



Times Higher Education
**Sustainability
Impact Ratings**

SDG

14

Life Below Water



SDG 14.2.1 Fresh-water ecosystems (community outreach)

Although Taiwan is surrounded by the sea, due to its climate and geographical conditions, the available freshwater resources are insufficient, making water resource the most significant element on Taiwan's social and economic development. In recent years, countries all over the world have become aware of the importance of sustainable development, which highlights the maintenance of biodiversity, and ecological conservation, and water resources play the crucial role. NCUE's Environmental Education Center, and Center for General Education are responsible for the planning and implementation of environmental programmes related to the freshwater ecosystem. We provide free education to nationwide communities, NCUE's students, and junior and high school teachers by applying for programmes funded by the Taiwan government. The courses include observing freshwater ecosystems, freshwater organisms, and indicator organisms in freshwater, freshwater water quality parameters, freshwater ecosystem water quality parameters, and testing the water quality in the campuses and communities, water for industrial use, which includes irrigation, industrial water, energy water, agriculture, and fisheries. In addition, the courses also explore the water pollution issue in sightseeing, individuals, and enterprises to promote water conservation. These programmes aim to improve the knowledge of NCUE's students, junior and high school teachers, and nationwide communities on water conservation and their awareness of freshwater environment protection.

1. NCUE's Environmental Education Center

The Environmental Education Center offers programs, including "24-hour, 100-hour courses for the certification of environmental education personnel", the "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change," Department of Biology's "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project".

(1) 24-hour, 100-Hour Courses for Environmental Education Personnel Certification

The Environmental Education Center's duty is to nurture environmental education talents. In conjunction with the project "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" project, EEC provided relevant education courses for the local and nationwide communities from July to October 2024, with the details shown in Table 1 and the activities shown in Figure 1-2:

Table 1. Environmental education course activities

Educational activities	Time	Number of participants
Special program at NCUE under 24-hour for the certification of environmental education personnel	August 2024	20
100-hour courses for the certification of environmental education personnel	July 2024	8



Figure 1. Special Program for Environmental Education Personnel at NCUE



Figure 2. Environmental Education Personnel 100-Hour Program: outdoor instruction

(2) Course Information Link:

<https://www.facebook.com/media/set/?set=a.1080081833905178&type=3>

<https://www.facebook.com/media/set/?set=a.1082290977017597&type=3>

2. "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change", "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project":

Under these projects, the University offered the courses "Coastal Biological Resources" and "Sustainable Development and Practices of Coastal Biological Resources," which integrate theories and practices. The curricula covered coastal biodiversity, eco-friendly aquaculture techniques, water and sediment quality testing, fish consumption culture, and the promotion of low-carbon aquaculture. In collaboration with local communities, the courses also advanced marine conservation and sustainable fisheries. In the same year, NCUE carried out the industry-academia collaboration project "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project," conducting a series of marine citizen science courses at Xinbao Wetland and Wanggong Fishing Harbor. Activities included:

- (1) Habitat surveys of hard clams (winter, spring, summer, and autumn; four sessions in total, including sediment improvement trials)
- (2) Volunteer training for habitat surveys (4 sessions, 41 participants)
- (3) "Seed Teacher Training" (3 sessions, 91 participants)
- (4) "Little Clam Detectives" educational activities (4 sessions, 185 participants)

The training and practical sessions encompassed water quality testing, biodiversity surveys, bivalve

classification, coastal tourism, and conservation education promotion. NCUE also collapsed with Cao-Hu Junior High School, Hanbao Elementary School, and Lukang Elementary School to integrate scientific investigation with local education. Project results show that sediment improvement effectively promotes the growth of coarse-sediment indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. In addition, the participation of citizen scientist also effectively increases survey data and strengthens community water resource safety and conservation awareness, successfully establishing a demonstration model that combines scientific research with educational promotion. Activities photos are shown in Figure 3.

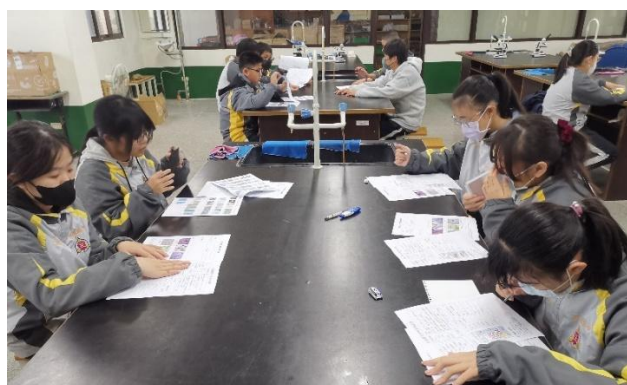


Figure 3. “Little Clam Detectives” Water Quality Investigation Workshop, Caohu Junior High School

3. Center for General Education

In 2024, the Center for General Education offered one class of the related general education course “Water Resources and Human Civilization.”

Link for reference information:

https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1131/00243_0CCGE0175120.pdf

SDG 14.2.2 Sustainable fisheries (community outreach)

NCUE's Environmental Education Center, Department of Biology, and Department of Geography has applied funding from governmental agencies to provide free educational programs and field research related to fisheries, aquaculture, and tourism for local communities, as well as for junior and senior high school teachers and students. These initiatives are grounded in place-based education principles and aim to strengthen community engagement while enhancing participants' knowledge and interest in fisheries, aquaculture, and associated eco-tourism industries. Implementation strategies are subject to iterative review and adaptive modification based on project performance evaluations, ensuring that program delivery remains responsive to local needs and emerging challenges. In addition to raising awareness, the programs are intended to foster the development of future professionals capable of contributing to the sustainable growth of fisheries, aquaculture, and eco-tourism sectors in the region. A summary of related projects is shown in Table 1:

Table 1. Related activities and projects

Project Name	Funding Agency
Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change	Ministry of Education
Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project	Wanggong Community Development Association, Fangyuan Township, Changhua County
Monitoring of Agro-Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)	National Science and Technology Council
Geographical Writing and Local Practices — Reconstructing Geographical Records of the Fangyuan Coastal Community in Changhua	Ministry of Education
Transformations of Changhua's Coastal Landscape: Cross-Scale Spatial Development and Socio-Ecological Dynamics Driven by Artificial Structures — The Case of the Fangyuan Coast and the Seaside Walkway (Main Project with Subproject VI)	National Science and Technology Council

1. Environmental Education Centre and Department of Biology: “Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change” and “Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project”:

Under these projects, the University offered the courses “Coastal Biological Resources” and “Sustainable Development and Practices of Coastal Biological Resources,” which integrate theories

and practices. The curricula covered coastal biodiversity, eco-friendly aquaculture techniques, water and sediment quality testing, fish consumption culture, and the promotion of low-carbon aquaculture. In collaboration with local communities, the courses also advanced marine conservation and sustainable fisheries. In the same year, NCUE carried out the industry–academia collaboration project “Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project,” conducting a series of marine citizen science courses at Xinbao Wetland and Wanggong Fishing Harbor. Activities included:

- (1) Habitat surveys of hard clams (winter, spring, summer, and autumn; four sessions in total, including sediment improvement trials)
- (2) Volunteer training for habitat surveys (4 sessions, 41 participants)
- (3) “Seed Teacher Training” (3 sessions, 91 participants)
- (4) “Little Clam Detectives” educational activities (4 sessions, 185 participants)

The training and practical sessions encompassed water quality testing, biodiversity surveys, bivalve classification, coastal tourism, and conservation education promotion. NCUE also collapsed with Cao-Hu Junior High School, Hanbao Elementary School, and Lukang Elementary School to integrate scientific investigation with local education. Project results show that sediment improvement effectively promotes the growth of coarse-sediment indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. In addition, the participation of citizen scientist also effectively increases survey data and strengthens community water resource safety and conservation awareness, successfully establishing a demonstration model that combines scientific research with educational promotion. Activities Photos are showed in Figure 1.



