Kyoto University International ONLINE Symposium 2021 on Education and Research in Global Environmental Studies in Asia : Restarting International Cooperation After Covid-19 Pandemic

Poster Presentations

Kyoto University International ONLINE Symposium 2021

on Education and Research in Global Environmental Studies in Asia

Restarting International Cooperation After Covid-19 Pandemic

Graduate School of Global Environment Studies

Kyoto University

2021

Study Field 1

Engineering · Technology · Science

No.	Poster Title
E01	A STUDY ON RECYCLING POTENTIAL WASTE FROM FOOD AND BEVERAGE SERVICE SECTOR IN DA NANG
E02	**Misplaced. Removed to Study Field 3**
E03	Analysis of Water Quality Indices and Artifical Neural Neworks Model for Classifying Water Pollution in a Tropical River
E04	APPLICATION OF CO-COMPOSTING FOR STABILIZATION OF SLUDGE FROM SEAFOOD PROCESSING WASTEWATER TREATMENT SYSTEM
E05	Assessment of total concentrations of heavy metals in industrial sludges from North region of Vietnam and their potential impact on ecosystem
E06	Best Buy Options for Air Quality Control: Feasible Implementation Strategies for Indonesia
E07	Blackwater septic tanks: monitoring proxies and effects of the long septage storage periods
E08	**Misplaced. Removed to Study Field 3**
E09	Challenge and opportunity for reconstruction and modification technology activated sludge in municipal WWTP in Vietnam
E10	Characteristics and Biomethane Potential of Beef Cattle Slaughterhouse Waste and Its Co-Digestion Effect with Cattle Dung
E11	Characterization of selected air pollutants from rice straw open burning in the Mekong Delta of Vietnam

E12	CONCENTRATIONS AND CARBONACEOUS COMPOSITIONS OF PM0.1 AND PM2.5 IN HIGH POLLUTION EVENT DAYS IN HANOI
E13	Development, Validation and Application of 3D-Printed IoT-Based Water Quality Monitoring System in Carey Island, Malaysia
E14	Effect of Rainfall Pattern on Chemical Leaching from Excavated Dolerite
E15	Effective Synthetic Wastewater Treatment Using Activated Carbon Derived from Banana Peel
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E17	**Misplaced. Removed to Study Field 3**
E18	Environmental impact evaluation and hotspot analysis of volatile fatty acids production from waste wood chips
E19	Experimental Evaluation on Corroded High Strength Cables from Collapsed Myaungmya Bridge
E20	Fine particle-bound polycyclic aromatic hydrocarbons (PAHs) at an urban site of Ha Noi, Viet Nam: Concentrations, Source Diagnosis and Health Implications
E21	Hemodyanamic analysis of CT (Computed tomography) based reconstructed patient's left coronary artery model with respect to Two Way Fluid Structure Interaction (FSI) simulation
E22	Hexabromocyclododecane and Tetrabromobisphenol A in indoor dust from metropolitan Bangkok, Thailand: Implications for child exposure
E23	**Resign for publication**
E24	Interaction of Climate Change, Urban Air Pollution, and Human Health: Indonesia Case Study

E25	Life Cycle Assessment of Asian Diets
E26	Palm Kernel Shell Derived Adsorbent for the Removal of Cationic Dye from Aqueous Solution
E27	Phage therapy assessment of biofilm-forming Enterobacter hormaechei isolated from Shrimp gut as eradication agent
E28	Predicting the effect of recycling promotion measures on waste separation behavior in Da Nang City, Vietnam
E29	Production of bioactive soy sauce (醤油) in a bioreactor for food security.
E30	Production of Gamma-aminobutyric Acid (GABA) from Bacillus cereus isolated from moromi of a commercial Koikuchi Shoyu
E31	Quantification and Characterization of Microplastics in Wastewater
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E34	Separation of phosphate from aqueous solution using waste clamshell
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E36	Study on biogas production from anaerobic co-digestion of food waste and rice straw in Hanoi
E37	The Evaluation of Point System in Promoting Waste Separation in Dongying, China
E38	The Preliminary Test on Graphene Oxide-Based Electrochemical Sensor for a Detection of Ciprofloxacin
E39	**Misplaced. Removed to Study Field 3**

Study Field 2

Agriculture · Forestry · Biology

No.	Poster Title
A01	An Approach to Identify Potential Forest Landscape Restoration Sites: A Case of Southern Palawan
A02	Application of RPA technology in forestry research.
A03	Biomonitoring Lead (Pb) Pollution in Bandung, Indonesia Using Lichen
A04	chemical composition of coffee husk compost
A05	Citric Acid Assisted Treatment Of Tannery & Surgical Industry Wastewater By Hydroponically Grown Tagetes erecta L. (Marigold)
A06	Development and Testing of Power Tiller-Mounted One-row Transplanter for Improving Vegetable Farming Practices in Cambodia
A07	Effect of rice distillers' by-product and brewers' grain incorporated biochar and ensiled cassava root on growth of cattle in Laos
A08	Effect of soil type on nitrogen flux pattern in tropical forests of Vietnam – a comparison of Oxisols and Ultisols
A09	Effects of spatial variations on soil N dynamics in Japanese Cypress forest through 15N tracing method
A10	Estimation of Potential Soil Loss in Pantabangan-Carranglan Watershed, Philippines using InVEST
A11	Evaluation of different amendments of red mud and MSW compost on soil conditioning : A restorative perspective
A12	Hot water- and cold water extracted carbohydrate effected by rice straw residue burning

on-field

A13 Impact of aerobic yeast fermentation on the nutrient content of cassava root pulp

A14 Non-destructive method for classifying soon-deteriorated strawberry (Fragaria × ananassa) using fluorescence image in an early stage

A15 **Resign for publication**

A16 Rediscovering the Essence of University Museum while Surviving the Pandemic: Experience from Museum of Zoology of ITB (MZI) Indonesia

A17 Research for Determination of Plan Species in the Waste Disposal Area of Danang City

A18 SHIFTING OF PADDY (Oryza sativa) PRODUCTION UNDER CLIMATE CHANGE SCENARIO: A STUDY CASE IN SUBANG DISTRICT, INDONESIA

A19 **Resign for publication**

A20 Stressors and Measures on Mangrove Risks in Indonesia

Study Field 3

Rural & Urban Development

No.	Poster Title
R01	A study on the impact of traditional Japanese shopping streets “Shōtengai” on the walkability of Japanese cities.
R02	Adapting Traditions to make them sustainable: A meta-analysis of the traditional Samoan Fale Tele architecture evolution (and its driving factors)
R03	Assessment of personal exposure to fine particulate matters (PM2.5) in the city of Bamako-Mali.
R04	Counter-cartographic activism in peripheral territories: contestation and collaboration practices for rights enforcement
R05	Dispersed urban green contributes to biodiversity and ecosystem services
R06	Housing Vulnerability in Earthquake Prone Areas: A study on Rural Housing in Puebla, Mexico on the Earthquake of 2017/09/19
R07	Impact of cyclone Aila on educational institutions in southwestern Bangladesh: Extent of loss, damage and recovery
R08	Investigating the Impact of Movement Restriction on Land Surface Temperature in Three Epicenters Cities of COVID 19 in Indonesia
R09	Living (With+On) Infrastructure: Design strategies of Post Infrastructural Urban Context of NPO KAMC, Yokohama , Japan
R10	Potential of incremental approach in community-led housing: A case in Yangon, Myanmar
R11	Regional Identity of Tonami Scattered Village -Through the Investigation of the Attitude of the Residents in Goromaru Area –

R12	Spatial and Project Planning Characteristic of Post disaster Settlement: A case Study of Reconstruction After Typhoon Morakot
R13	The Impact of Heritage Tourism on Local Communities from the Perspective of Residents' Perceptions——A Case Study of Pingyao, China
R14	The potential for Solesolevaki (community cooperation) in building disaster resilient communities in Fiji
R15	Water management in a high-altitude cold desert region: Traditional systems and local innovations in Ladakh, India
R16	Young villager migration intention: comparison between the peri-urban village and remote village of Indonesia.
E02	A Study on the Relocation and Reconstruction of Kumano Hongu Taisha Shrine in the Meiji Period
E08	Building Community-Based Resilient Housing in Thua Thien Hue, Vietnam
E17	Energy-Saving Technologies and Environmental Impacts of Residential Buildings in Thailand: A Review
E39	The similarities and differences of Architectural factors between the Quoc Hoc and the Hai Ba Trung High School

Study Field 4

Policy・Economics・Culture

No.	Poster Title
P01	A Study on the Features of Nishimura Kahei's Stone Lantern Rengeji and Okunoin
P02	A systematic study of Water-Energy-Food security Nexus: Case study in South Korea
P03	An Evaluation of Air Pollution Control in Ulaanbaatar
P04	Comparison of Single Use Plastic Policies in Asia and Africa
P05	Implementation of Payment for Forest Environmental Services and its Influence on Local Livelihoods in Thua Thien Hue Province, Vietnam
P06	Recruiting System of Japanese Spiritual Communities:　Environmentalism as a Fishing Hook
P07	The Effects of Feed-in-Tariff (FiT) on the Residential Retail Price of Electricity among Regions in the Philippines
P08	The Soft Edge of Climate Stewardship: How Climate Action Will Turn Soft Power
P09	The Third Pillar of Climate Policy: Rectifying Loss and Damage
P10	Understanding water use behavior in communities of four Southeast Asian countries through water use flow diagrams
P11	What are the clean energy and decarbonization strategies of ExxonMobil, Chevron, BP, and Shell?
P12	Youth's Awareness on Climate Change: The Case of Fridays For Future Japan

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A STUDY ON RECYCLING POTENTIAL WASTE FROM FOOD AND BEVERAGE SERVICE SECTOR IN DA NANG

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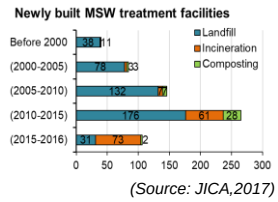
** Civil Engineering Department, University of Technolgoy and Education, The University of Danang

1. BACKGROUND

- Municipal solid waste (MSW) rapidly increased by year in Vietnam.
- Food and beverage (F&B) service sectors discharged a huge mount of waste every day.
- Landfill is the common method for MSW treatment.
- Lack of study on waste composition and characteristics, particularly in F&B service.

(Source: MONRE,2011)



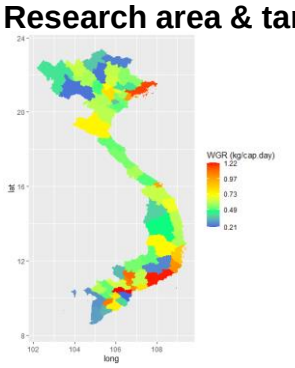
(Source: JICA,2017)

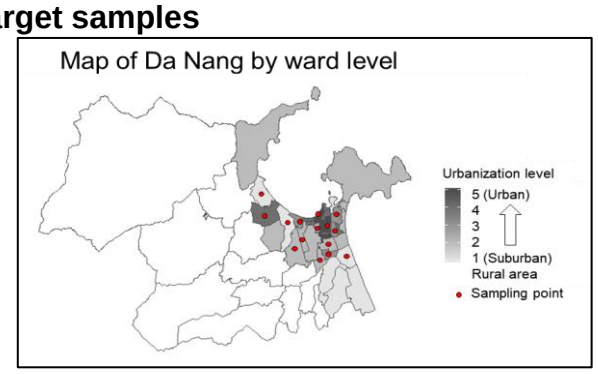

(Source:www.bestpricetravel.com)


(Source:VnExpress International)

2. METHODOLOGY

2.1. Research area & target samples





- 15 out of 45 wards were selected as research areas in considering population density.
- 400 cafe shops and restaurants were stratified sampling regarding their business type, business scale, location.
- Café (CF): serving coffee, juice, or snacks.
- Small restaurant (SR): serving common foods and drinks.
- Large restaurant (LR): serving high quality foods and drinks.

2.2. Outline of study

- Measure daily generated waste in 7 consecutive days.
- Detimine the detailed composition of waste by physical components, recyclable components.




3. RESULTS & DISCUSSION

3.1. Waste generation rate

Business	RW	OW	HW	GW	Total
CF	6±1	10±2	0.03±0.01	85±14	102±16
SR	133±44	148±48	0.66±0.48	230±65	525±52
LR	104±44	154±55	0.06±0.02	244±86	488±152
ANOVA	16,7***	46,3***	2,36***	36,5***	64***

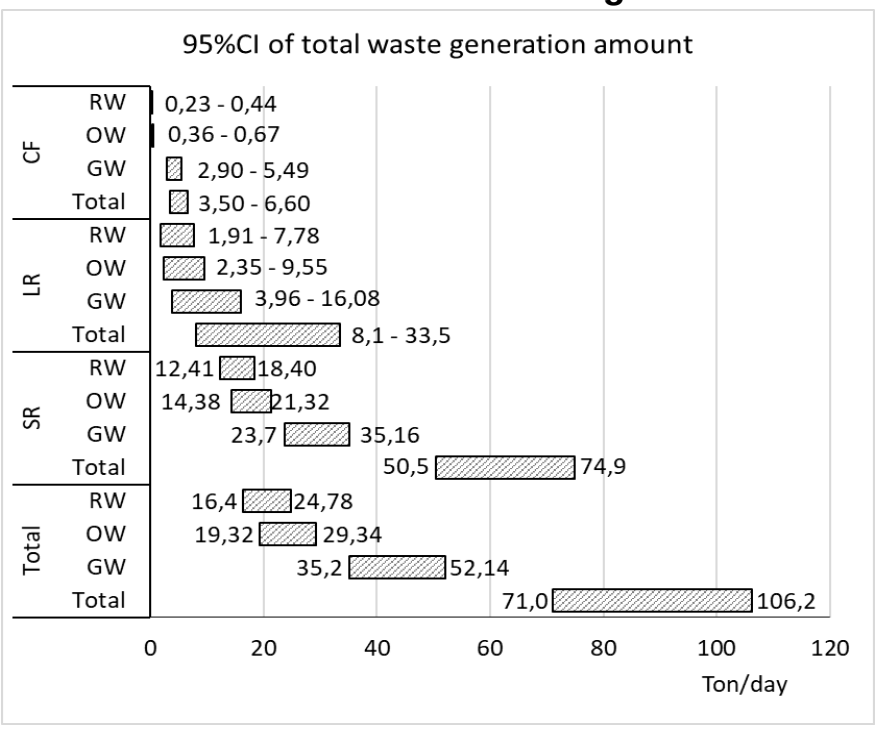
***: p<0,001 Unit: g/seat.day

RW: recyclable waste, OW: organic waste, HW: hazardous waste, GW: general waste

3.2. Waste composition & Recycling potential

Composition	CF	SR	LR
Separated recyclables	**6,60%**	**24,57%**	**23,27%**
Plastic	2,13%	0,11%	0,56%
Metal	0,63%	1,79%	2,53%
Glass	0,12%	20,27%	17,56%
Paper	3,72%	2,39%	2,61%
Separated organic waste	**10,22%**	**28,48%**	**28,59%**
General waste	**83,18%**	**46,95%**	**48,13%**
Recycling potential	***65,28%***	***37,98%***	***38,72%***
Paper	6,55%	0,95%	1,65%
Plastic	6,38%	3,12%	3,35%
Food waste	50,11%	33,63%	32,64%
Metal	1,73%	0,17%	0,25%
Glass	0,48%	0,09%	0,80%
Non-recyclables	***17,9%***	***9,0%***	***9,4%***
Paper	3,30%	2,33%	1,96%
Plastic	7,37%	0,39%	0,40%
Food waste	0,00%	3,36%	3,39%
Rubber	0,03%	0,05%	0,01%
Garden waste	4,46%	0,63%	0,64%
Textile	0,39%	0,13%	0,10%
Metal	0,04%	0,01%	0,05%
Glass	1,04%	0,42%	0,98%
Ceramic	0,11%	0,20%	0,30%
Harzadous	0,03%	0,08%	0,01%
Others	1,14%	1,36%	1,57%

3.3. 95%CI estimation of total waste generation



Kyoto University International ONLINE Symposium 2021 on Education and Research in Global Environmental Studies in Asia

Analysis of Water Quality Indices and Artificial Neural Networks Model for Classifying Water Pollution in a Tropical River

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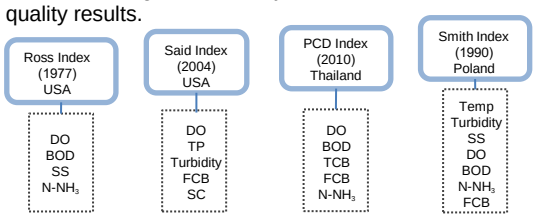
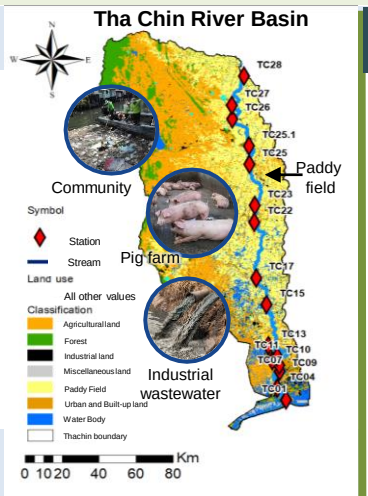
ABSTRACT

Water Quality Index (WQI) has been widely used for marine and river classification worldwide. However, most of the indices do not apply to all water types depending on physical, chemical, and biological parameters in different locations. In Thailand, Pollution Control Department (PCD) has designed a WQI guideline from expert opinions using five parameters (DO, BOD, Ammonia, Total Coliform Bacteria (TCB) and Fecal Coliform Bacteria (FCB)) in which the method assesses the chemical and biological parameters. However, the physical parameters such as pH and Total Suspended Solid (TSS) are not included. This research aims to compare the WQI values between PCD and other international guidelines at Tha Chin River Basin, Thailand, and to construct a WQI model using Artificial Neural Networks (ANNs). Three WQIs (PCD (Thailand), Ross Index (Taiwan), and Said Index (USA)) were selected for calculation in this study. Ross Index using 4 parameters (DO, BOD, SS, and Ammonia) and Said Index using 5 parameters (TP, Turbidity, DO, Conductivity, and FCB) are calculated and compared with the PCD Index. In the ANNs model, the key parameters and calculated WQI values of suggested methods are used as inputs. And, model performance can be assessed through Mean Square Error (MSE) and Correlation Coefficient (r). The results of WQI values through three methods expressed that the water quality at downstream of the Tha Chin River is worse than the upper part because of urbanization, industrial estates, and limitations of water treatment systems. More specifically, using the Said Index, when FCB is higher than 12,000 MPN per 100 ml, the WQI scores indicate negative values that are not in the index value ranges from 0 to 3. Based on the WQI purpose to identify the river water quality status, the Said Index is not appropriate to apply in Thailand. Thus, the PCD and Ross Indices are considered to contribute in the ANNs model.

INTRODUCTION

- Water Quality Index (WQI) has been developed and introduced worldwide for measuring water quality.
- WQI in Thailand has been used for 10 years with 5 input parameters and complex equations.
- Different WQI guidelines may cause different water quality results.





OBJECTIVES

- To compare the WQI values between PCD and other international guidelines at Tha Chin River Basin, Thailand.
- To construct a WQI model using Artificial Neural Networks (ANNs).

METHODOLOGY

Water Quality Index (WQI)

PCD Index (5 parameters) **:** DO, BOD, Total Coliform Bacteria (TCB), FCB and N-NH_3

$$WQI = \frac{\sum(SI_{DO}, SI_{BOD}, SI_{TCB}, SI_{FCB}, SI_{AN})}{5}$$

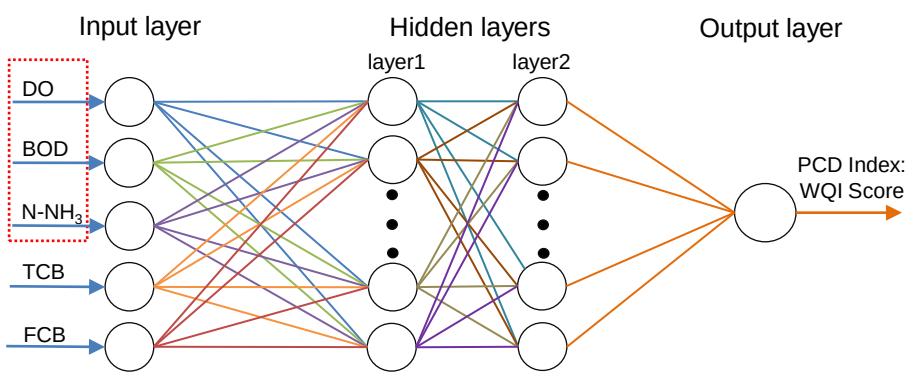
Ross Index (4 parameters) **:** DO, BOD, SS and N-NH_3

$$WQI = \frac{\sum(SI_{DO}, SI_{BOD}, SI_{SS}, SI_{AN})}{4}$$

Said Index (5 parameters)**:** DO, TP, Turbidity, FCB and Specific Conductivity (SC)

$$WQI = \log\left[\frac{(DO)^{1.5}}{(3.8)^{TP}\,(Turbi)^{0.15}(15)^{\frac{fecal}{10000}} + 0.14(SC)^{0.5}}\right]$$

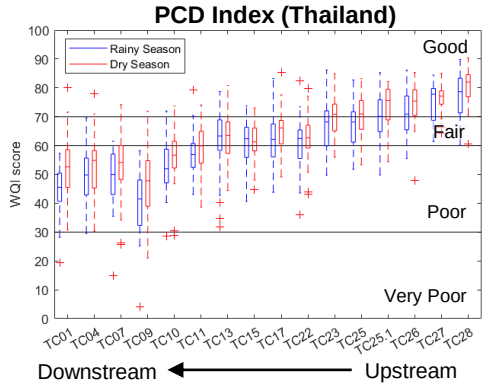
Artificial Neuron Networks (ANNs)

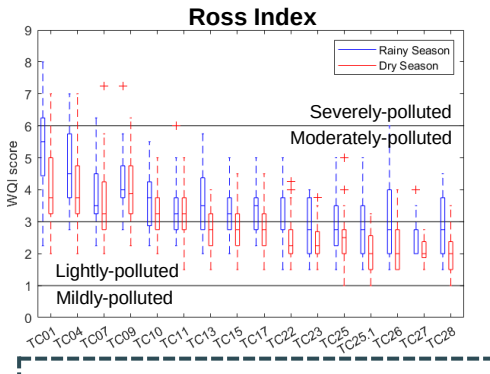


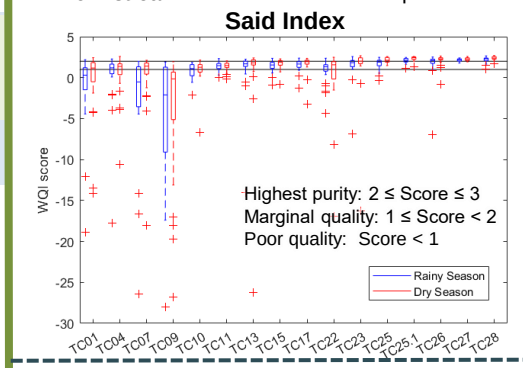
1. Adjusting number of hidden neurons between 6 and 31 for both layers at each station
2. Using 3 and 5 input parameters to construct models and comparing their performance

RESULTS AND DISCUSSION

Obj 1: Comparison of WQI Methods



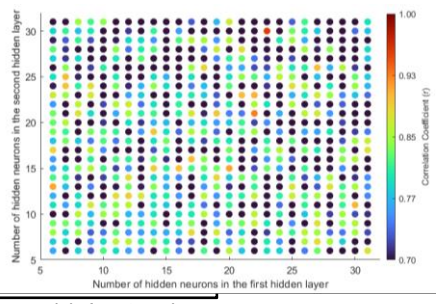




Obj 2: Artificial Neuron Networks

Performance Optimization:

Adjusting number of hidden neurons in two layers at station TC07



Model Performance

Setting models for 16 stations

Station	Inputs: 5 Parameters				Inputs: 3 Parameters			
	No. of Hidden Neurons		r	MSE	No. of Hidden Neurons		r	MSE
	Layer 1	Layer 2			Layer 1	Layer 2		
TC01	7	29	0.9907	2.00	14	11	0.9235	15.85
TC04	14	10	0.9895	2.10	11	12	0.9448	10.66
TC07	12	13	0.9891	2.48	23	30	0.9535	10.37
TC09	6	27	0.9959	1.22	18	27	0.9280	23.20
TC11	19	17	0.9966	0.52	21	9	0.9228	10.58
TC13	9	6	0.9923	1.57	14	18	0.9230	15.21
TC22	9	23	0.9909	1.48	18	7	0.9110	13.72
TC23	21	16	0.9901	1.29	29	30	0.8813	13.41
TC25	17	29	0.9943	0.70	19	26	0.9281	8.57
TC26	23	9	0.9895	1.38	6	23	0.8873	14.11
TC28	8	20	0.9991	0.08	31	11	0.9333	6.44

CONCLUSIONS

- **Season Effects on Water Quality**: Water quality in the rainy season tends to be worst than in the dry season, which represented by both PCD and Ross indices.
- **Important Finding:** Said Index is not appropriate to apply in the Tha Chin River due to the strong negative values from high fecal coliform bacteria.
- **Application of ANNs:** A good model performance (r > 0.989) for 16 stations was obtained by setting a suitable number of hidden neurons. And, the model performance (r > 0.887) through three inputs, which are able to simulate real-time WQI values, is slightly lower than 5 inputs.

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Said, A., Stevens, D. K., & Sehlke, G. (2004). An innovative index for evaluating water quality in streams. Environmental management, 34(3), 406-414.
Pollution Control Department (2016b). Thailand water quality index calculation- manual.
Ross, T. J. (2005). Fuzzy logic with engineering applications. John Wiley & Sons.

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APPLICATION OF CO-COMPOSTING FOR STABILIZATION OF SLUDGE FROM SEAFOOD PROCESSING WASTEWATER TREATMENT SYSTEM

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** Mikuniya Corporation, Japan; *** Graduate School of Global Environmental Studies, Kyoto University

INTRODUCTION

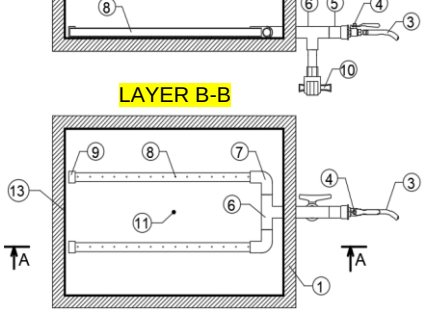
Seafood Processing

The diagram of sludge treatment in Seafood processing factory

MATERIALS AND METHODS

Experimental model construction

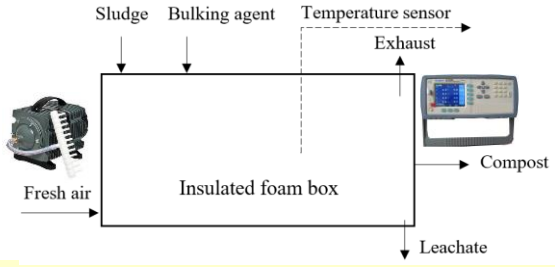
- Where: 1-Styrofoam box wall; 2-Lid cover; 3-Air pipe; 4-Air supply valve; 5-Threaded connection; 6-T pipe connection D21; 7-Coupling pipe D21; 8-Air distribution pipe D21; 9-Pipe end cap; 10-Ball valve D21; 11-Temperature sensor; 12-Signal wire; 13-Nylon layer ; 14-Exhaust pipe
- Air blower: 15 W, > 0.015 Mpa, flow: 10 Liters/min) with the mode of 2 minutes of blowing and 58 minutes of breaking.
- Data logger (Multi-Channel Digital Thermometer AT-4508).



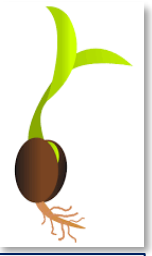

Dewater Sludge


Rice Straw


Green Wastes



The seed germination index (GI) of Green bean



Model 1 (MH1): 4 kg of dewater sludge + 2 kg of dry rice straw
Model 2 (MH2): 6 kg of dewater sludge + 10 kg of fresh green wastes

Co-composting EVALUATION

F. Zucconi *et al.*, 1981

The dewater sludge and bulking agent characteristics

Samples	Mois. (%)	Ash (%)	TOC (%)	T-N (%)	T-P (%)
Dewater Sludge	80.2 - 83.6	10.7 - 14.2	28.6 - 35.3	4.12 - 5.01	0.93 - 1.38
Rice Straw (Wet)	18.47	12.04	27.38	0.56	0.63
Rice Straw (Dry)	1.52	15.15	36.80	1.07	0.31
Green Wastes (Wet)	34.78	9.00	22.6	0.85	0.62
Green Wastes (Dry)	1.40	14.99	39.03	1.15	0.67

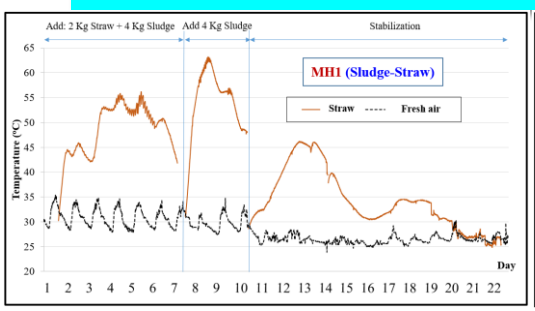
CONCLUSIONS

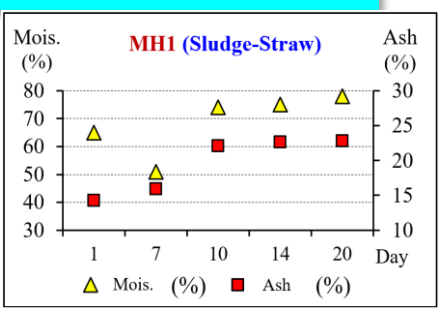
Sludge from the seafood processing WTTS contained a high concentration of moisture and nutrients. Sludge after the dewatering process was collected and disposed at the landfill.

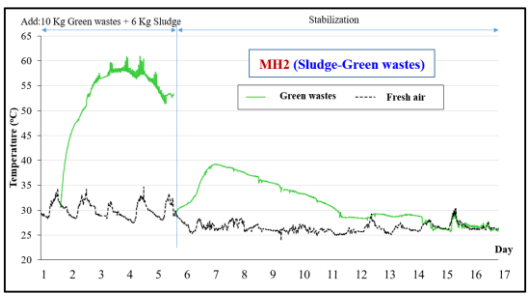
Observation of the phenomena and assessment methods combination of the compost quality showed that the sludge mixed with dry rice straw was more effective than green wastes. The dry straw-compost ensured met the microbial organic fertilizer and achieved growth indicators of plant growth when compost was tested on peas and sprouts. The GI index on the compost solution made with dry straw has a value of 120-134, so it should have the potential to provide nutrients according to the demand of plants.

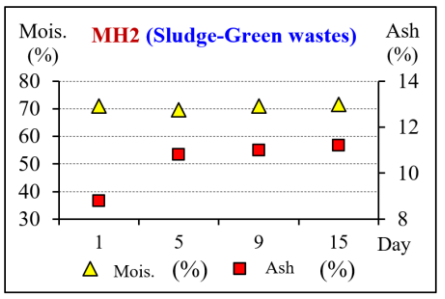
RESULTS AND DISCUSSION

Variation of physical parameters during the sludge decomposition process

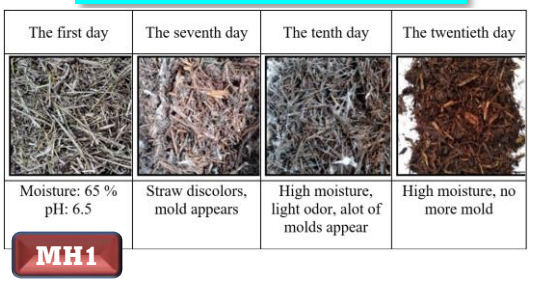


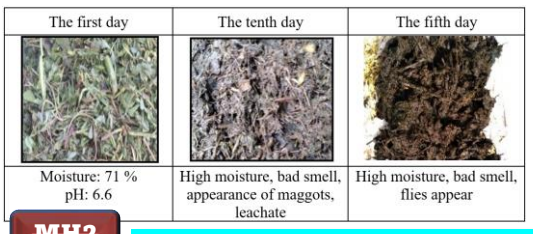




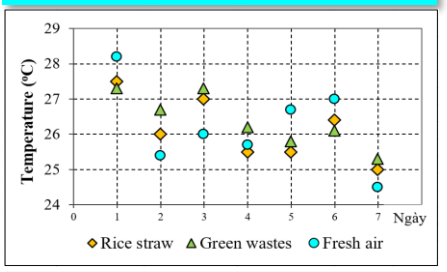


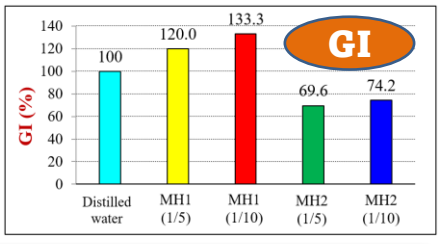
Sensory evaluation of materials





The stability of compost and GI value





Analysis results of decomposed sludge (MH1-MH2) & Farm straw compost*

Composts	Particle size (mm)	Mois. (%)	pH (-)	TOC (%)	T-N (%)	P_2O_5 (%)
MH1 (Rice straw)	5 - 8	48	6.8	21.90	2.60	0.029
MH2 (Green wastes)	> 5	72	8.5	34.30	0.89	0.034
Straw Compost*	> 5	69	7.0	18.66	0.51	0.033
TCVN 526:2002	4 -5	< 35	6 - 8	≥ 13	≥ 2.5	≥ 2.5

Compost test results on sprouts (2 evaluation indicators: stem mass and root length)

MH1-Compost
MH2-Compost
T-Blank (fresh soil)

Aknowledgement

Vo Diep Ngoc Khoi was funded by Vingroup Joint Stock Company and supported by the Domestic Master/PhD Scholarship Programme of Vingroup Innovation Foundation (VINIF), Vingroup Big Data Institute (VINBIGDATA), VINIF.2020.TS.48.

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Assessment of total concentrations of heavy metals in industrial sludges from North region of Vietnam and their potential impact on ecosystem

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[3]University of Science, Vietnam National University (VNU)

Background

Industrial sludges from wastewater treatment plants in two industrial areas and a groundwater treatment plant in northern Vietnam were investigated in this study. The total concentrations and their sequences of heavy metals (As, Cd, Cu, Cr, Ni, Hg, Pb, Zn) and other toxic elements (Mn, Pd, Sb, V) in the sludges were measured using ICP-MS methods. In addition, the surface characteristics of the samples were analyzed using SEM-EDS and FTIR techniques. Based on Vietnam's current waste management regulation (MONRE 2013), the two industrial sludges were belonged to the hazardous waste category. In contrast, the sludges of the groundwater treatment plant showed a low content of heavy metals and toxic elements. The sequential extraction method revealed that the heavy metals in the industrial sludges exhibited higher immobilization forms than those in the sludges of the groundwater treatment plant. The mobilization ability of heavy metals would be related to the surface function groups of the sludges, which were dominated by (-COOH) and (-OH) groups. The potential ecological risk assessment calculations indicated that the industrial sludges had high potential risk, which was mainly affected by the content of Cd in the sludge samples.

Introduction

Heavy metals contamination of water bodies presents a significant threat to environment and public health because of theirtoxicity, accumulation in the food chain and persistence in nature. Strict regulations and guidelines have been imposed or recommended in many countries to restrict heavy metals contamination of natural water bodies

Industrial sludge containing high level of heavy metals is a potential source of contamination to the environment. In this study, concentrations of heavy metals (HMs – As, Cd, Cr, Cu, Hg, Pb, and Zn) in industrial sludge samples collected from different industrial zones in the North of Vietnam were analyzed using ICP-MS method.

This study analysed the data for the spatial and seasonal distribution of the heavy metals. Our results indicated that, in general, the industrial sludges were rich in organic content, T-N and T-P. industries presence in the studied industrial zones.

Materials and Methods

Sampling sites

12 sludge samples were collected at the wasterwater treatment plant of Ba Thien Industrial Park (Vinh Phuc, Vietnam) for 4 seasons in 2020
16 other sludge samples were collected from Thanh Cong Cement company (Hai Duong) for 5 types of industrial activities)
Control sample: natural soils nearby the industrial park

Sample pre-treatment and analysis

Using Standard method (EPA Method 3050B)
Characteristic of sludges
Heavy metals analysed by ICP-MS equipment (12 elements: Cu, Pn, Zn, Fe, Mn, As, Hg, Ni, Cr,…)
SEM, EDS samples were analysed by AIST-HUST
Determining ecological risks of heavy metals using Hakanson method (1980)
Statistical analysis was performed using SPSS

Results and Discussion

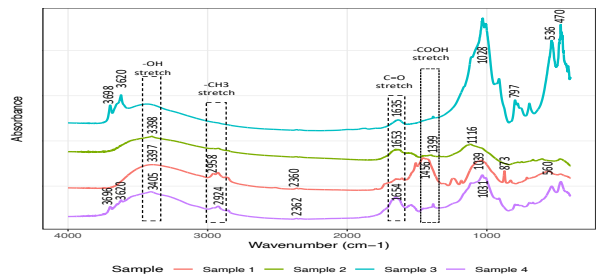
Figure 1 shows SEM images of the industrial sludges. A surface morphology of sludge can be observed in the SEM photographs. The carbon coated surfaces were relatively homogenous. EDS data showed that the Fe and Si were dominant in the sludge.
Concentration variation in sludge samples were shown in Figure 4. The data presented that there is not much difference among seasons. Pb and Cu are the main pollutants in the sludge samples.
Some industrial activities (metallurgical, mechanical, chemistry and WWTP) sludges were compared in total heavy metal concentrations. The result showed that Cu, Pb was relatively higher in mechanical factory than other factory, while Vanadium was highest in metallurgical factory. It means each industrial activites had separate heavy metal release depending on producing process.
The ecological risk (RI) values calculated from Ba Thien and Thanh Cong sludges were all high and got the very high risk. It is reasonable and considered to be hazardous waste which could not be disposed freely into the environment (Table 2).

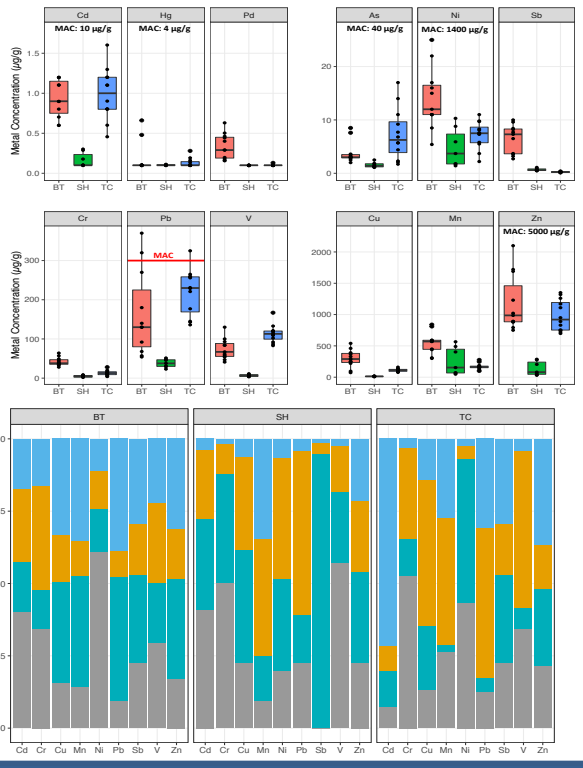
SLUDGE CHARACTERISTIC

Para.	BT1	BT2	BT3	TC1	TC2	TC3	CON.
DO	11.2	10.5	10.7	11.4	13.5	17.6	12.8
ORP	203	192	182	199	189	173	266.3
TOC	729	839	203	687	605	302	365.1
T-N	611.3	953.4	1232.5	610.4	405.5	758.4	441.8
T-P	45.4	23.4	32.2	49	31.1	40	34.0

BA THIEN INDUSTRIAL PARK

SEASONS	As	Cr	Pb	Cu	Cd	Zn	RI	Degree Ecol. Risk
SPRING	19.1	29.6	21.9	106.1	128.7	16.6	323.3	Very high risk
SUMMER	21.1	24.0	44.3	130.3	96.6	21.7	338.0	Very high risk
AUTUMN	53.7	33.3	20.6	159.6	137.9	36.8	441.8	Very high risk
WINTER	18.4	26.4	147.0	147.0	156.3	21.0	381.4	Very high risk





Conclusion

The mean concentrations of all heavy metals were generally higher in sludges than those in agricultural soils, indicating that industrial and wastewater treatment activities have contributed to the accumulation of heavy metals in the sludges. In addition, the organic and total nitrogen and phosphorus were high in many sludge samples.

The ecological risk as assessed by Interim freshwater sediment quality guidelines (ISQG) was low to moderate in all industrial sludge samples. Our study provided evidence on pollution control effort of the industry in Vietnam but at the same time highlighted the potential of industrial sludge to become a polluting source of the soil or water resources.
The detailed characteristics of the sludges and species of heavy metals in the sludges from three water treatment plants (two of them are wastewater treatment systems) in northern Vietnam were investigated. The results suggested that despite multiple step treatment, sludges from industrial zones can still be hazardous due to exceeding the maximum allowable level of Pb in the sludge.

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Best Buy Options for Air Quality Control: Feasible Implementation Strategies for Indonesia

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*****WHO Indonesia

Background

- ✓ In Indonesia, mostly air pollution in Indonesia comes from coal-fuel power plants, industry and transportation while the long-term impact cause track respiratory disease, inflammation, cardiopulmonary and cancer.
- ✓ Potency of World Health Organization conference 2018, the 1st Air Pollution and Health that covers knowledge management products to support intervention air quality control to be adopted in Indonesia.

Objective **To propose "best buy options" as a guideline for local action to execute air quality control and monitoring in Indonesia (both in regional and national scale)**

Public Participations for Air Quality Control

NGO in Indonesia

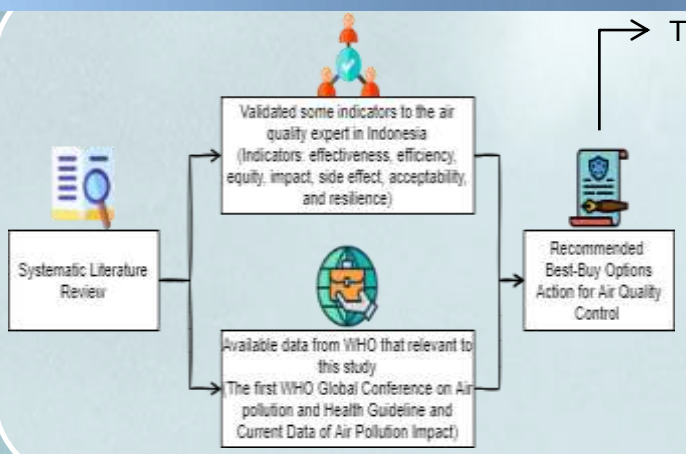
Youth Organizations

Intervention actions held by Indonesian society

Need the best option (technical document) for air quality control

- ❖ **Agency Targets :** Ministry of Transportation, Ministry of Environment and Forestry , Local Government, Ministry of Energy and Minerals
- ❖ **Target Pollutants :** SO_2,NO_2,HCl,Cl_2,NH_3,HF,H_2S,Hg,As,Cd,Zn,CO,CO_2

Methodology



The **fourteen recommendation actions** for air quality control:

No	Recommended Actions
1	Tightening inspection household waste's burn
2	Promoting low-emission vehicle technology
3	Encouraging people to public transport
4	Tightening emission from industry
5	Creating chimney emission testing portal
6	Adding air pollution monitoring station
7	Digitizing an accessible air quality information

No	Recommended Actions
8	Improving bike route facilitation in the city
9	Installation of solar panel on rooftop buildings
10	Prohibition management of land burning
11	Providing incentive to accelerate biofuel transition
12	Integrating actions of air quality control to primary and secondary school's curriculum
13	Dissemination clear air action to learning system
14	Preparation of facilitation to mitigate forest fire

Result and Discussion

An assessment of the action recommendations needs to be carried out to determine the best action or option (best – buy options) for air quality

Action ID	Indicators A	B	C	D	E	F	G	Total
1								18
2								18
3								16
4								19
5								19
6								15
7								18

Action ID	Indicators A	B	C	D	E	F	G	Total
8								19
9								18
10								18
11								18
12								20
13								18
14								18

High, score = 3 **Medium**, score = 2 **Low**, score = 1

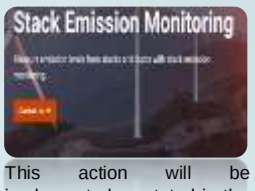
The indicators used *:* A) effectiveness, B) efficiency, C) equity, D) impact/ side effect , E) acceptance, F) coherence, and G) robustness*

Result: Top 4 best actions : No. 4, 5, 8, 12 (highest scores)
*indicators based on : *BASE Evaluation Criteria for Climate Adaptation (BECCA)*

Action No. 4
Tightening Emission Rate from Industry

This action has been implemented based on regulation standard. However, there is no form of tightening in national scale.

Action No. 5
Providing Portal for Emission Report



This action will be implemented as stated in the Ministry of Health's National Health Environmental Action Program/NEHAP 2020-2024

Action No. 8
Bike Route Facilitation in City

This action will be implemented at the regional level, based on the National Capital City priority Project on the 2020-2024.

Action No. 12
Air Quality Control in School Curriculum

Implemented successfully in the Schools' Lesson Plan "Learning Houses" to maintain air quality under the Ministry of Education and Culture supervision.

Monitoring Process and Action

AQMS Portal

Free Emission Test - Jakarta

MoE

Gover ment

Conclusion

1) The 1st WHO Global Conference of Air Pollution and Health's data combined with BASE Evaluation Criteria result in the top four best recommendation actions to be implemented in the national action plan to reduce the worst impact of air pollution in Indonesia.
2) Integrating air quality control into curriculum is the most recommended action and it has been implemented in several primary and secondary schools. However, it is necessary to expand the topics about air pollution from industry, coal-fuel plants, and indoor pollution.
3) Ministry of Health and MoE are advised to implement actions from the community to the national level and supported by NGOs, youth organizations and the private sector.

References

Ministry of Health of the Republic of Indonesia. 2018. Indonesian Health Profile 2018. Jakarta(ID): Ministry of Health of the Republic of Indonesia.

World Health Organization. 2018. WHO's First Global Conference on Air Pollution and Health. Improving air quality, combatting climate change – saving lives. doi: 10.1080/2162402X.2017.

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Blackwater septic tanks: monitoring proxies and effects of the long septage storage periods

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Background

Although septic tanks are the most applied on-site sanitation system in low- and middle-income countries, the monitoring and evaluating data are limited and demandingly challenging due to the chaotic nature of constructed septic tanks with unstandardised designs. This study aimed to:

- **Scrutinise the present conditions of septic tanks**
- **Suggest the proxy parameter to overcome the challenge of the monitoring in the complex and chaotic settings**

Methods

Study Area

- Hanoi city covers an area of 3,358.6 km^2 with a population of 8.25 million people (GSO, 2021).
- 84% of households relied on septic tanks (Huynh et al., 2021).

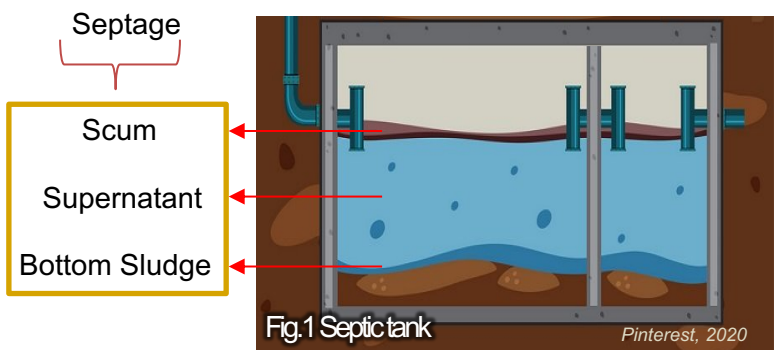

Fig.1 Septic tank

- Fifteen blackwater septic tanks were chosen to study.
- Septic tanks in Hanoi had long septage storage periods (up to 20 yrs.).

Sampling


Fig.2 Accessing hole


Fig.3 Sampling tube


Fig.4 Effluent sampling

- Septage (scum, supernatant, and bottom sludge) was collected through accessing holes (Fig.2) by using a sampling tube (Fig.3). Each layer was collected independently.
- Effluent were collected at the effluent pipes of the septic tanks by an auto-sampler (Fig.4).
- All samples were analysed for related physiochemical parameters such as COD, BOD, TS etc.

Analysis

- The statistical analysis was carried out by using the data source from the field study in 2019 – 2020, and the data were partly published by Huynh et al., 2021.

Result and Discussion

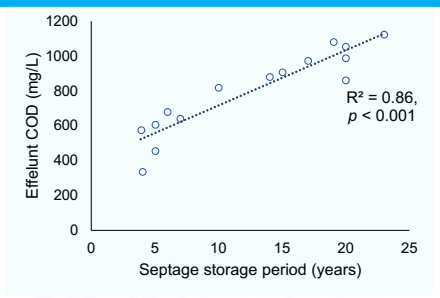

Fig.5 Correlation between septage storage period and effluent COD

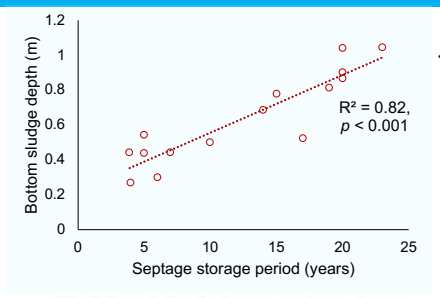

Fig.6 Correlation between septage storage period and sludge depth

- Effluent COD were found higher when septic tanks had longer septage storage periods (Fig.5).

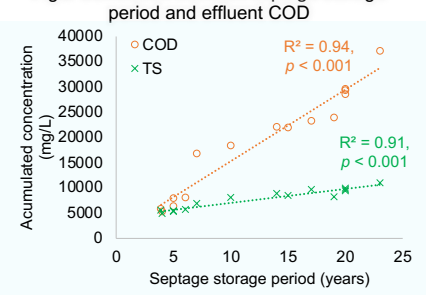

Fig.7 Correlation between septage storage period and accumulated COD and TS

- Septage storage periods were found in the range of **3.9 - 23 yrs.**, and recognised with a strong correlation to bottom sludge accumulation (Fig.6).
- Longer septage storage periods influenced a higher concentration of supernatant COD and TS, gradually accumulated by time in the septic tanks (Fig.7).

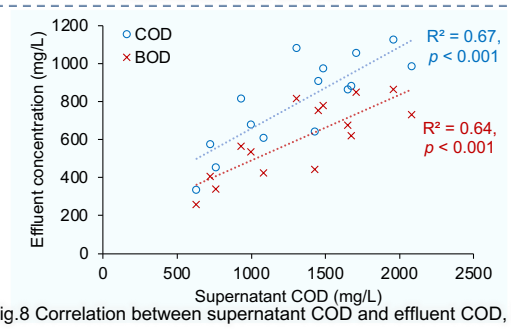

Fig.8 Correlation between supernatant COD and effluent COD, BOD

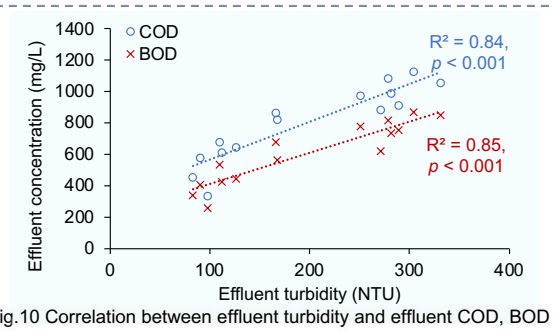

Fig.10 Correlation between effluent turbidity and effluent COD, BOD

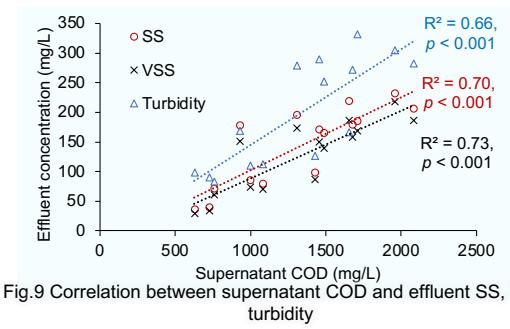

Fig.9 Correlation between supernatant COD and effluent SS, VSS , turbidity

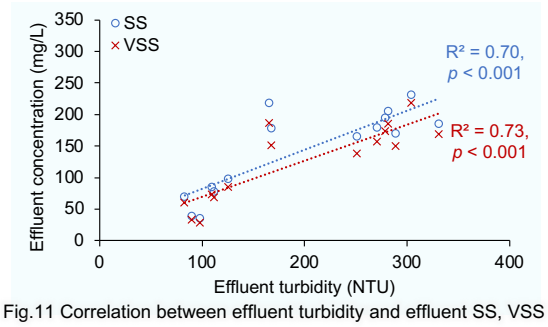

Fig.11 Correlation between effluent turbidity and effluent SS, VSS

- Good correlations were observed between supernatant COD and effluent parameters.
- It indicates **a possibility of proxy parameter for the site when effluent is not possibly collected.**
- Strong correlations between effluent turbidity and other effluent parameters were shown.
- This could be **a proxy for effluent monitoring, gaining benefits of cost and time saving.**

Conclusion

- Longer septage storage period did not only indicate higher sludge depth accumulation but also organic accumulation, resulting in decreasing of effective volume and lowering the treatment performance.
- To overcome the challenge of practical monitoring, supernatant COD and effluent turbidity could be the proxies for estimating effluent quality.

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Challenge and opportunity for reconstruction and modification technology activated sludge in municipal WWTP in Vietnam

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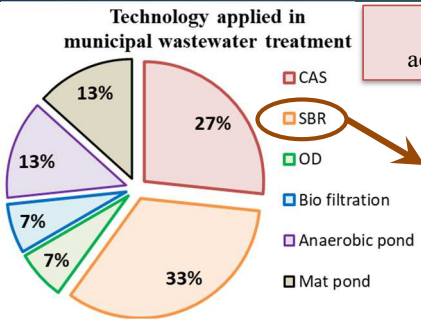
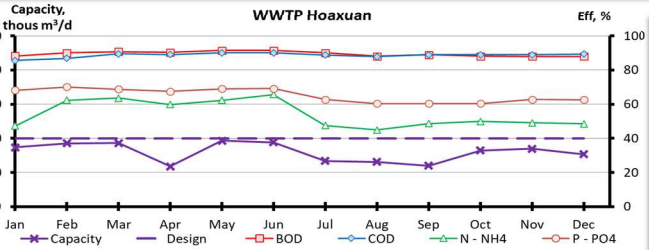
** Professor of Department of Environment Technology, Danang University of Science and Technology

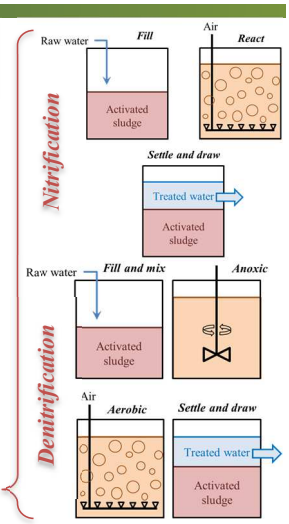


Background: 60% municipal WWTP in Vietnam has been applied technology activated sludge but the concentration of Nitrogen higher than discharge standard



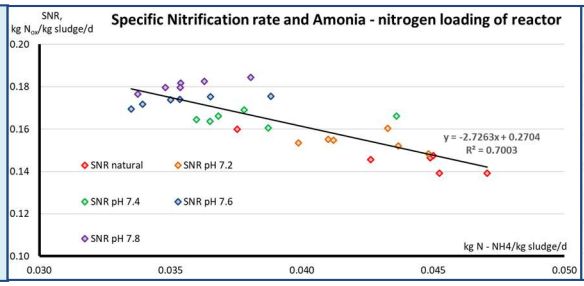
Parameter	Influent	Effluent	Vietnamese discharge standard	Russian discharge standard – water reuse quality
BOD, mg/l	53 ÷ 96	6.32 ÷ 10.42	30	3.00
COD, mg/l	84 ÷ 125	11.27 ÷ 13.20	75	30
N – NH_4, mg/l	10.86 ÷ 18.65	5.73 ÷ 9.41	5	0.39
N – NO_3, mg/l	0.18 ÷ 0.74	17 ÷ 23	30	9.10

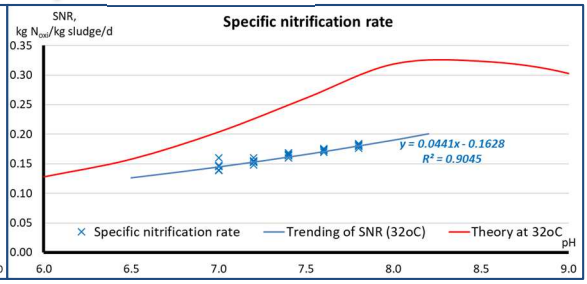
Method: modification technology activated sludge in Sequencing Batch Reactor through the optimization of nitrification and denitrification processes

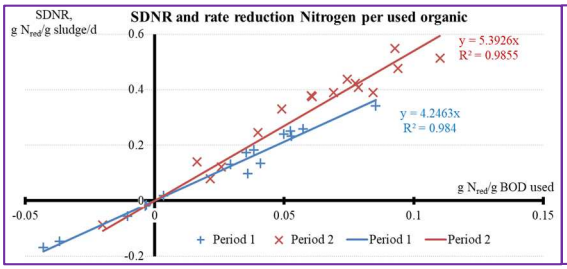


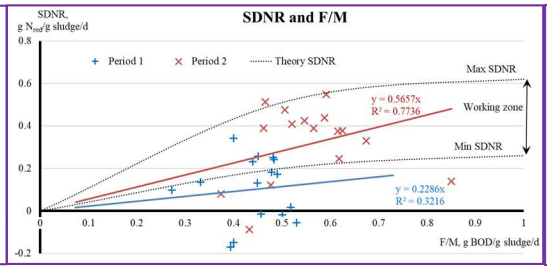
Nitrification

The optimal specific Nitrification rate is 0.16 – 0.18 kg N_{ox}/kg sludge/d. Besides that, at 32°C, the performance of process biological Nitrification archive 50 – 60% when compared with kinetic theory (pH in range 7.4 – 7.8.)









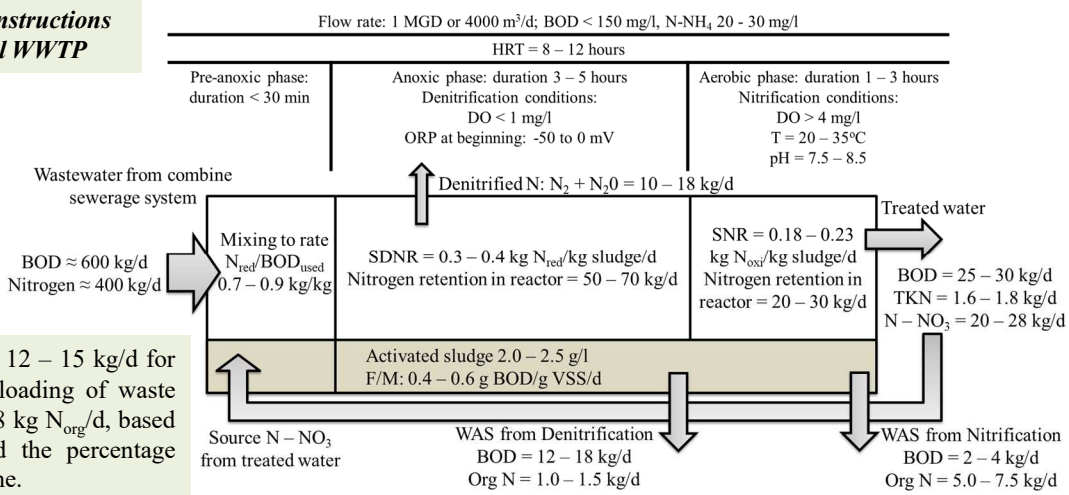
Denitrificaiton

with the optimal conditions of anoxic phase, the SDNR values tends to peak – 0.5 g N_{red}/g sludge/d. After that, the optimal F/M ratio from 0.4 – 0.6 g BOD/g VSS/d. Therefore, the SDNR of reactor in range 0.35 – 0.45 g N_{red}/g sludge/d and ratio N_{red}/BOD_{used} from 0.05 to 0.11.

The recommendations of operation and reconstructions biological reactor in Vietnamese municipal WWTP

The main block has been divided in 3 steps: pre-anoxic, anoxic and aerobic; corresponding to the order of the phases in the SBR or 3 biological activated reactor reactors in continuous-flow conditions. The HRT from 8 – 12h, depending on the concentration of pollution and the ratio between organic matters and nutrient in wastewater.

The loading of effluent in biological reactor is 12 – 15 kg/d for BOD and 10 – 20 kg/d for Nitrogen. Total loading of waste activated sludge is 14 – 22 kg BOD/d and 6 – 8 kg N_{org}/d, based on the raising of concentration MLVSS and the percentage concentration of activated sludge by tank volume.



Kyoto University International ONLINE Symposium 2021
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Characteristics and Biomethane Potential of Beef Cattle Slaughterhouse Waste and Its Co-Digestion Effect with Cattle Dung

Anriansyah Renggaman[1,2], Hong Lim Choi[2*], Sartika Indah Amalia Sudiarto[1,2], Andi Febrisiantosa[2]

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BACKGROUND

Drastic change in food consumption pattern has led to increasing number of livestock being slaughtered causing increased generation of slaughterhouse waste (Lee et al., 2015). Slaughterhouse waste contains high energy potential to be utilized as substrate for anaerobic digestion. However, high fat content might hinder the anaerobic digestion of beef cattle slaughterhouse waste (BCSW). Substrate co-digestion might overcome this problem. However, limited studies are available for the co-digestion using BCSW and cattle dung (CD). Therefore, this study was conducted to determine the characteristics of BCSW and the effect of its co-digestion with CD to anaerobic digestion parameters such as lag phase period (λ), CH_4 production (M_{max}), and effective digestion time (T_{eff})

METHODOLOGY

Beef Cattle Slaughterhouse Waste

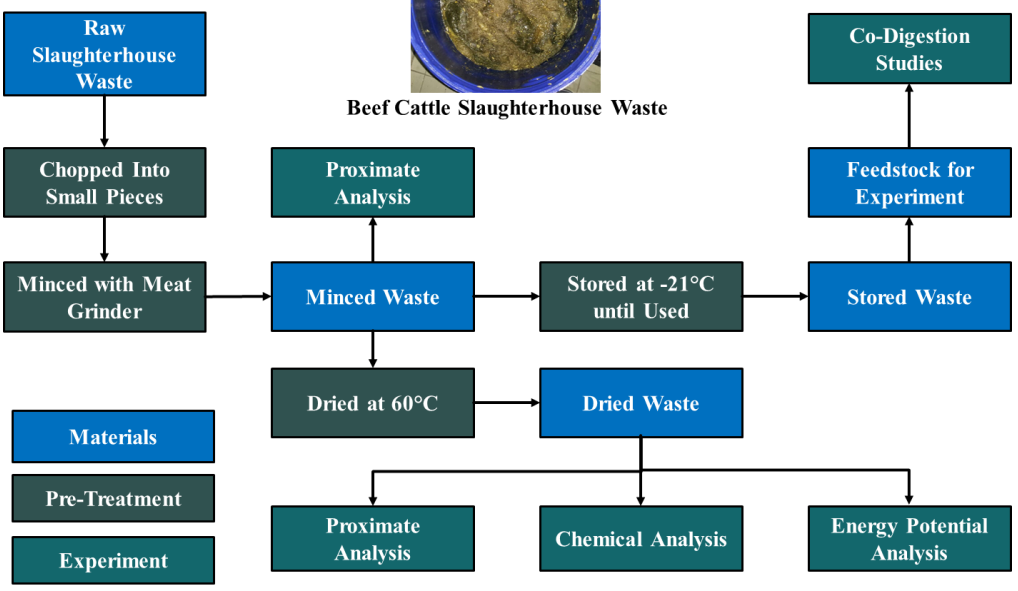

Table 1. Experimental design of anaerobic co-digestion experiment of BCSW with CD and its mixtures

Code	Substrate (% VS basis)[1]		
	BCSW	CD	OLR (g VS/L)
C1	100	0	932
C2	0	100	912
C3	67	33	925
C4	50	50	922
C5	33	67	918

[1] The S/I ratio of 1 was used for all the mixtures and experiments were performed in triplicate

Modified Gompertz formula (Equation 1) was utilized to determine the λ and M_{max} (Renggaman et al., 2021)

$$M(t) = M_{max}\exp\left\{-\exp\left[\frac{R_{max}e}{M_{max}}(\lambda - 1) + 1\right]\right\} \quad \text{(Equation 1)}$$

RESULTS AND DISCUSSION

Table 2. Characteristics of BCSW and CD utilized in this study

Parameters[1]	Beef Cattle Slaughter Waste[2]	Cattle Dung[2]
Total Solid (%FM)	16.7±0.3^A	32.1±0.2^B
Volatile Solid (%DM)	93.2±0.6^A	91.2±2.1^A
Fixed Solid (%DM)	5.4±0.2^A	8.8±2.1^A
Energy Content (MJ/kg DM)	29.3±0.2^B	17.5±0.8^A
Total Kjedahl Nitrogen (%DM)	3.2±0.3^A	2.5±0.3^A
Protein (%DM)	19.8±1.9^A	15.4±1.7^A
Fat (%DM)	57.4±0.3^B	3.1±0.1^A
Neutral Detergent Fiber (%DM)	18.9±0.6^A	61.3±0.1^B
Acid Detergent Fiber (%DM)	13.1±0.5^A	23.5±0.6^B
Hemicellulose (%DM)	5.8±0.2^A	37.9±0.5^B

[1] %FM: % of fresh matter, %DM: % of dry matter;
[2] Values expressed as mean ± standard deviation
[A,B] Means in the same row with different uppercase letter differs significantly ($p<0.05$)

Table 2 showed that BCSW contained high volatile solid (VS) content of 93.2% of dry matter (%DM) and high energy content of 29.3 MJ/kg dry matter. While CD also contained high VS content of 91.2%DM and moderate energy content of 17.5 MJ/kg DM.

Table 3. Anaerobic digestion parameters from BCSW co-digestion with CD

Parameters[1]	C1[2,3]	C2[2,3]	C3[2,3]	C4[2,3]	C5[2,3]
M_{max} (Nml CH_4/g VS_{added})	578.5±14.4^c	397.2±15.3^a	422.0±13.8^a	496.8±12.2^b	557.9±16.7^c
R_{max} (Nml CH_4/g VS_{added}/d)	30.8±2.6^b	22.0±0.8^a	24.7±0.3^a	29.6±1.8^b	30.8±1.4^b
λ (d)	10.2±1.7^a	8.3±0.4^a	7.1±1.6^a	7.5±1.7^a	8.2±1.0^a
R^2	0.999	0.998	0.999	0.999	0.998
T_{90} (d)	32.7±2.4^b	29.9±0.4^b	27.5±1.7^a	27.5±1.5^a	29.9±1.7^b
T_{eff} (d)	22.6±2.4^a	21.6±0.4^a	20.4±0.8^a	20.1±0.9^a	21.7±0.8^a

[1] M_{max}: Maximum CH_4 potential production, R_{max}: Maximum CH_4 production rate, λ: Lag phase period, R^2: Correlation coefficient, T_{90}: Time required to obtain 90% of M_{max}, T_{eff}: Effective digestion time (T_{90} - λ), d: days;
[2] Values are expressed as mean ± standard deviation
[3] Means in the same row with different lowercase letter differs significantly ($p<0.05$)

During sole anaerobic digestion, BCSW produced high M_{max} (578.5 Nml CH_4/g VS_{added}) but had long λ of 10.2 days. While CD produced low M_{max} (397.2 Nml CH_4/g VS_{added}) and moderate λ of 8.3 days (Table 3). Co-digestion between BSCW and CD resulted in 3 to 27% decrease of M_{max} compared to BCSW sole digestion and only slightly affects ($p>0.05$) other co-digestion parameters such as λ (2 – 3 days faster) and T_{eff} (1 – 3 days faster). Low micronutrient content in BCSW (5.4 %DM) and CD (8.8 %DM) might be the cause of this phenomenon. These results indicated that CD might not be suitable to be co-digested with BCSW. Other livestock waste with high micronutrient content might be necessary to improve BCSW anaerobic digestion parameters.

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Lee, J.; Koo, T.; Han, G.; Shin, S.G.; Hwang, S. Anaerobic digestion of cattle offal: protein and lipid-rich substrate degradation and population dynamics of acidogens and methanogens. *Bioprocess and biosystems engineering,* **2015**, *38*, 2349-2360.

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Kyoto University International ONLINE Symposium 2021 on Education and Research in Global Environmental Studies in Asia

Characteristics of selected air pollutants from rice straw open burning in the Mekong Delta of Vietnam

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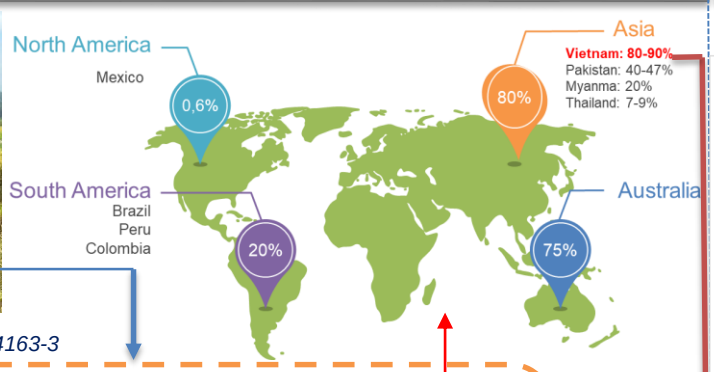
* School of Environmental Science and Technology, Hanoi University of Science and Technology
** Faculty of Environment, Hanoi University of Natural Resources and Environment

1. BACKROUND

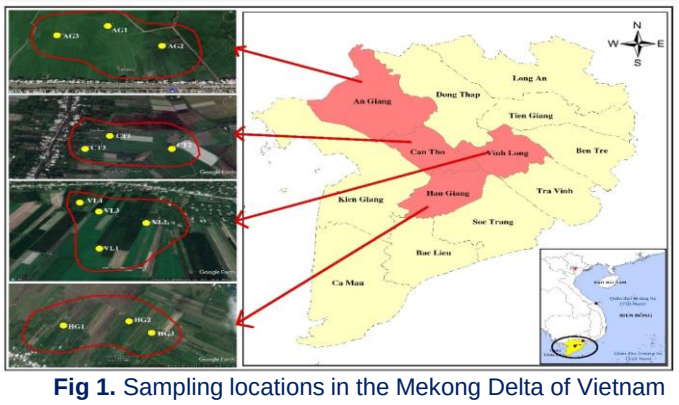


Soure: https://doi.org/10.1007/s11356021-14163-3

Aim

Determination of emission characteristics of PM
Determination of emission characteristics of gaseous pollutants

2. METHODOLOGY



Study area:

- **2018:** An Giang and Hau Giang ;
- **2019**: Vinh Long Province and Can Tho City

Fig 1. Sampling locations in the Mekong Delta of Vietnam

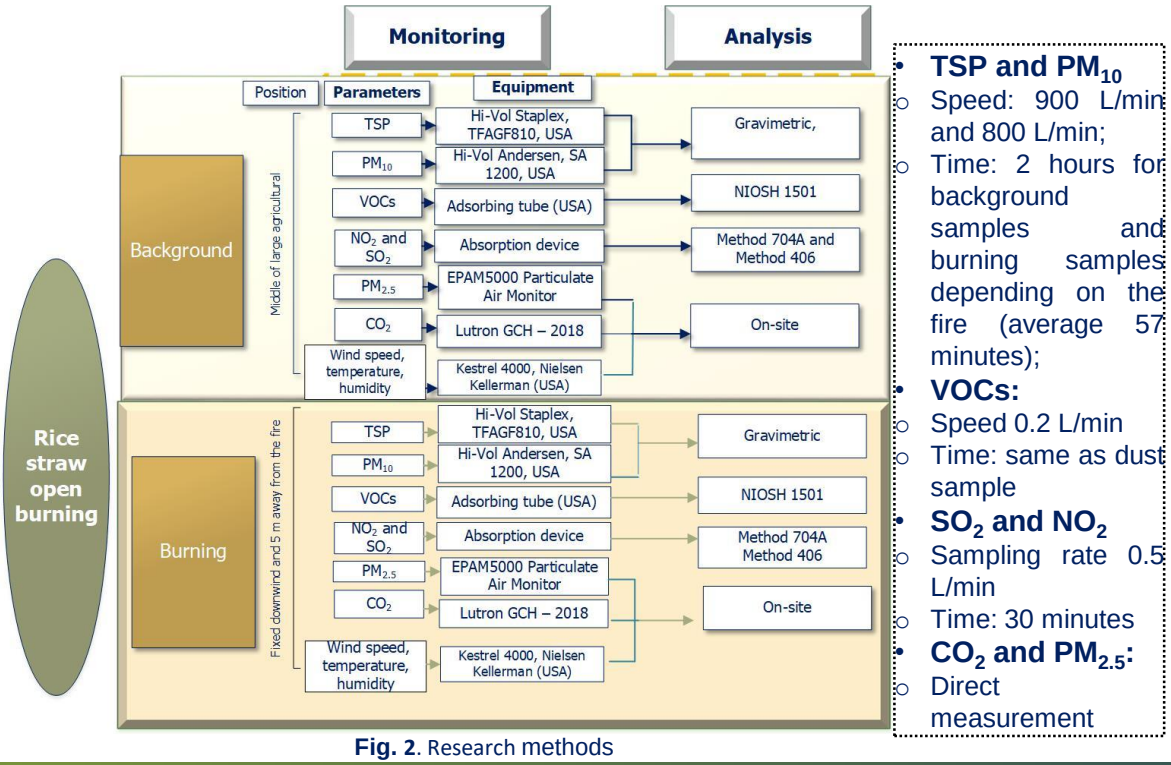
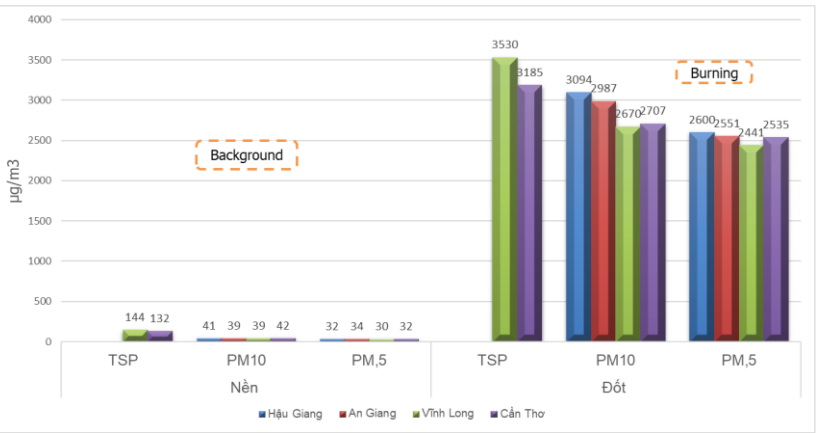


Fig. 2. Research methods

- **TSP and PM_{10}**
  - Speed: 900 L/min and 800 L/min;
  - Time: 2 hours for background samples and burning samples depending on the fire (average 57 minutes);
- **VOCs:**
  - Speed 0.2 L/min
  - Time: same as dust sample
- **SO_2 and NO_2**
  - Sampling rate 0.5 L/min
  - Time: 30 minutes
- **CO_2 and $PM_{2.5}$:**
  - Direct measurement

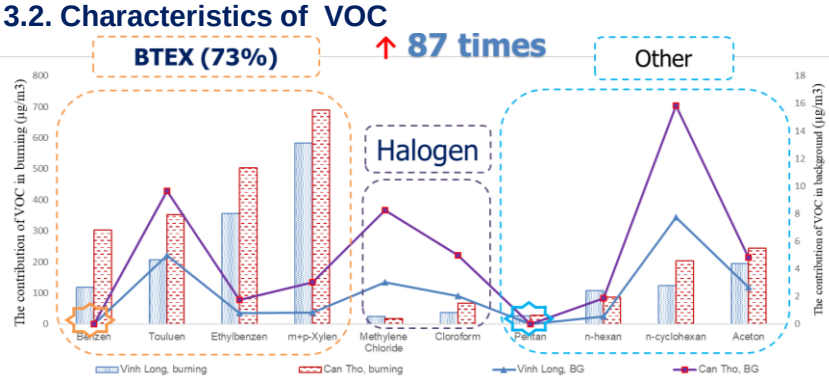
3. RESULT AND DISCUSSION

3.1. Characteristics of PM

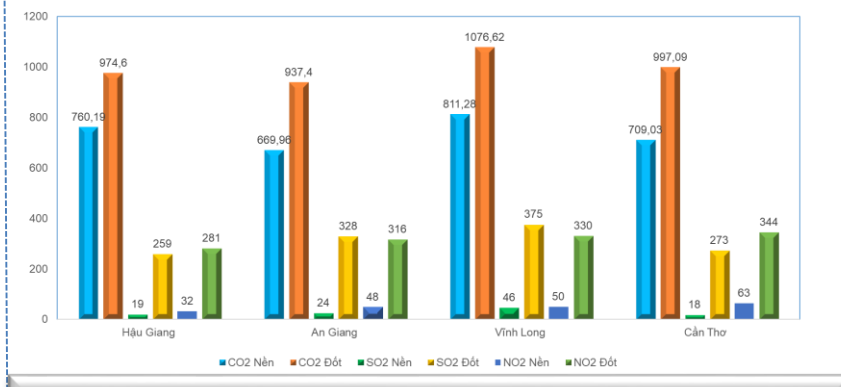


PM (burning)/PM (burning)↑ → $PM_{2.5}$ (82) > PM_{10} (72) >TSP (25)

3.2. Characteristics of VOC



3.1. Characteristics of gas pollution



4. CONCLUTIONS

- The characteristics of PM, VOC and primary gaseous pollutants from RSOB in the Mekong Delta of Vietnam were studied.
- The results showed that the RSOB made the concentration of PM ($PM_{2.5}$, $PM_{10,}$ and TSP) in the ambient air in the surrounding area increase from 25 to 82 times compared to the background concentration, in which the smaller the size of PM ($PM_{2.5}$), the greater the increase.
- BTEX group was found to be the dominant contributor to the total of 10 speciated VOCs, accounting for 73%.

References

1. Phuong, P.-T. H., Nghiem, T.-D., Thao, P.-T. M., Pham, C.-T., Thi, T.-T. & Thanh Dien, N. (2021) Impact of rice straw open burning on local air quality in the Mekong Delta of Vietnam, *Atmospheric Pollution Research.* **12**, 101225 https://doi.org/10.1016/j.apr.2021.101225

Kyoto University International ONLINE Symposium 2021
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Concentrations of $PM_{0.1}$ and $PM_{2.5}$ at high polluting events day in Hanoi and the effects of meteorological conditions

Authors: Dat Quoc Nguyen*, Ha Thi Le Vo*, Anh Dieu Van*, Hien Thi Thu Nguyen*, Thuy Bich Ly*, Nam Duy Dao*, Anh Doan Thuc Le*, Anh Duc Hoang*, Hanh Thi Hong Cao*, Dung Trung Nghiem*, Tien Vu Nguyen*

** School of environmental science and technology, Hanoi University of Science and Technology*

Introduction

Environmental pollution, especially air pollution, is known as one of the most serious global problems today. The problem of air pollution occurs not only developing countries but also in developed countries. The high concentrations of fine ($PM_{2.5}$) and ultrafine ($PM_{0.1}$) particles in the atmosphere can have adverse effects on the environment and human health. Particulate matter in general also acts as an agent to transport bacteria, viruses and molds into the human body.

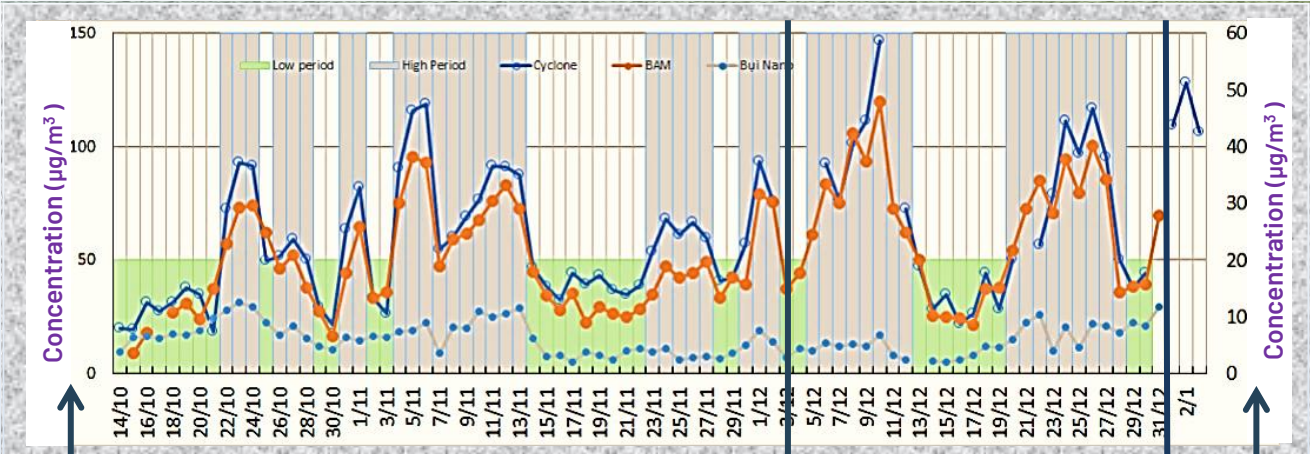
Research Objective

This study focused on determining the mass concentration of PM and meteorological factors during periods of high pollution levels in Hanoi.
Research object were $PM_{2.5}$ and $PM_{0.1}$. Daily samples were collected on the top of third-storey building, inside Hanoi University of Science and Technology, Vietnam from the middle of October to December 2020.

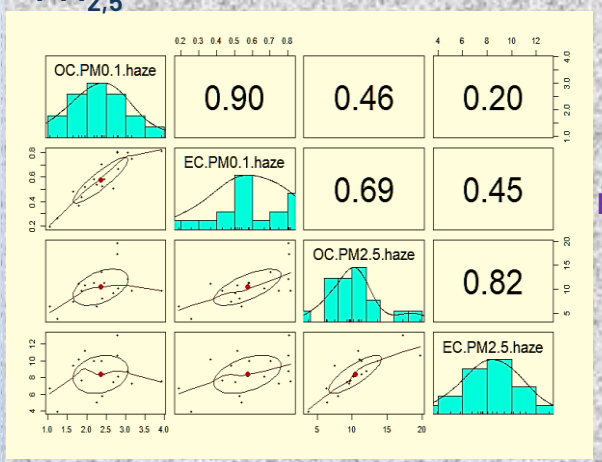
Methodology

1. Sampling method: Using Nano Sampler device to capture $PM_{0.1}$ and Cyclone device to capture $PM_{2.5}$.

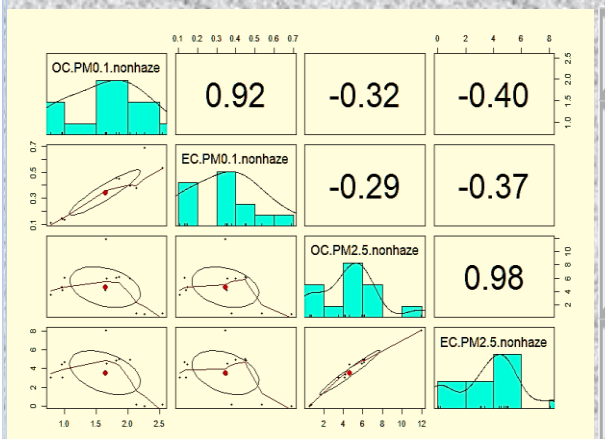
2. Analytical method:
-The OC-EC component was analyzed on a DRI instrument based on the IMPROVE method.
-Using the regression analysis and correlation matrix to analyze the influence of meteorological factors.



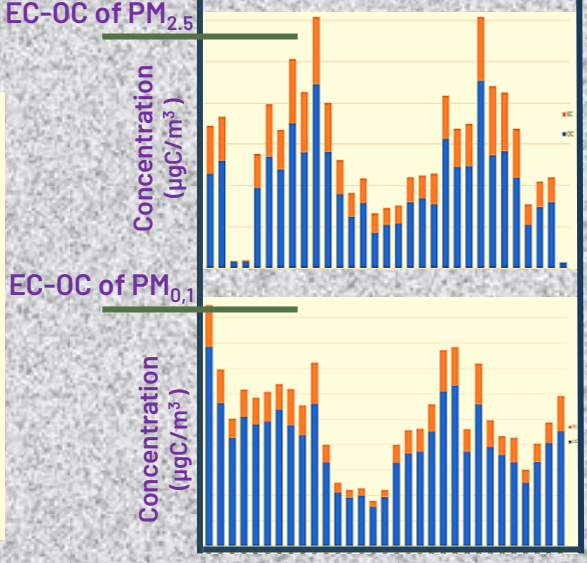
$PM_{2,5}$ Haze



Non-Haze



EC-OC of $PM_{2.5}$



$PM_{0,1}$

EC-OC of $PM_{0,1}$

Results of regression analysis

Parameter	Coefficient of multiple determination (adjusted R^2)	Slope	Variable ($p<0,05$)
$PM_{2.5}$	0.70	-17.32	Ws
		-0.10	Wd
		-11.75	$Ws_{(p)}$
		-0.55	RH
		-0.09	$Wd_{(p)}$
$PM_{0.1}$	0.47	-0.94	Ws
		-0.10	RH
		0.01	Wd

Note: $Ws_{(p)}$: Wind speed in the previous day; $Wd_{(p)}$: Wind direction in the previous day

Result

There were seven periods of high pollution levels for 2.5 months of sampling. The daily $PM_{2.5}$ concentrations were in the range of 19-147 µg/m³, which were 2.5-4 times higher than the WHO guideline. Meanwhile, the concentrations of $PM_{0.1}$ varied from 2-13 µg/m³ with an average value of 6 µg/m³. High correlations of OC and EC in both particle sizes during Haze and Non-haze periods implied that, these elements were attributed to same origin. The EC/OC ratios were also found in the range of 1.6-3 for $PM_{2.5}$ and 3.3-7.6 for $PM_{0.1}$, suggesting that the sources of pollution could be transportation, domestic cooking, biomass and coal burning sources.. The investigated meteorological factors could explain 70% $PM_{2.5}$ variations but only 47% of $PM_{0.1}$ variations.

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Development, Validation and Application of 3D-printed IoT-based Water Quality Monitoring System in Carey Island, Malaysia

Yong Jie Wong*, Akinori Kamiya*, Rei Nakayama*, Yoshihisa Shimizu* and Nik Meriam Nik Sulaiman**

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**Department of Chemical Engineering, Faculty of Engineering, University of Malaya, 50603, Kuala Lumpur, Malaysia

Introduction

Recent technological advances and developments have evolved the application of the Internet of Things (IoT), low-cost sensors, and three-dimensional (3D) printing for near-real-time water quality monitoring; however, these technologies have not yet been widely implemented in field operations. In this study, a solar-powered 3D-printed IoT-based water quality monitoring system (WQMS) that measures turbidity and water level every 2 h was developed and utilized in a palm oil plantation on Carey Island, Malaysia, for two months.

The findings of this study are expected to provide comprehensive information, including on practical implications, to relevant authorities and practitioners for decision making, future development and application of 3D-printed IoT-based WQMSs. The ultimate objective is to address the inadequacies in water monitoring programs, particularly in developing countries, to contribute to the fulfillment of the UNSGDs.

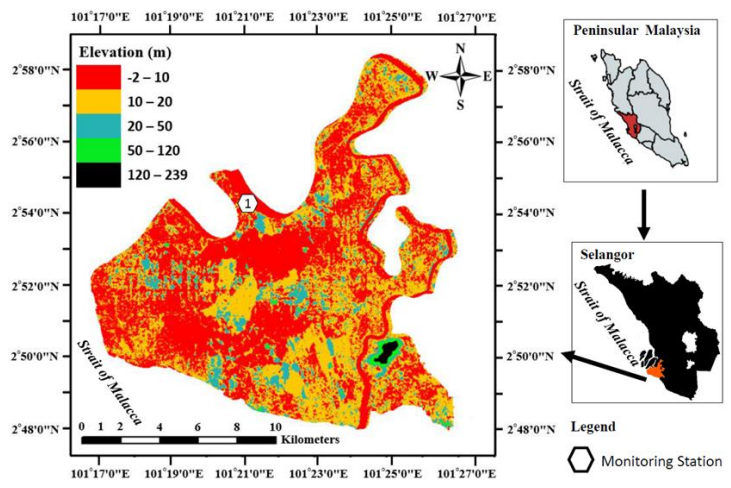


Fig.1: Geographic location of Carey Island

Methodology

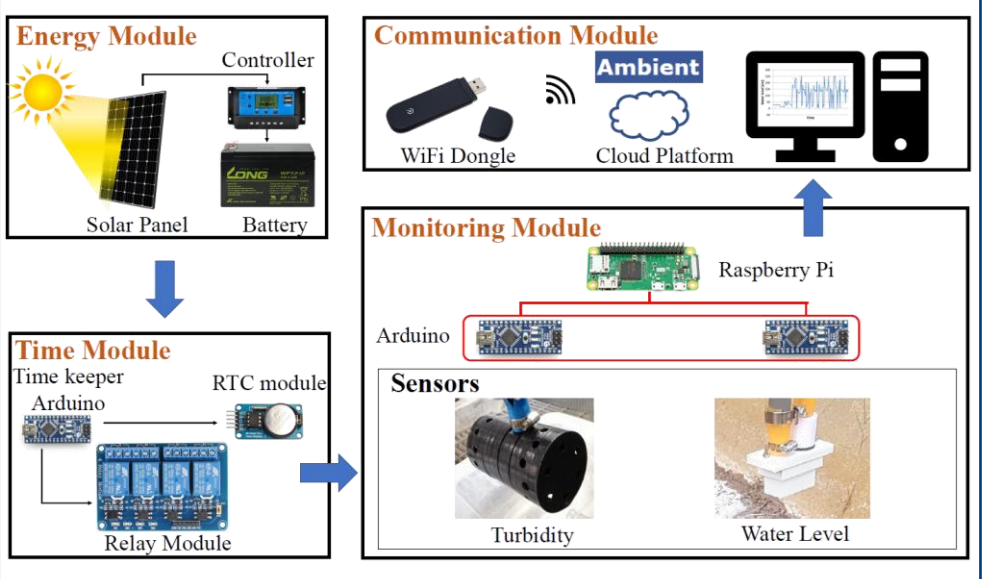
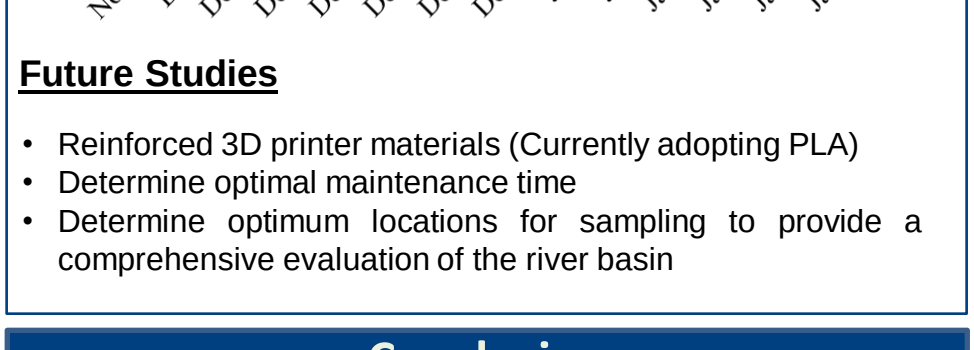


Fig.2: Overview of 3D-printed IoT-based water quality monitoring system.

Results & Discussions

Sensor Calibration



Field Deployment

Future Studies

- Reinforced 3D printer materials (Currently adopting PLA)
- Determine optimal maintenance time
- Determine optimum locations for sampling to provide a comprehensive evaluation of the river basin

Conclusion

The study revealed the high potential of utilizing solar energy as the primary energy source for operating low-power WQMSs in tropical countries. The proposed WQMS implemented demonstrates the effective integration of IoT with 3D printing, microcomputers, and low-cost sensors, paving a new path for the development of cost-effective and reliable systems for water quality monitoring.

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Effect of Rainfall Pattern on Chemical Leaching from Excavated Dolerite

Authors: Yingzhou Shao*, Jiajie Tang*, Lincoln W. Gathuka*, Tomohiro Kato *, Atsushi Takai * and Takeshi Katsumi *

* *Kyoto University*

Background

Photo of tunnel excavation

- Rocks/soils containing geogenic contaminants, like arsenic, may be excavated during construction processes, and could leach unacceptable concentrations of contaminants.
- Utlization of the rocks is promoted, therefore understanding the ***leaching behavior*** is important to assess the environmental risk.

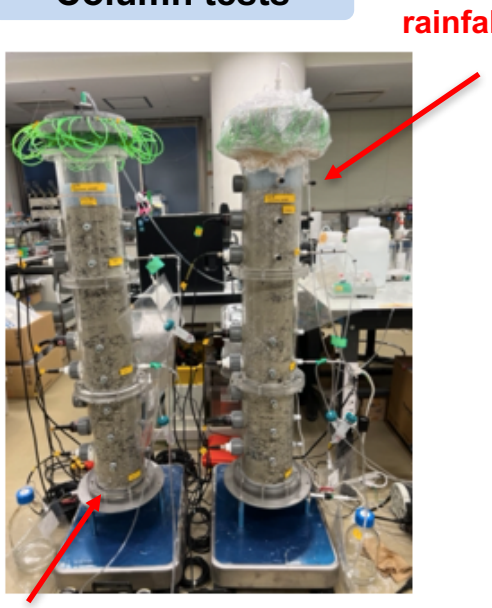
Objective:

- The work focuses on how changing ***wet and dry conditions*** influence the leaching behavior of ***geogenically contaminated rocks/soils.***
  - ***Continuous*** and ***intermittent rainfall*** were simulated using rainfall-type column tests.
  - The ***pH*** and ***electricity conductivity*** were measured as fundamental information.

Materials

Photo of the excavated dolerite. It contains geogenic arsenic

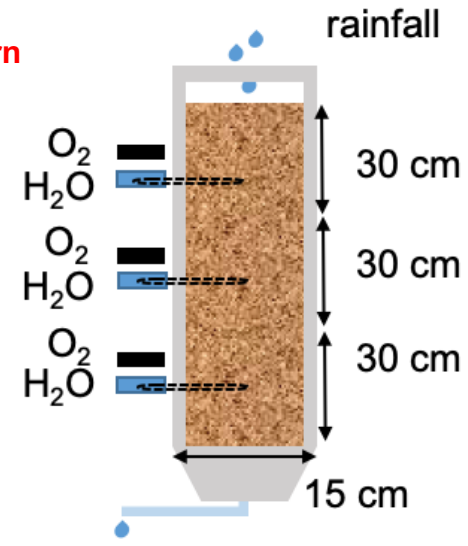
Column tests



Continuous rainfall pattern

Intermittent rainfall pattern

Photo of column tests



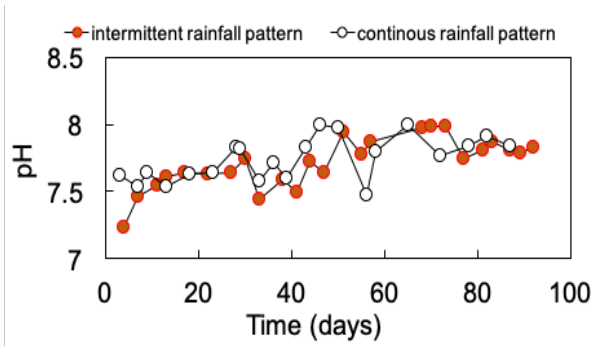
Schematic diagram of column test

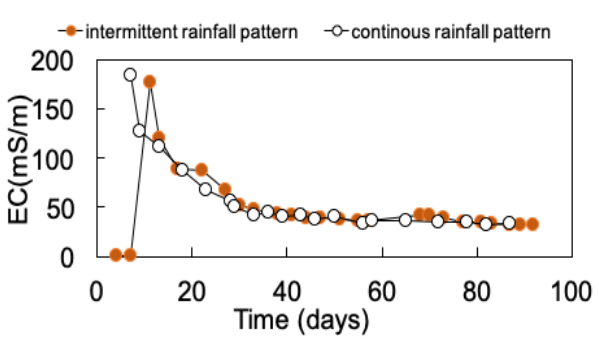
Experiment conditions

Parameter	Value
Column Diameter	15 cm
Column Height	90 cm
Rainfall water	Distilled water
Dry density	2.51 g/m^3
Rainfall pattern	15 mL/h, every day 105 mL/h, 1 day each week

- ***Arsenic concentration*** has not been measured yet.

Results and Discussion





The variation of pH and electrical conductivity (EC) with time.

- Alkaline leachates are released from the dolerite. The trends in pH are similar regardless of rainfall pattern.
- Under the pH conditions, the dissolved arsenic should be less toxic and mobile.
- EC is reducing with time, which is an indication that lower concentrations of dissolved ions are contained in the leachate.

Effective Synthetic Wastewater Treatment Using Activated Carbon Derived from Banana Peel

Amy Aynee Chan*, Archina Buthiyappan*, Abdul Aziz Abdul Raman*

* Department of Chemical Engineering, Faculty of Engineering, University of Malaya

Background

Figure 1: Textile products

- Textile industries have used more than 10,000 types of dyes.
- > 7 x10^5 tons of dyes have been used per year in making textile products.
- Around 30-40% of dyes will be discharged to the environment.

Agricultural Wastes

- 1000 million tons/year
- Long-term availability
- Potential precursor in developing adsorbent

Banana Peels

- Banana production of 56.4 million metric tons
- Cellulose, hemicellulose, lignin, high carbon content

Agricultural Banana Peel Wastes → **High potential green adsorbent**

Objective

- To develop a green adsorbent from raw banana peel wastes.
- To characterize the newly synthesized activated carbon from banana peel.
- To evaluate the removal of color efficiency newly developed adsorbent.

Methodology

Banana peel wastes

Washed → Pyrolysis (500°C, 2h)

Dried at 105°C

KOH:Char 2:1

Pyrolysis (750°C, 2h) → Washed and dried → Stored

Optimization using RSM-CCD model by Design-Expert Software → FESEM analysis

Results and Discussion

1. Characteristics of Adsorbent

Raw banana peel wastes | Banana peel activated carbon

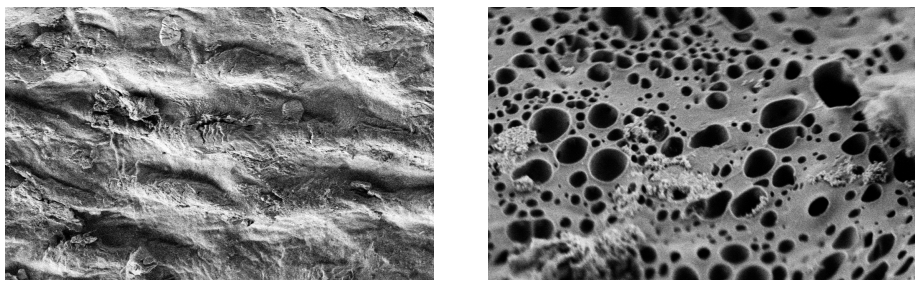


Figure 2: FESEM analysis

2. Adsorption Study

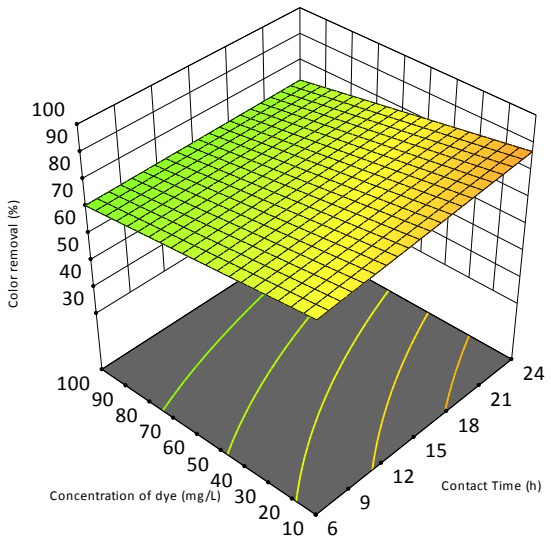


Figure 3: RSM-CCD plot

- When the dye concentration is fixed, color removal efficiency increases when the contact time increases from 6 h to 24 h.
- When the contact time is fixed, the color removal efficiency decreases when dye concentration increases from 10 mg/L to 100 mg/L.
- Maximum color removal efficiency of 98.7% was achieved under optimum condition.
- Banana peel activated carbon has higher porosity, thus higher color removal efficiency compared to raw banana peel wastes.

- pH: 3
- Adsorbent dosage: 5.0 g/L
- Initial dye conc.: 100 mg/L
- Contact time: 6 h

Removed → 98.7% RBBR dye

Agricultural banana peel wastes → Effective green adsorbent

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Emission Rate of Atmospheric Polyvinyl Chloride (PVC) Microplastic from Plastic Processing Activities

Authors: Thang Nguyen *, Ekbordin Winjikun (Advisor)**, Tatchai Pussayanavin (Committee member)**, and Nguyen Thi Kim Oanh (Committee member)**

* Marine Plastic Abatement Program, Asian Institute of Technology, Thailand

** Department of Environmental Engineering and Management, School of Environment, Resources and Development, Asian Institute of Technology, Thailand

BACKGROUND

Microplastics (MPs) are plastic particles in the size of 1 µm – 5 mm [1]. MPs have a homophobic surface, thus can adsorb **toxic pollutants** in the environment [2], and **airborne MPs** can adsorb some volatile **POPs or PAHs**. They have detrimental effects on biota as most of them are carcinogenic or genotoxic [3]. In addition, additives in plastics and MPs may be released from the matrix [4] and entering the bodies, interfere with hormones, modify genetic chains, etc. [5]. Thus, MPs can become a serious concern combine with their ubiquity [5] as they can enter the food web through ingestion and inhalation. **Atmospheric MPs** are also as a raft to **microorganisms**, protect them in the atmosphere and transport them to the lung directly [4].

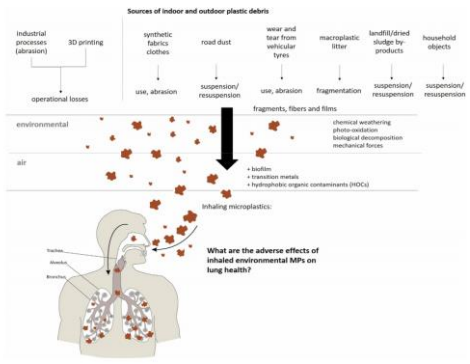

Figure 1: Atmospheric MP sources [2]

Mostly the MPs exposure tend to be **occupational** due to inadequate working conditions. Furthermore, atmospheric MPs from industrial processes may adsorb chemicals and become more toxic [4]. Occupational diseases are regularly found in synthetic textile, flock and **PVC factories** workers. Among them, PVC is a major concern. PVC dust, VC (its monomer), and their thermal decomposition products are considered toxic. **VC exposure** (as low as 1-5 ppm) can lead to **tumor growth** and **cancers**. **PVC dust** can easily settle and **remain in the lung** for a long time, slowly release toxic substances [6]. However, PVC dust is still treated as a nuisance dust [7]. Therefore, research on the emission of PVC dust from processing activities is the first step towards better protection against PVC MPs.

METHODOLOGY

The primary objective of this study is estimating the MP **emission rate** from cutting PVC pipes and identifying the PVC MP's **shapes and sizes**. PVC pipes (blue in color) were cut inside a closed chamber to capture the emitted MPs and prevent contamination. The total length of the PVC material processed was **exactly 1 m**. The inside-chamber air was collected by the vacuum pump on top, and led to the inlet of the high volume sampler with 5-mm U.S. sieve, onto a quartz filter paper. The duration of the sampling process was **15 minutes**. All samples were weighed by 5-digit balance and counted the visible particles and identify the shapes and sizes by microscope.

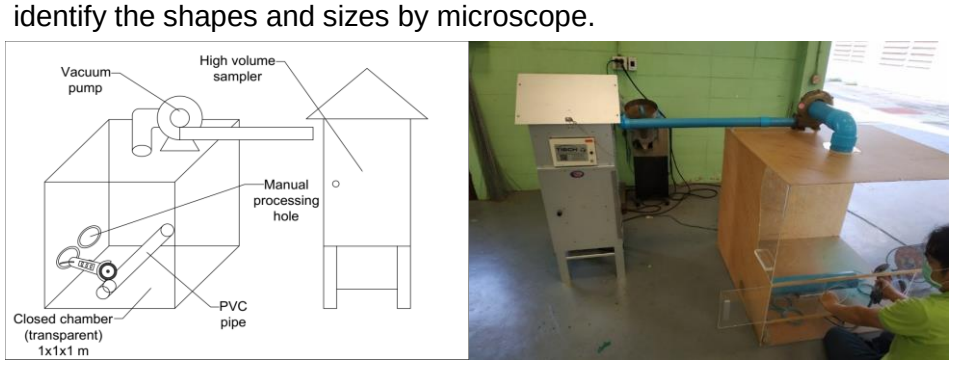

Figure 2: The experiment

RESULTS

The results were collected and used to calculate the MPs emission rate in weight and in number of visible particles. The average emission rate of PVC pipes cutting process was **0.10 ± 0.03 mg/s**, among that the average number of visible microplastics was **2,027 ± 341 particles/s**. Thus, the emission factor are 0.10 ± 0.03 mg, and the observable particles was 2,027 ± 341 particles per 1 m PVC pipe cut.

The shapes and sizes of the collected PVC particles were also observed. The dominant type of PVC MPs on the samples was fragment, accounted for almost 100% of the MPs. The fragments had the size of **50 µm or lower**, but the majority of them were in the range of **inhalable particles (PM_{10})**. It is likely that they were $PM_{2.5}$ particles. However, the pore size of the filter paper used was 2.2 µm, therefore it can only be certain that the size range of the particles was **2.2-2.5 µm**.

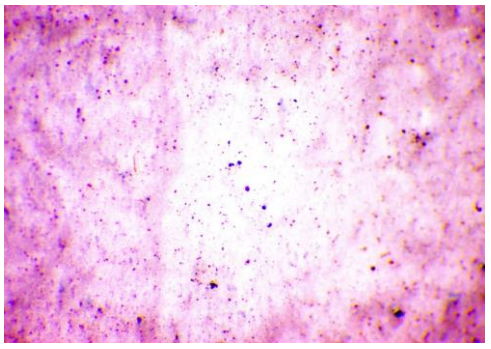

Figure 3: The samples in high exposure light

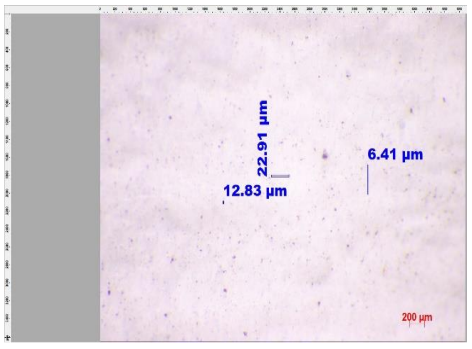

Figure 4: Sizes of fragment

DISCUSSION

These data can be used as the **initial data** for future research, as well as **emission inventory** activities for PVC processing factories. The values of the emission rate seem to be small, but when multiplied with the total working hours per day, which is normally 24 hours, the total emission would be high, with **PM_{10} and $PM_{2.5}$** particles to be the **dominant** types, posing risks of exposure for workers. These number can also be used as references in building **emission datasets** that serves the decision making processes.

This research focused on only **PVC MPs** from cutting **PVC pipes**, however, there are many other PVC items as well as other types of plastic. The methods employed in the research also had some **limitations** such as in identifying the shapes and sizes of small particles, and the Quartz filter paper's structure can interfere with the **observation process**. Therefore, future studies can focus on these aspects and their solutions (different materials, more advanced technologies). Finally, because almost 100% of the PVC in the sample was fragment, it might be considered **homogenous**, similar to PM_{10} or $PM_{2.5}$. Thus, it is possible that **modelling software**, such as AERMOD, can be applied to research on PVC MPs emitted from a PVC processing facility.

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[1] GESAMP (2019).
[2] Amato-Lourenço et al. (2020).
[3] Wang et al. (2018).
[4] Prata (2018).
[5] Zhang et al. (2020).
[6] Wagoner (1983).
[7] Mastrangelo et al. (2003).

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Environmental impact evaluation and hotspot analysis of volatile fatty acids production from waste wood chips

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Introduction

The recovery of resources from waste wood chips can reduce the challenge of resource consumption for sustainable development. The volatile fatty acid (VFA) product as a deicer is one of the recovered resources, which technology is based on biogas production technologies of recovering energy from waste streams. VFA production can replace traditional de-icing salts to reduce the problem of deteriorating durability of reinforced concrete, soil salinization, and destruction of vegetation. In this research, life cycle assessment (LCA) was utilized to evaluate the environmental impact hotspot of the VFA production in a big scale experiment (1000L) with the expectation of improving the environmental friendliness of VFA products. LCA identifies environmental impact hotspots provide suggestions for environmentally friendly improvement of VFA production.

Method

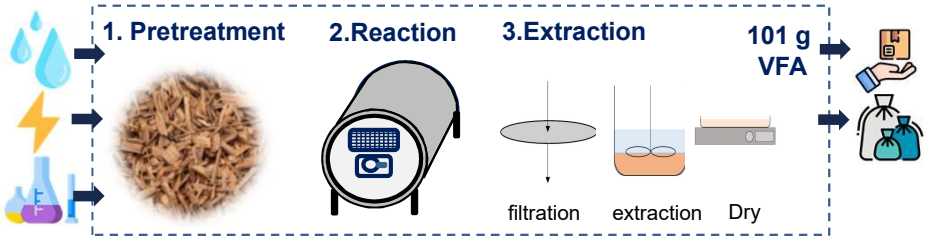

Fig. 1 System boundary of the VFA production. The function unit is defined as production of 101g of VFA from waste wood chips.

LCA is a well-known green design method for evaluating the environmental impact of a product or service. It follows the principles of ISO 14040 (ISO, 2006) and consists of four steps: goal and scope identification, inventory analysis, impact assessment and interpretation. LCA as a quantitative environmental sustainability assessment method is useful to integrate sustainability considerations in the experiment steps. In this research, LCA analysis was used to evaluate the environmental impacts of VFA production with resources, energy, chemicals consumption, and waste treatment (Fig 1). SimaPro software with Eco-invent databases and the EDIP 2003 impact assessment method was used for the LCA.

Result

The normalisation results for the environmental impact of each step point out that the reactor has the greatest impact (Fig.2). Hot-spot analysis helps to identify the main impact and shows that the energy requirement had the most remarkable impact as high as 73.91%, especially in the reaction step. The result further pointed out the importance of waste management and chemical use management, which account for 14.72% and 10.27% of the environmental impact, respectively (Fig. 3).

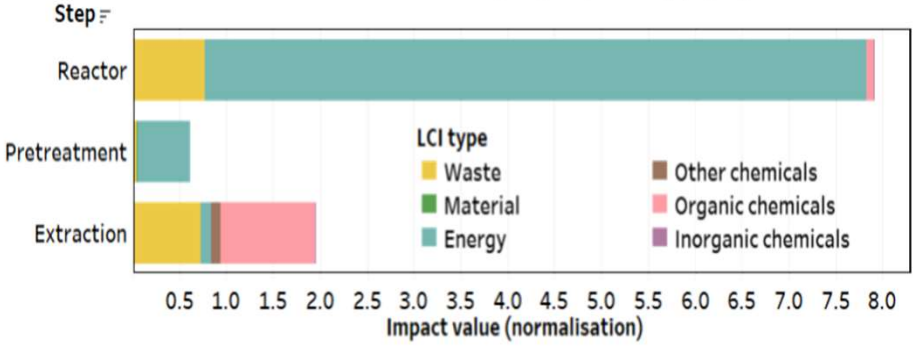

Fig. 2 Normalisation results of each step's environmental impact

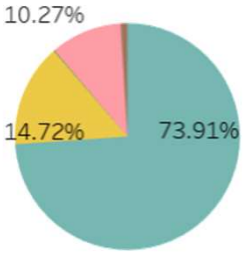

Fig. 3 Hotspot analysis on contribution of the environmental impacts of VFA production

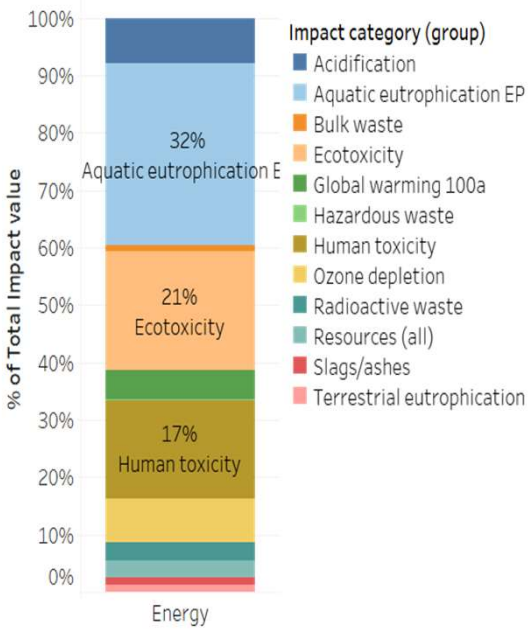

Fig. 4 Analysis of the impact categories of energy use in Japan

Since energy consumption has the greatest impact, the impact categories of energy use in Japan were analyzed. The electricity grid of Japan consists of coal in 28%, Natural Gas (LNG) in 35%, renewable energy in 9% and nuclear power in 4%. The impact of energy uses are mainly aquatic eutrophication EP (32%), ecotoxicity (21%), and human toxicity (17%) (Fig. 4). Improving production efficiency, such as reducing time and increasing throughput, will help reduce the environmental impact from energy consumption.

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Experimental Evaluation on Corroded High Strength Cables from Collapsed Myaungmya Bridge

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Introduction

- Many long-span bridges were built throughout Myanmar within the limited resources and construction time by the government around the 1990s to develop a better transportation network of the nation.
- Corrosion Attack is found to be one of severe background problems related to design, construction and maintenance of these bridges.

Problem Statement

- Connecting Yangon and Pathein Cities of Myanmar, 1270 feet long Myaungmya Suspension Bridge collapsed on 1st April 2018, after 22 years of service.
- The main cause of bridge collapse is the rupture of the main cables due to corrosion induced by water accumulation at the anchorage according to site investigation report.
- The steel strand of bridge cables is composed of seven 5-inch diameter wires with designed ultimate strength (1570 MPa).

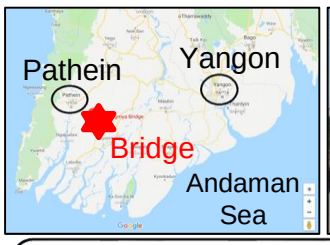
Objectives

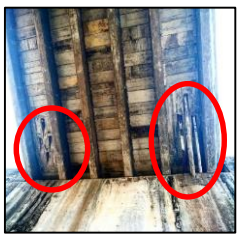
- To find out the influence of corrosion on steel bridge cables
- To evaluate the strength of steel bridge cables at its failure

Review on Past Studies

Possible scenarios of bridge cables' failure:

- Lack in structural integrity of cable, anchorage, & tower (Soil and Construction)
- Out-of-date corrosion protection system and Weakness in bridge maintenance





Methodology

NCHRP Report 534 and ASTM Standards

Study on Mechanical Properties
Chemical Analysis
Corrosion Analysis

→ the standard of steel strand used

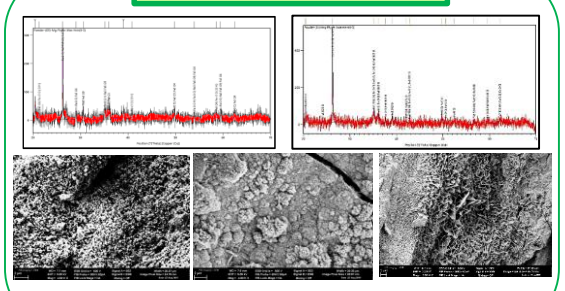
Study on Mechanical Properties

Hardness, Tensile and Fatigue Tests

Chemical Analysis

Spectroscopic Test

Corrosion Analysis



XRD and SEM Examinations

Discussion and Conclusion

- The corrosion stage of bridge cables from the bridge's anchorage part (the most critical area) is found to be **"Stage-4 Corrosion"** (with some cracks) and severe corrosion condition, initiating from the **pitting corrosion**. is also confirmed by SEM and XRD result.
- By Spectroscopic Test, the steel type used as bridge cables is found to be **high strength hypereutectoid steel** (%Carbon > 0.8%). **Tensile Test** ensures that the ultimate tensile strength of bridge cables at bridge failure is estimated as 1490 MPa (<1570 MPa) by the simplified model due to the presence of cracks although the average value is 1645 MPa. There is no great difference with the result of the **hardness test** for the average value of the core wire (1470 MPa). It is proved that type of steel used in bridge is ***high strength steel although the tensile strength is found to be less than the designed ultimate tensile strength***. Only the China Standard such as GB/T 33026 and GB/T 5224 is found to be the best fitted in determining steel standard.
- The steel cables at the time of failure are observed to be **sensitive to fatigue stress** because of the observed low exponents of S–N curves (<zero). Chemical composition in which the content of carbon and chromium is beyond the maximum limit also adds the brittle behavior of bridge cable.
- The formation of iron oxides and the chloride salts also highlights the **corrosive environment** of the bridge cable which may be induced as air-born salts (atmospheric corrosion) or the river water near the coastal area since there was water accumulation found in the anchorage.

Severe corrosion on bridge cables results in the Brittle Rupture of the main cables in the anchorage which leads to the catastrophic failure of the whole bridge.

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FINE PARTICLE-BOUND POLYCYCLIC AROMATIC HYDROCARBONs (PAHs) AT AN URBAN SITE OF HANOI, VIETNAM: CONCENTRATIONS, SOURCE DIAGNOSIS AND HEALTH IMPLICATIONS

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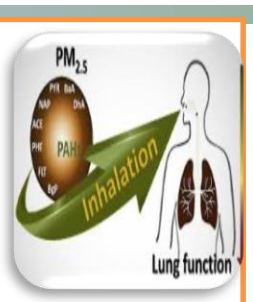
Introduction



Polycyclic aromatic hydrocarbons (PAHs):

- aromatic compounds with two or more fused benzene rings in their structural configurations.
- ubiquitous environmental pollutants generated primarily from the incomplete combustion of organic materials.
- one of the primary organic compound found in PM2.5 and of major health concern due to its carcinogenesis and mutagenesis.

Hanoi, Vietnam: high pollution of PM2.5 in winter

Objecttives

❖ To evaluate the level of PAHs bound to fine particle in an urban site of Hanoi, Vietnam, PAH potential sources, and the health risks

Method

Research Methods

Sampling:

Site: An urban site of Hanoi (21°00'20.8"N; 105°50'39.1"E)

Time: Jan.- Feb. 2018

Sampling equipment: Nano sampler device and Cyclon device

Fine particle bound PAHs analysis: ultrasonic extraction and GC/MS.

Source diagnosis: PAHs isomer diagnosis

Health risk estimation: WHO lifetime increased cancer risk (ILCR) model.

$$LADD_{inh} = \left(\frac{C_g \cdot ET \cdot EF}{AT_{car}}\right) \cdot \left[\left(\frac{InhR \cdot ED}{BW}\right)_{children} + \left(\frac{InhR \cdot ED}{BW}\right)_{Adult}\right] \cdot cf$$

$LADD_{inh}$: Lifetime average daily dose via respiration mg/kg/day

ILCR = LLDD x CSF

ILCR: Lifetime cumulative cancer risk

CSF: Cancer slope coefficient for exposure route

Result

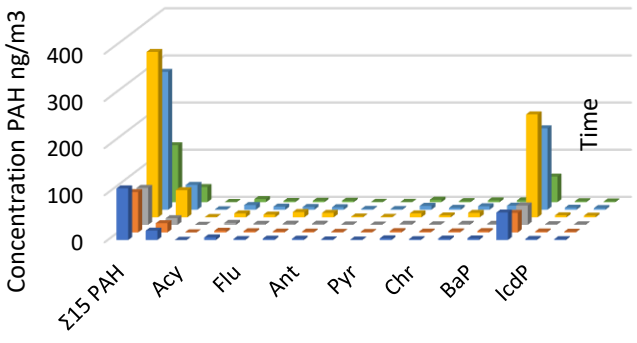


Fig. 1. Concentration of 15 PAHs in PM2.5

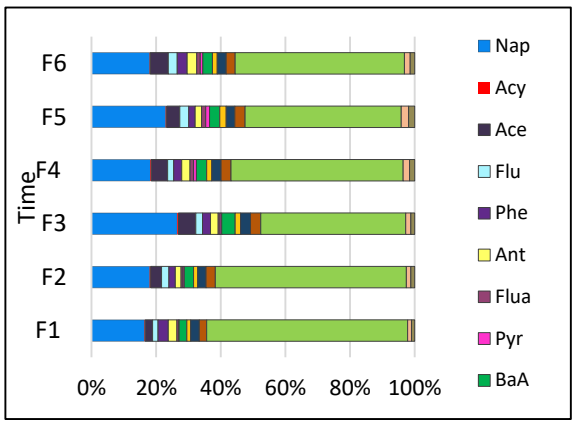


Fig. 2. Composition of PAHs in PM2.5

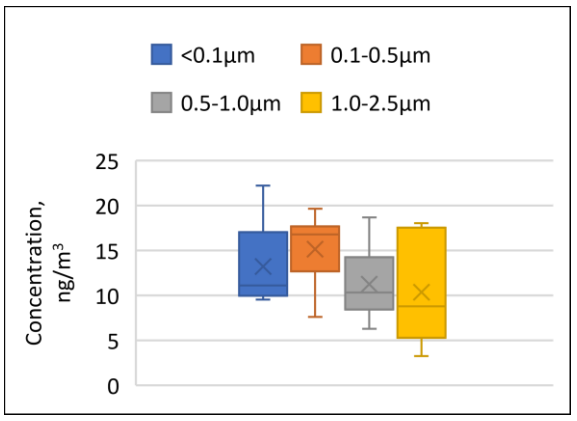


Fig. 3. Concentration of 15 PAHs according to particle size

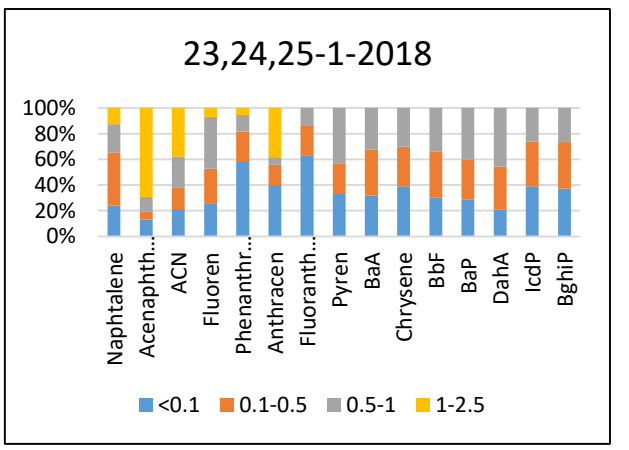
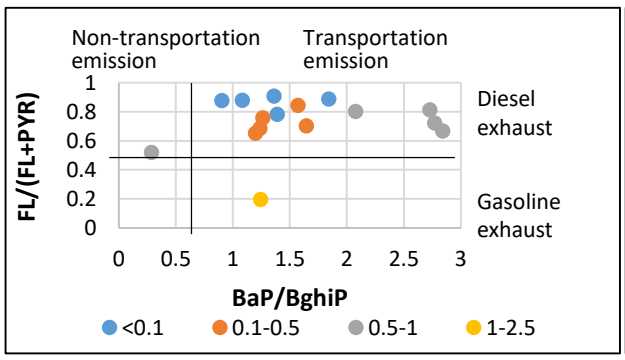
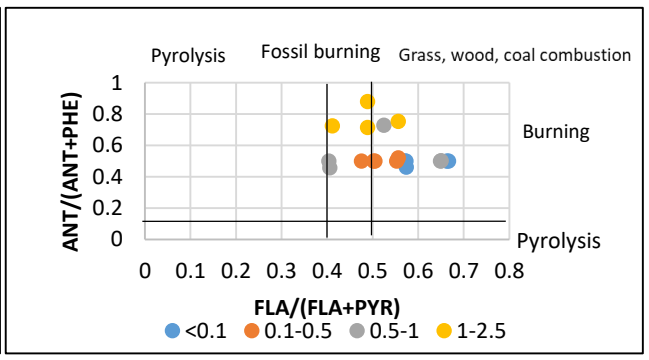


Fig. 4. Composition of PAHs in particle size fraction





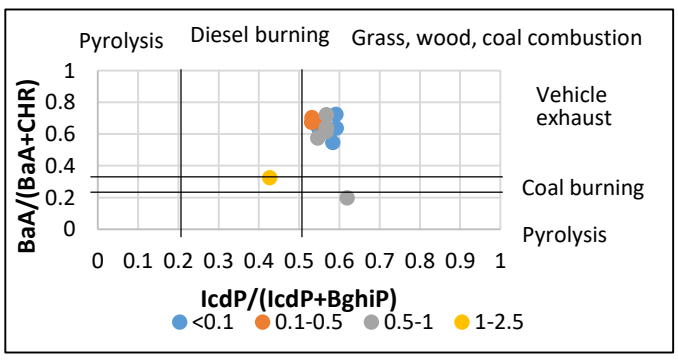


Table 1. Lifetime cumulative cancer risk for PAHs

Object	ILRC
Children	2.20E-06
Adults	4.82E-06

Conclutions

The total concentration of 15 PAHs in PM2.5 fluctuated greatly in the range of 78.40 - 350.7 ng/m^3. DahA was the most dominant PAHs followed by NaP

In term of size distribution, 5,6 ring- PAHs mainly associated with $<1\mu m$ particles, less than 5ring PAHs mainly distributed in the larger size fractions

The potential source of PAHs at the investigated site was from gasoline exhaust from transportation and the biomass burning

The cancer risk related to PAH exposure exceeded the "safe limit" recommended by the USEPA (10^{-6}) at the investigated sites

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Computational Analysis of CT scan based patient's left coronary artery (LCA) model with respect to Fluid Structure Interaction

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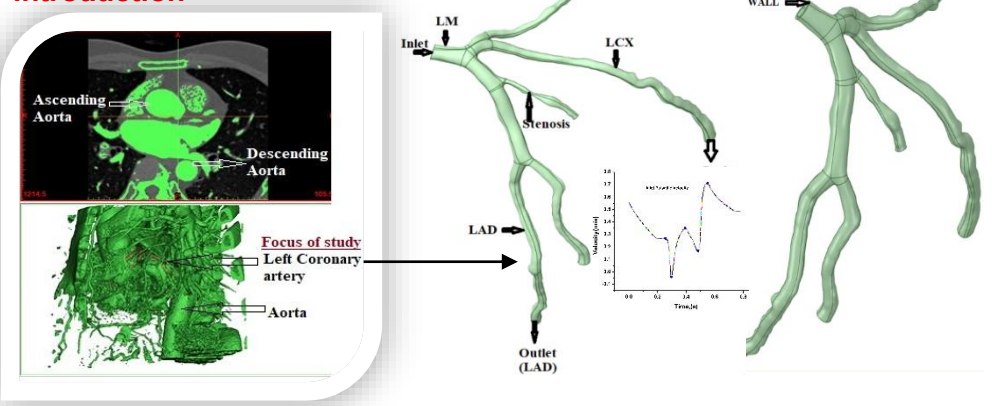
Introduction

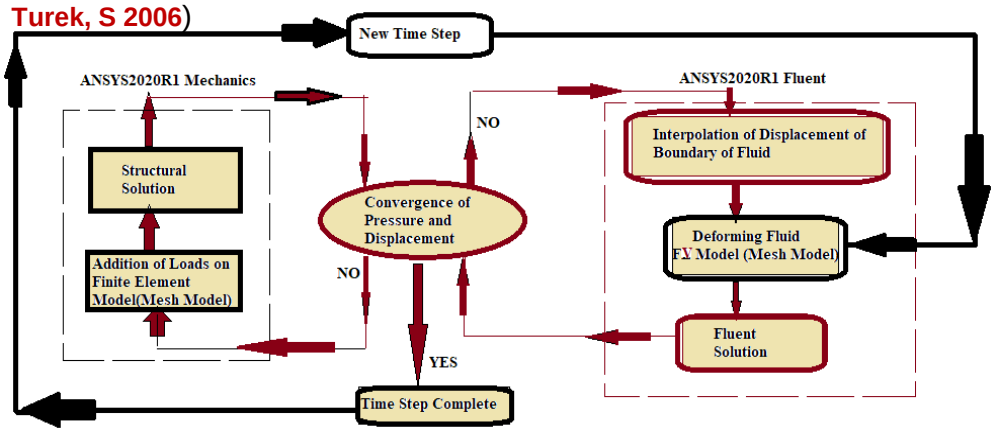


The hemodynamic parameters and arterial endothelium played an important role in the formation and development of vascular disorders (**Malek A M et al 1999**). CFD models in realistic arteries with wall interactions indicate disrupted flows and fluctuations in wall shear stresses, allowing for early identification of the development of stenosis. Numerical models of the blood flow in branched (Left Anterior Descending and Left circumflex LCx) sections of the left coronary artery (LCA) and wall thickness deformation is established. A real geometry model of patient having stenosis was reconstructed using 2d CT scan images (computed tomography) and converted into 3D model using image processing software MIMICS. The artery wall thickness (0.5mm) is later developed using commercial software ANSYS 2020R1. The pulsatile blood flow velocity at inlet is assigned and outflow at outlet boundary condition is given to the real model. (**Athani A et al 2021**)

Two-way coupled fluid structure interaction simulation has been carried out for single phase blood flow inside the presence of flexible artery wall (endothelium layer).

2. Methodology

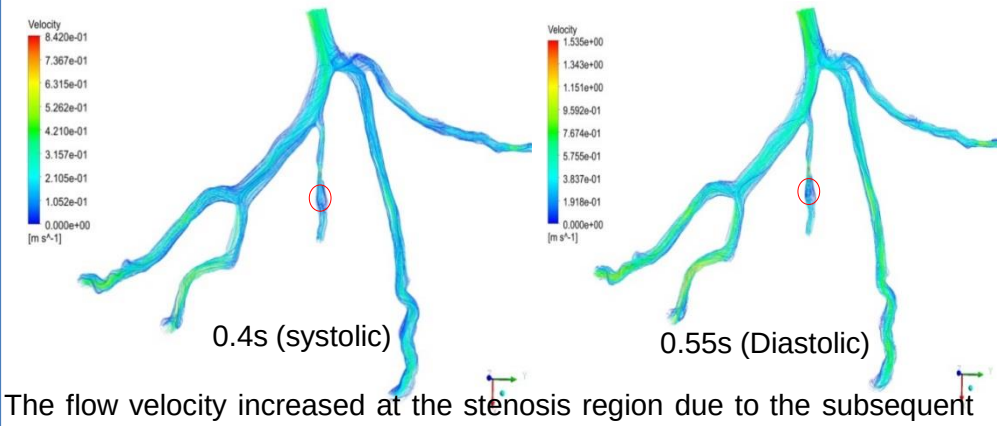
FSI coupling is performed by the creation of two models that are separately comprised the fluid and the solid domain. The FSI was resolved using a standard Arbitrary Lagrangian-Eulerian (ALE) formulation. (**Hron, J. and Turek, S 2006**)



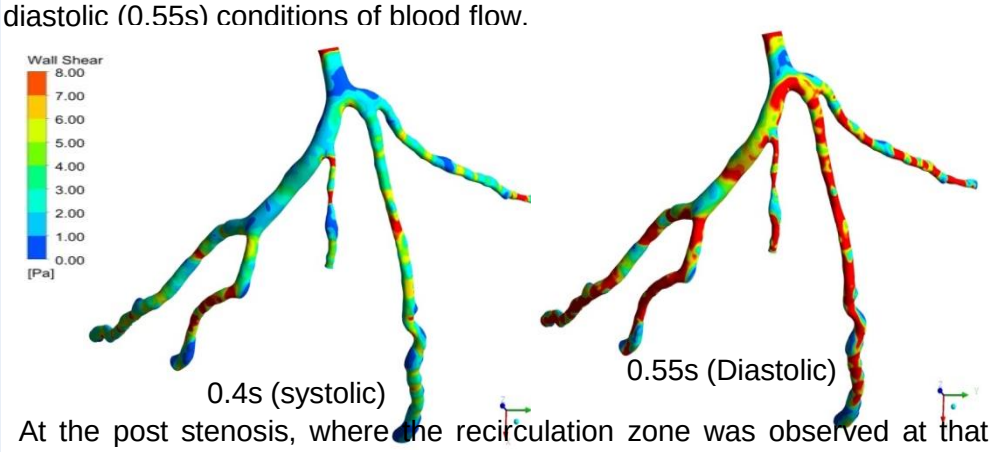
Fluid Properties	Value	Structural Properties	Value
Blood Density(ρ_f)	1050 kg/m^3	Artery Wall Density(ρ_s)	1300 kg/m^3
Viscosity	Carreau-model	Linear Elastic Isotropic	
Time Constant lambda (λ) [s]	3.313	Young's Modulus	1.08 (MPa)
Power-Law Index (n)	0.3568	Poisson's ration(υ)	0.49
Zero shear viscosity [Pa s],	0.056(kg/m-s)	Bulk Modulus	1.8E+07 (Pa)
Infinite shear viscosity	0.00345(kg/m-s)	Shear Modulus	3.6242E+05 (Pa)

3. Results and Discussion:

3.1 Velocity streamlines and Wall Shear Stress (WSS)



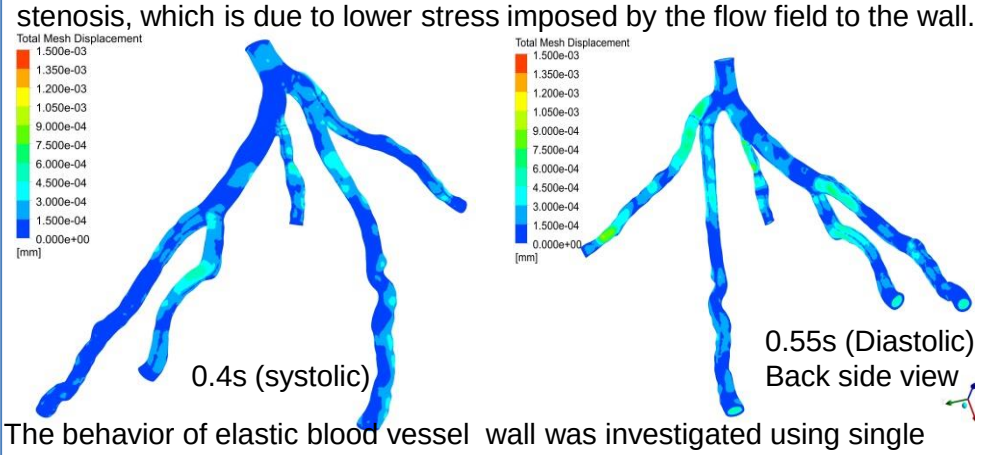
The flow velocity increased at the stenosis region due to the subsequent presence of plaque. According to CFD analysis, the small recirculation zone was observed at the bifurcation, and a high recirculation zone was seen at post stenosis regions. Higher the bifurcation angle of the artery reduces the velocity at that area. It is observed that the maximum velocity was found in the range 0 to 0.751 m/s and 1.532 m/s for systolic (0.4s) and diastolic (0.55s) conditions of blood flow.



At the post stenosis, where the recirculation zone was observed at that location, the WSS is suddenly decreased due to low blood velocity. The WSS is found in this region is about 1 Pa to 2 Pa only, which is the lowest of the WSS in CFD analysis.

3.2 FSI approach Elastic Vessel (Endothelium layer)

Displacement changes from 0.0015 mm to 0.012 mm in the left coronary artery. The maximum displacement was noted at the branch of the left anterior descending. The minimum displacement was observed across the stenosis, which is due to lower stress imposed by the flow field to the wall.



The behavior of elastic blood vessel wall was investigated using single phase blood model (Non-Newtonian fluid, Carreau model).

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Hexabromocyclododecane and Tetrabromobisphenol A in indoor dust from metropolitan Bangkok, Thailand: Implications for child exposure

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Background

- Hexabromocyclododecane (HBCDD) and Tetrabromobisphenol A (TBBPA) are chemical compounds added to commercial goods, e.g., construction materials, plastic, electrical equipment, and household item products and some baby products, to reduce flammability and thus improve product safety. Those compounds can be released and polluted in indoor environments significantly, and adsorbed to indoor dust.
- The ingestion pathway is considered the most common route of human exposure to HBCDD and TBBPA through accidental ingestion of indoor dust.
- Children spend most of their day for indoor activities such as house and daycare centers. Therefore, the accidental ingestion of indoor dust may impact the children's health, such as interrupting the endocrine, immune, reproductive, and nervous systems, and long-term exposure can lead to cancer.

Objectives

- The objective of this study was to investigate HBCDD and TBBPA levels in indoor dust samples collected from residential houses and daycare centers from metropolitan Bangkok, Thailand and evaluate the risk of children exposed to these compounds through indoor dust ingestion.

Methodology

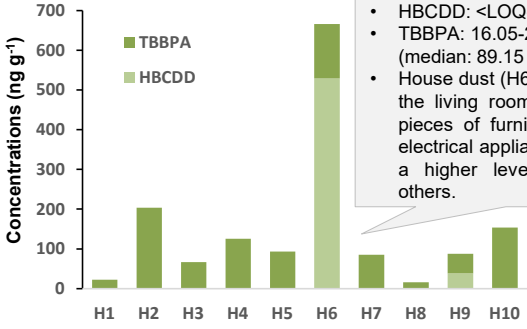
The estimated daily intake (EDI)

$$EDI = \frac{C_{(House+School\ dust)} \times IR \times EF}{BW}$$

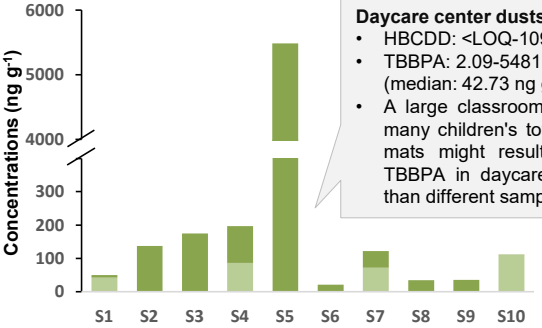
C_{dust} = The concentration of the target contaminant in the house dust and school dusts (ng/g);
IR = The daily ingestion of dust (g/day);
EF = Exposure fraction;
BW = The bodyweight (kg)

Results and discussion

- **HBCDD and TBBPA in indoor dust from metropolitan Bangkok, Thailand**

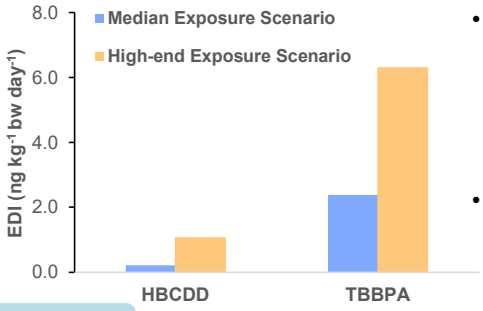


House dusts
- HBCDD: <LOQ-528.37 ng g^{-1}
- TBBPA: 16.05-203.53 ng g^{-1} (median: 89.15 ng g^{-1})
- House dust (H6) was collected from the living room containing several pieces of furniture and household electrical appliances. It may be why a higher level of HBCDD than others.



Daycare center dusts
- HBCDD: <LOQ-109.75 ng g^{-1}
- TBBPA: 2.09-5481.75 ng g^{-1} (median: 42.73 ng g^{-1})
- A large classroom containing many children's toys and nap mats might result in higher TBBPA in daycare dust (S5) than different samples.

- **The median values of estimated daily intake (EDI) of HBCDD and TBBPA in indoor dust (house and daycare centers) from metropolitan Bangkok, Thailand**



- The EDI of HBCDD and TBBPA from the high-end exposure scenario were below the oral reference dose (RfD) guideline value suggested by U.S.EPA (200 ng kg^{-1} bw day^{-1} for HBCDD and 600,000 ng kg^{-1} bw day^{-1} for TBBPA).
- This finding may not affect Thai children in the short term. However, it could lead to an increase in potential health concerns over a long period of time.

Conclusion

• This is the first study of HBCDD and TBBPA concentrations in indoor dust in Thailand.
• HBCDD is less polluted in indoor dust than TBBPA. One of the reasons is the HBCDD has been included in POPs list since 2013. Therefore, it is less contaminated indoor dust while TBBPA is still widely used in electronic devices, households, furniture and children's products. Thus, TBBPA was found to contaminate in a high concentration in indoor dust, increasing potential health concerns for children.
• Further studies are required to identify several contaminants in indoor dust and the potential health risks from different pathways. This improves our understanding of the health risks associated with the indoor environment.

Acknowledgements

• This study was supported by research funding from the Thailand Research Fund (RSA5880046) and the Royal Golden Jubilee (RGJ) PhD. Program scholarship of Thailand Research Fund (PHD/0129/2559) and Fundamental Fund (BRF2-NDFR29/2564) from Mahidol university.

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Interaction of Climate Change, Urban Air Pollution, and Human Health: Indonesia Case Study

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** Graduate School of Integrated Science and Technology, Shizuoka University, Shizuoka, Japan, *** SEAMEO BIOTROP - IPB University, Bogor, Indonesia

BACKGROUND

- Climate change and air pollution are the two main global challenges that are currently focused of attention. Changes in the global climate system due to humans affected are mostly caused the burning of fossil fuels and forest fires.
- Both of them have many related ways to connect each other, which is in the same sources emit both greenhouse gases and air pollutants. For example, emissions from vehicle include particulate matter (PM), nitrogen oxides, carbon monoxide, and carbon dioxide (CO_2).

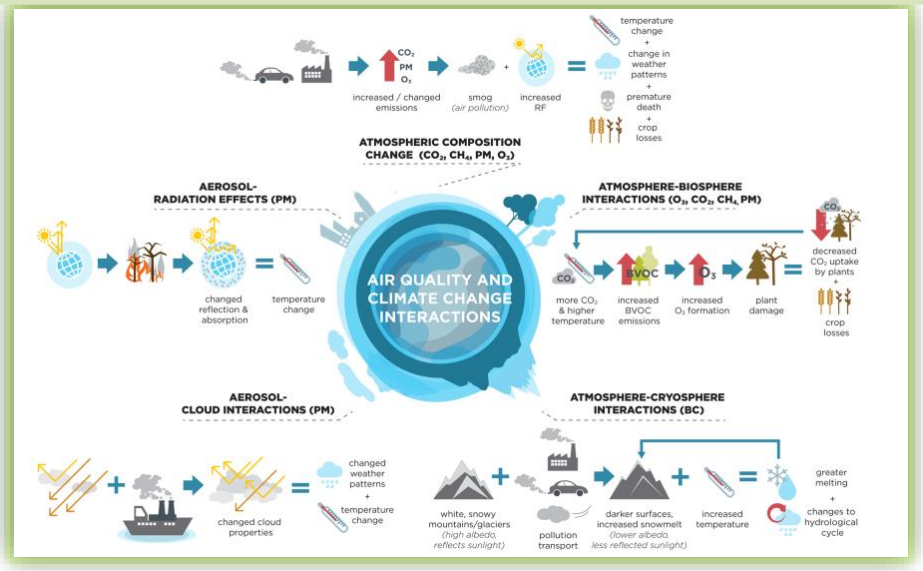

Fig. 1 An overview of the main categories of air quality and climate change interactions including a depiction of an example interaction or feedback for each category [1].

- An overview of the groups of processes relevant to air quality and climate change interactions are provide in **Fig. 1**. Moreover, the atmospheric chemistry processes in the air has a direct and indirect impact that can impact to the human health.
- Hence, from Haryanto (2018), Urban areas in Indonesia are being most affected by air pollution. The greatest current problems in Indonesia caused 50% of morbidity across the country. Therefore, this review aimed to discuss the interaction of climate change, urban air pollution, and human health in Indonesia using the emission scenario.

METHODOLOGY

This review was built by searching for papers and studies published in 2015 or later with titles related to "urban air pollution" or "air quality" and "climate change", and included the word "health impact" as the main topic.

RESULT AND DISCUSSION

- ✓ The emission scenario is a combination of projected activities and control strategies. The activity data is then fed into the GAINS model (greenhouse gases – air pollution interactions and synergies) to calculate current and future emissions.
- ✓ The BAU model for PM2.5 emissions is projected to continue to increase in the future to reach more than 150 kt by 2050. The largest contributor to emissions is known to come from light duty-vehicle diesel **(Fig. 2).**
- ✓ Meanwhile, the BAU Model (6℃) for CO2 emissions is projected to continue to increase in the future until it reaches a figure of approximately 1250 Mt in 2050. This time, the largest emission contributor comes from power plants, which currently use electricity from fossil fuels, the main one in Indonesia.
- ✓ Air pollution and climate change interact then have a negative impact on health conditions (**Fig. 3**). Climate change and air pollution in Indonesia greatly affect many aspects of the country, one of which is human health. Air pollution in Indonesia, especially in big cities, affects urban areas through the transportation sector (80%).

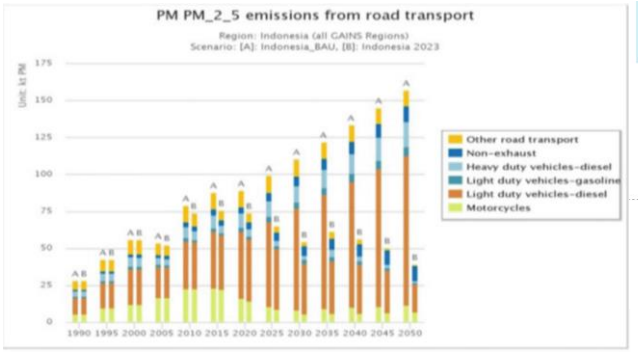

Fig. 2 PM2.5 (BAU vs EURO 4 2023) and CO2 (BAU 6℃ vs 2℃) road transport emission scenarios [2]

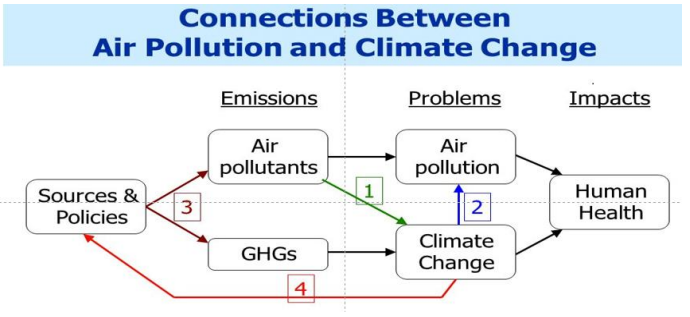

Fig. 3 Air pollution, climate change, and human health interaction [3].

- ✓ The large number of vehicles and the lack of infrastructure have resulted in traffic congestion resulting in high levels of air pollution.
- ✓ The number of diseases related to air pollution cases, such as acute respiratory infection, bronchial asthma, bronchitis, and eye and skin irritations, is predicted to be higher and more severe because the source of air pollution, energy demand, is projected to increase sharply until 2050 and will have a direct impact on the environment, increase in air pollutant parameters.
- ✓ It is necessary to have air quality control actions in Indonesia at various levels, namely national, regional, and community.

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[2] Haryanto, B. 2018. Climate Change and Urban Air Pollution Health Impacts in Indonesia. In: Akhtar R., Palagiano C. (eds) Climate Change and Air Pollution. Springer Climate. Springer, Cham.
[3] West, JJ. 2016. Connecting Climate Change, Air Pollution, and Human Health [PowerPoint slides]. Retrieved from https://slideplayer.com/slide/8493561/.

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LIFE CYCLE ASSESMENT OF ASIAN DIETS

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BACKGROUND

Food demanding has increased as the world population increase. Food production and consumption are ones of significant influences on environmental problems, and a person's choice to eat makes a difference from an environmental perspective. 25% of GHGs emissions come from agricultural and food production. However, studies on the environmental impacts of Asian diets are still limited.

The objectives of this study are:

- to assess and compare the environmental impacts from the diets in Asia,
- to determine the dominant food groups on the impacts, and
- recommend reducing the impacts along with the scenario developed based on the healthy diet system (HDS).

METHODOLOGY

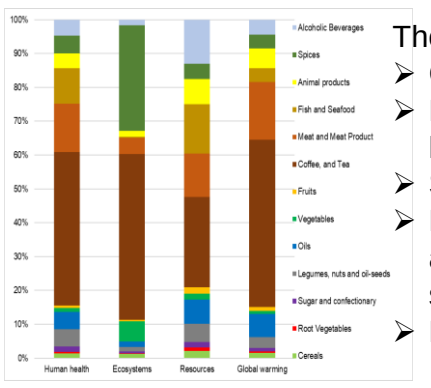
Goal and Scope Definition

- Functional Unit: food consumption in kg/capita/day
- System boundary: cradle-to-farm gate
- ReCiPe 2016 (v1.04)

Foreground data
- FAO food balance sheets (2018)
- 13 categorized food groups

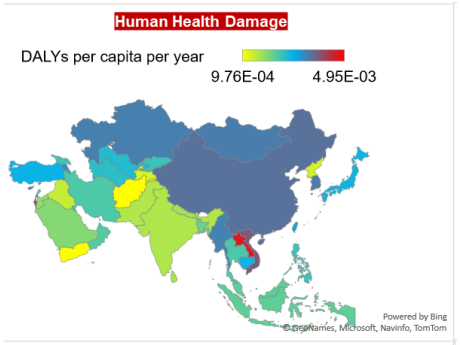
Background data
- Existing studies
- Ecoinvent (v3.6) database
- Agri-footprint (v5.0) database

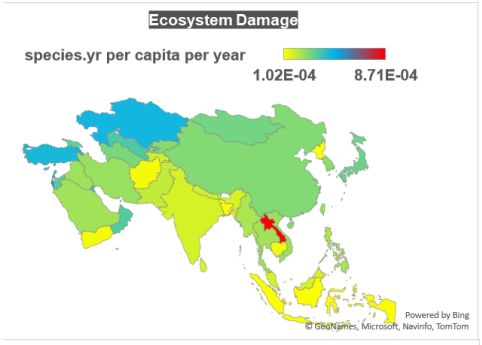
RESULTS AND DISCUSSION

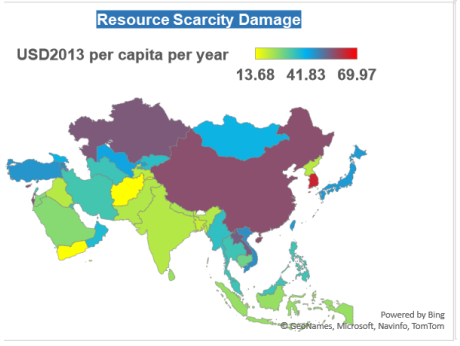


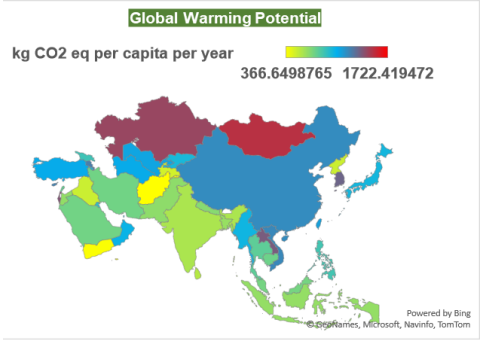
The impacts of 1 kg of consumption

- Coffee and tea in all impact categories.
- Meats (14%), fish and seafood (11%) to human health damage.
- Spices (31%) to ecosystem damage.
- Meats ((13%), fish and seafood (14%), alcoholic beverages (13%) to resource scarcity damage.
- Meats (17%) to global warming potential.

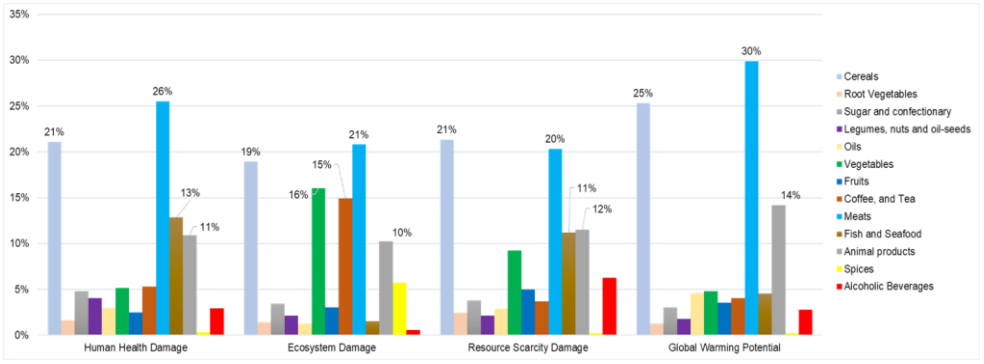








- Hong Kong SAR, Laos, and Macao SAR had the largest impacts to human health damage.
- Laos, the only country, had the most significant impact to the ecosystem damage.
- Hong Kong SAR, Macao SAR, and South Korea had large impacts to resource scarcity damage.
- High global warming potential occurred in Hong Kong SAR, Mongolia, Kazakhstan, Macao SAR, and Israel.



- Meats/meat products, fish and seafood, and cereals are the major contributors in Asia.
- Meats/meat products (26%), and cereals (21%) contributed to human health damage.
- Meats/meat products (21%), cereals (19%), vegetables (16%) and coffee & tea (15%) contributed to ecosystem damage
- Cereals (21%), and meats/meat products (20%) contributed to resource scarcity damage.
- Meats/meat products (26%), and cereals (21%) contributed to global warming potential.

Based on the healthy diet scenarios (HDS), in which 2300 kcal/p/d as benchmarked according to FAO,

- overall reduction under HDS_1 and HDS_3 for meats, fish and seafood, animal's products and cereals had occurred >17% of impacts reduction in Asia.
- By conducting a scenario analysis of food groups separately would be beneficial for the impact reduction.
- As meats' contribution is higher, impacts reduction from the meat consumption in Asia would be recommended for the future studies.

ACKNOWLEDGEMENT
This research was supported by the Faculty of Graduate Studies, Mahidol University (2019 Mahidol Postgraduate Scholarships).

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Palm Kernel Shell Derived Adsorbent for the Removal of Cationic Dye from Aqueous Solution

Authors: Yan Ying Tan*, Archina Buthiyappan*, Abdul Aziz Abdul Raman*, Mohd Izzudin Izzat Zainal Abidin*

* Department of Chemical Engineering, Faculty of Engineering, University of Malaya

Background 01

Figure 1. Dye wastewater pollution.

Dye wastewater

- Dye wastewater has mutagenic and carcinogenic properties
- Synthetic dyes are generated at a global scale of 7 x 10^5 tons annually

Adsorption technology

✓ High efficiency
✓ Less residues and by-products
✓ Low operating cost
✓ Simple operation
✓ Workable over a wide pH range

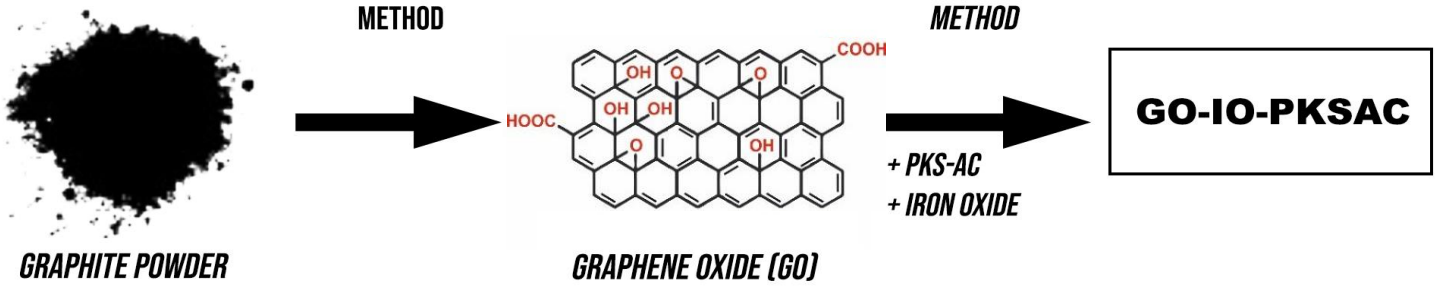
Ternary biomass-based adsorbent

Palm kernel shell
✓ Abundantly available (production of 3.1 million tons/year in Malaysia)
✓ Low cost, eco-friendly

Graphene oxide
✓ Rich active oxygen-containing functional groups

Iron oxide
✓ Possess magnetic properties which can aid in post-treatment separation

Methodology 02



Results and Discussion 03

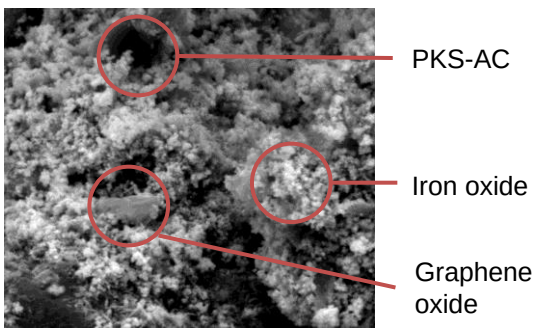


Figure 2. SEM image of GO-IO-PKSAC.

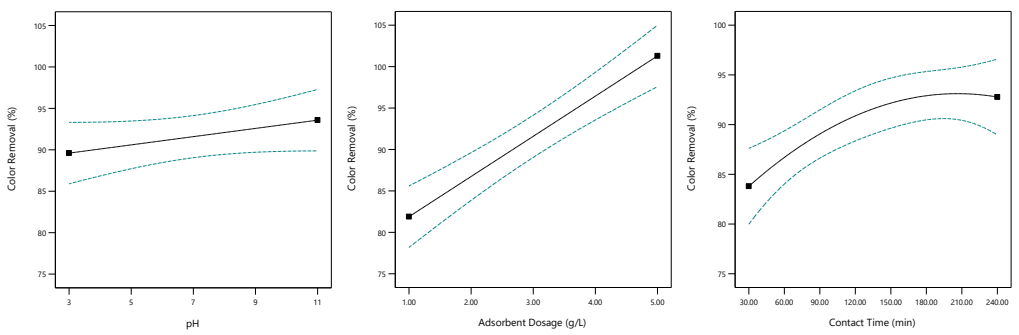


Figure 3. Effects of operational parameters on color removal.

Effects of operational parameters

Solution pH
✓ Color removal increases from pH 3 to pH 11

Adsorbent Dosage
✓ Color removal increases from adsorbent dosage of 1 g/L to 5 g/L
✓ More active sites presence

Contact Time
✓ Color removal increases with time until equilibrium established
✓ Complete color removal was achieved at 138 min of contact time

Short summary

1. A biomass-based ternary adsorbent was successfully developed
2. Under optimum condition, complete color removal was achieved

Optimum condition

pH	Adsorbent dosage	Adsorption time	Color removal
7.3	4.8 g/L	138 min	100.0%

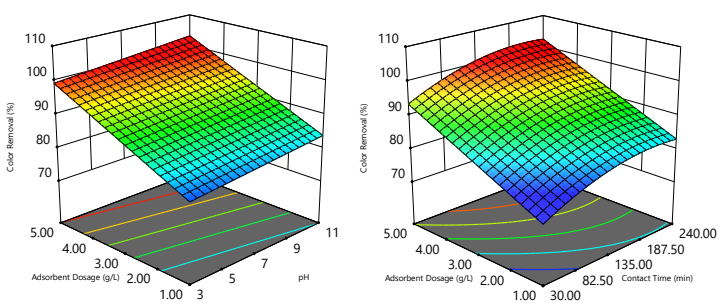


Figure 4. 3D RSM-BBD plots.

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Phage therapy assessment of biofilm-forming *Enterobacter hormaechei* isolated from Shrimp gut as eradication agent

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*corresponding author: Kamarisima@sith.itb.ac.id

Background

Survival rate of shrimp (*L.vannamei*) culture

Water quality management

Pathogenic bacteria

Disease Control

Fig 1. Gram staining of E. hormaehei U7 (10000x)

Problems

Antibiotic resistance bacteria

Solution

Phage theraphy

Methodology

Enrichment culture of E. hormaechei U7, ΦBt and ΦBc

(LB media, 37°C, 120rpm)

Biofilm-forming assay

(96 well plate, *LB media, 37°C, initial bacteri concentration 10^7 CFU/mL)*

Biofilm eradication and prevention assay

(37°C, initial pH 7, 1% salinity, static, initial bacterial concentration 106 CFU.ml^{-1})

Results and Discussion

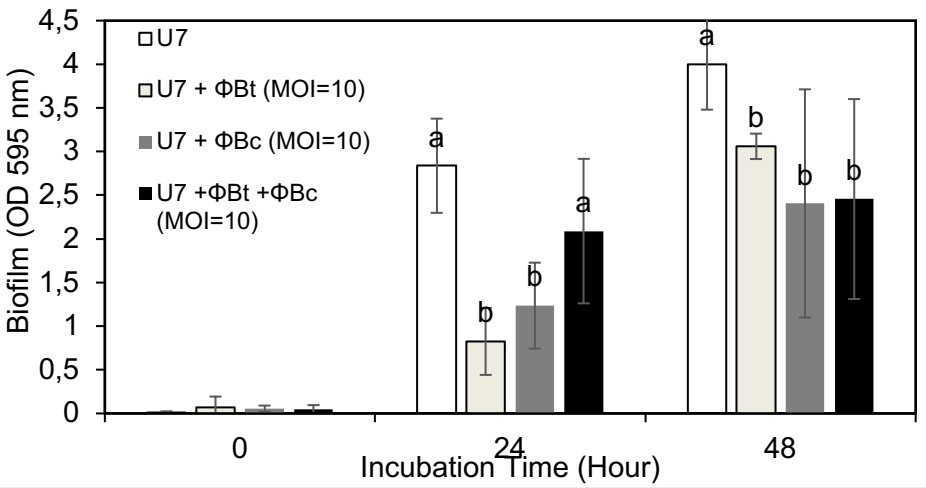

Fig 2. Biofilm prevention assay by of ϕBt and ϕBc on *E. hormaechei* U7. Single Factor ANOVA statistical test with a follow-up T-test was carried out between treatment and control at each incubation time. a, b significantly different (n=3).

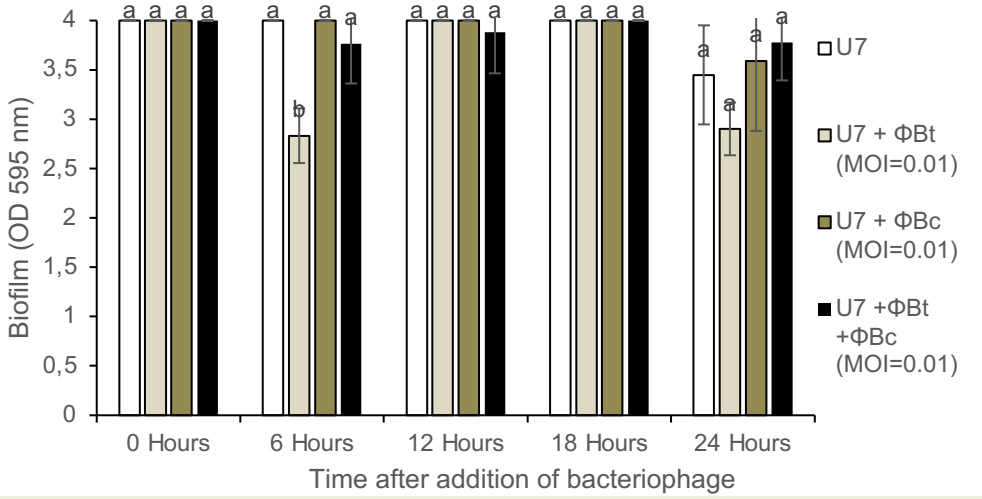

Fig 3. Biofilm eradication assay by of ϕBt and ϕBc on *E. hormaechei* U7. Single Factor ANOVA statistical test with a follow-up T-test was carried out between treatment and control at each incubation time. a, b significantly different (n=3).

- ΦBt have the ability to inhibit *E. hormaechei* growth and are able to prevent and eradicate biofilms better than ΦBc and cocktail bacteriophages.
- the mixed phage treatment had a more stable absorbance from 24 to 48 hours, with the lowest biofilm formation rate compared to other treatments (0.02 OD_{595}.$hour^{-1}$) → mixed phage can maintain biofilm absorbance from 24 to 48 hours.
- Bacteriophage ΦBt may be applied as biofilm biocontrol agents on *E. hormaechei*

Acknowledgement
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Predicting the effect of recycling promotion measures on waste separation behavior in Da Nang City, Vietnam

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*University of Science and Technology, The University of Danang
** Graduate School of Environmental and Life Science, Okayama University

Background and Objectives

In recent years, an official pilot program of waste separation at source (WSS) was introduced in some areas of Da Nang city, Vietnam. Under program, the residents were encouraged to separate recyclables for selling to informal sectors or donating to their community for fundraising. The residents were instructed through explanatory meetings and distributed the leaflet.

This study focused on measuring the effect of the existing WSS program on waste separation behavior, predictive models of waste separation behavior and their application in estimating the effect of promotion measures on behavior.

Methodology

- ▷ A questionnaire survey was conducted by face-to-face interview for 600 households in Da Nang city.
- ▷ To measure the effect of the WSS program on waste separation behavior, the authors conducted a comparison between waste separation behavior before and after implementing the program.
- ▷ Logistic regression was also used to develop predictive models of separation behavior for 14 recyclable categories. Sensitivity analyses of the models were carried out to predict changes in participation rates and waste amount caused by the implementation of various promotion measures.

Results and Discussion

1 – Effect of WSS program on waste separation behavior

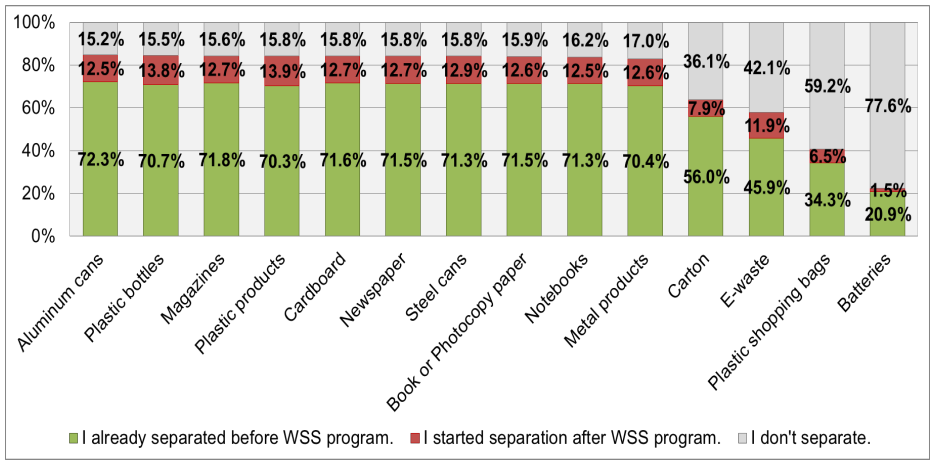

Fig. 1 *Participation rate on waste separation*

The level of 'the involvement in WSS program'

The participation rates after the WSS program were increased by 1.5%−13.9%.

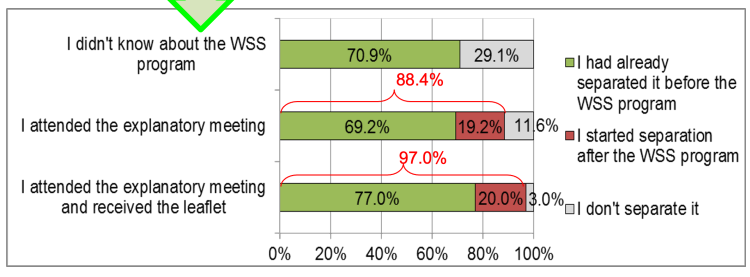

Fig. 2 *Participation rate of Plastic bottles by the level of 'the involvement in WSS program'*

2 - Behavioral modeling

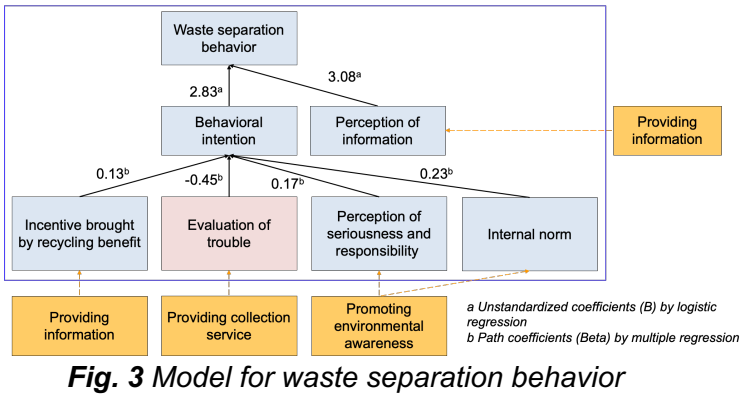

Fig. 3 *Model for waste separation behavior*

* The yellow part indicated the promotion measures and relationship between these measures and influencing factors of waste separation behavior

3 – Prediction of effect of proposed promotion measures on waste separation behavior

Table 1 *Effect of promotion measures on participation rate through sensitivity analysis of the models*

Calculated condition of predictor variables		Predicted participation rate								
		Aluminum cans	Plastic bottles	Steel cans	Notebooks	Metal products	Carton	E-waste	Plastic shopping bags	Batteries
Predicted waste participation rate by original data		88.7%	88.6%	88.0%	87.7%	85.8%	62.1%	61.7%	52.1%	28.7%
Providing information	Maximization of Perception of information	94.8% (+6.1%)	95.7% (+7.1%)	95.5% (+7.5%)	95.5% (+7.8%)	95.3% (+9.5%)	91.1% (+29.0%)	88.2% (+26.5%)	85.6% (+33.5%)	77.7% (+49.0%)
	Maximization of Incentive brought by recycling benefit	92.1% (+3.4%)	91.0% (+2.4%)	91.6% (+3.6%)	91.7% (+4.0%)	91.7% (+5.9%)	–	–	–	–
Providing collection service	Minimization of Evaluation of trouble	94.5% (+5.8%)	93.5% (+4.9%)	92.8% (+4.8%)	92.9% (+5.2%)	90.2% (+4.4%)	63.7% (+1.6%)	64.2% (+2.5%)	57.2% (+5.1%)	36.4% (+7.7%)
Promoting environmental awareness	Maximization of Perception of seriousness and responsibility	90.2% (+1.5%)	91.0% (+2.4%)	90.7% (+2.7%)	90.7% (+3.0%)	88.6% (+2.8%)	62.6% (+0.5%)	–	–	–
	Maximization of Internal norm	92.1% (+3.4%)	90.2% (+1.6%)	90.2% (+2.2%)	90.2% (+2.5%)	87.9% (+2.1%)	–	–	–	–

* The predicted effects of each promotion measure on participation rate are indicated in parenthesis.

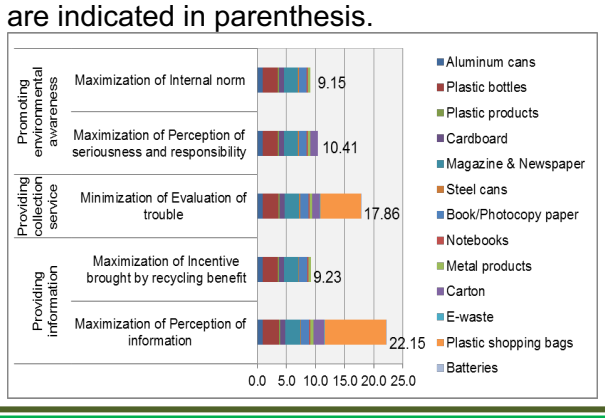

Fig. 4 *Expected the amount of separated recyclable waste by promotion measures (g/cap/day)*

* Total waste generation amount was 231.49 g/cap/day.

Conclusion

- ▷ In this WSS program, attendance of the explanatory meeting raised the participation rates.
- ▷ Provision of information was the most effective promotion measure, with the highest predicted increase in recycling participation rates (6.1−49.0%) and the amount of separated recyclables (up to 9.6% of total waste generated), followed by provision of collection services, with a predicted increase of 1.6−7.7% in participation rates and 7.7% in the amount of separated recyclables.
- ▷ For further improvement, promotion of environmental awareness should be considered.

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Production of a bioactive soy sauce (醤油) in a bioreactor for food security

Chong Shin Yee, Zul Ilham and Wan Abd Al Qadr Imad Wan-Mohtar

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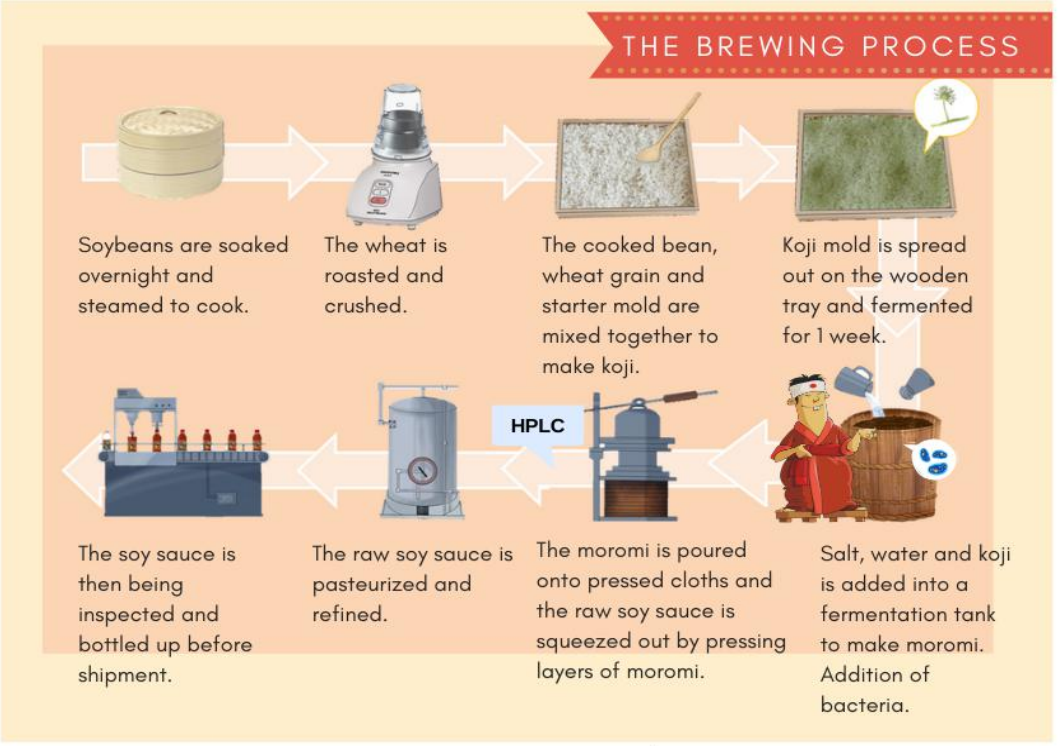
Introduction

Soy sauce, which contains a variety of bioactive compounds such as gamma-aminobutyric acid (GABA), has recently been demonstrated to be a functional food. The numerous microbial compositions play a critical role in defining the quality, functionality, flavour, and fragrance of soy sauce and form the foundation of soy sauce fermentation. Thus, it is vital to investigate the interactions of microorganisms to increase the functionality of soy sauce in order to boost the Asian food sector and achieve SDG #2, Zero Hunger.



OBJECTIVE

To enhance koji-moromi GABA production using the Trio of *Aspergillus oryzae* strain NSK, *Bacillus cereus* strain KBC *and Tetragenococcus halophilus* strain KBC in soy sauce making.

METHODOLOGY

The first stage of making soy sauce is the koji fermentation which involves the fermentation of a mixture of soybean, wheat and inoculated with a starter mold (*Aspergillus oryzae*). While for the second stage is the brine fermentation which the matured koji is being added into an 18-20% brine solution for further fermentation. In this study, there is an addition of bacteria culture during moromi stage in order to boost the GABA production in soy sauce brewing.

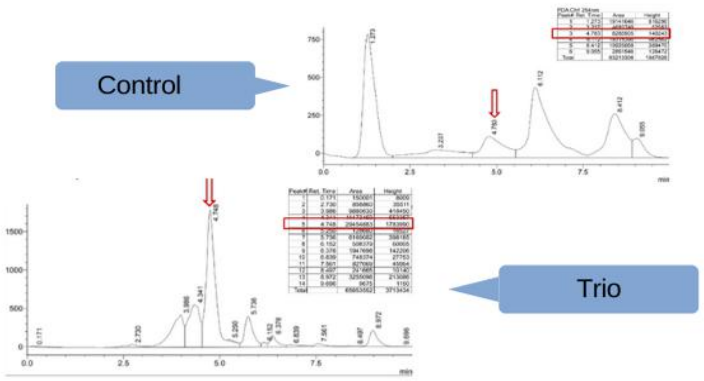
RESULTS

The GABA production is enhanced using the Trio of *Aspergillus oryzae* strain NSK, *Bacillus cereus* strain KBC and *Tetragenococcus halophilus* strain KBC **(160 mg/L)** when compared to the control **(120 mg/L)** in soy sauce making.

Analysis

The GABA content of the soy sauce samples was determined through High-Performance Liquid Chromatography (HPLC). The GABA content of the sample was determined by comparing the peak of the graph with the standard curve of GABA. The standard curve was obtained by running 4 different concentrations of pure GABA (0.125 mg/L, 0.5 mg/L, 0.75 mg/L, and 1.0 mg/L) through an HPLC machine and a plotted graph result.

HPLC



Conclusion

The overall study indicates that the Trio of *Aspergillus Oryzae* strain NSK, *Bacillus cereus* strain KBC and *Tetragenococcus halophilus* strain KBC are capable of producing GABA and subsequently boosting up the GABA production during the soy sauce fermentation.

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Production of Gamma-aminobutyric Acid (GABA) from *Bacillus cereus* isolated from *moromi* of a commercial *Koikuchi Shoyu*

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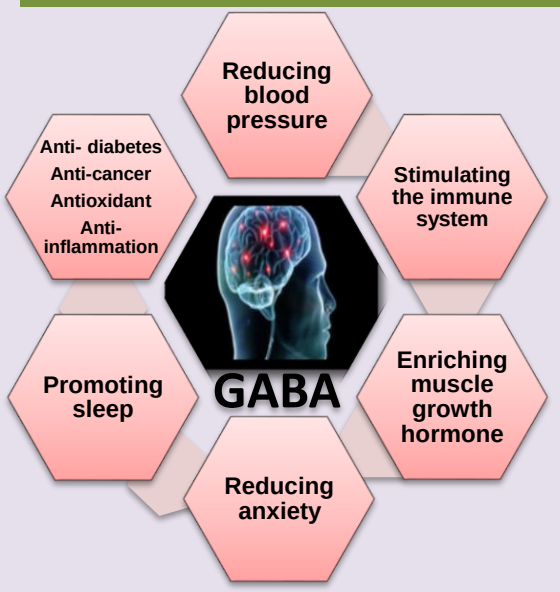
[1]Functional Omics and Bioprocess Development Laboratory, Institute of Biological Sciences, [2]Biomass Energy Laboratory and
[3]Department of Chemistry, Faculty of Science, Universiti Malaya, Kuala Lumpur 50603, Malaysia

Background

Gamma-aminobutyric acid (GABA) is a non-protein amino acid with multiple bioactivities resulting in a rising demand for GABA production through microbial fermentation in comparison to chemically synthesized GABA. Therefore, screening for novel, high-GABA-producing microorganisms is essential. Soy sauce is a traditional liquid condiment produced in a two-stage fermentation process, koji and *moromi*, and consists of a complex microbial niche. It can be a potential natural functional food for GABA production and is considered an ideal source for microbial isolation. In this study, a newly isolated bacteria from commercial soy sauce *moromi* in Malaysia has been tested for its GABA-producing potential under different conditions.

GABA bioactivities



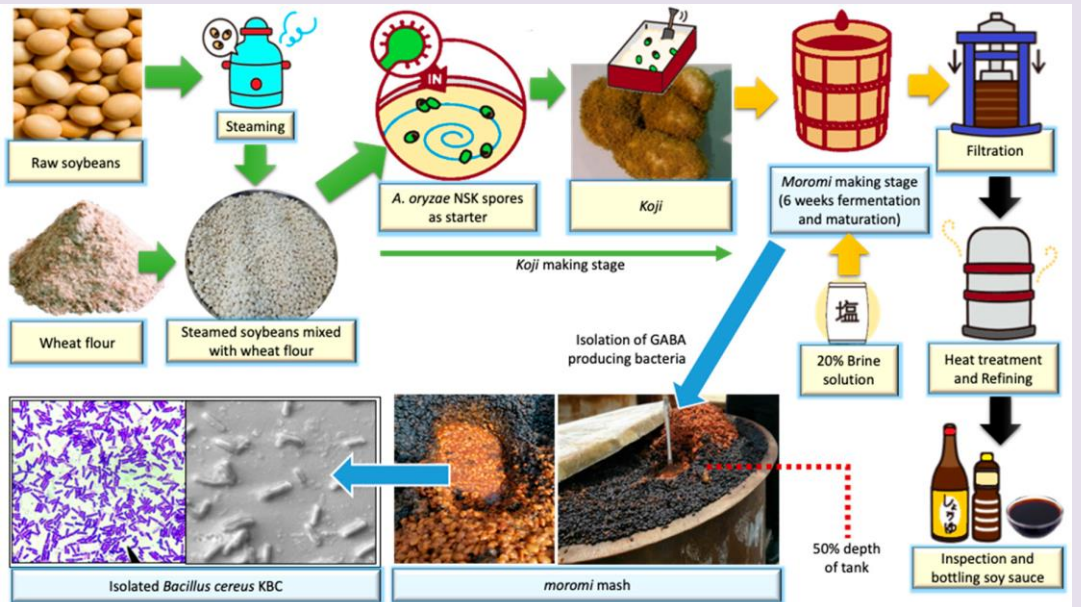
Objectives

- Screening of GABA-producing microorganisms
- Optimization of GABA production
- Enhancement of soy sauce

Conclusion

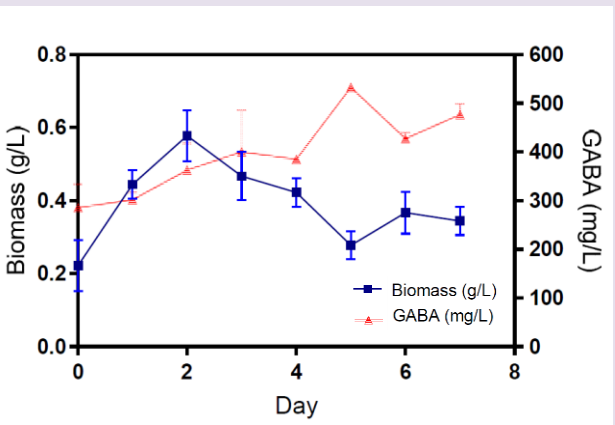
A novel bacteria strain was successfully isolated from soy sauce *moromi*. *Bacillus cereus strain KBC* exhibited high GABA-producing potential and can be used for the production of GABA-rich soy sauce. These findings may allow the development of an innovative functional food material rich in GABA particularly soy sauce.

Methodology



Soy sauce production blueprint and isolation point for *Bacillus cereus* strain KBC

Results

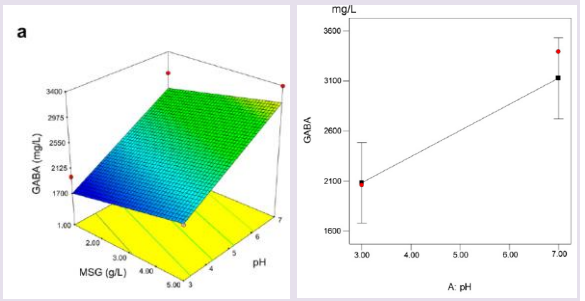


Biomass and GABA production of *Bacillus cereus* strain KBC under unoptimized conditions

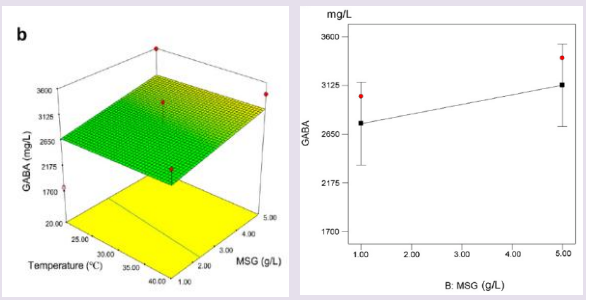
532.74 mg L^{-1} of GABA under unoptimized conditions

3393.02 mg L^{-1} of GABA under optimized conditions (pH 7, 5 g/L MSG, 40°C)

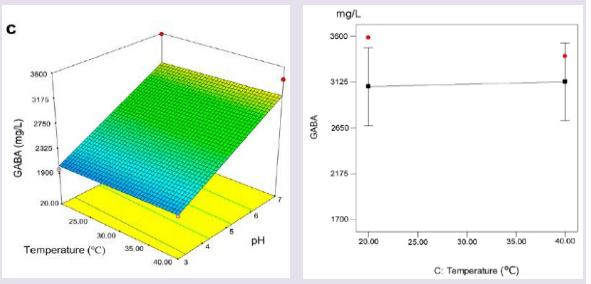
GABA potential of *Bacillus cereus* strain KBC



Effect of MSG and pH



Effect of temperature and MSG



Effect of temperature and pH

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Quantification and Characterization of Microplastics in Wastewater

Authors: Me Me Maw*, Suwanna Kitpati Boontanon*, **, Ranjna Jindal*, Narin Boontanon***, and Shigeo Fujii**

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**Graduate School of Global Environmental Studies, Kyoto University
***Faculty of Environment and Resource Studies, Mahidol University

Introduction

- **Microplastics (MPs)** are less than 5 mm in size of small plastics particle. MPs are grouped in two types i) **Primary microplastic-**plastics pellets, microbeads ii) **Secondary microplastics-**formed due to the degradation of big plastics caused by the weathering effects in the environment and mechanical impacts on them.
- Occurrence of the MPs in freshwater bodies and aquatic organisms has proven the seriousness of microplastics (MPs) pollution in Thailand.
- In addition, wastewater treatment plants (WWTPs) have been considered as an important point source of MPs contamination to environment.
- MPs removal in WWTPs is high however, all the MPs could not be removed completely because it was not designed for MPs removal.

Objective

This study aimed at the quantification and characterization of the MPs released from an activated sludge system in a domestic wastewater treatment plant (WWTP) at Mahidol University (MU), Salaya campus, Thailand

Methodology

Sampling Area

- A domestic wastewater treatment with capacity of 3,000 m^3/day serving approximately 20,000 people was selected for this study. It is an activated sludge system adopted much in the urban area of Thailand.

MPs sampling by pumping and filtration

- Influent and effluent samples (750L) were collected within 30 min using a submersible pump followed by filtration with 100 µm filter bags.

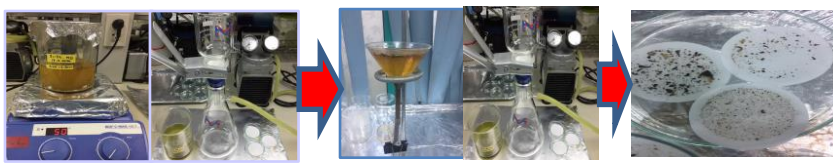
Influent sampling from outlet of automatic fine screen

Effluent sampling from outlet of secondary sedimentation pond

Fig.1 Microplastics sampling at MU WWTP

MPs extraction by organic removal and density separation

- Removing of impurities from wastewater that interfere to MPs identification.



Organic removal by Fenton's reagent at 50°C for 1 hr.

Density separation with NaI (5.3 M) for overnight

Dried the filter papers at 40°C for 24 hrs.

Fig.2 Microplastics extraction from wastewater samples

Quantification and Characterization of the extracted MPs

- Picked up the suspected big size MPs, identified the shape and chemical composition of each MPs by stereomicroscope and ATR-FTIR.

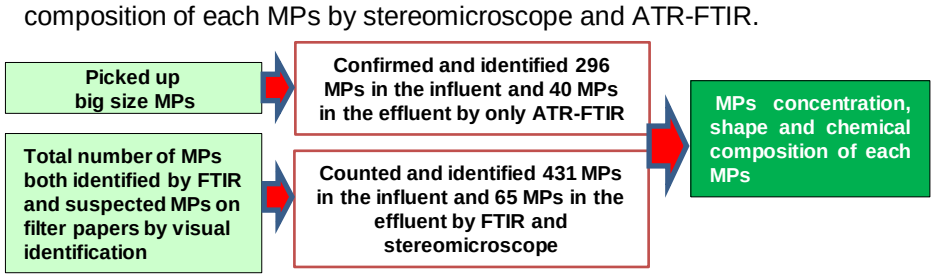


Fig.3 Quantification and Characterization of extracted MPs

Results and Discussion

Microplastics concentration and its removal

- Microplastics removal efficiency of this plant was found to be **85% removal efficiency.**

Table1.Difference in MPs concentrations based on limit of identification method

Type of MPs identification method	MPs in influent	MPs in effluent
Based on the MPs identified by only ATR-FTIR	**0.4 MPs/L**	**0.05 MPs/L**
Based on MPs identified by ATR-FTIR and suspected MPs counted by stereomicroscope (visual identification)	**0.6 MPs/L**	**0.09 MPs/L**

- **PVC, PET, PS, PE, PP, PMMA and PTFE/P** were most prevalent types of MPs in the influent sample.
- **PP, PET and PMMA** were identified in high abundance in the effluent.

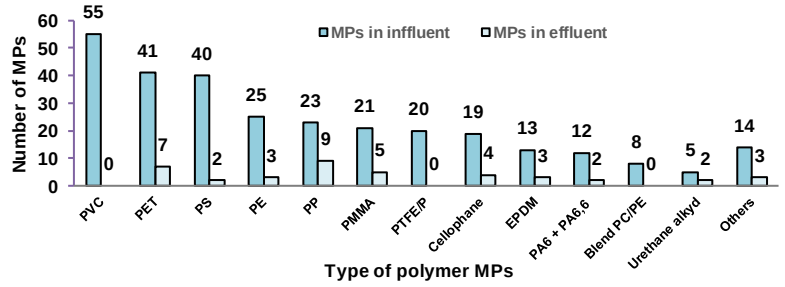


Fig.4 Relative abundance of different type of MPs in wastewater

- Depending on their various shapes and types, some types of MPs were removed and so not found in the effluent. Especially, **PVC, blend PC/PE fragments shaped, fibers shaped PMMA, PE and PVC, and microbead MPs were not observed in the effluent.**

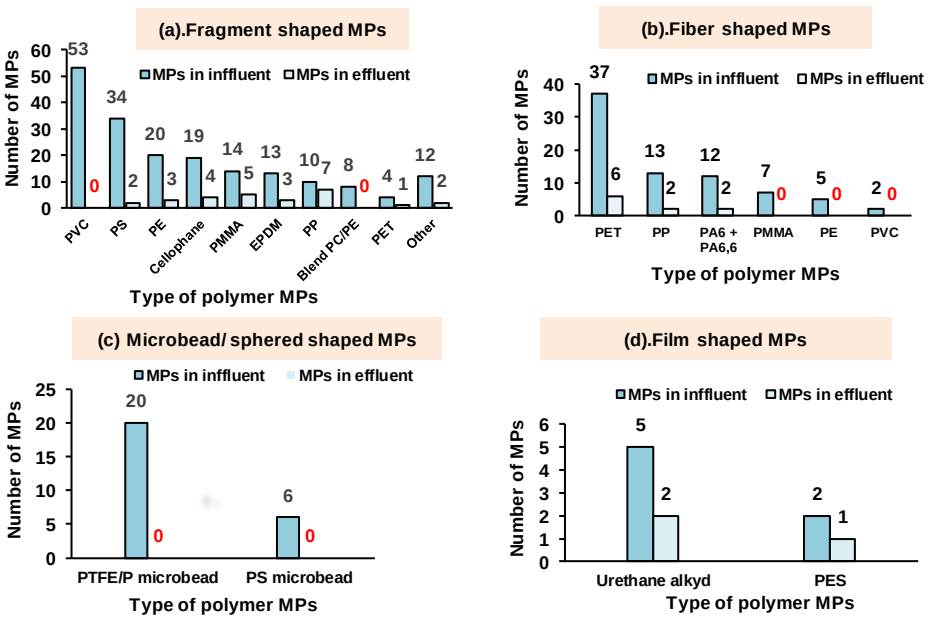


Fig.5 Relative abundance of different type and shape of MPs

Conclusion and Future Work

- Types of polymer and shapes of MPs are important parameters that could affect MPs removal in wastewater treatment plants.
- There is an urgent need to develop the effective, time efficient, and lost cost MPs dentification methods by focusing of various complex environmental samples and specific target cut-off size of MPs for understanding the removal process mechanism.

Acknowledgement

This study was financially supported by the "Capacity Building Initiative for Myanmar (CBIM-II)" scholarship by Norwegian Government to Mahidol University.

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Research of ammonium transformation by activated sludge process with nitrification: Experiment at laboratory scale

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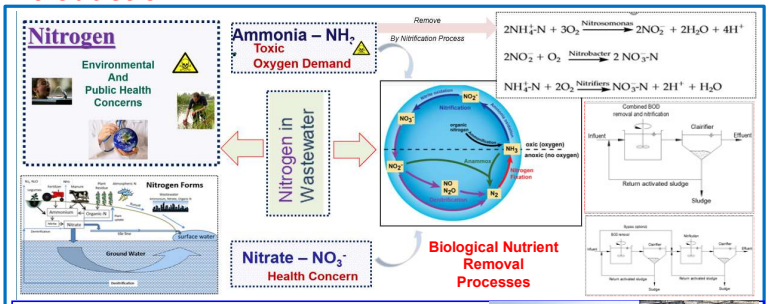
Faculty of Environment, Danang University of Science and Technology (DUT), Viet Nam

Introduction



DANANG CITY-VIETNAM

- Municipal wastewater has low COD/N ratio
- Applied technology:Activated sludge process-ASP (CAS/SBR,AO/A2O,)
- Interested in organic matter treatment & not yet interested in nutrients treatment → Especially Nitrogen → **Study on the biological nitrogen removal process is necessary**

Research → Ammonium transformation by activated sludge process with nitrification **: Experiment at laboratory scale**

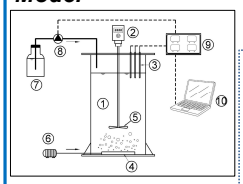
Methodology

Approach

Collecting data → Designing model → Operating model → Evaluating results

- Designing model: *- Reactor; - Aeration systems; - Titration-solution dosing system,…*
- Operating model: *- Adaptation of activated sludge to nitrification; - Rate of ammonium utilization by activated sludge process with nitrification*

Model



(1) Reactor
(2) Stirring device
(3) temperature; pH & DO probe
(4) reaction vessel
(5) Stirrer blade
(6) Aerator
(7) Alkaline titration solution
(8) Alkaline Quantitative Pump
(9) Data parsing device
(10) Computer

Experimental process

The artificial wastewater samples with C/N ratio varies from 5 to 10. Carbon and nitrogen sources are taken from $C_6H_{12}O_6$ and NH_4Cl. Macro and micro - nutrients is added in artificial wastewater.

(i) Adaptation of activated sludge to nitrification;

(ii) Determining the ammonium utilization rate;

→ Operation loading in range 0.33 ÷ 0.39 g COD / g MLVSS.day at pH 7 ÷ 8 and temperature 29.8 ÷ 31.3 °C;

→ Sampling & Analysing: pH, DO, Alkalinity, COD, N-NH_4^+, N-NO_2^-, N-NO_3^-, MLSS, MLVSS

Results and Discussion

Adaptation of activated sludge to nitrification

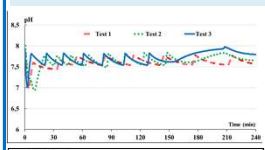
Parameter	Time	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12
Alkalinity (mg$CaCO_3$/L)	S	224	220	240	200	280	267	135	144	200	210	210	220
	E	85	150	164	80	100	100	35	48	34	48	45	50
COD (mg/L)	S	200	210	200	250	338	338	332	332	400	320	240	350
	E	48.3	35.5	30.3	37.6	24.0	25.6	32	22.4	30.4	30.6	35	35
N-NH_4^+ (mg/L)	S	12.6	15.2	15.9	21.3	26.8	26.8	26.8	26.8	40	36.2	33.2	38.2
	E	2.28	2.4	2.52	2.7	1.4	1.38	2.22	0.84	3.22	1.96	4.7	3.34
N-NO_3^- (mg/L)	S	5.23	5.1	6.4	4.51	6.0	5.6	4.74	4.46	4.51	3.77	3.5	4.1
	E	6.8	8.2	9.7	11.2	13.3	14.6	13.1	13.1	21.4	21.5	20.3	20.1
MLVSS (g/L)	S	3.16	3.1	3.17	3.15	3.44	3.66	3.15	3.4	3.39	3.37	3.25	3.28
	E	3.39	3.25	3.39	3.32	3.76	3.81	3.84	3.72	3.87	3.89	3.48	3.58

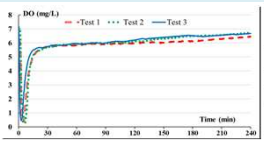
Notes: B: batch; S: starting; E: ending

Autotrophic bacteria (nitrifiers) appeared, adapted and were able to oxidize ammonium to nitrate.

- At the end of each adaption batch (12 batches): Alkalinity decreases, N-NH_4^+ decreases and N-NO_3^- increases.
- In the last of four adaption batches (B9 to B12), N-NO_3^- increased rapidly and was stable in different batches.

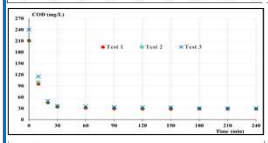
The ammonium utilization rate (AUR)

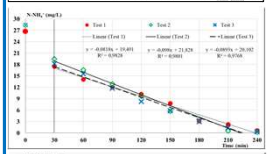


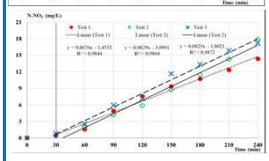


Test	(1) mg $CaCO_3$/ test	(2) mg $CaCO_3$/ mg N	(3) mg N-NO_3/L	(4) mg N-NO_3/L
1	102.03	7.11	0.31	0.52
2	125.45	7.02	0.27	0.32
3	124.57	7.26	0.29	0.33

Notes: (1) Total amount of alkalinity consumed in each test; (2) Amount of alkali consumed per mg of nitrogen oxidized: (3) N-NO_3 concentration: starting in each test ;(4) N-NO_3 concentration: ending in each test







→ In the first 10 minutes, DO concentration sharply decreases and drops to 0.25 ÷ 0.46 mg/L. After that, DO starts to increase and maintain over 5.5 mg/L after 30 min of operation.

→ In the first 10 minutes, the COD removal rate achieved 0.67 ÷ 0.75 g COD/L.h and the specific COD removal rate reached 4.32 ÷ 4.81 g COD/g VSS.day. This rate gradually decreased and was negligible after 30 min of each test.

→ In nitrification phase (after 30 minutes of each test.): the AUR achieved 4.91 ÷ 5.85 mg N / L.h and nitrate production rate (NPR) are 4.13 ÷ 5.08 mg N / L.h.

→Special AUR achieved 30.84 ÷ 37.83 mg N / g MLVSS.day (average 34.35). Special NPR achieved 25.97 ÷ 32.57 mg N / g MLVSS.day (average 30.31). The amount of alkali consumed for each 1.0 mg of nitrate-nitrogen formed in range 7.10 ÷ 7.26 mg $CaCO_3$/mg N (average 7.13).

Conclusion & Recommendation

Conclusion: Experimental ammonium tranformation by ASP with the nitrification:

(1). For artificial wastewater has a C/N ratios from 5 to 10: when operation loading in range 0.33 ÷ 0.39 g COD / g MLVSS.day at pH 7 ÷ 8 and temperature 29.8 ÷ 31.3°C , nitrification process takes mainly after 30 minutes of operation and after 4 hours of operation, the concentration of N-NH_4^+ at all test is lower than 1 mg/L.

(2). The ammonium utilization rate achieved 4.91 ÷ 5.85 mg N / L.h and nitrate production rate are 4.13 ÷ 5.08 mg N / L.h.

(3). Special ammonium utilization and nitrate production rate achieved 30.84 ÷ 37.83 mg N / g MLVSS.day (average 34.35) and 25.97 ÷ 32.57 mg N / g MLVSS.day (average 30.31) respectively.

Recommendation: Continue to research of ammonium transformation by activated sludge process with nitrification in urban wastewater and industrial wastewater with low C/N ratio in Vietnam

Acknowledgement: **Phan Thi Kim Thuy** was funded by Vingroup Joint Stock Company and supported by the Domestic Master/ PhD Scholarship Programme of Vingroup Innovation Foundation (VINIF), Vingroup Big Data Institute (VINBIGDATA), code **[VINIF.2020.TS.24].**

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Study on reuse of waste plastic residual from scrap villedge as an aggregate in cement brick

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* School of Environmental Science and Technology, Hanoi University of Science and Technology
** Vietnam Institute of meteorology, hydrology and climate change

1. Research background

Plastic waste

Craft village

Solid waste (with plastic chips)

Landfill

2. Methodology

Solid waste (with plastic chips)

Cement, sand, stone, water

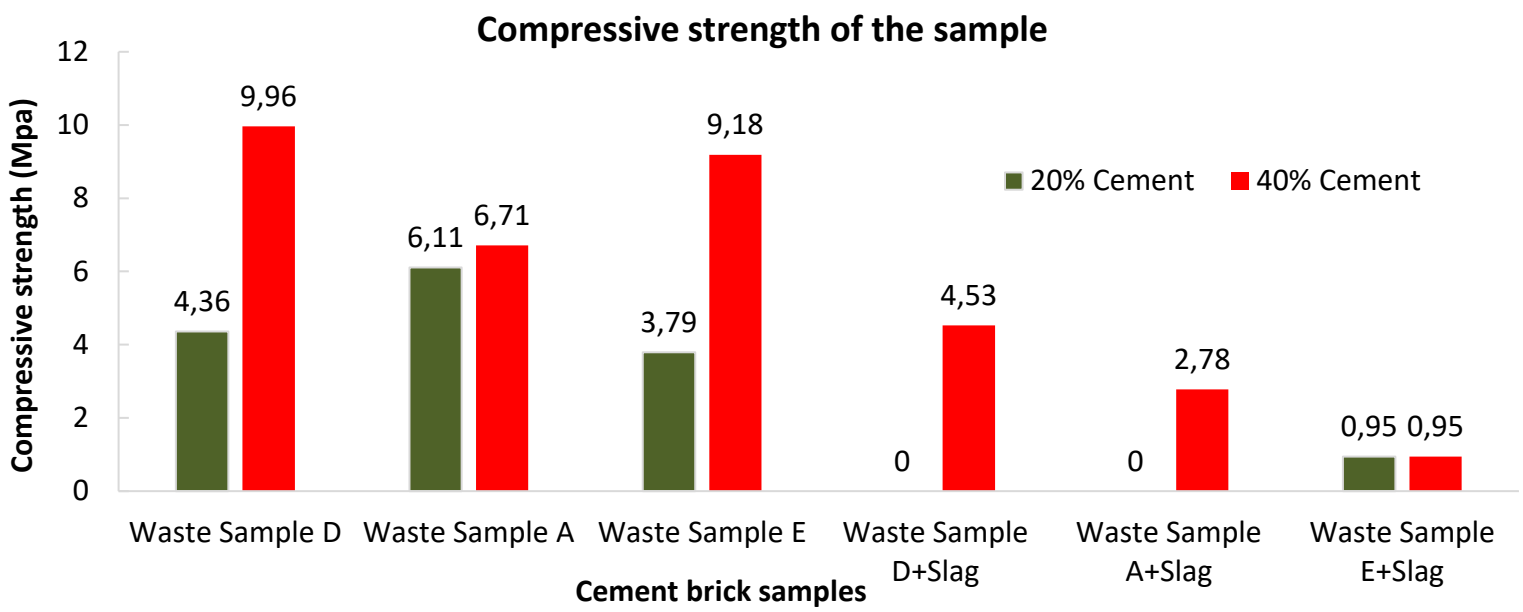
Mixing

Moulding

Drying

Cement bricks

3. Results and Discussion



The test results of concrete brick samples showed that the percentage of waste plastic chips, denatured aluminum slag can reach 25-35% of the mixing volume. The compressive strength of the test samples can reach the grade of M35 bricks, even close to the grade of M100 bricks. The addition of denatured aluminum slag requires further research as well as additional consideration of adding a binding additive to increase the compressive strength of the product brick

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SEPARATION OF PHOSPHATE FROM AQUEOUS SOLUTION USING WASTE CLAMSHELL

Ho Hong Quyen*, Hoang Hai*, Tran Vu Chi Mai*, Nguyen Duong Quang Chanh*, Masashi Kurashina** and Mikito Yasuzawa**

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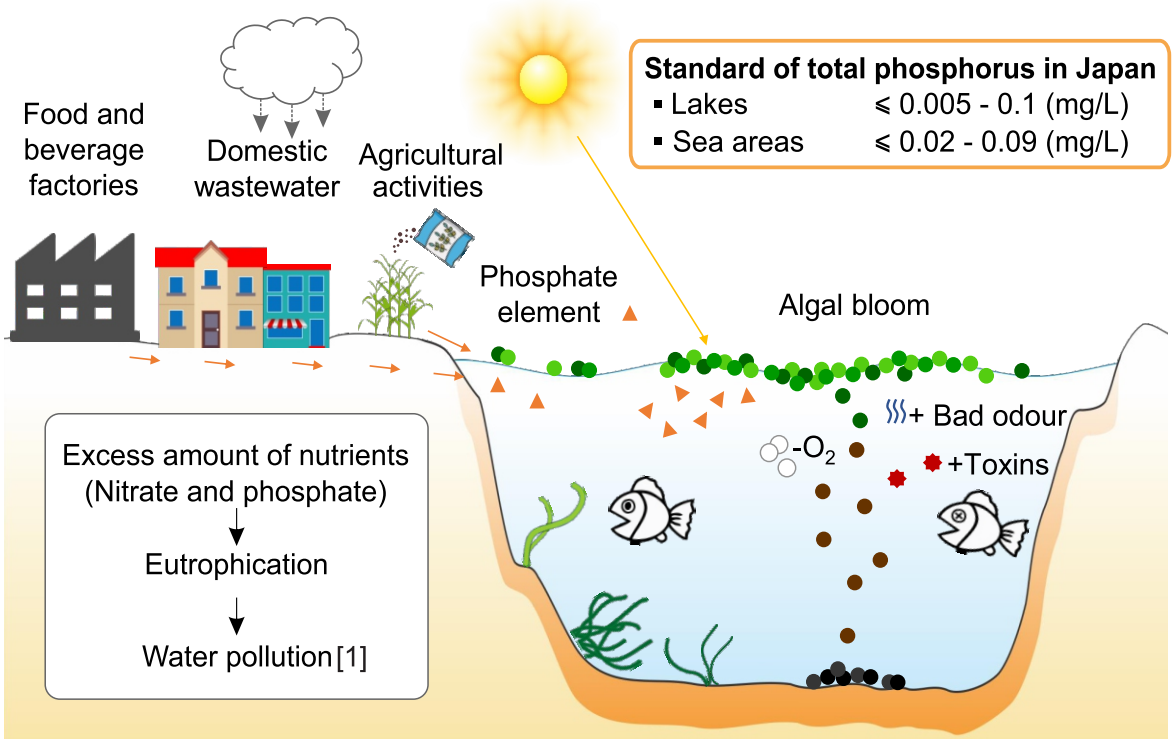
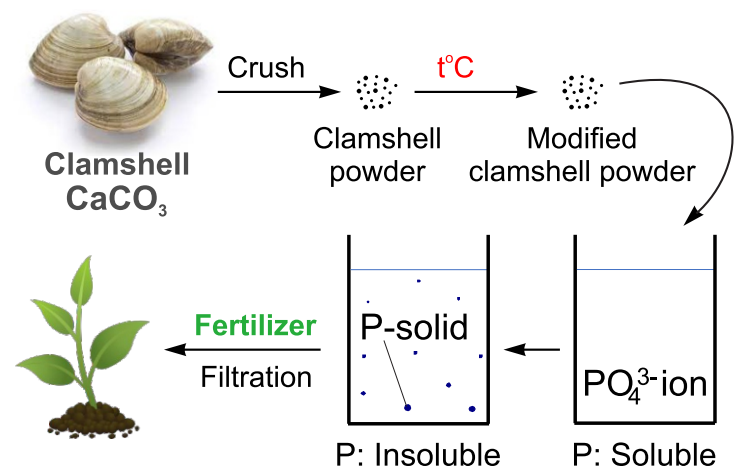
** Department of Applied Chemistry, Graduate School of Science and Technology, Tokushima University, Japan

INTRODUCTION



Standard of total phosphorus in Japan
- Lakes ⩽ 0.005 - 0.1 (mg/L)
- Sea areas ⩽ 0.02 - 0.09 (mg/L)

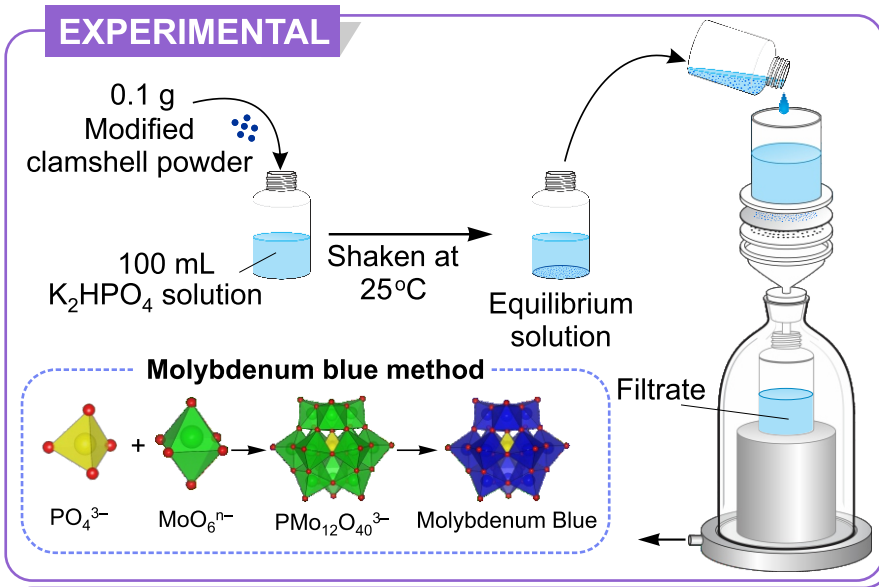
THIS WORK



OBJECTIVE

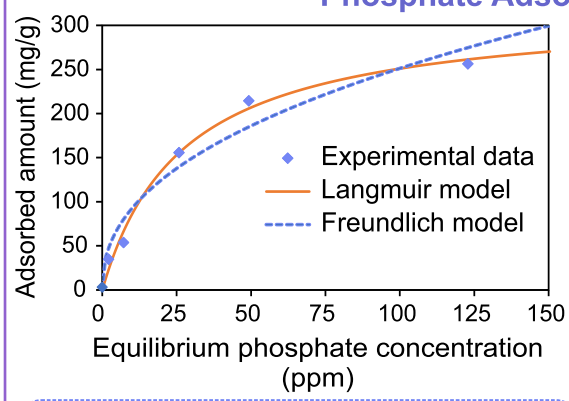
- Improve phosphate removal capacity by modified clamshell.
- Investigate phosphate removal mechanism.

EXPERIMENTAL



RESULTS & DISCUSSION

Phosphate Adsorption Isotherms

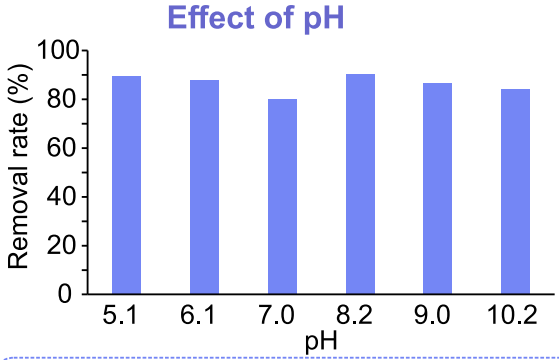


Both Langmuir and Freundlich isotherms were fitted well with the experimental data.

Comparison of phosphate removal capacity to other different materials

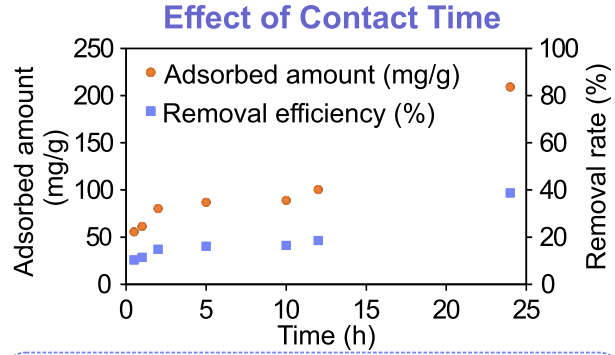
Material	Qmax (mg/g)
Iron oxide from red mud waste	12.9
Calcite	6.0
$CaCO_3$ - montmorillonite	0.3
Zeolite (from fly ash)	8.3
Mg-modified corn biochar	239.0
BOF slag	30.0
Thermally modified clamshell (this work)	**319.0**

Effect of pH



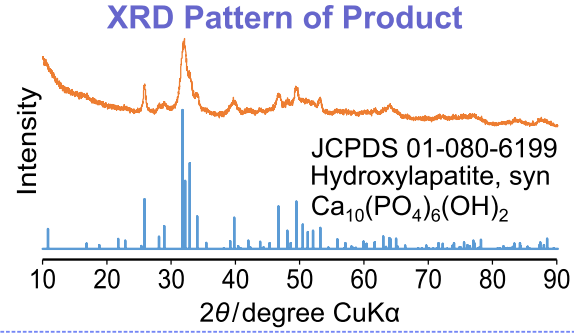
There was the great dissolution of Ca^{2+} ions from modified clamshell to solution in any pH value.

Effect of Contact Time



The maximum phosphate removal capacity and the phosphate removal rate were 209.0 mg/L and 38.7 % after 24 h, respectively.

XRD Pattern of Product



$10Ca^{2+} + 6PO_4^{3-} + 2OH^- \rightarrow Ca_{10}(PO_4)_6(OH)_2\downarrow$ → Fertilizer [2]

CONCLUSION

- The thermally modified clamshell can be used for phosphate removal as low-cost material.
- Maximum removal capacity was 319.0 mg/g at wide pH range from 5 to 10.

REFERENCES

[1] Marine Pollution Bulletin 136 (2018) 394-400
[2] Advances in Nanoparticles 1 (2012) 21–28.

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on Education and Research in Global Environmental Studies in Asia 2021

Strengthening bentonite slurry using gellan gum

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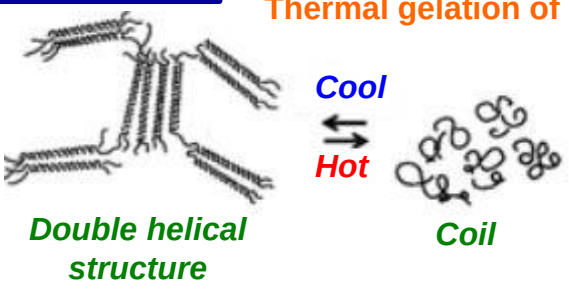
Introduction

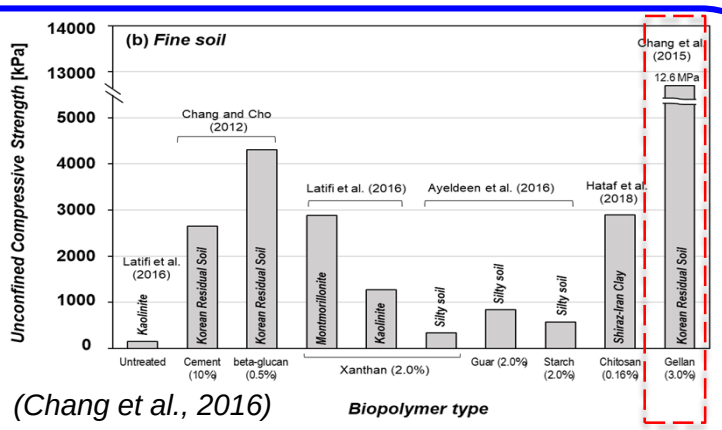
Thermal gelation of gellan gum



(Cameron et al., 2013)

Its capable of forming hydrocolloid gels when mixed with heated water

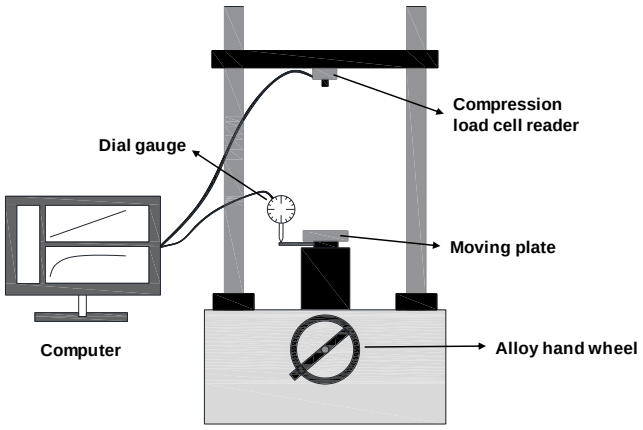
Application



(Chang et al., 2016)

AIM: **Strengthening bentonite slurry as bentonite is used as material for slurry wall stability**

Experiment Procedure: Unconfined Compression Test

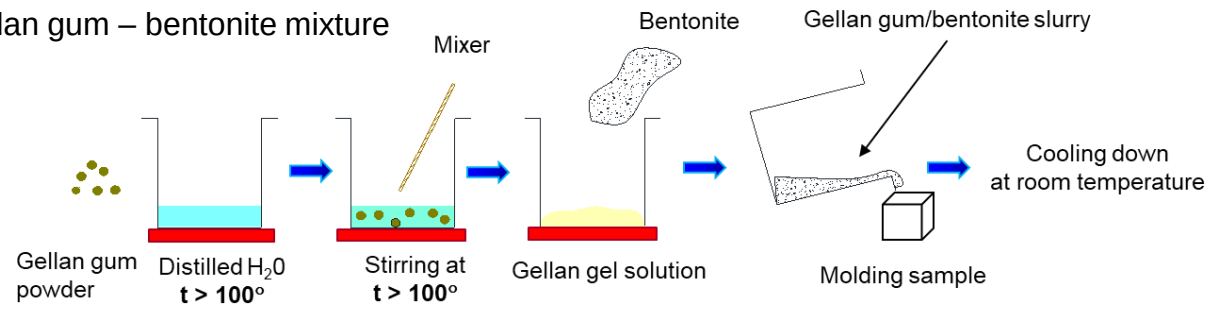


Gellan gum – bentonite mixture

(Tran and Katsumi 2021)

Axial strain rate: 1.7 %/min
Maximum strain: 15%

Gellan gum – bentonite mixture

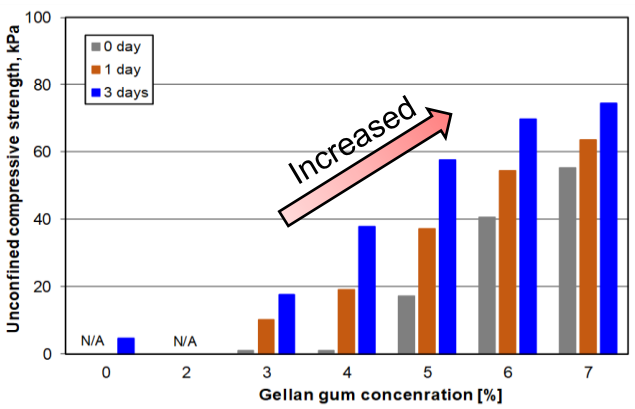


Experimental conditions

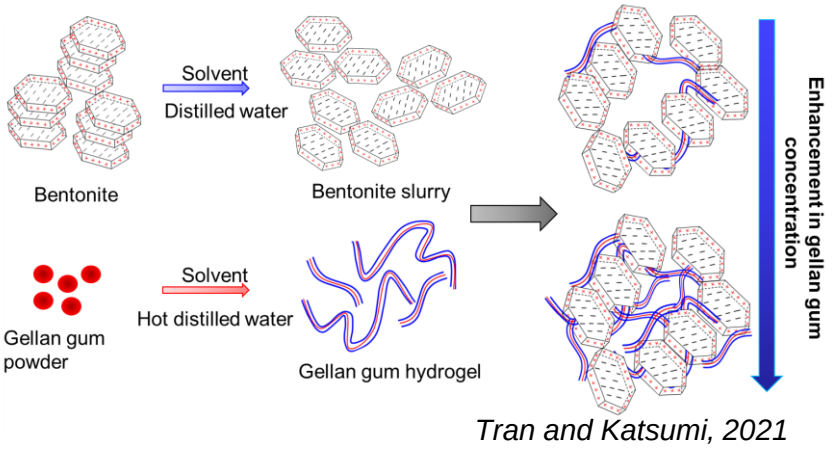
Conditions	Gellan gum concentration [%]						
	0	2	3	4	5	6	7
Initial	M00	M02	M03	M04	M05	M06	M07
1 day of drying	M10	M12	M13	M14	M15	M16	M17
3 days of drying	M30	M32	M33	M34	M35	M36	M37

Results and Discussions

Strengthening behaviors



Changes of UCS with gellan gum concentration and temperature

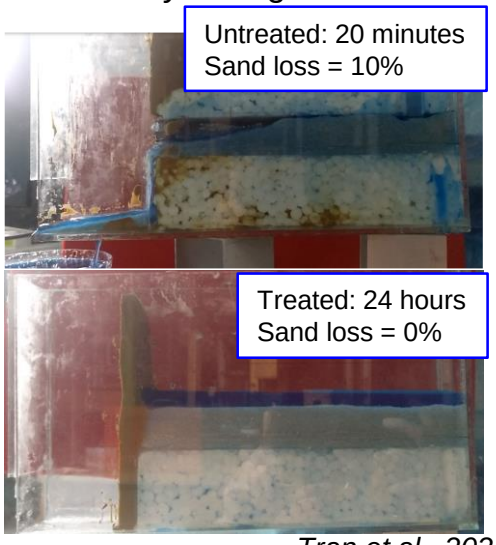


Tran and Katsumi, 2021

Gellan gum and bentonite interaction

Promising future application:

Gellan gum – treated bentonite slurry: new material for slurry wall stability during excavation



Tran et al., 2021

Results

- ✓ Increase of UCS as gellan gum concentration was increased
- ✓ Curing temperature: affecting factor of soil strengthening process

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Study on biogas production from anaerobic co-digestion of food waste and rice straw in Hanoi

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INTRODUCTION

In 2019, the national municipal solid waste was 35,624 tons/day, an increase of 46% compared to 2010.

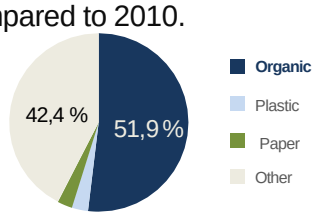


Figure 1. MSW composition in Hanoi

High percentage of organic content.
Landfill pollution.

Rice straw is the main by-product from paddy, estimated to generate more than 32 million tons/year.

Open-field burning.
Causing dust, air pollution.

The supermarket chain rapid thrives. In 2019, Hanoi had 141 supermarkets, and generated a large amount of food waste.

Easy to separate.

Anaerobic co-digestion of Food Waste (FW) and Rice Straw (RS) to treat them and to recover a renewable energy-biogas, producing a potential energy source, e.g., power generation or fuel gas.

METHODOLOGY

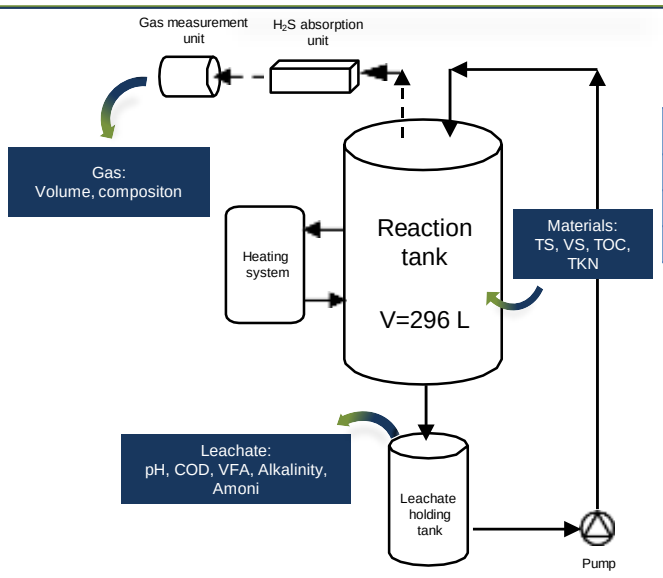


Figure 3. Schematic diagram of the anaerobic leach bed reactor

Table 1. Characteristics of food waste, rice straw and sludge

	MC (%ww)	TS (%ww)	VS (%TS)	TOC (mgC/gTS)	TKN (mgN/gTS)	Ratio C/N
Rice straw	15,03	84,97	75,81	340,1	12,6	27
Food waste	91,49	8,51	59,96	422,4	23,6	18
Sludge [a]	83,90	16,10	45,69	228,4	20,92	11

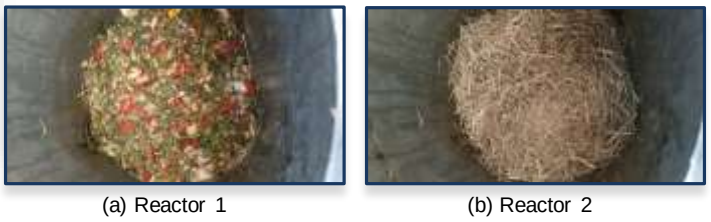
[a] Anaerobic sludge with good biodegradability and methanogenesis ability was used as inoculum to the digester, which was taken from the previous experiment.

Table 2. Anaerobic co-digestion experimental overview

	Reactor 1 FW	Reactor 2 FW+5%RS
Materials		
- Food waste	*100 kg*	*100 kg*
- Rice straw	***0 kg***	***5 kg***
- Sludge	*30 kg*	*30 kg*
Temperature	*37 ± 2 °C*	
Leachate circulation flow	*50 L/day*	
Retention	*60 days*	

MATERIALS

- FW mainly contains vegetable wastes, which was collected from MegaMarket Hoang Mai.
- RS was collected from the market in Thuong Tin.
- Materials are mixed shredded to average size.
- Experiments were conducted in parallel on two reactor.



(a) Reactor 1 (b) Reactor 2

Figure 2. Materials in this study

RESULTS & DISCUSSION

Day 0 to 10: Lag phase

pH decreases (<6.5), almost no methane production.

Day 10 to 30: Growth phase

pH strongly increases (~7,5) while COD on contrary (>15.000mg/L), production rate of CH_4 (>60%) also increases rapidly.

Day 30 to 60: Maturity phase

pH stays around 7,5. COD and gas generation rate slowly decreases.

Table 3. Summary of parameters in two reactor after anaerobic digestion

	Reactor 1 FW	Reactor 2 FW+5%RS
Total amount of biogas	**4000 L**	**6000 L**
Specific methane yield (L/kgVS)	469	402
Methane composition in the biogas	66%	62%
The produced amount of leachate	**85-90 L**	**75-80 L**
pH	7,78	7,75
COD (mg/L)	2427	3301
VFA (mg/L)	253	347
Amoni (mg/L)	1895	1570
Alkalinity (mg/L)	8500	7750
The remaining amount of solid waste	**37 kg**	**45 kg**
TS (%ww)	*20,94%*	*19,41%*
VS (%TS)	52,32%	58,39%
VS removal efficiency	*44,54%*	*51,57%*

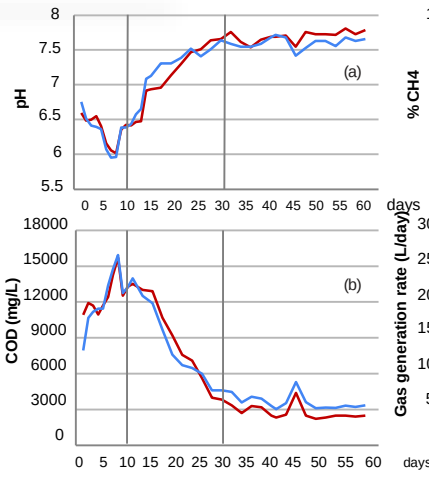


Figure 4. Variation of pH (a) and COD (b)

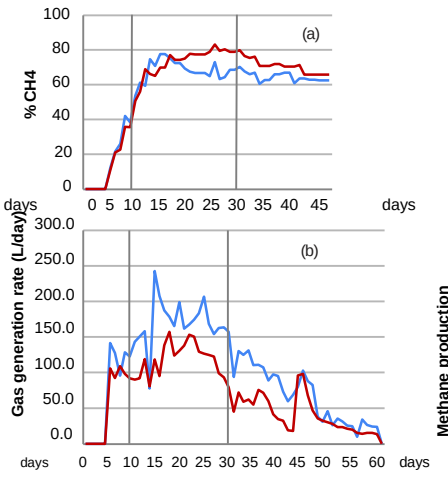


Figure 5. CH_4 percentage in biogas (a) and gas generation rate (b)

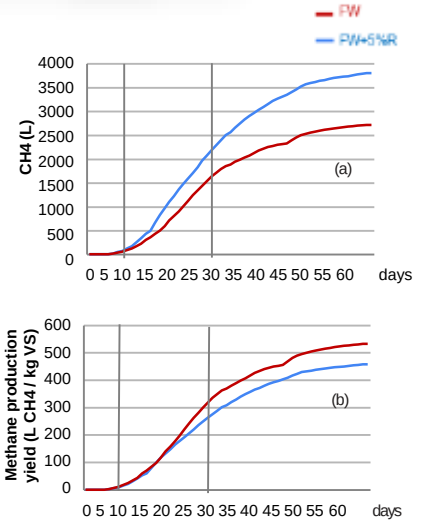


Figure 6. Variation of CH_4 volume (a) and the specific methane yield (b)

CONCLUSIONS

Food waste collected from supermarkets has the capability to generate gas quite effectively, which gave specific methane yield of 469 L/kgVS with average methane composition of 66% in the biogas. Co-digestion gave lower specific methane yield of 402 L/kgVS with average methane composition of 62% in the biogas but total biogas production increased by up to 50% in comparison with that of single food-waste digestion.

Rice straw not only contributes to improve the nutrient ratio for the anaerobic co-digestion, but also increase the efficiency of volume use of the reactor tank.

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The Evaluation of Point System in Promoting Waste Separation in Dongying, China

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Background

Since 2017, China promulgated mandatory waste separation policy which made many cities introduced incentive-type program to promote waste separation. Point system as the most representative incentive mechanism, has been introduced by many cities in China. It is an incentive system for waste classification that residents could earn points rewards by put the sorted waste into the designated equipment (intelligent garbage box) and use those points to exchange for daily necessities (Figure 1). The intelligent garbage box are often placed near the gate of residential community.

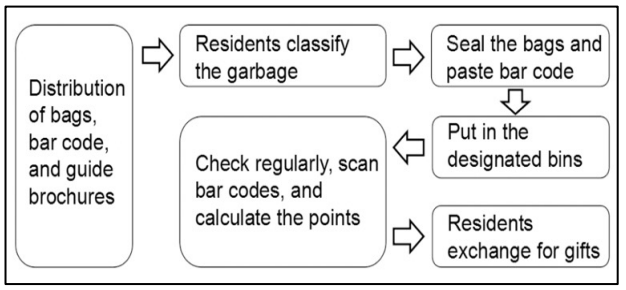

Figure 1. Process of waste classification with Point System

In recent years, there are some research discussed the feasibility and effectiveness of point system in China. While most of them are Chinese article and only focused on mandatory city in China. And most of them only focus on randomly selected operation periods. There are few research focus on the whole incentive mechanism operating period.

Therefore, the objective of this research is taking Chinese non-mandatory city-Dongying City as the research target, to clarify the Points System' impact on community waste separation and collection activities during the operation period. Participation rate and recycling rate are used as evaluation indicators.

Methodology

Research Area: Dongying District, Belongs to Dongying (Non-mandatory) city; which has 404 communities, 190,284 households. And the average daily domestic waste generation per household is 3.15kg. From 2020/09 to 2023/09, Waste Classification Pilot project are setting and implementing Point System in this city.

Data collection: taking point system data from 2020/09/15 ~ 2021/09/15 (12 months). The data comes from the point system operating privacy company. The community monthly **recycling rate (RR)** is the ratio of the total monthly recycling waste divided by the total monthly waste generation of the community, each household per day in Dongying district generated 3.15kg domestic garbage, and 30 days are set as 1 month for calculation. Refer to Harder et al. (2006), **participation rate(PR)** is defined as the proportion of households who participate in waste sorting and recycling at least once every 4 weeks.

Data analysis: multiple linear regression to verify which variables affect community monthly RR and PR.

Result and Discussion

(1) Point system operation results:

The longer the operating time, the higher the overall community PR; while the community average monthly PR is low.

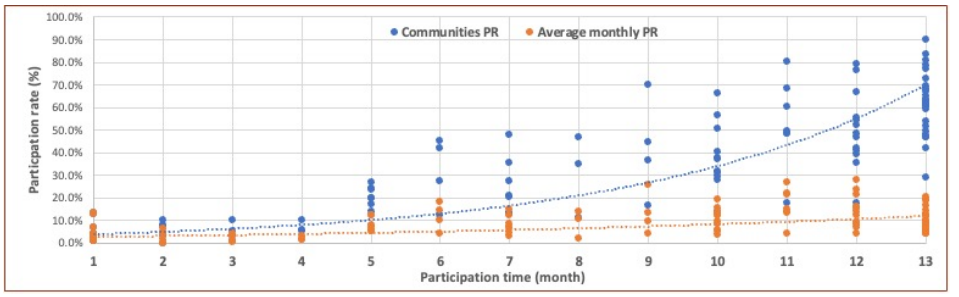

Figure 2. Changing of participation rate with Point system

(2) Multiple linear regression results :

Variable's selection: actual local community situation; staff feedback; the collected data characteristics.

Table 1. Description of variables

	Variables	Description	Range of variables
Dependent variables	RR	Community monthly recycling rate (%)	Community monthly collected waste(kg)/Community monthly generated waste(kg)
	PR	Community monthly participation rate (%)	Community monthly participants /Community whole household
Explanatory variable	D	Participation time (month)	Community point system operation time (1～13months)
Control variables	X1	First month recyclable waste (kg)	First month recyclable waste (kg) in one community
	X2	First month participants (household)	First month participants number (household) in one community
	X3	Community household number	Community total household number
	X4	Community building types	Villa area = 4; High-rise buildings (above 11 floors) = 3; Middle-rise buildings (7-11 floors) = 2; Multi-storey buildings (below 6 floors) = 1
	X5	Community residents' attributes	Whether if a community dominated by financial support personnel such as civil servants, teachers, state-owned enterprise employees, and oil company employees, 0=No, 1=Yes
	X6	Community equipment placement area	Whether it is placed with high foot traffic in the community, 0=No, 1=Yes
	X7	Community equipment attributes	Whether to add other attributes, such as express delivery, etc. , 0=No, 1=Yes

Table 2. Results of multiple regression analysis

VARIABLES	RR		PR	
	Coefficient	Standard Error	Coefficient	Standard Error
D	0.002 ***	0.0008	0.012 ***	0.0004
X1	5.56e-06 ***	5.77e-07	- -	-
X2	- -	-	0.002 ***	0.001
X3	-5.74e-06 ***	5.60e-07	-0.0003 ***	2.80e-06
X4	0.002 ***	0.003	0.018 ***	0.002
X5	0.002 ***	0.007	0.025 ***	0.004
X6	-0.001	0.007	-0.005	0.004
X7	-0.005 ***	0.009	-0.024 ***	0.004
Constant	0.004 ***	1.050	0.011 ***	0.005
R-squared		0.462		0.521
Observations		1365		1365
F	***	166.6	***	210.4

*** p<0.01, ** p<0.05, * p<0.1

Positive correlation at 1% (p<0.01) significance level to PR and RR: 'participation time(D)'; 'first month recyclable waste (X1)'; 'first month participants (X2) ' 'community building types(X4)' 'community residents attributes (X5)' ; Negative correlation at 1% (p<0.01) significance level to PR and RR: 'community size(X3)' ; 'community equipment attributes(X7)'

Summary

In general, Point System played a positive stimulating role to promote waste classification in Dongying city; Clarify the community-based attributes affect the change of RR and PR, such as community size, first month participation rate and recovery rate, building types and equipment.

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The Preliminary Test on Graphene Oxide-Based Electrochemical Sensor for a Detection of Ciprofloxacin

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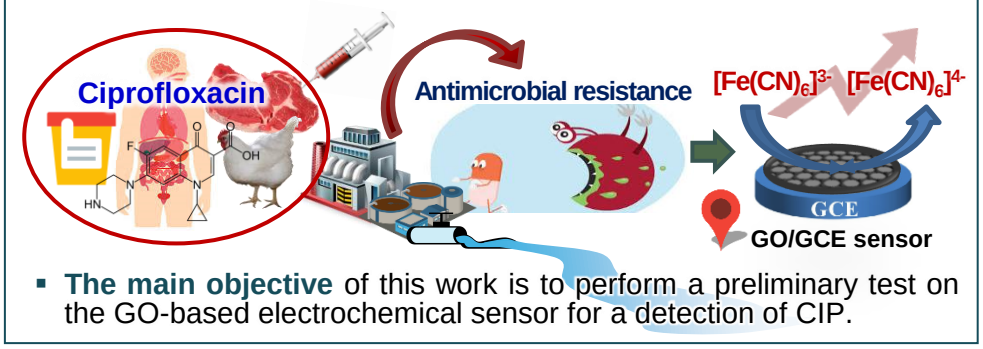
Introduction

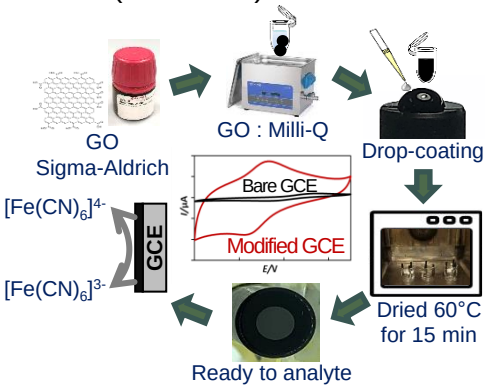
- **Ciprofloxacin (CIP)** is an antibiotic from the fluoroquinolone family. It has widely been used for the treatment of various illnesses, caused by gram (+) and gram (−) microorganisms. However, misuses and spreading of CIP can create antimicrobial resistances, which eventually render CIP an ineffective antibiotic against microorganisms.
- **Graphene oxide (GO)** is a 2-dimensional carbon nanostructure with chemical resistance, charge transfer, and electroactive abilities.
- **$[Fe(CN)_6]^{3-/4-}$** is an electroactive chemical, serving as an electron injector, promoting electrons transfer in an electrochemical cell.



- **The main objective** of this work is to perform a preliminary test on the GO-based electrochemical sensor for a detection of CIP.

Materials and Methods

- **Fabrication of GO/GCE:** 0.5 mg mL^{-1} GO dispersion was dropped on GCE (Scheme 1) and dried at 60 °C for 15 min.



Scheme 1 Fabrication of GO/GCE sensor.

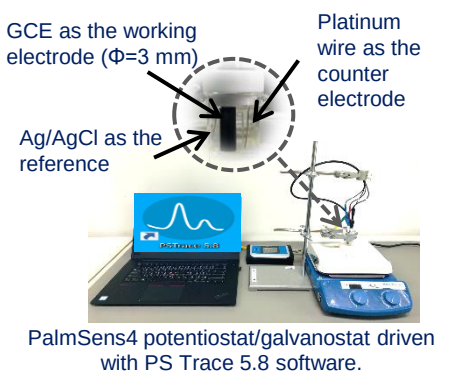
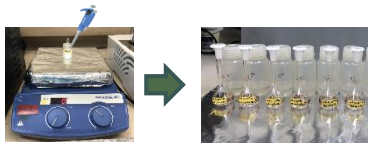


Fig. 1. Cyclic voltammetry experimental setup.

- **Electroanalytical measurements:** The sensors were operated in cyclic voltammogram (CV) mode with -0.1 V to +0.6 V potential window, 50 mV/s scan rate, and in 0.1 mM $[Fe(CN)_6]^{3-/4-}$ + 0.1 M KCl medium electrolyte (Fig.1).
- **CIP stock solution:** 338.1 mg CIP in 10 mL Milli-Q water + 92 µL HCL.



- **Sensing responses:** The GO/GCE was incubated in a CIP solution at a certain CIP concentration and employed for a CV scan in the electrochemical cell. The difference in electrochemical current ($\Delta I = I_0 - I_c$) at 0.38 V was recorded as sensing responses. (I_0 is the original current and I_c the response current).

References

Gui, R., Guo, H., & Jin, H. (2019). Preparation and applications of electrochemical chemosensors based on carbon-nanomaterial-modified molecularly imprinted polymers. Nanoscale Advances, 1(9), 3325-3363.
Santos, A. M., Wong, A., Almeida, A. A., & Fatibello-Filho, O. (2017). Simultaneous determination of paracetamol and ciprofloxacin in biological fluid samples using a glassy carbon electrode modified with graphene oxide and nickel oxide nanoparticles. Talanta, 174, 610-618.

Results and Discussion

FT-IR

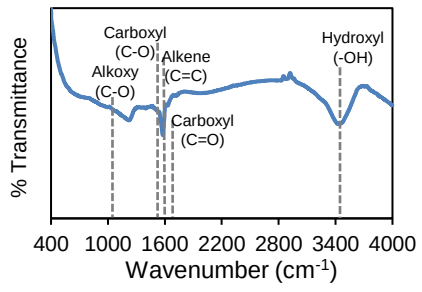


Fig. 2. FT-IR spectra of GO.

CV characterization

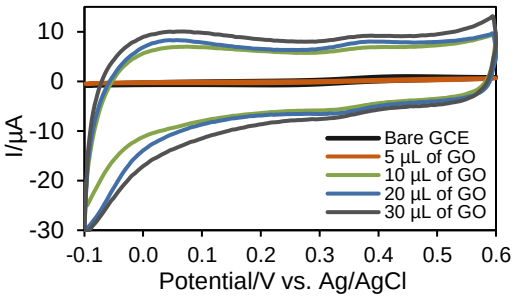
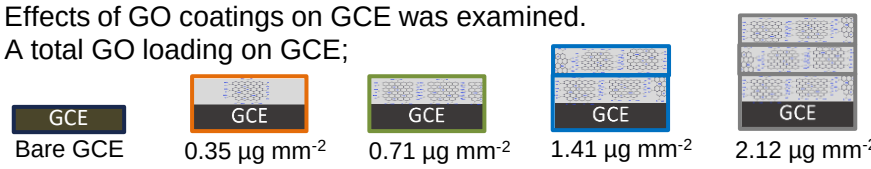


Fig. 3. CV responses of bare GCE and after modification of 0.5 mg mL^{-1} GO/GCE.

The electrochemical detection of CIP

- Effects of GO coatings on GCE was examined. A total GO loading on GCE;



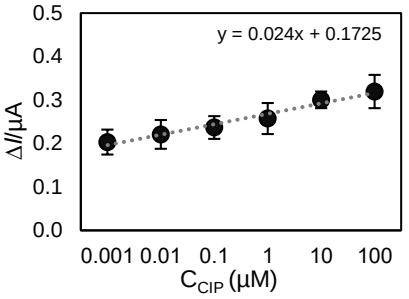


Fig. 4. Calibration curves of bare GCE in various CIP concentration.

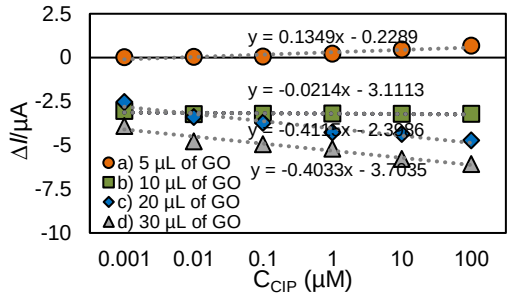


Fig. 5. Calibration curves of GO/GCE in various CIP concentrations with different GO loadings.

- The bare GCE shows increase in electrochemical current with respect to CIP concentration. The GO/GCE sensor exhibits stronger signals toward CIP, but the current signals go in the opposite direction.
- The peak currents of $[Fe(CN)_6]^{3-/4-}$ redox pair decreased due to CIP adsorbs on the electrode, it passivates and hinders electroactivity of the electrode and non-electroactive target molecule of CIP.

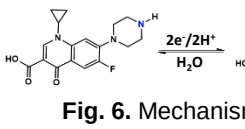


Fig. 6. Mechanism for the electro-oxidation of CIP.

- CIP exhibits a 2º amine group of structure, which acts as a basic center with the availability of non-bonding electrons as donor. Thus , it is suspected that the oxidation of CIP takes place at the –NH group to form -N-OH.
- GO offers hydrophilicity which can efficiently bind CIP and increase electrostatic interactions.

Conclusion

Graphene oxide was functionalized by reaction with ciprofloxacin. The electrochemical behavior of the $[Fe(CN)_6]^{3-}/[Fe(CN)_6]^{4-}$ redox couple in CIP solutions was clearly found with GO modified electrodes investigated by cyclic voltammetry leading to further develop and enhance electrochemical sensor for detecting antibiotics in the environment.

Acknowledgement

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Trends of Precipitation Extremes in Peninsular Malaysia under Wet and Dry Scenarios during 1989–2018

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Introduction

- In the tropical regions, the changes of precipitation extremes in response to global warming are highly uncertain due to the combine effects of unforced climate variability (for example, El Niño Southern Oscillation, ENSO), anthropogenic forcing and local factors.
- Peninsular Malaysia (or West Malaysia), is a tropical region located in the Southeast Asia that is highly vulnerable to both wet and dry extremes.
- Therefore, it is crucial to understand the extremes' characteristics and the potential driving factors to facilitate the development of climate resilience and adaptation strategies.

Objectives

- To investigate the trends of wet and dry precipitation extremes in Peninsular Malaysia from 1989–2018.
- To explore the teleconnections between extreme precipitation indices and the climate variabilities.

Methodology

Rainfall data from 26 rain gauge stations → Computation of five extreme precipitation indices → Trend Analysis (Mann-Kendall & Sen's Slope Tests) → Field Significance Test

Global mean temperature and ENSO anomalies → Correlation Analysis

Table 1. List of extreme precipitation indices used in this study.

Index	Index Name
Wet Indices	
PRCPTOT	Annual total wet-day precipitation
R95p	Total precipitation of very wet days
R20mm	Number of very heavy precipitation days
Dry Indices	
SPI-12	12-month Standardised Precipitation Index
CDD	Consecutive dry days

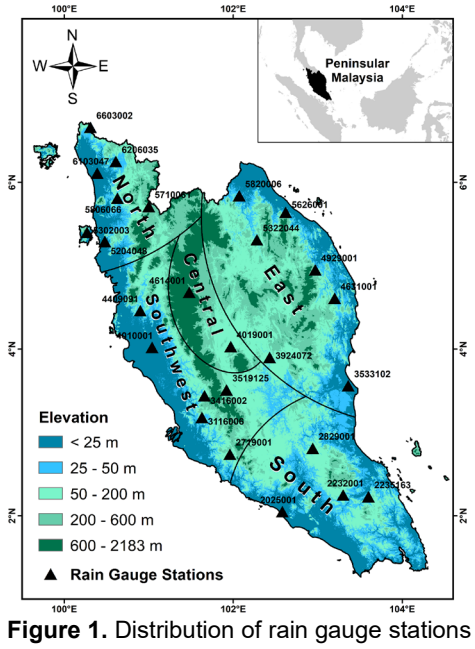

Figure 1. Distribution of rain gauge stations and topography of Peninsular Malaysia.

Results

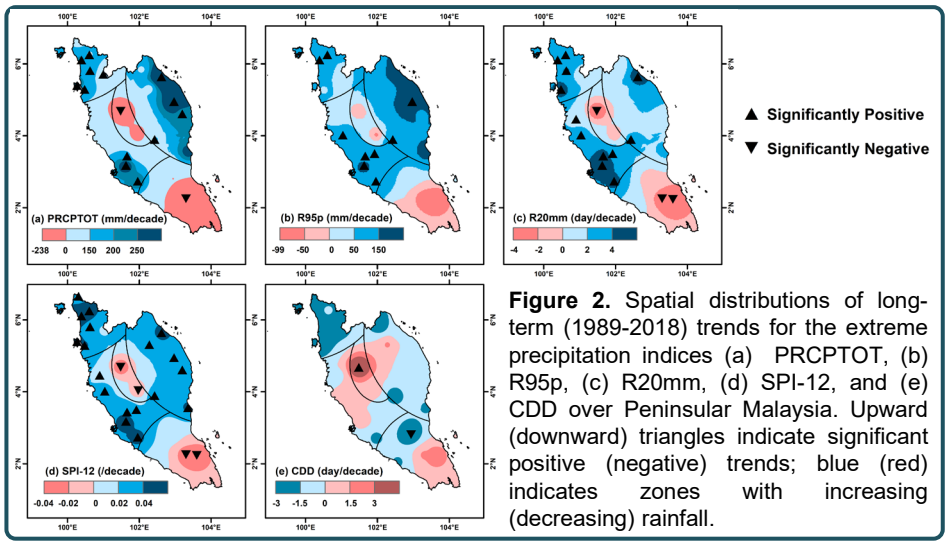

Figure 2. Spatial distributions of long-term (1989-2018) trends for the extreme precipitation indices (a) PRCPTOT, (b) R95p, (c) R20mm, (d) SPI-12, and (e) CDD over Peninsular Malaysia. Upward (downward) triangles indicate significant positive (negative) trends; blue (red) indicates zones with increasing (decreasing) rainfall.

Table 2. Trends of extreme precipitation indices in Peninsular Malaysia. Grey shaded values represent field significant trends at 5% level.

Index	North	East	Southwest	South	Central
Wet Indices					
PRCPTOT (mm/decade)	170.6	256.3	201.8	-129.7	-167.5
R95p (mm/decade)	56.4	163.7	111.7	-46.1	-61.1
R20mm (days/decade)	3.3	3.0	4.3	-2.4	-4.1
Dry Indices					
SPI-12 (/decade)	0.0463	0.0398	0.0438	-0.0159	-0.0275
CDD (days/decade)	-2.7	-1.2	0	1.9	6.0

Table 3. Correlations between extreme precipitation indices and those two potential influencing factors. Grey shaded values indicate significant at 5% level.

Influencing Factors	Index	North	East	Southwest	South	Central
Global Mean Temperature	PRCPTOT	0.515	0.216	0.340	-0.434	-0.471
	R95p	0.368	0.190	0.376	-0.433	-0.363
	R20mm	0.517	0.134	0.436	-0.487	-0.428
	SPI-12	0.542	0.248	0.321	-0.392	-0.484
	CDD	-0.102	-0.083	0.102	0.231	0.526
ENSO	PRCPTOT	-0.331	-0.285	-0.316	-0.437	-0.158
	R95p	-0.223	-0.072	-0.268	-0.525	0.002
	R20mm	-0.274	-0.396	-0.295	-0.323	-0.218
	SPI-12	-0.267	-0.302	-0.320	-0.472	-0.162
	CDD	0.322	0.278	0.493	0.134	-0.096

Discussions and Conclusion

- A regional difference in extreme patterns is observed, with the intensity and frequency of precipitation extremes in the north, east and southwest regions increasing substantially, as opposed to the significant decline in the south and central regions.
- The significant increasing of consecutive dry days in the central region also displays a strong signal of dry conditions in this region.
- The correlation analysis demonstrates a strong influence of global warming on the changes of precipitation extremes, particularly in the north, south and central regions, while the ENSO effect tends to enhance the dry conditions in the south region.
- However, the weaker correlations between precipitation extremes and ENSO effect could be due to the capacitor effect of ENSO (Rong *et al.*, 2010; Xie *et al.*, 2016), which requires further investigation.
- These findings conclude that wet extremes in the north, east and southwest regions of Peninsular Malaysia are getting more intense and frequent, while dry conditions in the central and south regions are likely to deteriorate under the strong influence of global warming.

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An Approach to Identify Potential Forest Landscape Restoration Sites: A Case of Southern Palawan

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[1]Department of Social Forestry and Forest Governance, University of the Philippines Los Baños; [2]Institute of Renewable Natural Resources, University of the Philippines Los Baños; [3]Conservation International Philippines Foundation Inc.

BACKGROUND

Deforestation has long been an issue in the Philippine forestry sector, which the government has started to reverse in recent decades. However, this trend should be sustained in the long term through the targeted application of Forest Landscape Restoration (FLR) modalities in areas with high potential for FLR. Hence, the study outlines a geospatial multicriteria approach that could aid in identifying these potential areas

METHODOLOGY

Historical forest change was derived from Landsat and MODIS image collections using decision tree ensemble machine learning and geoprocessing to generate consistent multitemporal (2000-2020) forest cover maps to establish the historical forest extent and identify change drivers. Then, the landscape's erosion-based land capability was modeled based on the Universal Soil Loss Equation. A raster-based weighted overlay analysis was used, made up of six parameters representing biophysical and management criteria and two exclusion parameters to determine the area's potential for FLR.

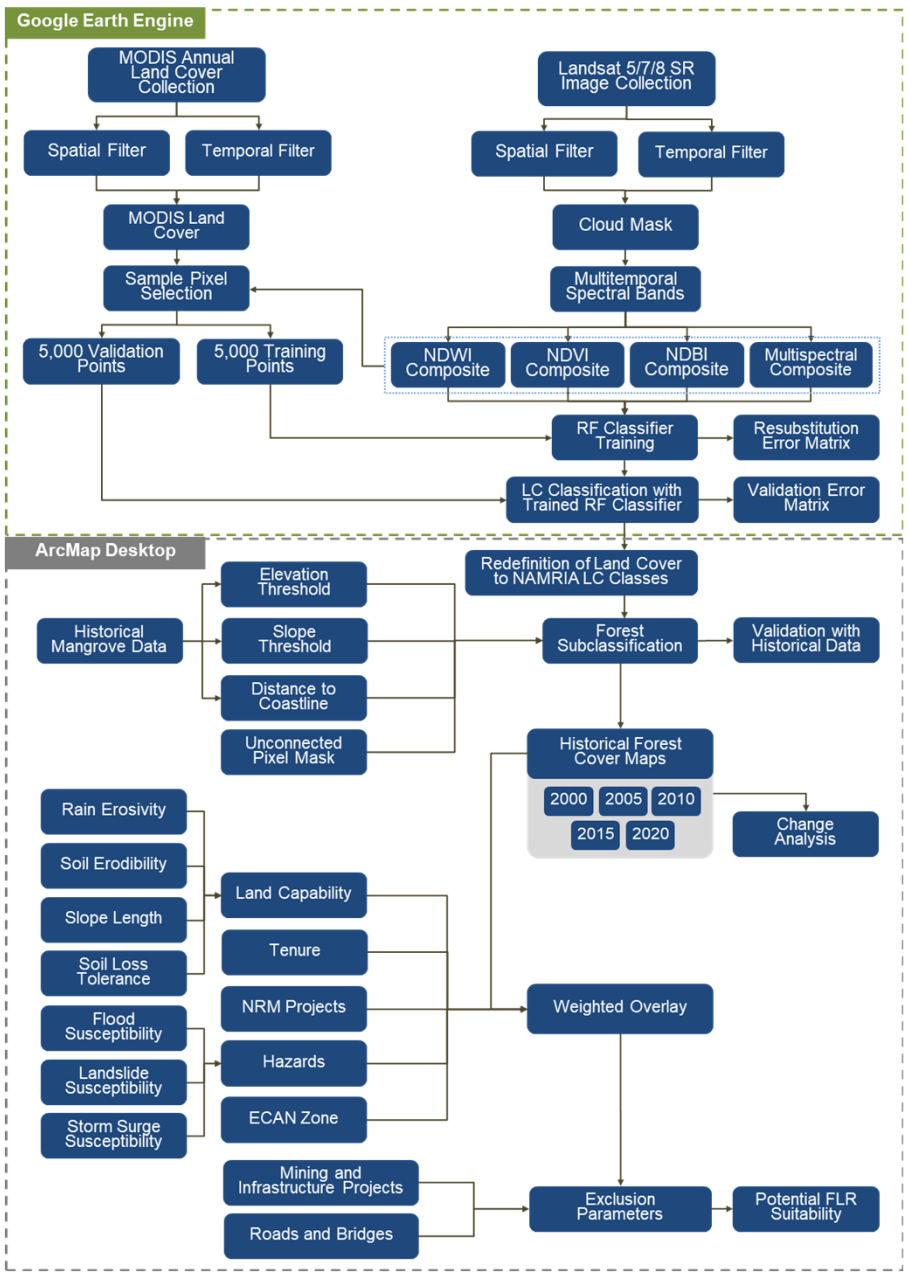

Figure 1. Graphical representation of the data and methods used

RESULTS AND DISCUSSION

Remotely sensed data show the area has lost 21,851 ha of terrestrial forests from 2000 to 2020, equivalent to 1,093 ha (1.03%) per year. Almost 40% of forest loss occurred during the last five years (2015-2020), an indication of increasing deforestation rates. Most forest loss (89.6%) can be attributed to the conversion to perennial crops, followed by transition to grasslands (9.7%). Hence, agricultural expansion is a key driver of deforestation in the area.

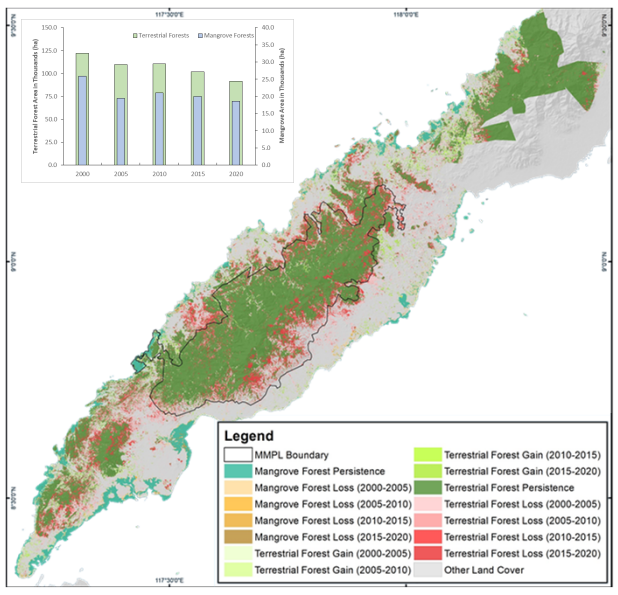

Figure 2. Historical forest cover change

Land Capability Classification	Description	Area (ha)
I-a	Strict Protection	247,685.6
II-a	Unlimited Production	92,033.7
II-b	Agroforest Production	52,824.7
II-c	Limited Production	22,866.7
	Grand Total	415,410.8

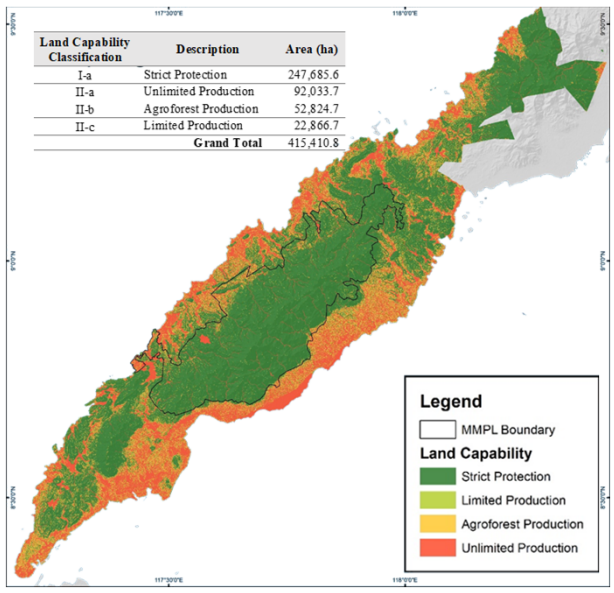

Figure 3. Erosion-based land capability

Class I-a, (strict protection areas), encompass 59.6% of the study site. Conversely, Class II production areas cover the remaining 40.4% covering a total of 167,725.1 ha. These are divided into three subclasses; Class II-a (unlimited production areas) comprise 54.8% Class II-b (agroforest production areas) cover 31.4% Class II-c areas (limited production areas) constitute 13.6%.

There were 83,625 ha highly suitable for forest restoration, 98% of which are for terrestrial forest restoration, and 2% for mangrove restoration. The majority of these were also highly suited to assisted natural regeneration and agroforestry as FLR modalities.

Suitability Class	Terrestrial Forest Restoration (ha)	Mangrove Forest Restoration (ha)
High Potential for Assisted Natural Regeneration or Agroforestry	61,486.5	879.4
High Potential for Afforestation or Reforestation	10,237.2	433.9
Very High Potential Assisted Natural Regeneration or Agroforestry	7,814.4	54.7
Very High Potential for Afforestation or Reforestation	2,680.1	39.2

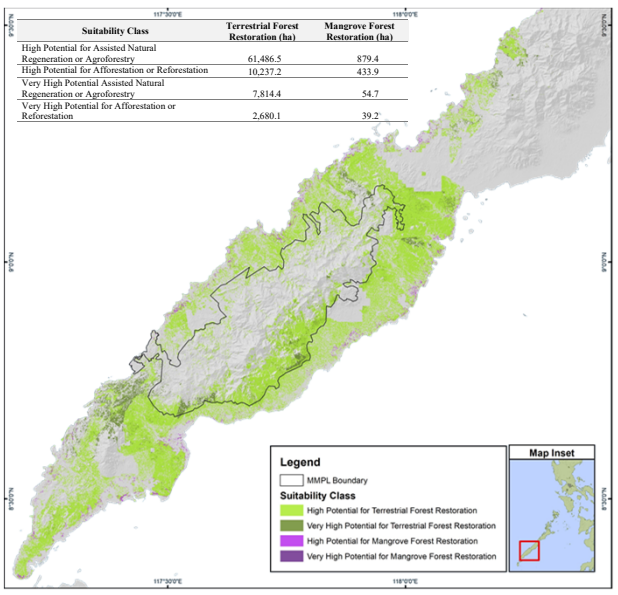

Figure 4. Suitability potential to FLR

These outputs could help local government to assess the carbon potential of forest and mangrove sites in Southern Palawan and will also aid identify opportunities for terrestrial and blue carbon sequestration and storage in the area in preparation for REDD+ initiatives.

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APPLICATION OF CO-COMPOSTING FOR STABILIZATION OF SLUDGE FROM SEAFOOD PROCESSING WASTEWATER TREATMENT SYSTEM

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** Mikuniya Corporation, Japan; *** Graduate School of Global Environmental Studies, Kyoto University

INTRODUCTION

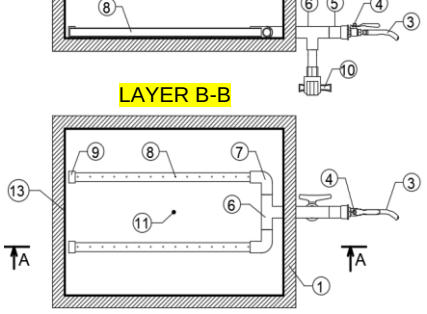
Seafood Processing

The diagram of sludge treatment in Seafood processing factory

MATERIALS AND METHODS

Experimental model construction

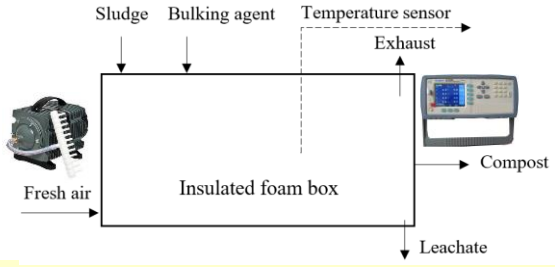
- Where: 1-Styrofoam box wall; 2-Lid cover; 3-Air pipe; 4-Air supply valve; 5-Threaded connection; 6-T pipe connection D21; 7-Coupling pipe D21; 8-Air distribution pipe D21; 9-Pipe end cap; 10-Ball valve D21; 11-Temperature sensor; 12-Signal wire; 13-Nylon layer ; 14-Exhaust pipe
- Air blower: 15 W, > 0.015 Mpa, flow: 10 Liters/min) with the mode of 2 minutes of blowing and 58 minutes of breaking.
- Data logger (Multi-Channel Digital Thermometer AT-4508).



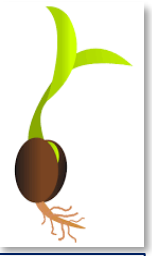

Dewater Sludge


Rice Straw


Green Wastes



The seed germination index (GI) of Green bean



Model 1 (MH1): 4 kg of dewater sludge + 2 kg of dry rice straw
Model 2 (MH2): 6 kg of dewater sludge + 10 kg of fresh green wastes

Co-composting EVALUATION

F. Zucconi *et al.*, 1981

The dewater sludge and bulking agent characteristics

Samples	Mois. (%)	Ash (%)	TOC (%)	T-N (%)	T-P (%)
Dewater Sludge	80.2 - 83.6	10.7 - 14.2	28.6 - 35.3	4.12 - 5.01	0.93 - 1.38
Rice Straw (Wet)	18.47	12.04	27.38	0.56	0.63
Rice Straw (Dry)	1.52	15.15	36.80	1.07	0.31
Green Wastes (Wet)	34.78	9.00	22.6	0.85	0.62
Green Wastes (Dry)	1.40	14.99	39.03	1.15	0.67

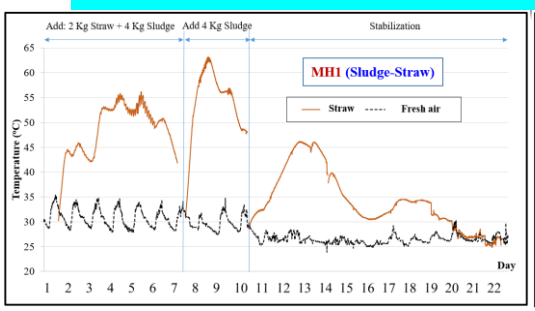
CONCLUSIONS

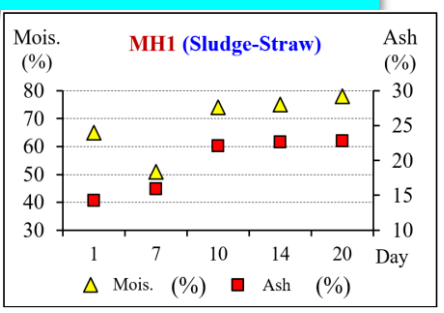
Sludge from the seafood processing WTTS contained a high concentration of moisture and nutrients. Sludge after the dewatering process was collected and disposed at the landfill.

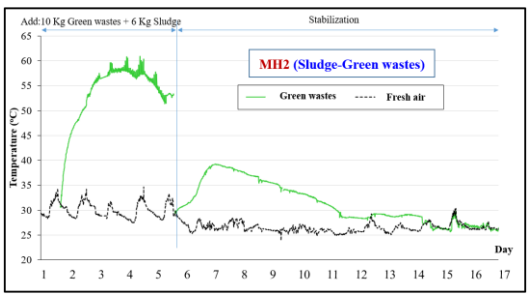
Observation of the phenomena and assessment methods combination of the compost quality showed that the sludge mixed with dry rice straw was more effective than green wastes. The dry straw-compost ensured met the microbial organic fertilizer and achieved growth indicators of plant growth when compost was tested on peas and sprouts. The GI index on the compost solution made with dry straw has a value of 120-134, so it should have the potential to provide nutrients according to the demand of plants.

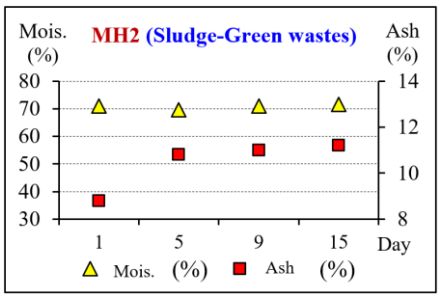
RESULTS AND DISCUSSION

Variation of physical parameters during the sludge decomposition process

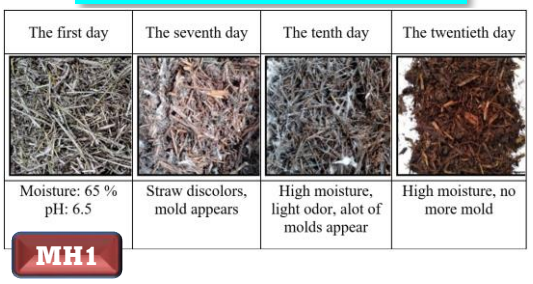


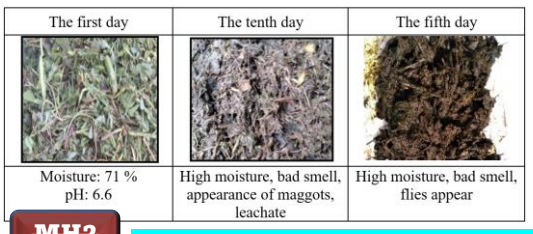




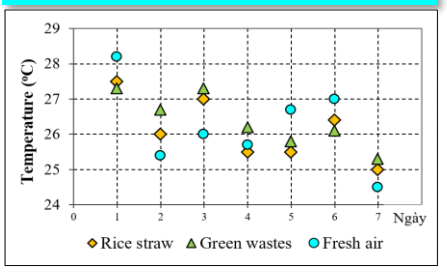


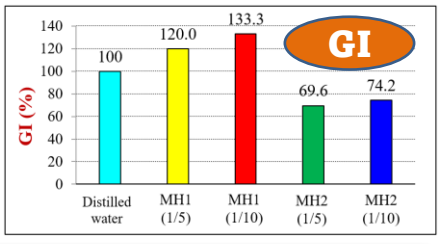
Sensory evaluation of materials





The stability of compost and GI value





Analysis results of decomposed sludge (MH1-MH2) & Farm straw compost*

Composts	Particle size (mm)	Mois. (%)	pH (-)	TOC (%)	T-N (%)	P_2O_5 (%)
MH1 (Rice straw)	5 - 8	48	6.8	21.90	2.60	0.029
MH2 (Green wastes)	> 5	72	8.5	34.30	0.89	0.034
Straw Compost*	> 5	69	7.0	18.66	0.51	0.033
TCVN 526:2002	4 -5	< 35	6 - 8	≥ 13	≥ 2.5	≥ 2.5

Compost test results on sprouts (2 evaluation indicators: stem mass and root length)

MH1-Compost
MH2-Compost
T-Blank (fresh soil)

Aknowledgement

Vo Diep Ngoc Khoi was funded by Vingroup Joint Stock Company and supported by the Domestic Master/PhD Scholarship Programme of Vingroup Innovation Foundation (VINIF), Vingroup Big Data Institute (VINBIGDATA), VINIF.2020.TS.48.

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Biomonitoring Lead (Pb) Pollution in Bandung, Indonesia Using Lichen

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Background

The city of Bandung is the 5th most populous city in Indonesia with the growth of the transportation sector increasing 11% per year, making it the largest contributor to lead (Pb) pollution. Pb is a neurotoxin for humans that can cause long term accumulation in the hemophilic, cardiovascular, and urinary systems because of its slow elimination process. Due to the dangers of airborne Pb, the Indonesian government has taken mitigation efforts to phase out leaded gasoline throughout Indonesia. Since July 1st, 2006, leaded fuel has ceased to be used in Bandung.

To evaluate the impact of this policy, an airborne lead monitoring system is needed. Biomonitoring, or the use of living organisms (bioindicators) to measure pollutants in an ecosystem, offers an easy and cost-effective method to measure air pollutants. Lichen, a symbiont between fungi and algae, is the most common organism used to monitor air pollutions, where its sensitivity to air pollution can be seen through changes in its diversity and accumulation of pollutants in its thallus. Thus, this study utilizes these two biomonitoring approaches to evaluate the impact of unleaded fuel on three roads in the city of Bandung.

Methodology

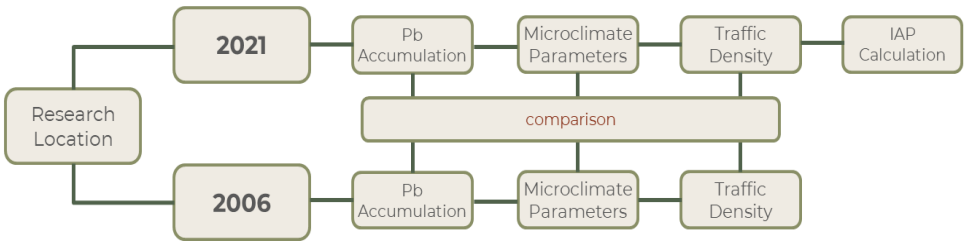

Figure 1. Research methodology diagram

This research was carried out on three streets of Bandung which represented different levels of traffic density from high to low, respectively Supratman St., Nyland St., and Penatayuda St. Lichen diversity was measured with the Index of Atmospheric Purity (IAP) through the calculation of total lichen frequency in a sampling grid in 2021. Pb accumulated in *Lepraria* sp. through atomic absorption spectrophotometry (AAS), microclimate parameters (temperature, air humidity, and light intensity), and traffic density was then compared between 2021 and 2006.

Results and Discussion

Lichen Diversity

The results of lichen diversity calculated through IAP values for Penatayuda St., Nyland St., and Supratman St. are as follows.

Table 1. Index of Atmospheric Purity measurements (*p<0.05)

	Penatayuda St.	Nyland St.	Supratman St.
IAP	14	15	16

According to the categorization of air quality levels based on IAP values, all locations are included in Level B (12.5<IAP<25) which indicates a high level of pollution. Highly disturbed city sites generally fall into the same category. Besides the high traffic density which is the main cause of air pollution, urban areas also limits the availability of substrates and microhabitat conditions which affect lichen diversity.

In 2021, 4 lichen species were observed from different genera namely *Lepraria* sp., *Parmotrema* sp., *Dirinaria* sp., and *Candelaria* sp. *Lepraria* sp. is considered a cosmopolite species because of its high tolerance for pollutants, hence its high abundance in all locations. Hence, this species was then used to compare Pb accumulation between 2006 and 2021.

Pb Accumulation in Lepraria *sp.*

For both 2006 and 2021, the lowest lead concentration was found on Penatayuda St. whereas the highest lead concentration was found on Supratman St. From 2006 to 2021, a significant decrease in lead concentrations in lichen was observed at all locations.

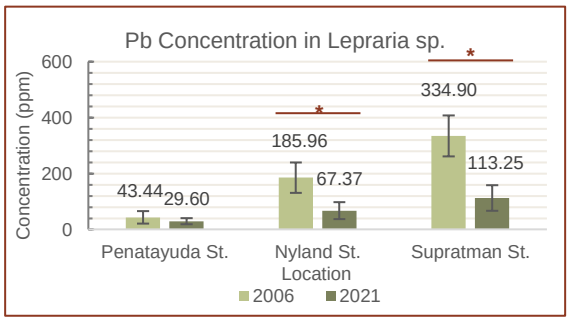

Figure 2. Pb accumulation in *Lepraria* sp. (*p<0.05)

The difference in Pb concentration accumulated in the thallus of *Lepraria* sp. between years can be caused by several factors, including the difference in traffic density and microclimate parameters.

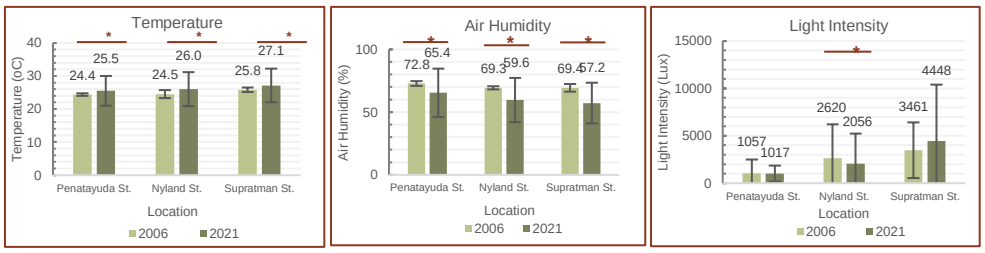

Figure 3. The results of microclimate parameter measurements (*p<0.05)

While a significant increase in temperature and decrease in air humidity was observed at all three locations, it was found that changes in microclimate parameters did not correlate with changes in lichen lead accumulation in this study.

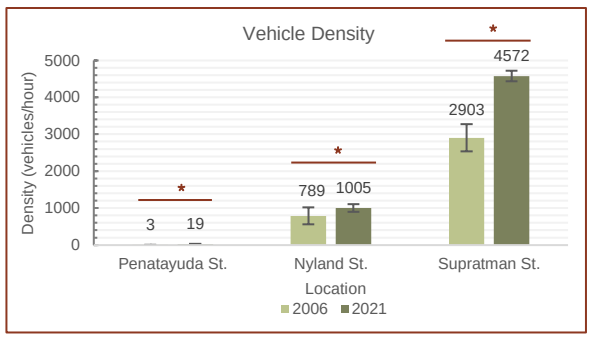

Figure 4. Vehicle density measurements (*p<0.05)

For both 2006 and 2021, the lowest average volume of motorcycles was found on Panatayuda St. and highest on Supratman St. A strong correlation was observed between traffic volume and Pb concentration in *Lepraria* sp. in 2021, indicating that Pb concentrations are higher in locations with high traffic activity as well.

However, this pattern is not observed when compared between 2006 and 2021. In 2021, the low accumulation of Pb in *Lepraria* sp. measured despite the increase in traffic volume indicates the decrease in airborne lead caused by the phase out of leaded gasolline. In Bandung, a decrease in airborne Pb of over 70% was observed for six years after the elimination of leaded gasoline. The decrease of Pb concentration in Bandung is a great success story of the phase out of leaded gasoline in Indonesia.

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CHEMICAL COMPOSITION OF COFFEE HUSK COMPOST

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* Department of Agronomy, Faculty of Agriculture and Forestry, Champasack University
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Abstract

The experiment aimed to evaluate the technique for making the organic compost from agricultural by-products (coffee husk). The organic compost from coffee husk was produced by stacking for three layers and its' main ingredients were used 1,000 kg of coffee husk mixed with 200 kg of cow manure and sprinkled with molasses and effective microorganisms (EM). The results of this study indicated that the compost from coffee husk was expressed longer period for fermentation (60 days) when compared with other types of compost and it was completed more than 80% of the decomposition. The percentage of NPK nutrients in the compost found total nitrogen (% total N), total phosphate (% total P) and total potassium (% total K) were 1.42, 6.32 and 0.04%, respectively and the value of organic matter (% OM) was 28.35% and pH was 7.27. The nutrient contents in coffee husk compost were compared to the composting standard of the Ministry of Agriculture and Forestry of Lao PDR, which it was investigated that only total potassium (% total K) value was lower than the standard value.

Introduction

Pakxong District, Champasak Province is located in the plateau at an altitude of about 600 meters above sea level averagely and the highest place is about 1,400 meters, with an average annual temperature of 19.90 degrees Celsius. This district is rich in natural resources where cover the peaks of the plateau, there is Lumse River across the city that provides a good potential for agricultural production as it is determined as an agricultural production zone and benefited for socio-economic development.

The location of Pakxong District has displayed good potential and it is a unique place for growing coffee, tea, industrial trees and vegetables. Coffee mill processing is largely produced by-products and is regarded as a waste material such as coffee husks. Farmers have annually poured by-products (coffee husk) into the coffee field as an organic fertilizer. Therefore, this experiment is interested to improve the quality of by-products (coffee husk) as organic compost.

Objective: to evaluate the technique for making the organic compost from agricultural by-products (coffee husk)

Materials and Methods

Location and duration:
The experiment was conducted in the demonstrative station (Pakxong District), Faculty of Agriculture and Forestry, Champasack University, Lao PDR. it is far from the city center about 60 kilometers and around 1,200 meters above sea level. The experiment was started from 2020 to 2021.

Making compost by coffee husks


1. coffee husks


2. Cattle manure


3. Mix Cattle manure on the top of coffee husks


4. sprinkled with molasses and EM


5. Complete three layers of compost


6. Cover the compost by plastic


7. flipping the compost


8. compost's fermentation


9. completed more than 80% of the decomposition in 60 days

Results

The results indicated that coffee husk fermentation was trended to increase the multi-nutrient. Nutrient contents were compared to the standard value (Ministry of Agriculture and Forestry.) which it was expressed almost the same standard value.

No.	Nutrient Contain	Coffee husks	Coffee husks compost	Compost standard value in Laos PDR
1	N	1.27	1.42	**1%**
2	P	0.06	6.32	**3%**
3	K	2.46	0.04	**0.5%**
4	OM	58.05	28.35	**≥ 30%**
5	pH	4.82	7.27	**6.5-8**
6	C/N	40.02	13.6	**≤ 20/1**

Conclusion

- Nutrient percentage of compost like N, P were higher than standard values but K was lower.
- pH and C/N content were similar to standard values as determined by the Ministry of Agriculture and Forestry.
- The compost made from coffee husks can be used as a organic fertilizer for crop.
- Convenience producing of compost processing derived coffee husks and it can be utilized to encourage farmers for growing crops

Reference

Ministry of agriculture and forestry, 2000. standard value of compost and statistic report.

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Citric Acid Assisted Treatment Of Tannery & Surgical Industry Wastewater By Hydroponically Grown *Tagetes erecta L.* (Marigold)

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*Department of Environmental Sciences, Faculty of Sciences, Hafiz Hayat campus, University of Gujrat, Pakistan, Postal Code 50700.

Background

- Industrial wastewater (WW) consists of numerous heavy metals, salts and many other toxic pollutants.
- Phytoremediation is low cost and sustainable method of WW treatment in comparison of other conventional methods.

Wastewater effluents

Bioremediation by plants

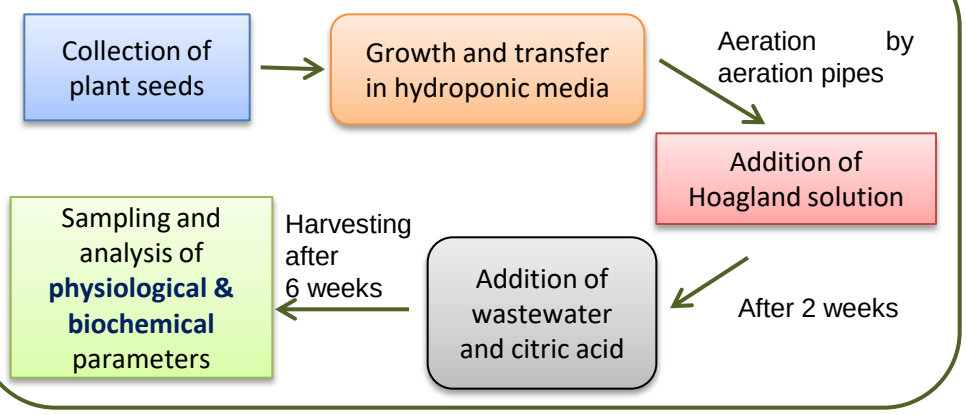
- Accumulation of heavy metals in roots and aerial parts of plants
- Chelating agents improve plant defense against metal toxicity

Objective

✓ To determine the phytoextraction potential of *Tagetes erecta L*. for Cr, Pb and Ni from wastewater.

✓ To determine the chelating potential of Citric acid in *Tagetes erecta L*. grown in industrial wastewater.

Methods and material



Results and discussion

- Significant reduction in Morpho-physiology attributes With increasing dose of wastewater in *T. erecta*
- Lowest growth of plant was observed at 100% wastewater.
- While maximum growth of plant growth was in presence of CA 10mM without wastewater.

Table 1. Decrease (%) of *T.erecta* Physiology grown in wastewater

Parameter	Plant physiology
RL	55-52%
PH	49.39-35.69%
Leaves	51.28-47.92%
FWR	56.09-53.23%
FWS	48.09-42.67%
FWL	51.36-41.98%
DWR	49.37-44.92%
DWS	53.99-51.23%
DWL	65.37-48.32%

Biochemical Parameters

- Significant damage to biochemical attributes with increase in heavy metal concentration and accumulation was shown under the application of wastewater.
- Plants treated with CA shown improved growth, biomass, photosynthesis pigments (Chl a, b, total and carotenoids) antioxidant enzymes activity (SOD, POD, APX, CAT), reduced hyper-reactive oxygen species (MDA, H_2O_2) and electrolyte leakage as compare to untreated plants with CA.
- Application of CA to plants treated with CA alleviated the stress and toxicity induced by heavy metals to *Tagetes erecta L*.
- Higher concentration and accumulation of Cr, Ni and Pb was shown in roots, stem and leaves as compare to untreated *Tagetes erecta L*. with CA.

Table 2. Metal accumulation in presence and absence of CA

	WW (0-100%)	CA 5mM	CA 10mM
Pb R	114.93-105.34%	22.42-11.52%	24.46-44.56%
Pb S	100.67-98.38%	18.63-11.60%	39.62-27.72%
Pb L	114.71-58.29%	49.93-15.01%	89.89-36.58%
Ni R	134.14-89.10%	34.39-18.84%	63.90-32.28%
Ni S	121.60-84.22%	38.78-11.80%	63.92-26.43%
Ni L	125.18-66.62%	50.06-14.11%	87.97-35.37 %
Cr R	138.84-116.19%	24.34-12.41%	50.79-24.45%
Cr S	120.56-105.58%	22.77-13.68%	50.65-29.28%
Cr L	137.83-82.52%	51.80-17.87%	91.80-47.05%

Conclusion

- Present study conclude that CA treated *Tagetes erecta L*. has increased potential for concentration and accumulation of Cr, Pb and Ni.
- Study suggests that application of CA might be useful strategy to enhance the phytoextraction potential of *Tagetes erecta L*. for Cr, Ni and Pb from wastewater.

Acknowledgment

I express my special thanks to my supervisor **Dr. Mujahid Farid**, without his assistance, direction, encouragement, suggestions, and continuous guidance; this could not have been possible.

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Development and Testing of Power Tiller-Mounted One-row Transplanter for Improving Vegetable Farming Practices in Cambodia

Authors: Lyhour HIN*, Than MET*, Chamnan SUOS* and Sokleng MANG*

* Faculty of Agricultural Engineering, Royal University of Agriculture, 12401 Phnom Penh, Cambodia

Introduction

- Vegetables are integral part of Cambodian diet and are consumed at least five days a week.
- However, local vegetable production remains slow and cannot meet the domestic demand, thus depending largely on imported produce. Unlike rice and upland crops,
- little attention has been paid to mechanized vegetable farming, and transplanting is chiefly done by hand.
- To increase vegetable production in the country, mechanical transplanters are required.

Objective

The aims of this paper were given as follows:

1. to compare the working capacity between a locally made transplanter and hand transplanting; and
2. to determine the break-even area of the transplanter.

Material and method

- The research was conducted at the Faculty of Agricultural Engineering, Royal University of Agriculture, Phnom Penh, Cambodia,
- The study period started from fabrication in January 2020 to finished testing in August 2021.
- The experiment was arranged in RCBD with two treatments replicated 4 times (2 m x 15 m each). The soil type was a sandy soil, and the seedlings used were okra aged 30 days.

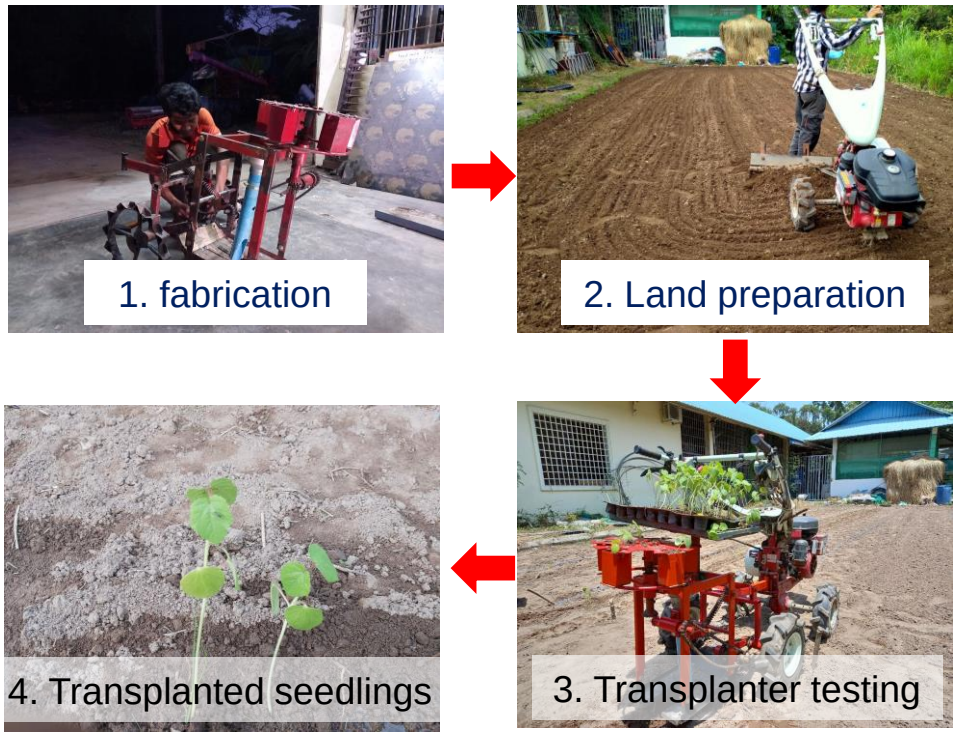

Figure 1. Process starting from fabricating transplanter to land preparation and to field testing.

Results and discussion

Table 1. Comparison of performance between transplanter and hand planting

Treatment	Speed (km h^{-1})	TFC (m^2 h^{-1})	EFC (m^2 h^{-1})	FE (%)
Transplanter	0.93 ± 0.03 a	370 ± 11.5 a	300 ± 4.9 a	81
Hand planting	0.12 ± 0.01 b	50 ± 5.8 b	45 ± 0.6 b	90
P (>t)	<0.001***	<0.001***	<0.001***	N/A

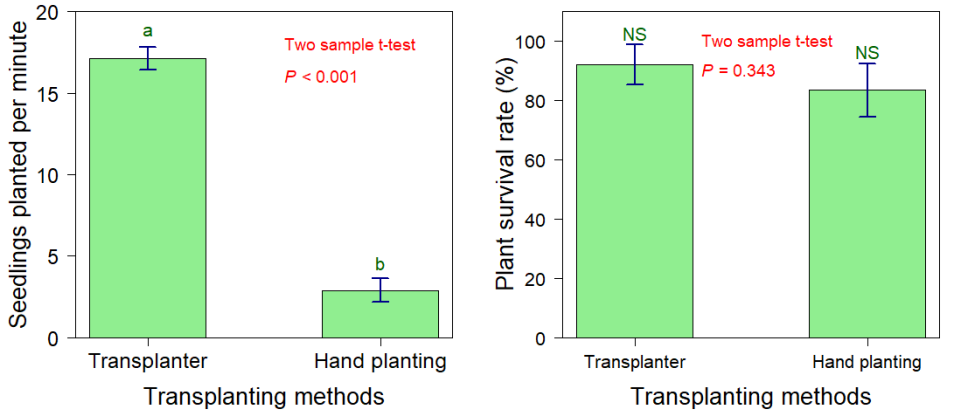

Figure 2. Plant number *(left)* and plant survival *(right)* between two treatments

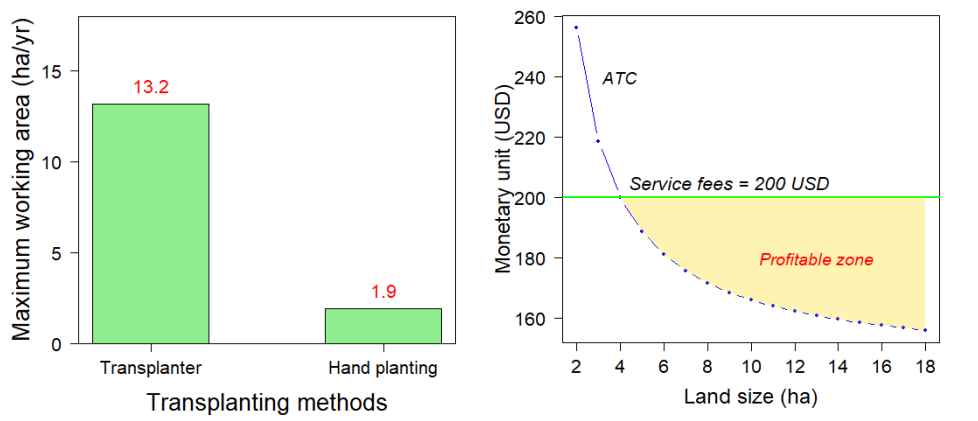

Figure 3. Maximum work area *(left)* & break-even area *(right) for transplanter*

Conclusion

- In conclusion, using the transplanter saves considerable amounts of time and labor, when compared to hand transplanting.
- Still, modification is needed to freely regulate plant spacing to suit different kinds of vegetable.

Acknowledgement

This study was made possible thanks to the funding provided by the BHEARD program and to the coordination of CE SAIN. Many thanks also go to students from the Faculty of Agricultural Engineering for assisting in the fabrication, facilitation of testing, and data collection.

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EFFECT OF RICE DISTILLERS' BY-PRODUCT AND BREWERS' GRAIN INCORPORATED BIOCHAR AND CASSAVA ROOT ON GROWTH OF CATTLE

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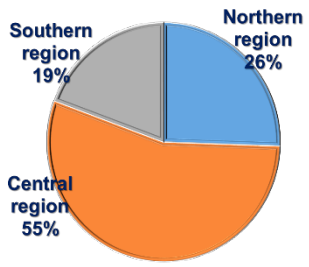
* Faculty of Agriculture and Forestry, Champasack University
** Graduate School of Global Environmental Studies, Kyoto University

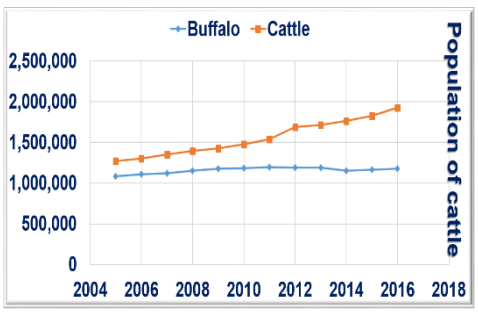
ABSTRACT

The experiments aimed to evaluate the efficacy of using cassava root, and by-product as feed for local cattle in Laos, and biochar was applied as an additive feed to improve live weight. Local cattle with an initial live weight of 100 – 120 kg LW were used in this study. The experimental design was arranged in a completely randomized design (CRD) with three replications of each treatment. The cattle were fed 30% of fresh cassava root, 1% of biochar, and 3% of urea (in diet DM) for 84 days the growth performance was better than other treatments. The growth rate period of 24 – 84 days was found to trend to improve the live weight gain of cattle (0.706 kg/day) when supplied 1% biochar. The native cattle performed the highest final weight (147.60kg) and average diary growth (ADG) (0.7524 kg) when added source of bypass protein from the brewers' grain followed by the addition of a source of bypass protein from wine production (rice distillers' by-product) and control ($p < 0.05$).

INTRODUCTION

Cattle are considered as one of livestock to ensure food security, poverty alleviation, and commercial production in the government agenda. Cattle have become increasingly valuable assets for smallholder farmers, particularly the poor due to increased demand. The available feed sources such as cassava root, leaves, and by-product incorporated with biochar to improve live weight gain of the local yellow cattle.





OBJECTIVES: To investigate biochar incorporated with the diets to improve live weight of local yellow cattle in Lao PDR.

MATERIALS AND METHODS

Location and duration

Conducted in the Integrated Demonstration Station, Faculty of Agriculture and Forestry, Champasak University, Lao PDR, it far from city center about 13 Km.

Animals and housing

The local "yellow" male cattle (116 – 122 kg LW) confined in individual pens, made from wood and bamboo with the size of each pen 1.5*2 m. Vaccinated epidemic diseases and drenching against internal parasites.

Treatments

Ex.II Composition of diets

Ingredients (DM diet)	Treatments		
	CT	BIO1	BIO2
Rice straw	37	36	35
Ensiled cassava root	30	30	30
Brewers' grain	30	30	30
3% Urea	3	3	3
% biochar	**-**	**1**	**2**
Total	100	100	100

BIO1: biochar 1%; BIO2: biochar 2%; Control: no biochar

Ex.I Composition of experimental diets

Feed ingridients%	FC0	FC10	FC20	FC30
Elephant grass	45	45	45	45
Biochar	1	1	1	1
Urea	3	3	3	3
Cassava root	**0**	**10**	**20**	**30**
Rice straw (ad lib)	51	41	31	21
Total	100	100	100	100
%CP	14	14	14	14

Ex.III Composition of diets

Ingredients (DM diet)	Treatments		
	CTL	RDB	BG
Rice straw (Semi-ad lib)	66	36	36
Ensiled cassava root (Semi-ad lib)	30	30	30
Brewers' grain	**0**	**0**	**30**
Rice distillers by-product	**0**	**30**	**0**
3% Urea	3	3	3
1% biochar	1	1	1
Total	100	100	100
%CP	11	17	18

CTL: control; RDB: Rice distillers by-product; BG: Brewers' grain

Feeding and management

Rice husks were carbonized in an "updraft" stove to produce biochar, 0.2-0.3 cm, ensiled (5 days) by using plastic, ensiled condition (pH of <4).

Chemical analysis

Feed samples were analyzed dry matter (DM), ash, nitrogen, NDF and ADF.

Data collection

The cattle were weighed before feeding and at 14 day intervals. Feed offered and residues were recorded daily. At the end, the samples of individual animal was analyzed.

RESULTS AND DISCUSSIONS

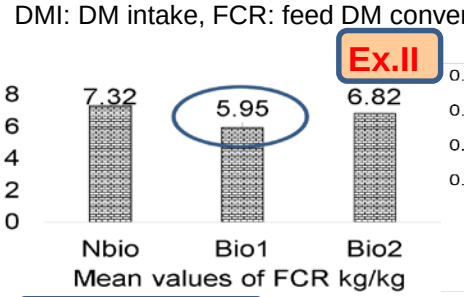
Growth and feed conversion

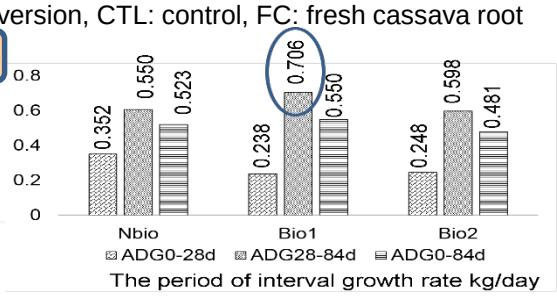
Ex.I Mean values for live weight, DM intake and feed conversion

Growth rate	CTL	FC10	FC20	FC30	*MSE*	P
Initial weight (kg)	107.6	101.6	99	96.3	5.048	0.4778
Final weight (kg)	124.1	119.6	118.6	117.5	5.377	0.8215
LW gain, g/d	196.4^{c}	214.7^{bc}	233.3^{ab}	252.4^{a}	11.148	0.0362
DMI, kg	239.5	246.8	270.5	289.9	14.095	0.1189
FCR kg/kg	14.6	13.7	13.9	13.7	0.990	0.9081

DMI: DM intake, FCR: feed DM conversion, CTL: control, FC: fresh cassava root

Ex.II

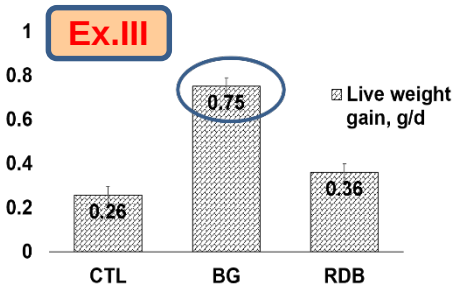




Conclusions

The utilization of 1% biochar (DM diet) incorporated with 1% brewers' grain/LW (DM) and 30% of fresh cassava root (DM diet) can significantly improve the growth rate of cattle.

Ex.III



Conclusions

The positive response from feeding biochar is in line with previous reports: cattle (Leng et al 2012; Sengsouly and Preston 2016). Several researchers were supported our experiment on the efficacy of cassava root for improving the live weight gain of cattle (Inthapanya et al. 2016; Sangkhom et al. 2017 and Saroeun et al. 2018). Winders et al. (2019) tested wet distillers' grains integrated with 0.8% biochar increased dry matter intake (DMI).

Growth and feed conversion

Sincere gratitude GSGES seeds research funding program to support fund for This study and appreciate ChU to provide the places and equipment.

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Effect of soil type on nitrogen flux pattern in tropical forests of Vietnam – a comparison of Oxisols and Ultisols

Authors: Saori Johno[1], Makoto Shibata[1, 2], Shinichi Watanabe[2], Nguyen Ho Lam[3], Shinya Funakawa[1, 2]

[1]Graduate School of Agriculture, Kyoto University, [2]Graduate School of Global Environmental Studies, Kyoto University
[3]Hue University of Agriculture and Forestry

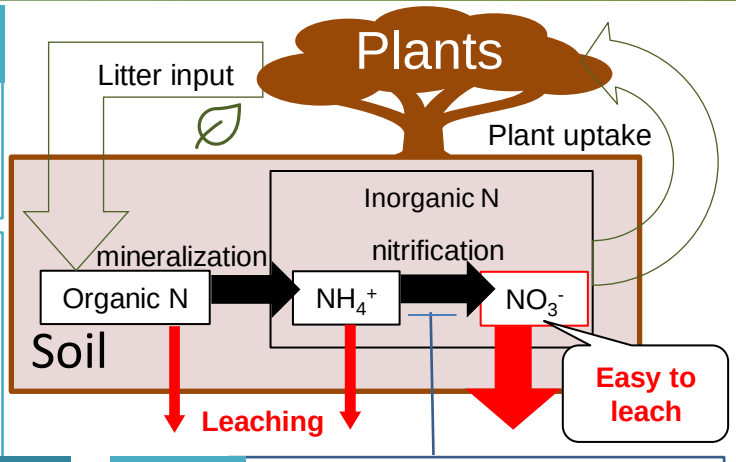
Background ~ NO_3^--N leaching in Oxisols~

Nitrogen (N) cycling in tropical forests has been studied without distinction for soil types. However, there are different properties between two major soils in tropical forest– **Oxisols** and **Ultisols**.

Oxisols
Poor ability to supply and retain nutrition

Ultisols
Higher ability to supply and retain nutrition
→**strongly acidic** due to Al^{3+} retention

Some previous studies showed…
More NO_3^--N leached in **Oxisols** than in **Ultisols**
- **Stronger soil acidity of Ultisols** inhibited nitrification and NO_3^--N leaching



In the case of strongly acidic Oxisols, is nitrification and NO_3^--N leaching inhibited?

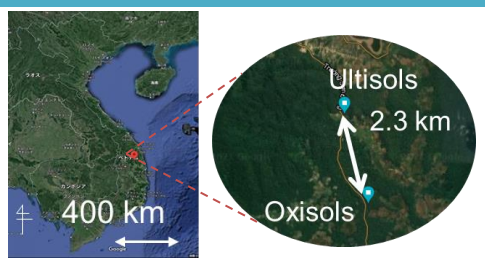
Theory Low pH condition inhibit nitrification

Objective

To compare nitrogen flux pattern for Oxisols and Ultisols under **equally acidic** condition

Study site & Methodology ~Measuring N flux by lysimeter method~ [Study period: July 2018—June 2019 (1 year)]

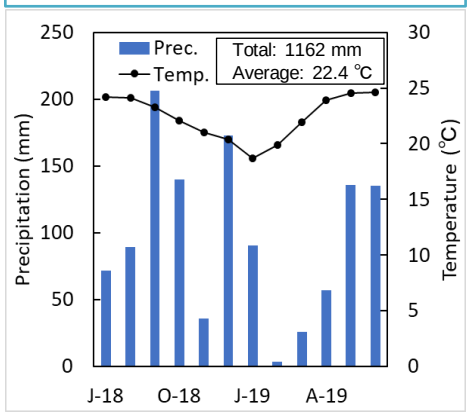
【Plots】
Oxisols plot （795 m a.s.l）
Ultisols plot （781 m a.s.l）
【Location】
Tropical forests in the Central Highlands of Vietnam



Equally acidic condition in Oxisols & Ultisols

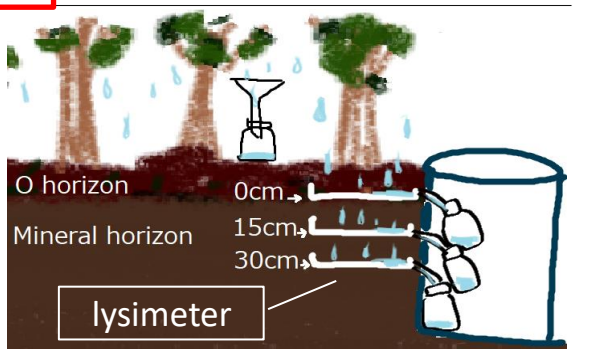
Soil physicochemical properties

Site	Depth (cm)	pH H2O	pH KCl	CEC / Clay	Exchangeable cation Base	Al	H	Base saturation (%)	Particle size Sand (%)	Silt	Clay
					($cmol_c\ kg^{-1}$)						
Ultisols	0-6	3.9	3.5	42	0.4	3.8	1.7	7	55	11	34
	6-22	4.8	3.7	32	1.0	2.3	0.8	24	48	12	40
	22-45	4.8	3.8	32	0.9	2.7	0.4	23	47	12	41
Oxisols	0-5	3.8	3.4	22	0.3	3.4	1.8	5	7	8	85
	5-15	3.9	3.6	16	0.2	2.6	1.3	4	7	7	86
	15-30	4.1	3.8	16	0.2	2.1	0.8	6	7	6	87



Climate of the study site

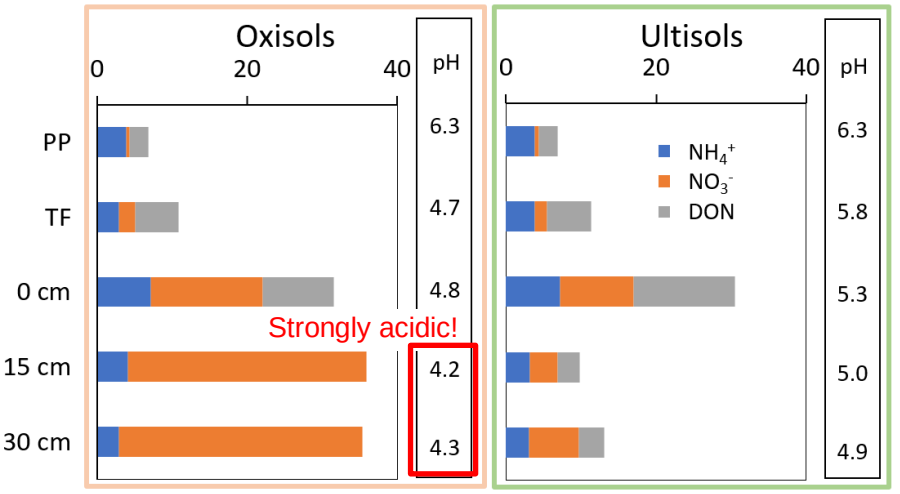
【Sampling (Once a month)】
Precipitation (PP), throughfall (TF) (by funnel)
Soil solution samples at 0, 15 and 30 cm depth (by lysimeter)
【Analysis of solution samples】
pH
Concentrations of total dissolved nitrogen (TDN), NH_4^+, NO_3^-, Dissolved organic nitrogen (DON)
Water flux (model estimation)
【Calculation of N flux】
Monthly N flux
= Concentrations of N × Monthly water flux



Results & Discussion

【Annual water flux】
Precipitation, throughfall: 1162 mm　　0, 15 & 30 cm: 835 mm
【TDN flux】
In Oxisols: @ 0 cm ≒ @ 15 cm ≒ @ 30 cm → **N leached into deeper layer**
In Ultisols: @ 0 cm > @ 15 cm → **N recovered by plants within topsoil**
✓ N flux pattern were different between Oxisols and Ultisols
【NO_3^-—N flux in Oxisols】
@ 0 cm < @ 15 cm → **Nitrification occurred**
【pH of the soil solutions】
In Oxisols < in Ultisols

Nitrification occurred even in strongly acidic condition!



Annual N flux and mean annual solution pH (kg N ha^{-1} yr^{-1})

Conclusion

Contrary to the theory, nitrification was active in Oxisols even with strong acidity

Future work: To clarify the mechanisms of active nitrification regardless of low pH condition in Oxisols

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Effects of spatial variations on soil nitrogen dynamics in *Japanese Cypress* forest through ^{15}N tracing method

Zixiao Wang, Makoto Shibata, Jinsen Zheng, Jiajie Du, Shinya Funakawa

Graduate School of Agriculture, Kyoto University

Introduction

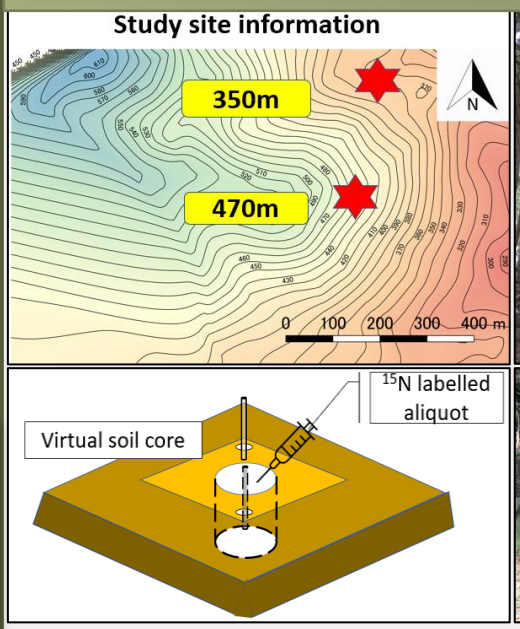
Soil inorganic nitrogen (N), i.e., NH_4^+ and NO_3^-, are essential resources for N cycling in forest ecosystems. Although uptake of tree actively participates in N dynamics, widely-used experiment set-ups for soil N transformation rates barely consider the significance of integrity and uptake of live fine roots. To avoid disturbing fine roots, an experiment combining *in-situ* incubation and ^{15}N tracing method with virtual soil cores was performed.

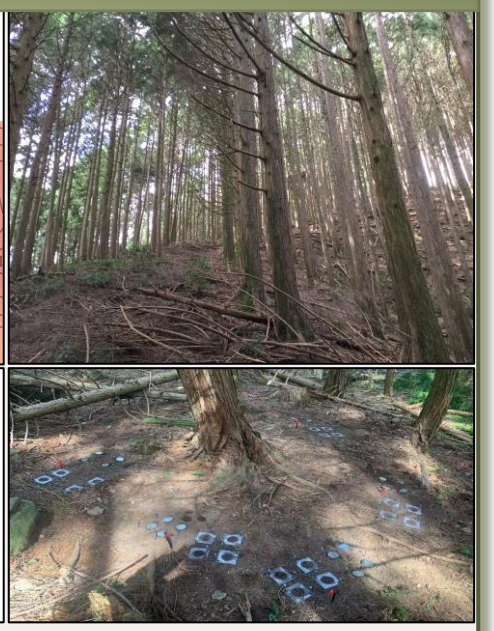
Objectives

a) The recovery of inorganic N sources by mature *Japanese Cypress* under different ambient inorganic N pool sizes.

b) The contribution of fine root uptake to gross N consumption rates.

Methods





in-situ incubation (0 and 24h) was conducted in late March 2021 at up and down slope in Mt. Hiei, Shiga Prefecture. Both sampling sites were dominated by *Japanese Cypress*. Paired inorganic ^{15}N aliquot were injected through virtual soil cores and 0-5cm soil were sampled after each time.

Results & Discussion

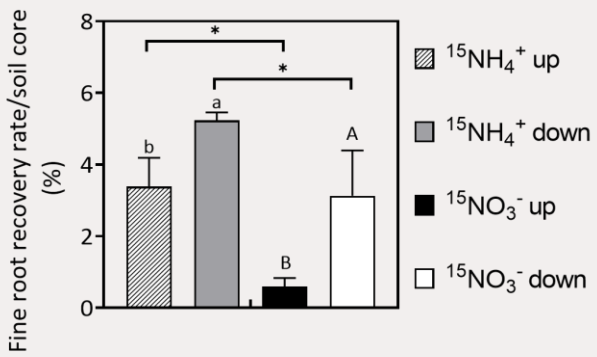


Fig 1. Fine root recovery per soil core

- NH_4^+ was recovered more than NO_3^- after 24 hours.
- Fine root recovery rate of NH_4^+ at down slope was higher than that at up slope although fine root biomass decreased.

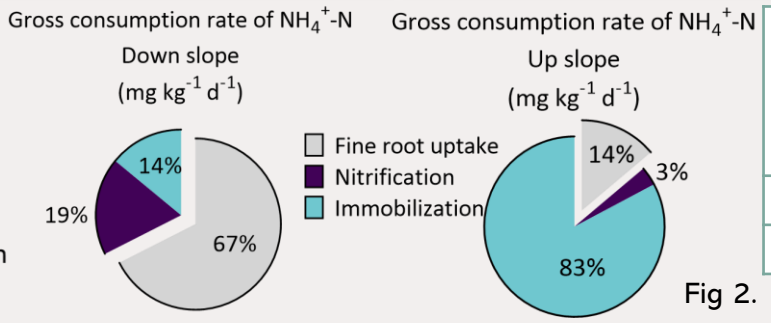


Fig 2.

Site	NH_4^+-N	NO_3^--N	Fine root biomass
	(mg N kg^{-1})	(mg N kg^{-1})	(kg m^{-3})
Up	84±15	3±1	1.2±0.9
Down	53±3	10±7	0.7±0.5

Table 1. Soil physico-chemical properties

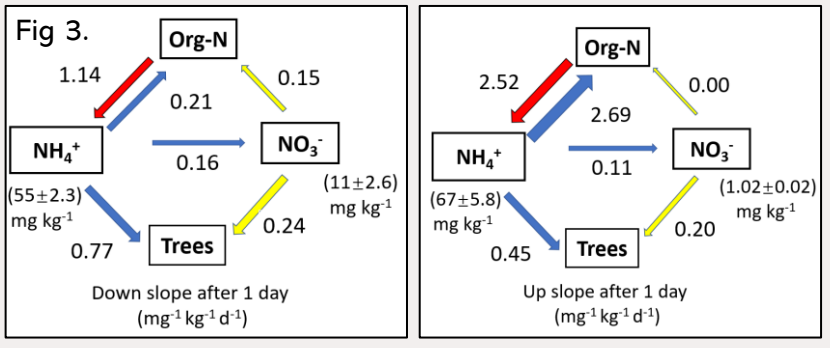


Fig 2 & 3. Proportion of fine root uptake in gross N consumption rates; Gross N transformation rates after 24h

Ammonification
Gross consumption of NH_4^+
Gross consumption of NO_3^-

- Fine root uptake rate of both NH_4^+ and NO_3^- at down slope was higher than that at down slope.
- Fine root uptake rate of NH_4^+ played an important role in gross NH_4^+ consumption rates.

Conclusions

a) The recovery of inorganic N sources by mature *Japanese Cypress* does not correspond to variations in ambient inorganic N pool sizes.

b) The significance of uptake of live fine roots should be considered in soil N transformation studies.

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Estimation of Potential Soil Loss in Pantabangan-Carranglan Watershed, Philippines using InVEST

Authors: Jan Joseph V. Dida*, Cristino L. Tiburan Jr.*, and Izuru Saizen **

* Institute of Renewable Natural Resources, College of Forestry and Natural Resources, University of the Philippines Los Baños
** Laboratory of Regional Planning, Graduate School of Global Environmental Studies, Kyoto University

Background

- In the Philippines, land use and land cover changes in the watershed are intensified by anthropogenic factors.
- These changes may also affect the soil erosion potential in a watershed.
- Soil erosion remains a serious and persistent problem, especially in the uplands (Olabisi, 2012).
- Given the importance of Pantabangan-Carranglan Watershed in supporting a multi-purpose dam and providing water, there is the need to estimate the soil erosion potential.

Figure 1. Google Earth Street Views of Carranglan (Top) and Pantabangan (Bottom) towns. © Google Earth

Methodology

- Pantabangan-Carranglan Watershed covers a total land area of 97,318 hectares and supports a multi-purpose dam for irrigation and hydroelectric generation (Peras et al., 2008).
- It is part of the towns of Pantabangan and Carranglan in the province of Nueva Ecija.

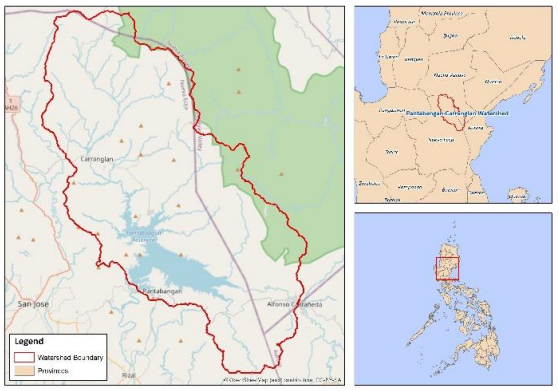

Figure 2. Location of the Study Area. Base map: © OpenStreetMap contributors.

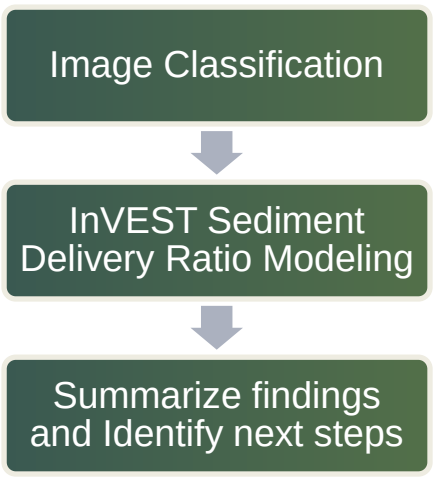

Figure 3. Flow of Activities

Results and Discussion

- The most dominant land use/land cover (LULC) is open/barren and forest for 2014 and 2020, respectively.
- There was an increase in the grassland and forest LULC types from 2014 to 2020.

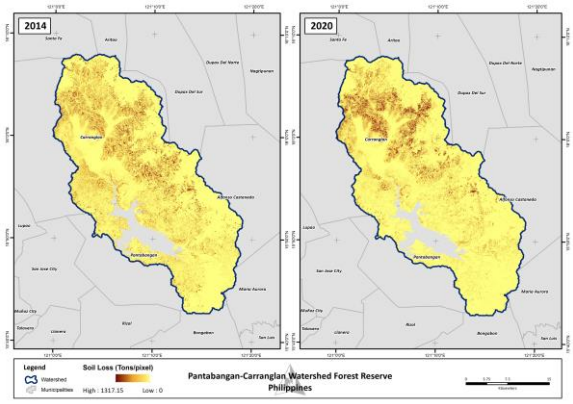

Figure 4. Total Potential Soil Loss in the watershed for 2014 and 2020.

- The total potential soil loss in the watershed decreased from 2014 to 2020.
- Majority of the soil loss were identified in the town of Carranglan followed by Pantabangan for both 2014 and 2020.
- The increase in forest and grassland LULC types contributed to the decrease in potential soil loss.
- The soil loss information can be used to supplement valuation studies.

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Evaluation of different amendments of Red mud-MSW compost on soil conditioning: A restorative perspective

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Abstract

The globalization of industries has inevitable contribution in societal progress. However, the by-products, residue-tailings and large volumes of waste production from these industries are negatively encroaching the landscape. Red mud, a by-product of aluminum manufacture, has long been recognized as a hazardous waste. The global stockpile of red mud is estimated to be over 4 billion tons. Red mud is added at a pace of at least 120 million tons per year to the stock every year. Rehabilitation on such areas require addition of composts and biofertilizers so as to make it suitable for re-vegetation purposes. Considering this view, the present study is based on a pot-experiment where different treatments were prepared with varying red mud concentration in addition to municipal solid waste compost (MSWC) in presence and absence of biofertilizers. Analysis of soil physical, chemical and microbial properties were performed. Our study revealed that in the treatment containing 5% red mud, MSWC and biofertilizer, content of soil organic carbon (SOC) was maximum with optimum microbial activity (MBC) as compared to the unamended soil. Also, the same treatment enhanced the pH, EC (mS cm -1) and moisture content (%) to the values (8.2±0.05, 2.26±0.15 and 8.29±0.11 respectively), optimum for re-vegetation. Our results give us a scope of utilizing two inexpensive wastes (red mud and MSWC) as a potent soil conditioner.

Introduction

- Aluminium has become the world's second largest metal after steel.
- Red mud is a solid waste produced during the Bayer process, which produces alumina from bauxite.
- Despite various attempts of utilizing bauxite waste, the amount of red mud in reservoirs is growing (Reddy et al., 2021).
- Due to its hazardous properties, it cannot be used alone as a soil replacement (Berta et al. 2021). This poster presents an experiment analyzing soil conditioning properties of red mud on adding municipal solid waste compost (MSWC) in presence as well as absence of biofertilizers.

Aim and objectives

Aim: To study the soil ameliorating properties of Red mud and MSW compost.

Objectives:

1. **To recognize physio-chemical properties of red mud and MSW compost which can help in soil restoring practices**
2. **To study different soil amendments with red mud and MSW compost in presence and absence of biofertilizers.**
3. **To find the suitable restorative soil amendment.**

Methodology

1. •The garden soil, RM and MSWC was crushed and sieved using a sieve of 2 mm mesh size.
2. •The soil for growing plants was prepared according to the amendments, eight amendments shown in Fig.1
3. •Bio-fertilizer (BF) used was the mixture of Trichoderma, Siderophore, PSB, IAA and ammonia producing bacteria.
   • The soil was mixed thoroughly and kept for stabilizing. Required moisture was maintained.

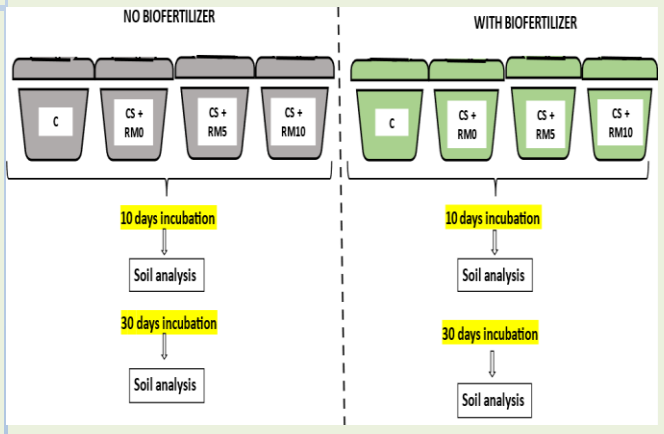

Fig. 1: Experimental design

Result (cont.)

- Both SOC and MBC showed an increase in the presence of biofertilizers with 5% of red mud.
- pH (8.2±0.05), EC (2.26±0.15 mS cm^{-1}), AMM-N (5.55±0.04 µg g^{-1}) and NIN-N(5.37±0.06µg g^{-1}) was optimum for treatment (CS+RM5+BF).

Conclusion

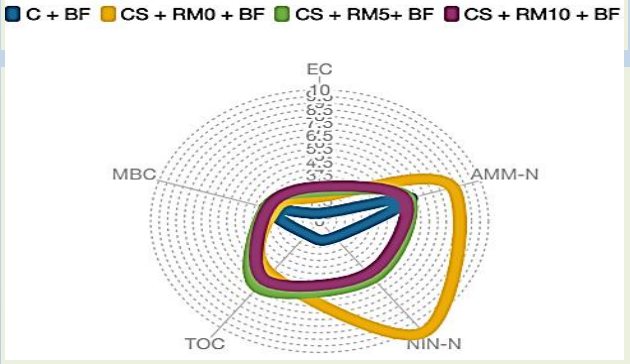

Fig.3. Radial diagram showing overall importance of treatments

- Treatment (CS+RM5+BF) was found to have potent soil conditioning properties necessary for plant growth.

Results

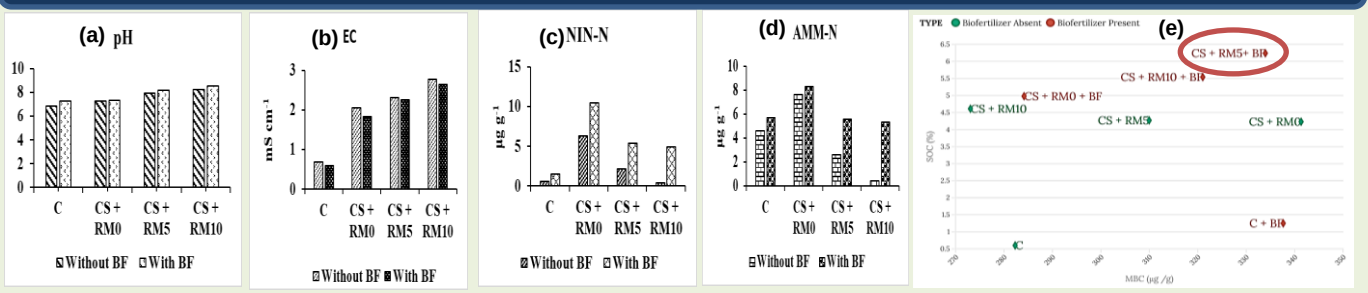

Fig. 2 (a-e): Graphs (Mean) showing variation in pH, EC, nitrate-N, ammonium-N, SOC and MBC, respectively among various treatments in the presence and absence of biofertilizers.

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Hot water- and cold water extracted carbohydrate effected by rice straw residue burning on-field

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I. Background and methodology

Rice straw burning on-field is a serious problem in Vietnam and wordwide!!!

Pre-burning | Post-burning

Bulk soil

Bulk soil+ water

- ✓ Soil organic carbon (SOC)
- ✓ Total Nitrogen (TN)
- ✓ pH
- ✓ NH_4^+
- ✓ NO_3^-

- ✓ Extracted at 80°C/4 hours→Hot water extracted carbohydrate (HWECH)
- ✓ Extracted at 25°C/30 mins→Cold water extracted carbohydrate (CWECH)

II. Results and discussion

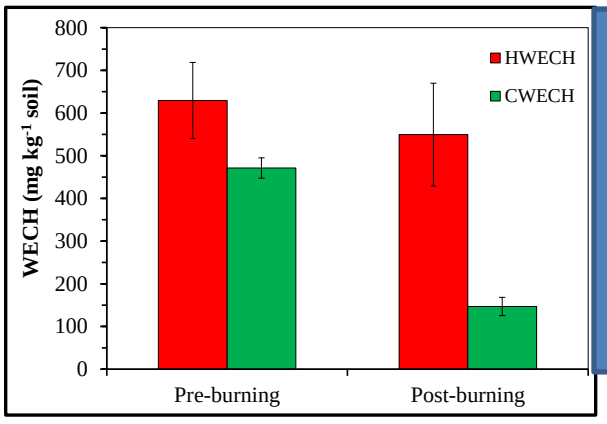
2.1. Change in bulk soil properties

We found that there is no significant changes for content of soil organic carbon (SOC), total nitrogen (TN), organic nitrogen and soil pH . There was only small change in NO_3^- (Table 1).

***Table 1**. Change in SOC, TN, Inorganic-N, and pH*

Treatments	SOC	TN	NH_4^+	NO_3^-	pH
	%		mg kg^{-1}		
Pre-burning	1.42 ± 0.06	0.14 ± 0.01	10.5 ± 0.5	1.9 ± 0.1	4.9 ± 0.1
Post-burning	1.38 ± 0.04	0.15 ± 0.01	10.4 ± 0.3	2.8 ± 0.1	5.0 ± 0.2

2.1. