinarians of the zoo and the team of NPUST Veterinary Teaching Hospital often work together to solve the health problems of wildlife captured in the zoo to safeguard the health of wildlife captured in the zoo together. The medical and care services for the zoo wildlife are very challenging. Although both caregivers and veterinary personnel are at risk of animal attacks, they still uphold the aim of maintaining animal well being and ecological education so as to fulfill USR. Further reading

4-4 Environmental Conservation and Disaster Prevention and Mitigation 13.3

Taiwan is located on the Ring of Fire and subtropic monsoon region. Due to climate change, natural disasters such as earthquakes, typhoons, and torrential rain have become more frequent. The government thus emphasize more on environmental conservation and disaster prevention and mitigation. The Soil and Water Conservation Technique Education Center (SoWaCTEC), Disaster Prevention and Mitigation Technology Research Center (DPC), and Compound Disaster Prevention Research Center (CDPRC) assist local governments in establishing the awareness of environmental conservation and disaster prevention and mitigation in community residents and enhancing the measures for disaster resilience, disaster prevention, and disaster mitigation of communities, and fulfilling USR.

Status of Education and Promotion of Slopeland Conservation

SoWaCTEC promotes soil and water conservation, farmland soil and water conservation, and slopeland disaster prevention techniques. To promote exchange and cooperation on soil and water conservation with Southeast Asian countries and establish the “Soil and Water Conservation International Demonstration Site” on the rear mountain of NPUST together with the Agency of Rural Development and Soil and Water Conservation (ARDSWC) of the Executive Yuan to demonstrate drainage engineering methods, slope protection engineering methods, and farm pond and water storage system, irrigation system, and contour bunding so as to improve farmland soil and water conservation professional techniques. SoWaCTEC organizes disaster prevention publicity activities every year to help low-income and vulnerable groups in remote townships to build sustainable beautiful and happy homes.

Status of Implementation of Disaster Prevention and Mitigation

1. Assist local governments and communities in implementing community disaster prevention drills, education, and publicity; and offer fundamental and special training for disaster relief volunteers and water conservation volunteers in times of normality.
2. Integrate and update disaster prevention and mitigation maps and information and disaster rescue resource database, with contents including the major disaster potential maps, disaster-prone facility maps, disaster shelter maps, and historical disaster maps of Pingtung County for the reference of disaster response and prevention.
3. Built the Backup Laboratory for Radioactive Analysis of Radiation Hazards with the assistance of the Atomic Energy Council (now Nuclear Safety Commission), Executive Yuan, to support the country’s enhancement of radioactive analysis capacity and assist the nuclear power plant 3 (NPP3) in performing environmental radiation and food radiation tests.
4. Assist NPP3 in drawing up the emergency response plan to evacuate and accommodate community residents smoothly in emergency.
5. Engage in the academic and technological applied research of compound disasters covering the disaster investigation, assessment, prevention and protection planning, and arrange slopeland disaster education and publicity for the public to enrich their disaster prevention competence.

Performance in Publicity and Research of Disaster Prevention and Mitigation

Statistics on Education and Publicity of Disaster Prevention and Mitigation and Training for Disaster Relief Volunteers and Water Conservation Volunteers in Past 3 Years

Year	Publicity and Education		of Disaster Prevention and Mitigation	
	Number of Sessions	Number of Participants	Number of Disaster Relief Volunteers (persons)	Number of Water Conservation Volunteers (persons)
2020	22	941	36	-
2021	33	1,225	45	18
2022	56	1,962	40	55

Statistics on University-Industry-Government Collaboration Projects on Disaster Prevention and Mitigation in Past 3 Years

Year	Number of University-Industry-Government Collaboration Projects	Amount (NT$)
2020	24	41,304,000
2021	34	51,120,498
2022	25	43,161,402

▲ Soil and Water Conservation Education and Publicity Activities in 2022

Further reading

▲ DPC assists in the evacuation drills for the public: Earthquake

▲ Soil and Water Conservation Technique Education Center;

▲ Disaster Prevention and Mitigation Technology Research Center

▼ Soil and Water Conservation International Demonstration Site

4-5 Sustainable Supply Chain 12.7 GRI204-1

As a government agency, we have established the "NPUST Instructions for Implementation of (Construction, Property, Labor Service) Procurement" in accordance with the *Government Procurement Act* and the related bylaws and a procurement system to enhance procurement efficiency and function through fair and open procurement processes to ensure procurement quality.