Figure 1. Sustainable Development and Practices of Coastal Biological Resources Course: students and teachers were testing water and sediment quality.

Project FB Page Link: <https://www.facebook.com/NCUEUSR/>

2. Monitoring of Agro–Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)

NCUE's Department of Geography is undertaking the National Science and Technology Council (NSTC) project "Monitoring of Agro-Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)." Fangyuan was designated as the core observation site to establish a place-based demonstrative observation program. This project implements long-term, fundamental, and critical monitoring of core socio-ecological system components, serving as the Changhua Station within the Long-Term Socio-Ecological Research (LTSER) network. Field research at the station encompasses water quality assessments, ecological surveys, and geomorphological monitoring in the Fangyuan, Hanbao, and Wanggong wetlands. A complete year of baseline surveys was accomplished in 2024, and continuous monitoring will be maintained in subsequent years. In-depth interviews with key local stakeholders constitute a vital element of the station's social research and provided the LTSER platform's local engagement network. These interviews systematically document and analyze stakeholder roles, functions, and relationships, as well as their experiences and observations of socio-ecological transformations, thus providing a robust social-ecological data foundation for the platform. Drawing upon insights from these interviews and local documentary sources, the station developed questionnaires to further assess residents' perceptions of environmental and renewable energy issues. Station staff also actively participate in local events to identify emerging concerns and explore collaborative opportunities with community partners. The long-term monitoring program aims not only to advance scientific understanding but also to address locally relevant needs. Activities photos are shown in the accompanying figure2-3.



Figure 2. Changhua Coastal Wetland Conservation Seminar



Figure 3. Faculty members and students are conducting topographic monitoring at Hanbao Wetland.

3. Geographical Writing and Local Practices — Reconstructing Geographical Records of the Fangyuan Coastal Community in Changhua

Using the coastal community of Fangyuan Township, Changhua, as the field of practice, this project adopts the method of geographical writing to investigate the spatial forms of abandoned traditional courtyard houses (sanheyuan) along the coast and to trace their developmental backgrounds, including the life histories of local residents. The aim is to reconstruct the geographical records of these sunset villages, integrating rural geography theories with the skills of geographical writing, while also assisting the community in gradually achieving the goals of landscape preservation and transformation.

Under the guidance of Professor Song Yu-Ling, thirty students from the Department of Geography enrolled in the course Rural Geography conducted three rounds of fieldwork in Fangyuan Township, Changhua County. A final presentation of the research findings was held at the Oilseed Academy, where local village heads, community leaders, artists, and returning youth were invited to participate in roundtable discussions, following the “World Café” format, to exchange ideas and reflect on the results of each group’s investigation of old houses.



Figure 4. An aerial photo of abandoned sanheyuan (traditional courtyard houses) in Fangyuan, Changhua County



Figure 5. The Project Presentation

4. Transformations of Changhua’s Coastal Landscape: Cross-Scale Spatial Development and Socio-

Ecological Dynamics Driven by Artificial Structures — The Case of the Fangyuan Coast and the Seaside Walkway (Main Project with Subproject VI)

Through a three-year project, this study examines the agro-fishery production landscape, the social structure/governance system, and demographic changes of Fangyuan Township, Changhua County. During the process, 60 local stakeholders were interviewed, including government agencies, producers, social organizations, and industry groups. The research investigates how the intervention of “artificial structures”—such as offshore wind turbines along the coast, the Fangyuan Wetlands Trail in the intertidal zone, and onshore installations including wind turbines and solar panels—affects the local production landscape. It further explores the interconnections and interactions within the related socio-ecological networks, analyzing the resulting socio-ecological impacts on the Fangyuan coastal area, as well as the balance between these impacts and the tourism development associated with the extension of the local “sea-cow” (oxen trained to carry the catch in the sea) cultural heritage.

SDG 14.2.3 Overfishing (community outreach)

NCUE offered local community residents and students courses related to coastal biological resources, fishing operations, and fisheries conservation, including the "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" and "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project", which is offered by the Department of Biology, College of Science.

Under these projects, the University offered the courses "Coastal Biological Resources" and "Sustainable Development and Practices of Coastal Biological Resources," which integrate theories and practices. The curricula covered coastal biodiversity, eco-friendly aquaculture techniques, water and sediment quality testing, fish consumption culture, and the promotion of low-carbon aquaculture. In collaboration with local communities, the courses also advanced marine conservation and sustainable fisheries. In the same year, NCUE carried out the industry-academia collaboration project "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project," conducting a series of marine citizen science courses at Xinbao Wetland and Wanggong Fishing Harbor. Activities included:

- (1) Habitat surveys of hard clams (winter, spring, summer, and autumn; four sessions in total, including sediment improvement trials)
- (2) Volunteer training for habitat surveys (4 sessions, 41 participants)
- (3) "Seed Teacher Training" (3 sessions, 91 participants)
- (4) "Little Clam Detectives" educational activities (4 sessions, 185 participants)

The training and practical sessions encompassed water quality testing, biodiversity surveys, bivalve classification, coastal tourism, and conservation education promotion. NCUE also collaborated with Cao-Hu Junior High School, Hanbao Elementary School, and Lukang Elementary School to integrate scientific investigation with local education. Project results show that sediment improvement effectively promotes the growth of coarse-sediment indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. In addition, citizen scientist participation also effectively increases survey data and strengthens community water resource safety and conservation awareness, successfully establishing a demonstration model that combines scientific research with educational promotion. Activities photos are shown in Figure 1.



Figure 1. Seed Teacher Training Workshop on Marine Citizen Science for Quantitative Marine Ecological Surveys – Focused on identifying and enumerating common bivalve species in the coastal wetlands of Changhua.

Project FB Page Link: <https://www.facebook.com/NCUEUSR/>

SDG 14.3.1 Conservation and sustainable utilization of the oceans (events)

NCUE has at least four programmes to promote conservation and sustainable utilization of the oceans, seas, lakes, rivers and marine resources. They include the Environmental Education Centre's "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change"; the Center for General Education's "Water Resources and Human Civilization" and "Introduction to Marine Life Sciences", Department of Geography's "Monitoring of Agro-Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)", as shown in Table 1. They are discussed in detail below:

Table 1. Related activities and projects

Project Name	Funding Agency
Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change	Ministry of Education
"Water Resources and Human Civilization" and "Introduction to Marine Life Sciences"	-
Monitoring of Agro-Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)	National Science and Technology Council
Transformations of Changhua's Coastal Landscape: Cross-Scale Spatial Development and Socio-Ecological Dynamics Driven by Artificial Structures — The Case of the Fangyuan Coast and the Seaside Walkway (Main Project with Subproject VI)	National Science and Technology Council

1. Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change:

Under the project, the courses "Coastal Biological Resources" and "Sustainable Development and Practices of Coastal Biological Resources," integrate theoretical instruction with practical application. The curricula covers coastal biodiversity, eco-friendly aquaculture techniques, water and sediment quality testing, seafood culture, and the promotion of low-carbon aquaculture. In addition, the project also collaborated with local communities to promote marine conservation and sustainable fisheries.

