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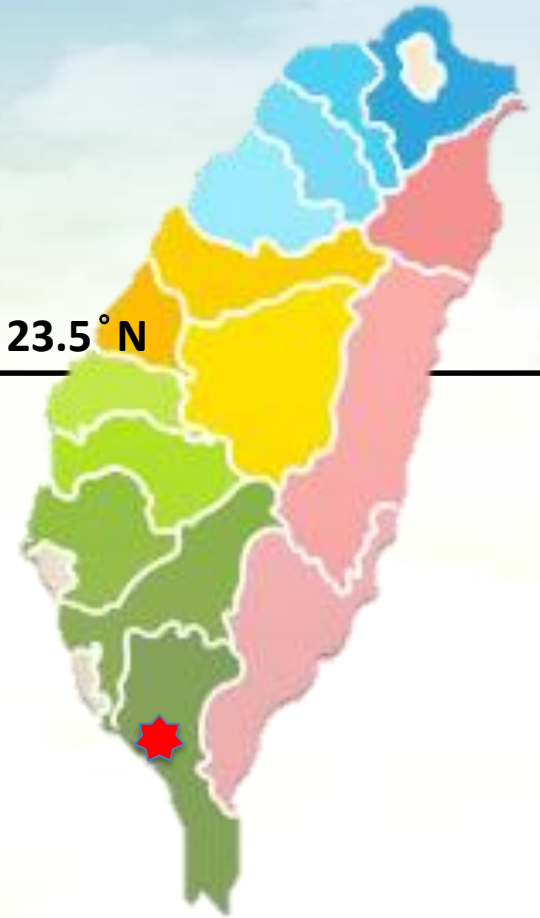
National Pingtung University of Science and Technology

NPUST Waste Handling Strategy and Program

The 3rd International Workshop on UI GreenMetric
9-11 April 2017

UI GreenMetric Ranking 2016
No. 1 in Taiwan
No. 5 in Asia
No. 37 in the world



Chang-Hsien Tai, Chin-Lung Chang, Jik Chang Leong
National Pingtung University of Science and Technology (NPUST), Taiwan

The “National Park” University

Neipu main campus
298 hectares

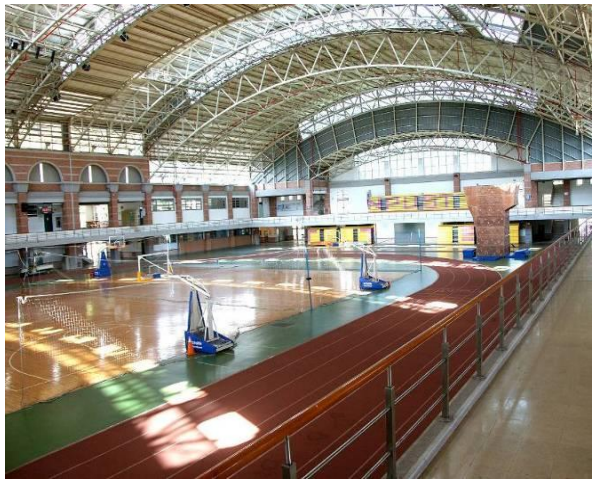
Baoli Experimental Forest Station
286 hectares