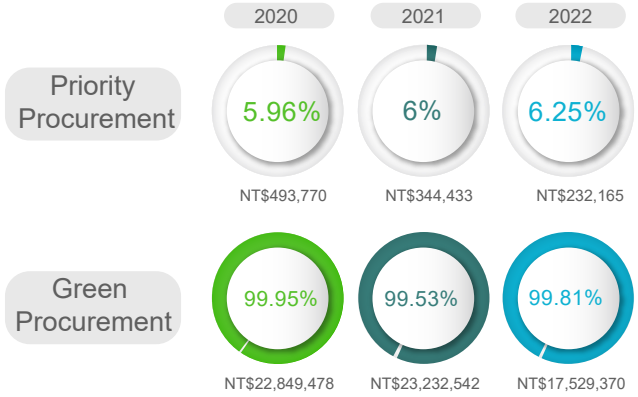
Sustainable Supply Chain Policy and Objectives

Sustainable Supply Chain Policy	Goal	Performance
Enforcement of the *Act of Gender Equality in Employment*	Suppliers are requested to hire workers with disabilities and indigenous workers in accordance with the *People with Disabilities Rights Protection Act* and the *Indigenous Peoples Employment Rights Protection Act* and are not allowed to hire personnel without the right to work.	1. Stipulated relevant regulations in the procurement agreements. 2. During 2020-2022 all suppliers complied with the terms in the procurement agreements.
Enforcement of Priority Procurement	Merchandise and service procurement is prioritized for disability welfare organizations and sheltered workshops, over the 5% requirement of the Ministry of Health and Welfare.	The 2022 amount of priority procurement was NT$232,165 or 6.25%, over the 5% requirement of the Ministry of Health and Welfare.
Enforcement of Green Procurement	Purchased water-efficient products, recycled products, and IT products at over 90% as requested by the Environmental Protection Administration, Executive Yuan.	The 2022 procurement amount of designated items was NT$17,529,370, with a rate of up to 99.81%, higher than the over 90% requirement requested by the Environmental Protection Administration, Executive Yuan.

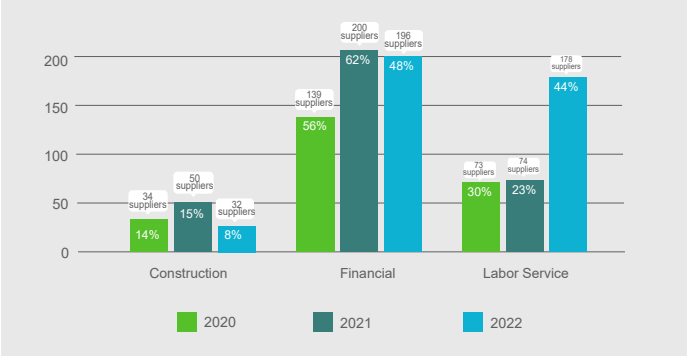
Priority Procurement and Green Procurement

To promote all-out green life, the government encourages all institutions and governmental organizations to implement green procurement and specify the procurement contents, covering food, clothing, housing, transportation, education, and entertainment, based on the rate of priority procurement. To implement green procurement and fulfill social responsibilities and practice a fair and reasonable system, during 2020-2022 we prioritized procurement of merchandise and services from disability welfare organizations and sheltered workshops at over 5.96%, 6.00%, and 6.25% respectively, all over the 5% requirement of the Ministry of Health and Welfare. During 2020-2022 the rate of green procurement was 99.95%, 99.53%, and 99.81% respectively, all higher than the over 90% requirement requested by the Environmental Protection Administration, Executive Yuan. During 2020-2022 all construction, financial, and labor service were purchased from local suppliers, i.e. 100% local procurement.

Amount and Rate of Priority Procurement and Green Procurement in Past 3 Year



Statistics on Suppliers by Procurement Type



*All suppliers are based in Taiwan (100% local procurement).

Environmental Sustainability-Highlights of Corresponding SDGs

Link to SDGs 13.3 15.1

The NPUST Yunus Social Business Centre and Green Hope Spring Social Enterprise co-organized the tree plantation activity in the NPUST botanical garden to support the 2021 Earth Day. (2021/4/22) Further reading

Link to SDGs 11.4

The Department of Wood Science and Design held the wood and bamboo furniture exhibition in collaboration with the Department of Product Design of Shu-Te University, the Department of Material Arts and Design of the Tainan National University of the Arts, and the Department of Arts and Design of National Tsing Hwa University. Apart from enhance the self-sufficiency of domestic materials, the exhibition has also redefined the use of domestic materials. (2021/11/22) Further reading

Link to SDGs 8.10 12.4 12.5

To enhance the disaster resilience and economic efficiency of agriculture, the interdisciplinary team of the Department of Materials Engineering developed the recycled composite plastics primarily with spent vehicle bumpers and PE bottles to as the material for the screen-greenhouse for agriculture. (2021/4/30) Further reading

Link to SDGs 4.7 13.3

Teachers and students of the Department of Soil and Water Conservation organized the 2022 environmental education and disaster prevention and mitigation publicity event. In the event multimedia water conservation teaching materials were integrated into mobile technology to create a quality outdoor classroom learning environment for the public to receive environmental education and develop the awareness of disaster prevention and mitigation through experiential activities. (2022/3/3) Further reading

Link to SDGs 15.1 15.5

In support of the Council of Agriculture (now Ministry of Agriculture)'s abolition of the "Rodent Control Week" policy, Chaozhou Town Office stopped rodenticide distribution and promoted the "Black Kite Habitat" project in collaboration with the Bird Ecology Lab of the Institute of Wildlife Protection to build a toxin-free living circle for predatory birds and attract the mice-eating black-winged kite (*Elanus caeruleus*) to stay. Apart from forming a rodent squad in nature to help farmers solve the rodent problem, this can also help build a balanced, eco-friendly environment. (2021/07/23) Further reading

Link to SDGs 4.3 12.4

The Department of Wood Science and Design organized the "vocational senior high School DIY Camp" for 18 students from senior high schools and vocational high schools. The camp included environmental education and introduced the circular use of domestic wood materials and byproducts and the development of Taiwan's wood industry to develop a friendly environment for forestation, forest use, and reforestation. (2022/3/5) Further reading

Environmental Sustainability-Highlights of Corresponding SDGs

Link to SDGs 4.7 11.4 15.2

The Department of Forestry undertook the “Love for Trees Education Promotion Project” of the Ministry of Education and invited teachers and schoolchildren of Sheng-Li Elementary School to the Victory Star VIP Zone for the orienteering event based on the old tree in the district. The event aimed to let schoolchildren understand the knowledge of trees and the culture of local communities to pass on the correct concept of tree maintenance and history. (2022/3/15) Further reading

Link to SDGs 4.3 11.3 12.8

Assistant Professor Wan-Yu Chou of the Institute of Landscape Architecture and Recreation Management and Assistant Pei-Yi Weng of the Department of Plant Science led the interdisciplinary USR team formed by students to organize the “Elementary School Agronomic Education: Environmental Aesthetics and Therapy Course Project” at Rong Hua Elementary School in Pingtung County to show senior-year teachers and students to learn the knowledge of environmental beautification and plantation. (2022/5/25) Further reading

Link to SDGs 6.3 6.6 12.8

In collaboration with Wanluan Township Office and the Blue Donggang Creek Conservation Association of Taiwan, the Center for General Education took over 100 students from different departments to support the UN Decade on Ecosystem Restoration through the purposive matching of anaerobic digestion residues from farmers around the livestock farms investigated by the township office to achieve the goal of river ecology restoration. (2022/4/8) Further reading

Link to SDGs 15.4 15.5 15.9

In collaboration with the Pingtung Branch of the Forestry and Nature Conservation Agency and Guan Sheng Ecosystem Co., Ltd., the Department of Forestry held the online Secondary Ecological Conservation Workshop: 2021 Eastern Grass Owl Conservation Platform Exchange Meeting” through the “Gaoping Region Ecology Map Building Project” to present a bigger picture for eastern grass owl (*Tyto longimembris*) conservation through the cross-agency collaboration platform with experts from the industry, government, academia, and research institutions. (2022/7/27) Further reading

Link to SDGs 2.4 8.2 12.3

The Department of Forestry organized the Forest Plain: Affordable Creative Dish Competition to encourage the creation of unlimited dishes by integrating products of the under-forest economy into local specialty ingredients so as to promote “local production and consumption”, “agri-food education”, and “low-carbon diet”. (2022/6/1) Further reading

Link to SDGs 2.4 12.8 13.2

Under the direction of the Agriculture and Food Agency, Council of Agriculture (now Ministry of Agriculture), the College of Agriculture and the Department of Plant Industry, the Agronomy Society of Taiwan, Agricultural Technology Park Preparatory Office, and Academia-Industry Consortium for Agricultural Biotechnology Park co-organized the Topical Agriculture Sustainable Carbon Management Conference to improve and value the policy development for carbon reduction and carbon sink enhancement in agriculture so as to facilitate the early achievement of net-zero emissions of Taiwan’s agriculture. (2022/11/15) Further reading