Project FB Page Link: <https://www.facebook.com/NCUEUSR/>

2. Center for General Education

The Center for General Education offered one class on "Water Resources and Human Civilization" and "Introduction to Marine Life Sciences" in 2024; the related links are listed below:

https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1122/00255_0CCGE0169820.pdf

https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1131/00243_0CCGE0175120.pdf

f

3. Monitoring of Agro–Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)

NCUE’s Department of Geography is undertaking the National Science and Technology Council (NSTC) project “Monitoring of Agro–Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3).” Fangyuan was designated as the core observation site to establish a place-based demonstrative observation program. This project implements long-term, fundamental, and critical monitoring of core socio-ecological system components, serving as the Changhua Station within the Long-Term Socio-Ecological Research (LTSER) network. Field research at the station encompasses water quality assessments, ecological surveys, and geomorphological monitoring in the Fangyuan, Hanbao, and Wanggong wetlands. A complete year of baseline surveys was accomplished in 2024, and continuous monitoring will be maintained in subsequent years. In-depth interviews with key local stakeholders constitute a vital element of the station’s social research and provided the LTSER platform’s local engagement network. These interviews systematically document and analyze stakeholder roles, functions, and relationships, as well as their experiences and observations of socio-ecological transformations, thus providing a robust social–ecological data foundation for the platform. Drawing upon insights from these interviews and local documentary sources, the station developed questionnaires to further assess residents’ perceptions of environmental and renewable energy issues. Station staff also actively participate in local events to identify emerging concerns and explore collaborative opportunities with community partners. The long-term monitoring program aims not only to advance scientific understanding but also to address locally relevant needs. Activities photos are shown in the accompanying figure 1.



Figure 1. Coastal Wetland Conservation in Changhua Seminar

4. Transformations of Changhua’s Coastal Landscape: Cross-Scale Spatial Development and Socio-Ecological Dynamics Driven by Artificial Structures — The Case of the Fangyuan Coast and the Seaside Walkway (Main Project with Subproject VI)

Through a three-year project, this study examines the agro-fishery production landscape, the social structure/governance system, and demographic changes of Fangyuan Township, Changhua County.

During the process, 60 local stakeholders were interviewed, including government agencies, producers, social organizations, and industry groups. The research investigates how the intervention of “artificial structures”—such as offshore wind turbines along the coast, a seaside walkway in the intertidal zone, and onshore installations including wind turbines and solar panels—affects the local production landscape. It further explores the interconnections and interactions within the related socio-ecological networks, analyzing the resulting socio-ecological impacts on the Fangyuan coastal area, as well as the balance between these impacts and the tourism development associated with the extension of the local “sea-cow” (oxen trained to carry the catch in the sea) cultural heritage.

SDG 14.3.2 Food from aquatic ecosystems (policies)

The NCUE's Environmental Education Center has also planted lotus flowers at the Baisha Lake on campus. After several months, the lotus flowers bloomed and produced lotus seeds, which serve as a source of food from the aquatic ecosystem on campus. These lotus seeds have been used to prepare delicious dishes such as lotus seed snacks and lotus flower tea. This ensures sustainable harvesting of food from the aquatic ecosystem on campus. The event photos are shown in Figures 1-2.



Figure 1. Lotus planted in the Baisha Lake



Figure 2. Delicious lotus seeds and freshly brewed lotus tea

SDG 14.3.3 Maintain ecosystems and their biodiversity (direct work)

NCUE has held several planned activities to maintain and expand existing plant and animal ecosystems and their biodiversity, especially threatened ecosystems. NCUE includes the Environmental Education Centre's "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" and "24-hour, 100-hour courses for certification of environmental education personnel", Department of Biology's "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project". They will be discussed in detail below:

1. "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change", "Changhua Coastal hard clams Habitat Survey and Conservation Education Promotion Program":

Under these projects, the University offered the courses "Coastal Biological Resources" and "Sustainable Development and Practices of Coastal Biological Resources," which integrate theories and practices. The curricula covered coastal biodiversity, eco-friendly aquaculture techniques, water and sediment quality testing, fish consumption culture, and the promotion of low-carbon aquaculture. In collaboration with local communities, the courses also advanced marine conservation and sustainable fisheries. In the same year, NCUE carried out the industry-academia collaboration project "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project," conducting a series of marine citizen science courses at Xinbao Wetland and Wanggong Fishing Harbor. Activities included:

- (1) Habitat surveys of hard clams (winter, spring, summer, and autumn; four sessions in total, including sediment improvement trials)
- (2) Volunteer training for habitat surveys (4 sessions, 41 participants)
- (3) "Seed Teacher Training" (3 sessions, 91 participants)
- (4) "Little Clam Detectives" educational activities (4 sessions, 185 participants)

The training and practical sessions encompassed water quality testing, biodiversity surveys, bivalve classification, coastal tourism, and conservation education promotion. NCUE also collapsed with Cao-Hu Junior High School, Hanbao Elementary School, and Lukang Elementary School to integrate scientific investigation with local education. Project results show that sediment improvement effectively promotes the growth of coarse-sediment indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. In addition, the participation of citizen scientist also effectively increases survey data and strengthens community water resource safety and conservation awareness, successfully establishing a demonstration model that combines scientific research with educational promotion. Activities photos are shown in Figure 1.



Figure 1. In winter, the NCUE team, in collaboration with the Changhua Marine Food Research Center, conducted sampling and surveys of hard clam habitats.

Project FB Page Link: <https://www.facebook.com/NCUEUSR/>

2. 24-Hour, 100-Hour Courses for Environmental Education Personnel Certification

The Environmental Education Center’s duty is to nurture environmental education talents. In conjunction with the project “Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua’s Two Cities Amid Climate Change” project, EEC provided relevant education courses for the local and nationwide communities from July to October 2024, with the details shown in Table 1 and the activities shown in Figure 2-3:

Table 1. Environmental education course activities

Educational activities	Time	Number of students
Environmental Educator 24-hour Certification -NCUE Class	August 2024	20
Environmental Educator 100-hour Certification Class	July 2024	8



Figure 2. NCUS’s Specialized Program for Environmental Education Personnel



Figure 3. Environmental Education Personnel 100-Hour Program

Course activities Information Link:

<https://www.facebook.com/media/set/?set=a.1080081833905178&type=3>

<https://www.facebook.com/media/set/?set=a.1082290977017597&type=3>

SDG 14.3.4 Technologies towards aquatic ecosystem damage prevention (direct work)

NCUE has ongoing projects and activities, which include the “Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua’s Two Cities Amid Climate Change”, Department of Biology’s “Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project,” and Department of Geography’s “Monitoring of Agro–Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)” as shown in Table 1. The following is a brief description.

Table 1. Related activities and projects

Project Name	Funding Agency
Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua’s Two Cities Amid Climate Change	Ministry of Education
Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project	Wanggong Community Development Association, Fangyuan Township, Changhua County
Monitoring of Agro–Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)	National Science and Technology Council

1. “Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua’s Two Cities Amid Climate Change” and “Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project” :

These projects combined theories and practices, including coastal biodiversity, eco-friendly aquaculture techniques, water and sediment quality testing, fish consumption culture, and the promotion of low-carbon aquaculture. In collaboration with local communities, the courses also advanced marine conservation and sustainable fisheries. In the same year, NCUE carried out the industry–academia collaboration project “Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project,” conducting a series of marine citizen science courses at Xinbao Wetland and Wanggong Fishing Harbor. Activities included:

- (1) Habitat surveys of Hard clams (winter, spring, summer, and autumn; four sessions in total, including sediment improvement trials)
- (2) Volunteer training for habitat surveys (4 sessions, 41 participants)
- (3) “Seed Teacher Training” (3 sessions, 91 participants)
- (4) “Little Clam Detectives” educational activities (4 sessions, 185 participants)

The training and practical sessions encompassed water quality testing, biodiversity surveys, bivalve classification, coastal tourism, and conservation education promotion. NCUE also collapsed with Cao-Hu Junior High School, Hanbao Elementary School, and Lukang Elementary School to

integrate scientific investigation with local education. Project results show that sediment improvement effectively promotes the growth of coarse-sediment indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. In addition, the participation of citizen scientist also effectively increases survey data and strengthens community water resource safety and conservation awareness, successfully establishing a demonstration model that combines scientific research with educational promotion. Relevant photographs are shown in Figure 1.



Figure 1. Teachers and students are conducting water and sediment quality assessment in Changhua Waters

Project FB Page Link: <https://www.facebook.com/NCUEUSR/>

2. Monitoring of Agro–Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)

NCUE’s Department of Geography is undertaking the National Science and Technology Council (NSTC) project “Monitoring of Agro–Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3).” Fangyuan was designated as the core observation site to establish a place-based demonstrative observation program. This project implements long-term, fundamental, and critical monitoring of core socio-ecological system components, serving as the Changhua Station within the Long-Term Socio-Ecological Research (LTSER) network. Field research at the station encompasses water quality assessments, ecological surveys, and geomorphological monitoring in the Fangyuan, Hanbao, and Wanggong wetlands. A complete year of baseline surveys was accomplished in 2024, and continuous monitoring will be maintained in subsequent years. In-depth interviews with key local stakeholders constitute a vital element of the station’s social research and provided the LTSER platform’s local engagement network. These interviews systematically document and analyze stakeholder roles, functions, and relationships, as well as their experiences and observations of socio-ecological transformations, thus providing a robust social–ecological data foundation for the platform. Drawing upon insights from these interviews and local documentary sources, the station developed questionnaires to further assess residents’ perceptions of

environmental and renewable energy issues. Station staff also actively participate in local events to identify emerging concerns and explore collaborative opportunities with community partners. The long-term monitoring program aims not only to advance scientific understanding but also to address locally relevant needs. The activity photos are shown in the Figure 2.



Figure 2. The team was monitoring geomorphology in Hanbao Wetland

SDG 14.4.1 Water discharge guidelines and standards

Both NCUE campuses have water quality and drainage standards.

1. The procedure is as follows:

(1) In accordance with the regulations of the Waste Disposal Act, the laboratory waste liquid of the Jinde campus is supposed to be cleaned and disposed of as industrial waste. Following application, the Environmental Protection Bureau of Changhua County Government approved the cancelation of the water pollution prevention and control permit of the Jinde campus and removed it from the management list of the government. The original sewage treatment facilities are still in normal operation.

(2) The Baoshan campus mainly treats general domestic sewage.

NCUE manages all generated effluent by routing it through a centralized wastewater treatment plant. The treated water is then discharged through outlets approved and regulated by the authorities. The university complies with the regulations outlined in the Water Pollution Control Act (Link: <https://law.moj.gov.tw/LawClass/LawAll.aspx?media=print&pcode=O0040001>) and Water Pollution Control Act Enforcement Rules (Link: <https://law.moj.gov.tw/LawClass/LawAll.aspx?media=print&pcode=O0040002>) in handling and reporting the discharge of wastewater. Every year in July, NCUE submits a report that includes the water quality testing results for both the raw wastewater and the discharged wastewater for the period from January to June of the current year. Additionally, in the following year, by January, NCUE submits a report that covers the water quality testing results for both the raw wastewater and the discharged wastewater for the period from July to December of the preceding year. These regular reports show compliance with the reporting obligations set forth in the Water Pollution Control Act and its implementing regulations.

Reporting website: Environmental Management System of Ministry of Environment (<https://ems.moenv.gov.tw/>)

The following is a screenshot of NCUE's reports on the webpage of the "Waste/Polluted Water Management System for Industrial and Sewage Systems" (WPMIS) of the Ministry of Environment as shown in Figure 1:

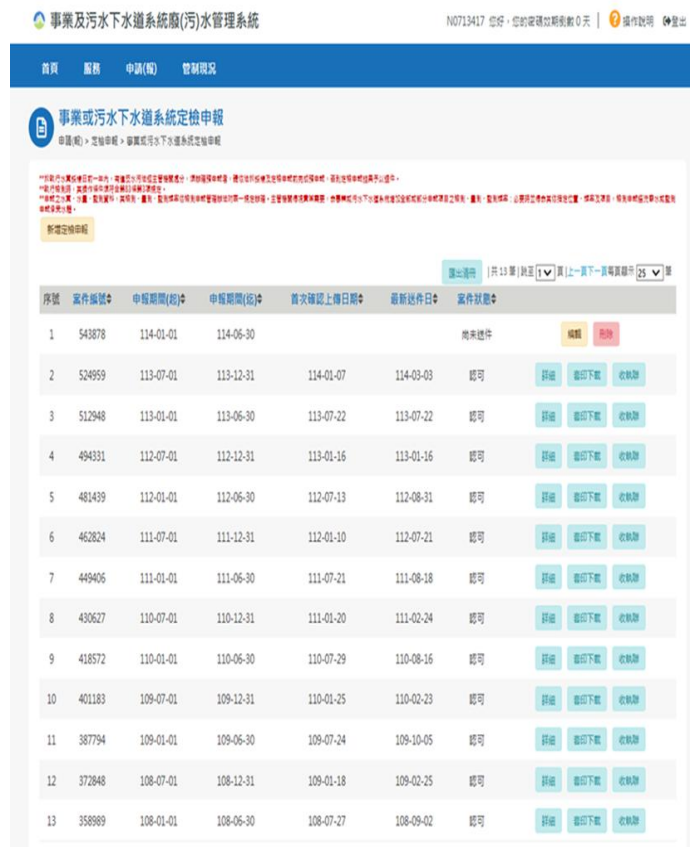


Figure 1. Screenshot of the “Wastewater Management System for Industrial and Sewage Systems” webpage of the Ministry of Environment

(3) The photos of the wastewater treatment plant are shown in Figure 2-5.



Figure 2-3. Jinde Campus Wastewater Treatment Plant



Figure 4-5. Baoshan Campus Wastewater Treatment Plant

(4) The Water Pollution Control Act requires annual calibration of the water meter for the effluence of the school's wastewater treatment plant. Figure 6 and Figure 7 show the calibration and correction report of NCUE's wastewater treatment plant effluent water meter issued by an inspection institution accredited by the Ministry of Environment.



AJE
Amount Jun Enterprise
量鈞企業有限公司
Amount Jun Enterprise Co., Ltd.
42051 台中市豐原區國瑞東路281巷7弄3號
TEL: 04-25220976 FAX: 04-25220977

校驗校正報告

Calibration Report

報告序號	AJ-1140402-01	校驗日期	2025/4/2
校驗客戶	國立彰化師範大學寶山校區	產品名稱	轉子式流量計
產品型號	F1-TR + DNFS	產品序號	S/N: 20160311
產品尺寸	DN 80 / 3"	校驗人員	林 孟 傑

現場校驗校正相關資訊

現場受測錶量測數值為 47.69 M3/hr；標準量測計器量測數值為 47.965 M3/hr

標準量測計器攜帶型超音波流量計(經TAF認可校正實驗室認證, 認證有效期至114/4/9)

現場受測錶設定參數 K = 15.030, 其偏差值計算如下:

$(47.69 - 47.965) / 47.965 \times 100\% = -0.57\%$

備註:

1. 偏差值 = $(Q - Q_s) / Q_s \times 100\%$
 Q 為現場受測錶量測數值
 Q_s 為標準量測計器量測數值
2. 報告結果依據使用者規範, 判斷合格與否
3. 現場校驗校正方法採流量動態流動時同步拍攝, 取得現場受測錶量測數值及標準量測計器量測數值, 再依據取得數值進行偏差值計算
4. 現場量測數值同步拍攝取樣照片如下頁
5. 現場受測錶設定參數, 為儀錶現場受測時內部設定值

AJ-1140402-01
P. 1/2



Figure 6. Calibration report of the water meter of NCUE's wastewater treatment plant effluent water meter (Page 1)



Figure 7. Calibration report of the water meter of NCUE's wastewater treatment plant effluent water meter (Page 2)

- (5) In accordance with the Water Pollution Control Act and Waste Disposal Act, the sludge removal and treatment operations have been carried out as required, Related photos as shown in Figure 8-11.

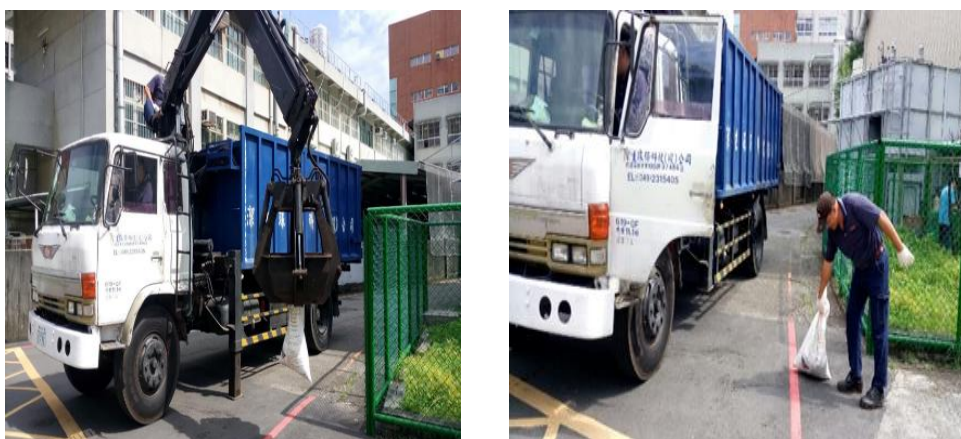


Figure 8-9. Sludge removal and treatment at Jinde Campus of NCUE



Figure 10-11. Sludge removal and treatment at Jinde Campus of NCUE

(6) According to the Water Pollution Control Act, water quality inspection is conducted once every six months, and the relevant photos are shown in Figure 12-15.



Figure 12-13. Water quality inspection at Jinde Campus



Figure 14-15. Water quality inspection at Baoshan Campus

2. In 2024, the variety of operations of wastewater treatment plants on both campuses, including water quality inspection and regular reporting all passed the examination.

SDG 14.4.2 Action plan to reducing plastic waste

NCUE implements campus-wide plastic waste sorting and recycling in accordance with the guidelines established by the Ministry of Environment. These include the “Restrictions on the Use of Shopping Plastic Bags, Targeted Users, Implementation Methods, and Effective Dates,” “Restrictions on the Use of Disposable Tableware, Targeted Users, and Implementation Methods,” “Restrictions on the Use of Single-Use Plastic Straws, Targeted Users, and Implementation Methods,” and “Guidelines for Administrative Agencies and Schools to Reduce the Use of Disposable Tableware and Packaged Drinking Water”. The plastic recycling data for the past three years at NCUE is as shown in Table 1, relevant photos are as shown in Figures 1-2.

Table 1: The plastic recycling data for the past 3 years at NCUE

Year	Plastics recycling (kg)
2022	10,581
2023	10,292.9
2024	9645.5



Figure 1. Signs indicating that plastic shopping bags are not provided for free, and that single-use plastic straws are not available for dine-in customers





Figure 2. Fourteen categories of establishments are not permitted to provide plastic shopping bags for free

For more details, please refer to the website for the regulation:

1. Restrictions on the Use of Plastic Shopping Bags, Implementation Methods, and Implementation Dates: <https://oaout.moenv.gov.tw/law/LawContent.aspx?id=GL006482#lawmenu>
2. Parties Subject to and Means for Disposable Tableware Use Restrictions: <https://oaout.moenv.gov.tw/law/LawContent.aspx?id=GL006481#lawmenu>
3. Restrictions on the Use of Single-Use Plastic Straws, Applicable Entities, and Implementation Methods: <https://oaout.moenv.gov.tw/law/LawContent.aspx?id=GL007530#lawmenu>
4. Guidelines for the Reduced Use of Disposable Tableware and Packaged Drinking Water in Administrative Agencies and Schools: <https://hwms.moenv.gov.tw/dispPageBox/getFile/Get.aspx?FileLocation=PJ-EPATW%5CFiles%5C&FileName=2650.pdf>
5. Operation Manual for Reducing the Use of Disposable Tableware and Packaged Drinking Water in Government Agencies and Schools: <https://hwms.moenv.gov.tw/dispPageBox/getFile/Get.aspx?FileLocation=PJ-EPATW%5CFiles%5C&FileName=2691.pdf>

SDG 14.4.3 Reducing marine pollution (policy)

Yes, NCUE's Center for General Education organized activities to prevent and reduce various types of marine and land-based pollution in 2024.

1. Center for General Education

In 2024, relevant general education courses were offered, "Water Resources and Human Civilization":

https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1121/00248_0CCGE0175120.pdf

"Introduction to Marine Life Sciences":

https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1122/00255_0CCGE0169820.pdf

2. In 2024, various units of the school organized the following general education lectures:

Organizer / Topic	Date	Capacity
General Education Lecture – Crisis of Taiwan's Satoyama Environment	2024/03/26	140
[Center of Protection and Occupational Safety and Health Lecture] 2024 "Zero Waste Campus Program – Turning Waste into Treasure for a Green Life"	2024/05/09	85

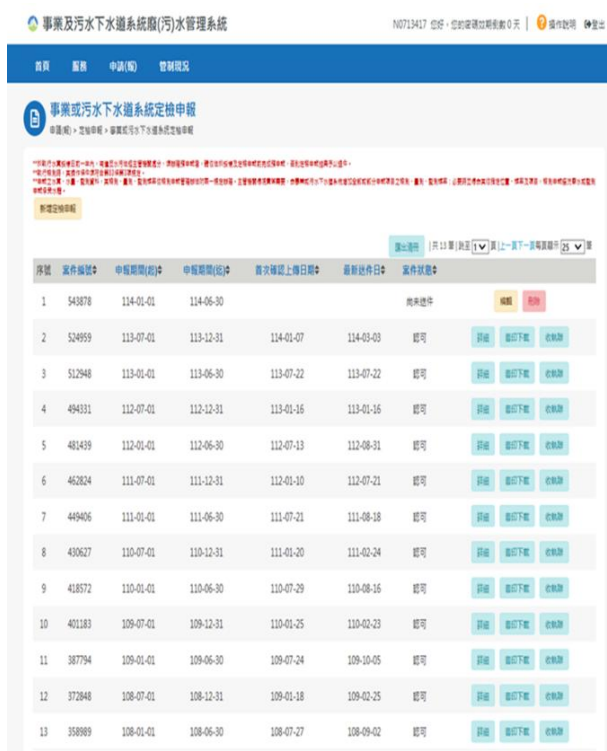
SDG 14.5.1 Minimizing alteration of aquatic ecosystems (plan)

In accordance with the regulations of the Waste Disposal Act, the laboratory waste liquid in NCUE is entrusted to be cleaned and treated as industrial waste, and the original sewage treatment facilities are still in normal operation, aimed at minimizing physical, chemical, and biological changes to related aquatic ecosystems.

1. Reduction of water quality changes in NCUE

(1) NCUE manages all generated effluent by routing it through a centralized wastewater treatment plant. The treated water is then discharged through outlets approved and regulated by the authorities. The university complies with the regulations outlined in the Water Pollution Control Act (Link <https://law.moj.gov.tw/LawClass/LawAll.aspx?media=print&pcode=O0040001>) and Water Pollution Control Act Enforcement Rules (Link <https://law.moj.gov.tw/LawClass/LawAll.aspx?media=print&pcode=O0040002>) in handling and reporting the discharge of its wastewater. Every year in July, NCUE submits a report that includes the water quality testing results for both the raw wastewater and the discharged wastewater for the period from January to June of the current year. Additionally, in the following year, by January, NCUE submits a report that covers the water quality testing results for both the raw wastewater and the discharged wastewater for the period from July to December of the preceding year.

The following is a screenshot of NCUE's reporting on the webpage of the "Waste/Polluted Water Management System for Industrial and Sewage Systems" (WPMIS) of the Ministry of Environment as shown in Figure 1.



序號	案件編號	申報期間(起)	申報期間(迄)	首次確認上傳日期	最新檢件日期	案件狀態
1	543878	114-01-01	114-06-30			尚未檢件
2	524959	113-07-01	113-12-31	114-01-07	114-03-03	認可
3	512948	113-01-01	113-06-30	113-07-22	113-07-22	認可
4	494331	112-07-01	112-12-31	113-01-16	113-01-16	認可
5	481439	112-01-01	112-06-30	112-07-13	112-08-31	認可
6	462824	111-07-01	111-12-31	112-01-10	112-07-21	認可
7	449406	111-01-01	111-06-30	111-07-21	111-08-18	認可
8	430627	110-07-01	110-12-31	111-01-20	111-02-24	認可
9	418572	110-01-01	110-06-30	110-07-29	110-08-16	認可
10	401183	109-07-01	109-12-31	110-01-25	110-02-23	認可
11	387794	109-01-01	109-06-30	109-07-24	109-10-05	認可
12	372848	108-07-01	108-12-31	109-01-18	109-02-25	認可
13	358989	108-01-01	108-06-30	108-07-27	108-09-02	認可

Figure 1. A screenshot of the "Wastewater Management System for Industrial and Sewage Systems"

webpage of the Ministry of Environment

(2) The photos of the wastewater treatment plant are shown in Figure 2-5.



Figure 2-3. Jinde Campus Wastewater Treatment Plant



Figure 4-5. Baoshan Campus Wastewater Treatment Plant

(3) In accordance with the Water Pollution Control Act, NCUE's wastewater treatment plant have to calibrate the water meters annually. The following Figure 5 and Figure 6 are the calibration and correction reports of the school's wastewater treatment plant effluent water meter, which are issued by an inspection institution accredited by the Ministry of Environment.



AJE
Amount Jun Enterprise
量鈞企業有限公司
Amount Jun Enterprise Co., Ltd.
42051 台中市豐原區國權東路281巷7-3號
TEL: 04-25220976 FAX: 04-25220977

校驗校正報告
Calibration Report

報告序號	AJ-1140402-01	校驗日期	2025/4/2
校驗客戶	國立彰化師範大學寶山校區	產品名稱	轉子式流量計
產品型號	F1-TR + DNFS	產品序號	S/N: 20160311
產品尺寸	DN 80 / 3"	校驗人員	林 孟 傑

現場校驗校正相關資訊

現場受測錶量測數值為 47.69 M3/hr ; 標準量測計器量測數值為 47.965 M3/hr

標準量測計器為型超音波流量計(經TAF認可校正實驗室認證, 認證有效期至114/4/9)

現場受測錶設定參數 K = 15.030 , 其偏差值計算如下:

$(47.69 - 47.965) / 47.965 \times 100\% = -0.57\%$

備註:

1. 偏差值 = $(Q - Q_s) / Q_s \times 100\%$
Q 為現場受測錶量測數值
Qs 為標準量測計器量測數值
2. 報告結果依據使用之規範, 判斷合格與否
3. 現場校驗校正方法係流量動態流動時同步拍攝, 取得現場受測錶量測數值及標準量測計器量測數值, 再依據取得數據進行偏差計算
4. 現場量測數值同步拍攝照片如下頁
5. 現場受測錶設定參數, 為儀錶現場受測時內部設定值

AJ-1140402-01
P. 1/2



Figure 6. The calibration report of the water meter of NCUE's wastewater treatment plan (Page 1)

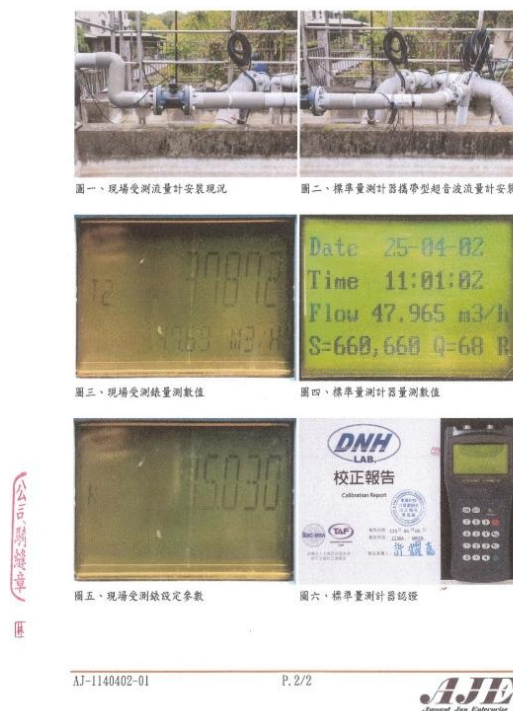


Figure 7. Calibration report of the water meter of NCUE's wastewater treatment plant (Page 2)

(4) In accordance with the Water Pollution Control Act and Waste Disposal Act, the sludge removal and treatment operations have to be carried out as required, Related photos as shown in Figure 8-11.



Figure 8-9. Sludge removal and treatment at Jinde Campus



Figure 10-11. Sludge removal and treatment at Baoshan Campus

(5) In accordance with the Water Pollution Prevention and Control Act, water quality inspection is conducted once every six months, and the relevant photos are shown in Figure 12-15.



Figure 12-13. Water quality inspection at Jinde Campus



Figure 14-15. Water quality inspection at Baoshan Campus

(6) In 2024, the variety of operations of wastewater treatment plants on both campuses, including water quality inspection and regular reporting all passed the examination.

2. “Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua’s Two Cities Amid Climate Change” and 2024 Local Marine Conservation Guardianship Program - “Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project”:

Under the third USR projects, the University offered the courses “Coastal Biological Resources” and “Sustainable Development and Practices of Coastal Biological Resources,” which integrate theories and practices. The curricula covered coastal biodiversity, eco-friendly aquaculture techniques, water and sediment quality testing, fish consumption culture, and the promotion of low-carbon aquaculture. In collaboration with local communities, the courses also advanced marine conservation and sustainable fisheries. In the same year, NCUE carried out the industry–academia collaboration project “Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project,” conducting a series of marine citizen science courses at Xinbao Wetland and Wangong Fishing Harbor. Activities included:

- (1) Habitat surveys of hard clam (winter, spring, summer, and autumn; four sessions in total, including sediment improvement trials)
- (2) Volunteer training for habitat surveys (4 sessions, 41 participants)
- (3) “Seed Teacher Training” (3 sessions, 91 participants)
- (4) “Little Clam Detectives” educational activities (4 sessions, 185 participants)

The training and practical sessions encompassed water quality testing, biodiversity surveys, bivalve classification, coastal tourism, and conservation education promotion. NCUE also collapsed with Cao-Hu Junior High School, Hanbao Elementary School, and Lukang Elementary School to integrate scientific investigation with local education. Project results show that sediment improvement effectively promotes the growth of coarse-sediment indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. In addition, the participation of citizen scientist also effectively increases survey data and strengthens community water resource safety and conservation awareness, successfully establishing a demonstration model that combines scientific research with educational promotion. Relevant photographs are shown in Figure 16.



Figure 16. Teachers and students were conducting water and sediment quality assessment in Changhua waters.

Project FB Page Link: <https://www.facebook.com/NCUEUSR/>

SDG 14.5.2 Monitoring the health of aquatic ecosystems

NCUE has ongoing projects and activities, including the Environmental Education Center's "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change". Department of Biology's "Changhua Coastal Hard clams Habitat Survey and Conservation Education Promotion Program"; Department of Geography's "Monitoring of Agro-Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)". The following is an introduction.

1. "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change", "Changhua Coastal Hard clams Habitat Survey and Conservation Education Promotion Program":

Under the third USR projects, the University offered the courses "Coastal Biological Resources" and "Sustainable Development and Practices of Coastal Biological Resources," which integrate theories and practices. The curricula covered coastal biodiversity, eco-friendly aquaculture techniques, water and sediment quality testing, fish consumption culture, and the promotion of low-carbon aquaculture. In collaboration with local communities, the courses also advanced marine conservation and sustainable fisheries. In the same year, NCUE carried out the industry-academia collaboration project "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project," conducting a series of marine citizen science courses at Xinbao Wetland and Wanggong Fishing Harbor. Activities included:

- (1) Habitat surveys of hard clam (winter, spring, summer, and autumn; four sessions in total, including sediment improvement trials)
- (2) Volunteer training for habitat surveys (4 sessions, 41 participants)
- (3) "Seed Teacher Training" (3 sessions, 91 participants)
- (4) "Little Clam Detectives" educational activities (4 sessions, 185 participants)

The training and practical sessions encompassed water quality testing, biodiversity surveys, bivalve classification, coastal tourism, and conservation education promotion. NCUE also collaborated with Cao-Hu Junior High School, Hanbao Elementary School, and Lukang Elementary School to integrate scientific investigation with local education. Project results show that sediment improvement effectively promotes the growth of coarse-sediment indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. In addition, the participation of citizen scientist also effectively increases survey data and strengthens community water resource safety and conservation awareness, successfully establishing a demonstration model that combines scientific research with educational promotion. Relevant photographs are shown in Figure 1.



Figure 1. Ecological Survey and Monitoring

Project FB Page Link: <https://www.facebook.com/NCUEUSR/>

2. “Monitoring of Agro–Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)”:

NCUE’s Department of Geography is undertaking the National Science and Technology Council (NSTC) project “Monitoring of Agro–Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3).” Fangyuan was designated as the core observation site to establish a place-based demonstrative observation program. This project implements long-term, fundamental, and critical monitoring of core socio-ecological system components, serving as the Changhua Station within the Long-Term Socio-Ecological Research (LTSER) network. Field research at the station encompasses water quality assessments, ecological surveys, and geomorphological monitoring in the Fangyuan, Hanbao, and Wanggong wetlands. A complete year of baseline surveys was accomplished in 2024, and continuous monitoring will be maintained in subsequent years. In-depth interviews with key local stakeholders constitute a vital element of the station’s social research and provided the LTSER platform’s local engagement network. These interviews systematically document and analyze stakeholder roles, functions, and relationships, as well as their experiences and observations of socio-ecological transformations, thus providing a robust social–ecological data foundation for the platform. Drawing upon insights from these interviews and local documentary sources, the station developed questionnaires to further assess residents’ perceptions of environmental and renewable energy issues. Station staff also actively participate in local events to identify emerging concerns and explore collaborative opportunities with community partners. The long-term monitoring program aims not only to advance scientific understanding but also to address locally relevant needs. Activities photos are shown in the figure 2.



Figure 2. A team was monitoring the geomorphology of the Hanbao Wetland

SDG 14.5.3 Programmes towards good aquatic stewardship practices

NCUE has ongoing projects and activities, which include “Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua’s Two Cities Amid Climate Change”, Department of Biology’s “Changhua Coastal Hard clams Habitat Survey and Conservation Education Promotion Program”. The following is a brief introduction.

“Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua’s Two Cities Amid Climate Change”, “Changhua Coastal Hard clams Habitat Survey and Conservation Education Promotion Program”.

Under the projects, the University offered the courses “Coastal Biological Resources” and “Sustainable Development and Practices of Coastal Biological Resources,” which integrate theories and practices. The curricula covered coastal biodiversity, eco-friendly aquaculture techniques, water and sediment quality testing, fish consumption culture, and the promotion of low-carbon aquaculture. In collaboration with local communities, the courses also advanced marine conservation and sustainable fisheries. In the same year, NCUE carried out the industry–academia collaboration project “Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project,” conducting a series of marine citizen science courses at Xinbao Wetland and Wanggong Fishing Harbor. Activities included:

- (1) Habitat surveys of hard clam (winter, spring, summer, and autumn; four sessions in total, including sediment improvement trials)
- (2) Volunteer training for habitat surveys (4 sessions, 41 participants)
- (3) “Seed Teacher Training” (3 sessions, 91 participants)
- (4) “Little Clam Detectives” educational activities (4 sessions, 185 participants)

The training and practical sessions encompassed water quality testing, biodiversity surveys, bivalve classification, coastal tourism, and conservation education promotion. NCUE also collaborated with Cao-Hu Junior High School, Hanbao Elementary School, and Lukang Elementary School to integrate scientific investigation with local education. Project results show that sediment improvement effectively promotes the growth of coarse-sediment indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. In addition, the participation of citizen scientist also effectively increases survey data and strengthens community water resource safety and conservation awareness, successfully establishing a demonstration model that combines scientific research with educational promotion. Relevant photographs are shown in Figure 1.

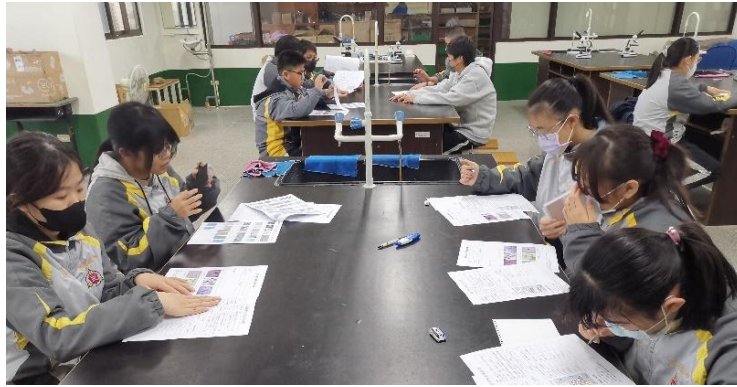


Figure 1. Little Clam Detectives” Water Quality Investigation Workshop, Cao-Hu Junior High School

Project FB Page Link: <https://www.facebook.com/NCUEUSR/>

SDG 14.5.4 Collaboration for shared aquatic Ecosystems

NCUE has ongoing projects and activities, which include the Department of Geography's "Monitoring of Agro-Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)". Their brief descriptions follow.

NCUE's Department of Geography is undertaking the National Science and Technology Council (NSTC) project "Monitoring of Agro-Fishing Socio-Ecological Systems in the Coastal Wetlands of Western Taiwan (3/3)." Fangyuan was designated as the core observation site to establish a place-based demonstrative observation program. This project implements long-term, fundamental, and critical monitoring of core socio-ecological system components, serving as the Changhua Station within the Long-Term Socio-Ecological Research (LTSER) network. Field research at the station encompasses water quality assessments, ecological surveys, and geomorphological monitoring in the Fangyuan, Hanbao, and Wanggong wetlands. A complete year of baseline surveys was accomplished in 2024, and continuous monitoring will be maintained in subsequent years. In-depth interviews with key local stakeholders constitute a vital element of the station's social research and provided the LTSER platform's local engagement network. These interviews systematically document and analyze stakeholder roles, functions, and relationships, as well as their experiences and observations of socio-ecological transformations, thus providing a robust social-ecological data foundation for the platform. Drawing upon insights from these interviews and local documentary sources, the station developed questionnaires to further assess residents' perceptions of environmental and renewable energy issues. Station staff also actively participate in local events to identify emerging concerns and explore collaborative opportunities with community partners. The long-term monitoring program aims not only to advance scientific understanding but also to address locally relevant needs. The activity photo is shown in the Figure 1.



Figure 1. Changhua Coastal Wetland Conservation Seminar

SDG 14.5.5 Watershed management strategy

1. NCUE manages all generated effluent by routing it through a centralized wastewater treatment plant.

The treated water is then discharged through outlets approved and regulated by the authorities. The university complies with the regulations outlined in the Water Pollution Control Act (Link <https://law.moj.gov.tw/LawClass/LawAll.aspx?media=print&pcode=O0040001>) and Water Pollution Control Act Enforcement Rules (Link <https://law.moj.gov.tw/LawClass/LawAll.aspx?media=print&pcode=O0040002>) in handling and reporting the discharge of its wastewater. Every year in July, the University submits a report that includes the water quality testing results for both the raw wastewater and the discharged wastewater for the period from January to June of the current year. Additionally, in the following year, by January, the University submits a report that covers the water quality testing results for both the raw wastewater and the discharged wastewater for the period from July to December of the preceding year.

The following is a screenshot of NCUE's reporting on the webpage of the “Waste/Polluted Water Management System for Industrial and Sewage Systems” (WPMIS) of the Ministry of Environment as shown in Figure 1.

序號	案件編號	申請期間(起/止)	審核期間(起/止)	首次補正上傳日期	最新送件日期	案件狀態
1	543878	114-01-01	114-06-30			尚未送件
2	524959	113-07-01	113-12-31	114-01-07	114-03-03	許可
3	512948	113-01-01	113-06-30	113-07-22	113-07-22	許可
4	484331	112-07-01	112-12-31	113-01-16	113-01-16	許可
5	481439	112-01-01	112-06-30	112-07-13	112-08-31	許可
6	463824	111-07-01	111-12-31	112-01-10	112-07-21	許可
7	449406	111-01-01	111-06-30	111-07-21	111-08-18	許可
8	430627	110-07-01	110-12-31	111-01-20	111-03-24	許可
9	418572	110-01-01	110-06-30	110-07-29	110-08-16	許可
10	401183	109-07-01	109-12-31	110-01-25	110-02-23	許可
11	387794	109-01-01	109-06-30	109-07-24	109-10-05	許可
12	373848	108-07-01	108-12-31	109-01-18	109-02-25	許可
13	358989	108-01-01	108-06-30	108-07-27	108-09-02	許可

Figure 1. The screenshot of the “Wastewater Management System for Industrial and Sewage Systems” webpage of the Ministry of Environment

2. The photos of the wastewater treatment plant are shown in Figure 2-5.



Figure 2-3. Jinde Campus Wastewater Treatment Plant



Figure 4-5. Baoshan Campus Wastewater Treatment Plant

3. The Water Pollution Control Act requires annual calibration of the water meter for the effluent of the school's wastewater treatment plant. The following Figure 6 and Figure 7 show the calibration and correction report of the school's wastewater treatment plant effluent water meter issued by an inspection institution accredited by the Ministry of Environment.



量鉤企業有限公司
Amount Jun Enterprise Co., Ltd.
42051 台中市豐原區國瑞東路281巷7弄3號
TEL: 04-25220976 FAX: 04-25220977

校驗校正報告
Calibration Report

報告序號	AJ-1140402-01	校驗日期	2025/4/2
校驗客戶	國立彰化師範大學寶山校區	產品名稱	轉子式流量計
產品型號	F1-TR + DNFS	產品序號	S/N:20160311
產品尺寸	DN 80 / 3"	校驗人員	林 孟 傑

現場校驗校正相關資訊

現場受測錶量測數值為 47.69 M3/hr；標準量測計器量測數值為 47.965 M3/hr

標準量測計器攜帶型超音波流量計(經TAF認可校正實驗室認證, 認證有效期間至114/4/9)

現場受測錶設定參數 K = 15.030, 其偏差值計算如下:

$(47.69 - 47.965) / 47.965 \times 100\% = -0.57\%$

備註:

1. 偏差值 = $(Q - Q_s) / Q_s \times 100\%$
Q 為現場受測錶量測數值
Qs 為標準量測計器量測數值
2. 報告結果依據使用規範, 判斷合格與否
3. 現場校驗校正方法係採流量動態流動時同步拍攝, 取得現場受測錶量測數值及標準量測計器量測數值, 再依據取得數值進行偏差值計算
4. 現場量測數位同步拍攝照片如下頁
5. 現場受測錶設定參數, 為儀錶現場受測時內部設定值

AJ-1140402-01
P. 1/2



Figure 6. Calibration report of the water meter of NCUE's wastewater treatment plant effluent water meter (Page 1)

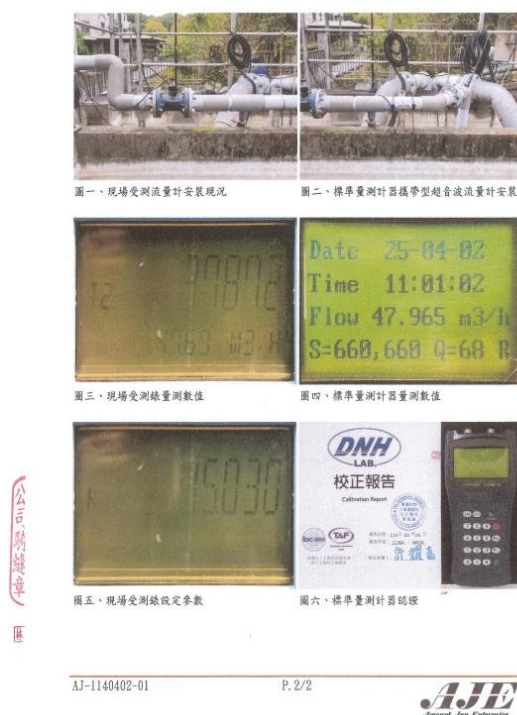


Figure 7. Calibration report of the water meter of NCUE's wastewater treatment plant (Page 2)

4. In accordance with the Water Pollution Control Act and Waste Disposal Act, the sludge removal and treatment operations have to be carried out as required every two years, Related photos as shown in Figure 8-11.



Figure 8-9. Sludge removal and treatment at Jinde Campus



Figure 10-11. Sludge removal and treatment at Baoshan Campus

5. According to the Water Pollution Prevention and Control Act, water quality inspections have to be conducted once every six months, and the relevant photos are shown in Figures 12-15.



Figure 12-13. Water quality inspection at Jinde Campus



Figure 14-15. Water quality inspection at Baoshan Campus

6. In 2024, the variety of operations of wastewater treatment plants on both campuses, including water quality inspection and regular reporting all passed the examination.