Tajen Experimental Forest Station
576 hectares

Green Ecological Campus

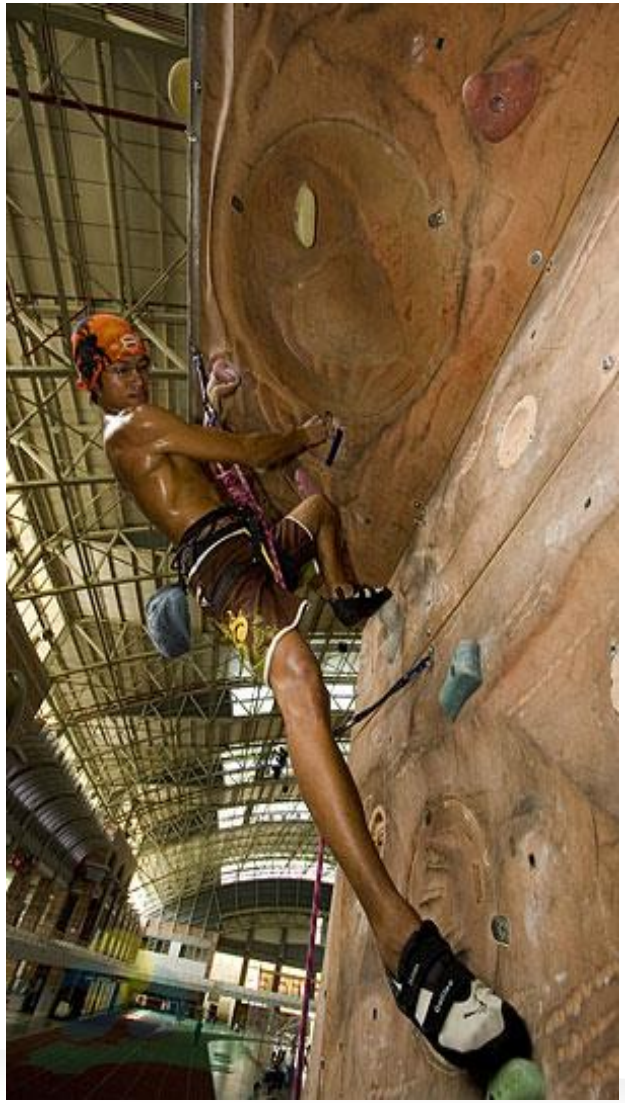
Recreational Facilities

Multi-functional Gym



Swimming Pool

Rock Climbing Facility



Golf Course

Gym

Academic Division

6 colleges, 35 departments and graduate institutes, 3 centers, 6 educational programs

Agriculture	☐ Animal Science ☐ Aquaculture ☐ Biological Sci and Tech	☐ Bioresources (Grad) ☐ Food Science ☐ Forestry	☐ Plant Industry ☐ Plant Medicine ☐ Wood Science and Design
Engineering	☐ Biomechatronics Engr ☐ Civil Engineering ☐ Environmental Sci and Engr	☐ Environmental Source and Disaster Reduction (BS) ☐ Materials Engr (Grad)	☐ Mechanical Engr ☐ Soil & Water Conservation ☐ Vehicle Engineering
Management	☐ Agribusiness Mgmt ☐ Business Mgmt ☐ Fashion Design and Mgmt ☐ Finance (Grad)	☐ Finance (Intl BS) ☐ Hotel Restaurant Mgmt ☐ Industrial Mgmt	☐ Landscape Architecture and Recreation Mgmt (Grad) ☐ Mgmt Info Systems ☐ Mgmt Innovation Tech (Grad)
Humanity & Social Sciences	☐ Child Care ☐ Hakka Cultural Ind (Grad) ☐ Modern Language	☐ Recreation Sports and Health Promotion ☐ Social Work	☐ Vocational and Tech Edu (Grad) ☐ General Education (Center) ☐ Teacher Education (Center)
Veterinary Medicine	☐ Animal Vaccine Tech. (Grad)	☐ Veterinary Medicine	☐ Wildlife Conservation (Grad)
International	☐ Agribusiness Mgmt (MS) ☐ Chinese Language Center ☐ Food Science (MS)	☐ Ornamental Fish Sci Tech (MS, PhD) ☐ Soil and Water Engr (MS)	☐ Tropical Agriculture and Intl Cooperation ☐ Vaccine Tech (MS, PhD)

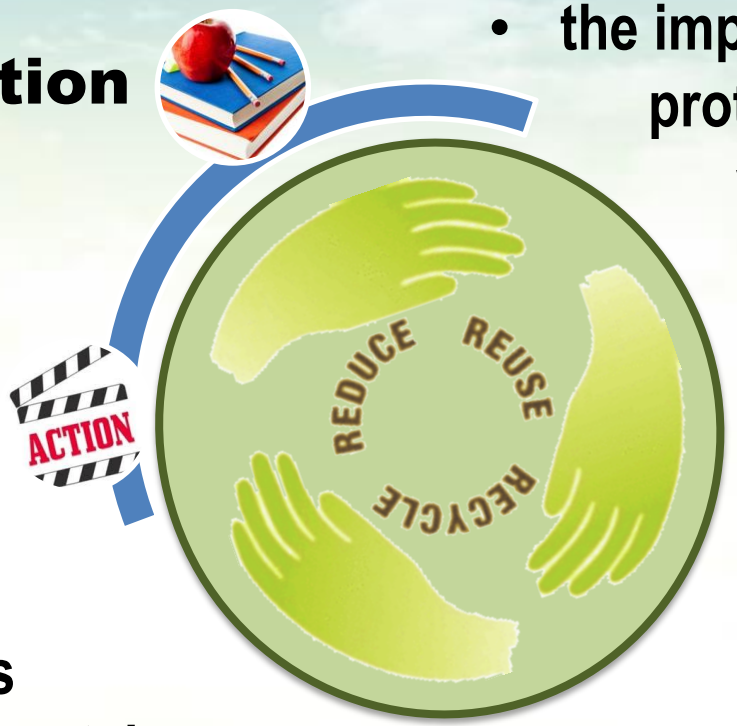
Faculty: 405 (full-time); 222 (part-time) | Enrollment: 11,453 (2015 data)

Categories of Wastes

- Liquid / Solid wastes in NPUST
  - Liquid: wash water from buildings and farms, liquid chemicals, and liquid food waste.
  - Solid: garbage, agricultural waste, papers, broken furniture, and solid food waste.
- NPUST wastes: general waste, hazardous waste, biodegradable (organic) waste, reusable waste, and recyclable waste
  - Hazardous wastes: could be inflammable, reactive, corrosive or toxic; are potentially threatening to the public health or the environment.
  - Organic wastes: food waste, biodegradable plants (wood, leaves, fruits and vegetables), animals byproducts (manure, etc.).
  - Reusable wastes.
  - Recyclable wastes: paper products, plastics, aluminum bottles, batteries, electronic wastes, and glass products.

Key Components of Waste Handling Program

- To cut down negative mankind impact on the environment.
- The best way to manage our waste is not to produce it in the first place.



- the importance of environmental protection, waste reduction, waste reusing and recycling.
- paper products generally easier to recycle than plastic, but also tend to biodegrade more easily than glass or aluminum can.
- NPUT encourages the use of paper containers instead of plastic and aluminum.

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Reduction of Waste Generation: Education


an outdoor faculty-staff activity and publicity campaign



Supplementary programs for kids


publicity campaigns for freshman and students


Programs for elderly

Reduction of Waste Generation: Action

- the effective use of computers and other technology to reduce the amount of paper used,
  - the use electronic means to communicate with staffs and students,
  - the use of phone and email instead of memos and faxes for inter-office memos, announcing meetings, and targeted communications,
  - the use of electronic means to "broadcast" important messages,
  - the use of electronic official document system to reduce the use of paper documents,
  - the use of online repair application system to replace paper applications,
  - the use of electronic communications for directories, forms, bulletins, manuals, reports, and storage if possible to reduce unwanted mail to offices; and
- the reduction of print runs,
- the change in printing habits so that more text is put on each page,
- the use of ipad in paperless College of Engineering meetings to reduce paper reading materials,
- the use of special paper saving features in Microsoft Excel and Microsoft PowerPoint.

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Reduction of Waste Generation: Action

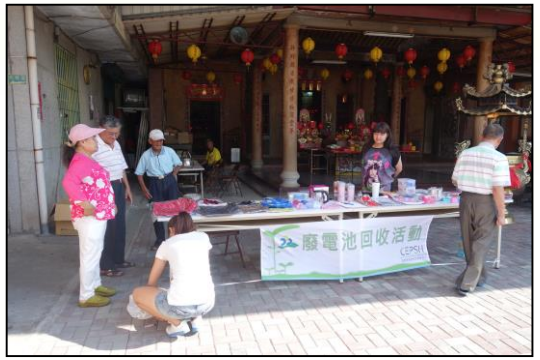

The use of mugs in meetings

To print on used papers for unofficial purposes

The make and use of soft cleaning agents


Non-recyclable utensils are not provided in on-campus food stores

Encouragement to use eco-friendly bottles



Off-campus recycling activitiy

- Use thinner paper for printing, copying etc.
- Reduce toner consumption through practice image reduction printing and light toner copying.

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Waste Collection in NPUST

Type	Common waste in NPUST
Paper	sketch papers, boxes, wrappers, advertisement papers, notebook
Plastic	food and beverage containers, disposable food service products, product wrappers
Glass	beverage containers, broken glass laboratorial containers
Metal	aluminum beverage containers, paper clips, staples, scrap metals from workshop
Food	cafeteria food waste, snacks
Wood	tree trunk and branches, broken wooden furniture
Other	Battery, leaves, fabric, mixed material (e.g. plastic and metal) products

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Waste Collection in NPUST

	Paper	Plastic	Glass	Metal	Battery	Food	Wood	Other
animal farms	●	●	●		●			
animal hospital	●	●	●		●			●
cafeteria and restaurants	●	●	●		●	●		
classroom corridors	●	●	●		●			●
cuisine classrooms	●	●	●		●	●		
dormitories	●	●	●	●	●			●
library/media center	●	●	●		●			●
offices	●	●	●		●	●		●
workshops								
- carpentry	●	●	●	●	●		●	
- fashion design	●	●	●		●			●
- mechanical	●	●	●	●	●			
- repair (OGA)	●	●	●	●	●		●	●

Remark: an individual trash bin is dedicated for: a specific waste type (●), and multiple waste types (●)

Collection of wastes from classified bins

Transferring of waste away from building for pickup

Collection of waste by dumpster truck

Evaluation of waste

- Kitchen waste
  - sorting
  - weighting
  - decomposing
- Reusable waste
  - sorting
  - storage
  - weighting
  - redistribution
- Recyclable waste
  - sorting
  - storage
  - weighting
  - recycling company
- Non-recyclable waste
  - sorting
    - incinerable
      - weighting
      - trash handling company
    - non-incinerable
      - weighting
      - trash handling company

Reuse of Student Waste

student flea market

collection of second hand clothing

cardboard boxes are collected, stored, and reused

- activities to repair and fix up reusable items
  - bicycles,
  - appliances,
  - etc.

Reuse of Organic Waste

Transparent treated animal specimen

Key rings and pendants made of snake or lizard skin peel offs

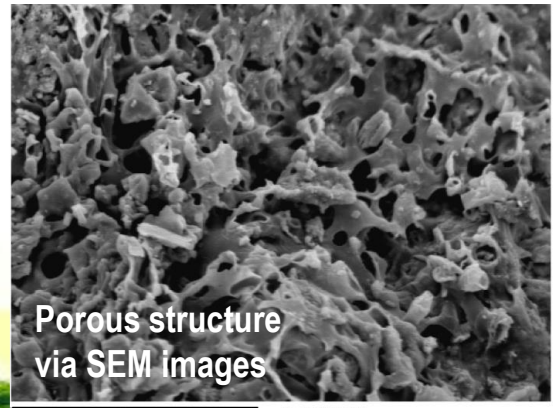
Drink coasters

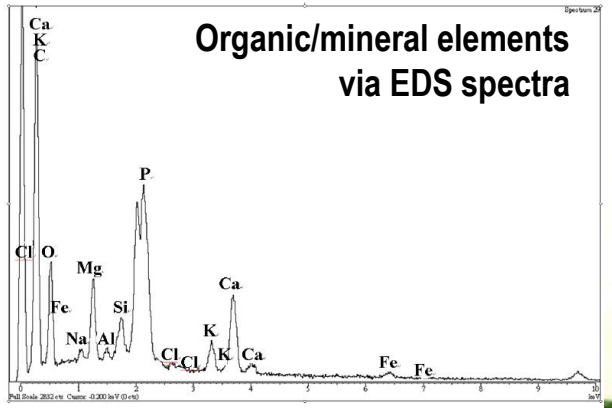
Collagen products

Reuse of Organic Waste - Biochar

- Motivation for applying biochar
  - Soil improvement
  - Waste management
  - Energy production

- Temperature of around 1000 K was found to be the optimal condition for producing mesoporous manure-derived biochars with surface area (over 60 m^2/g.
- The presence of nutrients in the biochar was highly pertinent to soil fertility, suggesting that it could be used as an excellent soil amendment.





63 cows in livestock farm

Paddle wheel solid-liquid separator

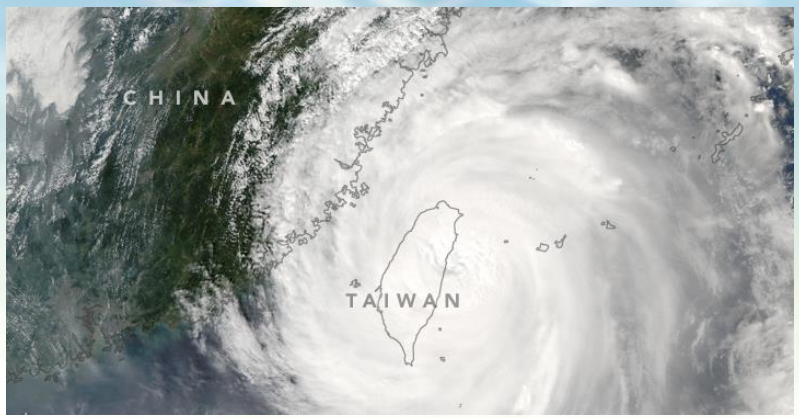
Liquid

Pennisetum watering

Solid

Organic manure fertilizer

Reuse of Wooden Waste



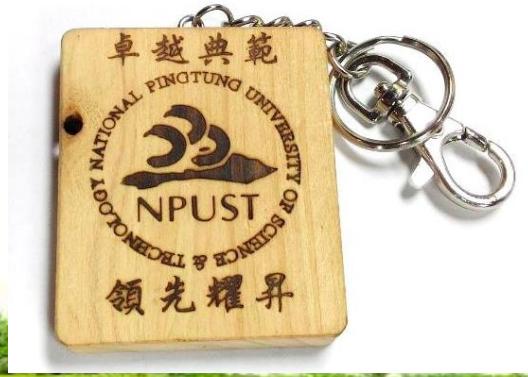
Destruction by typhoons

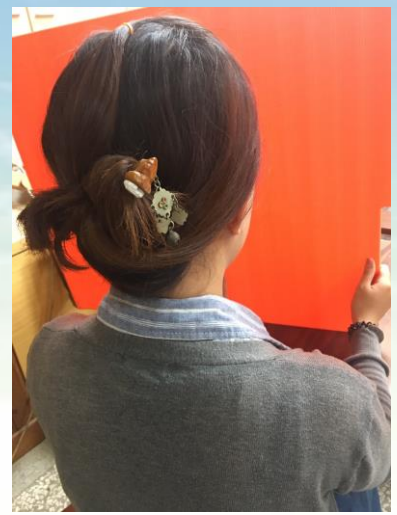
Wooden Triceratops

Artistic wood work

Reuse of Wooden Waste

Artistic woodwork





Wood craft workshop

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Waste Recycling in NPUST





Waste sorting and recycling activities by voluntary students


Dormitory contest



Recycling depot for papers, scraped metals, and plastics

Collection of used batteries in the Center for Environment Protection, Safety and Health

Handling of Hazardous Waste

- These wastes are generally categorized as:
  - Heavy metal waste: iron, nickel, cobalt, zinc, copper, chromium, lead, etc.;
  - Cyanide waste: cyanide-based waste or plated electrolytic waste;
  - Mercury waste: inorganic mercury and organic mercury waste;
  - Fluorine waste;
  - Mineral acids: hydrochloric acid, sulfuric acid, nitric acid, etc.;
  - Bases: sodium hydroxide, potassium hydroxide, sodium carbonate, calcium carbonate, other alkaline wastes;
  - Hexavalent chromium waste: hexavalent chromium compounds;
  - Fats and oils: heavy oil, lubricating oil, transformer oil, gear oil, etc.;
  - Halogen-based organic solvent waste: chloroform, methylene chloride, carbon tetrachloride, chlorobenzene, etc.; and
  - Non-halogen type organic solvent waste: ethers, alkanes, ketones, esters, etc.

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Handling of Hazardous Waste

Waste classification, label and collection in laboratory

Label affixed to each laboratory waste container

Liquid waste stored in temporary storage

Send off to the companies approved by EPA

Sorting of discard/expired chemicals

Temporary storage for discard/expired chemical

Temporary storage for discard/expired chemical

Removal of chemicals to the companies approved by EPA

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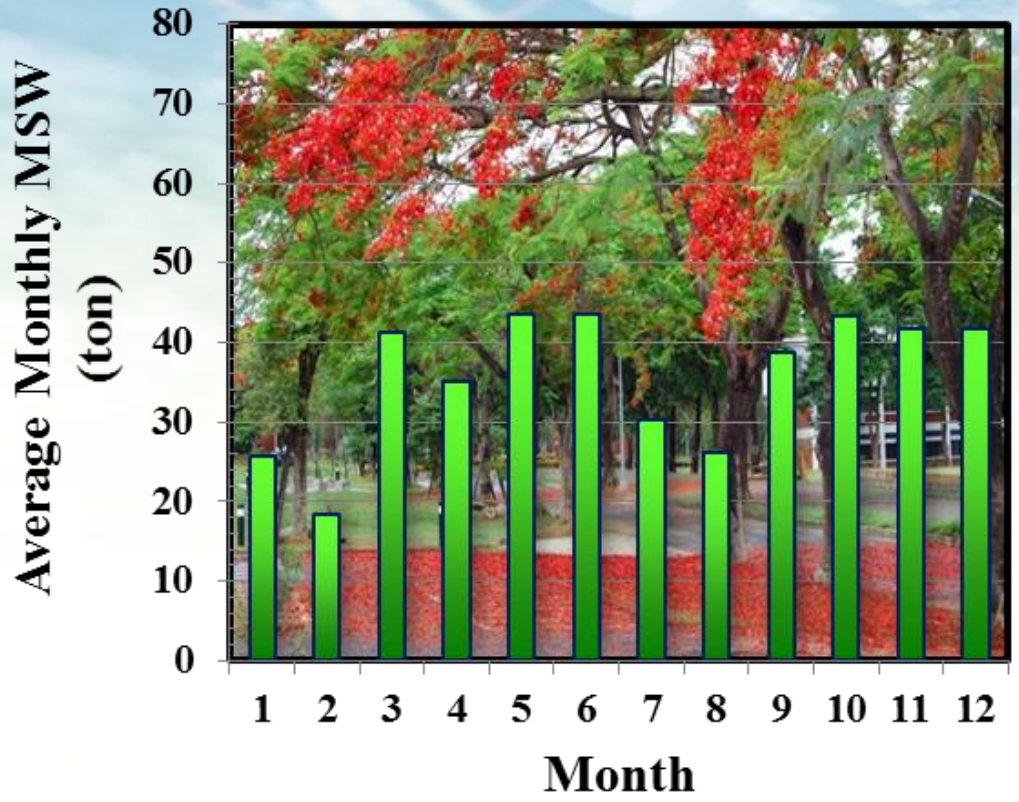
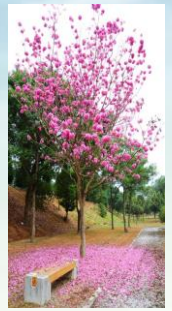
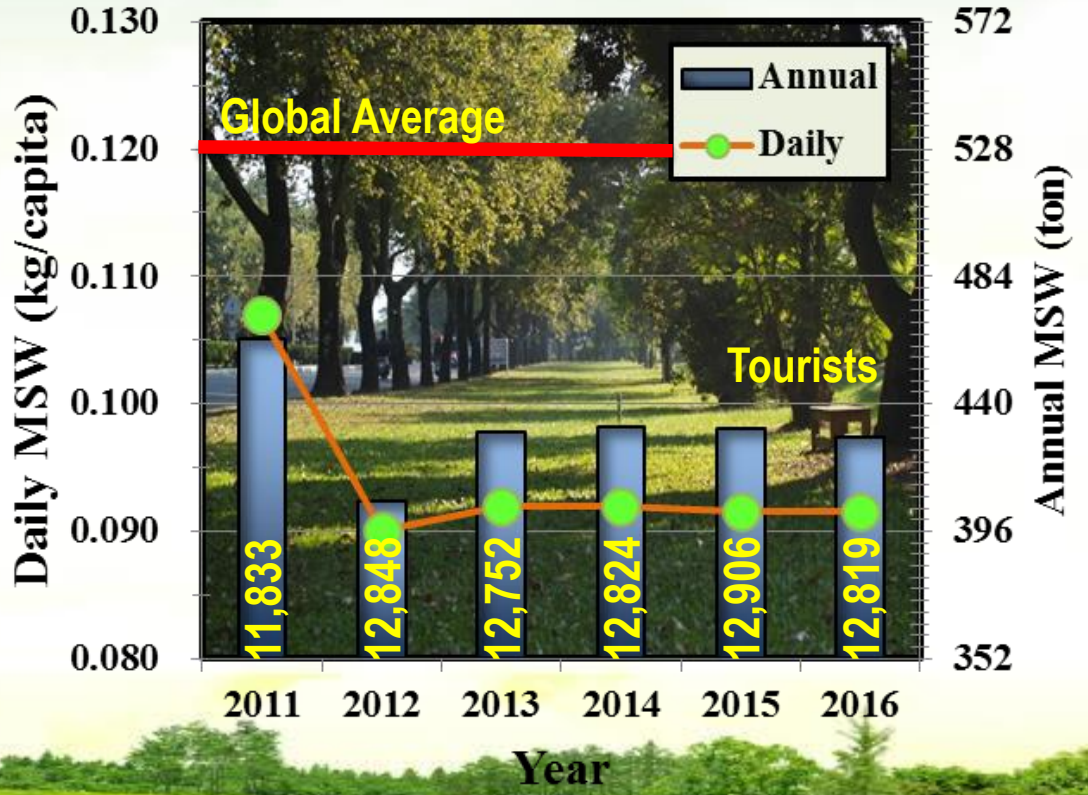
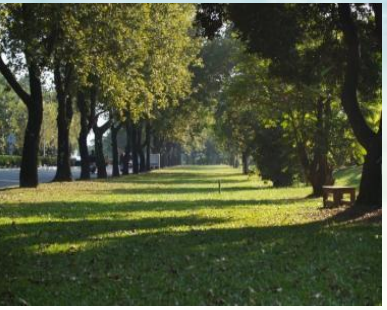
NPUST's Municipal Solid Waste







Strengthen of University Characteristics, Fulfillment of Social Responsibilities






Thank You

- Developing tropical agriculture education and industrial production model
- Becoming campus industrial paradigm for tropical agriculture education
- Laying the foundation for centennial NPUST

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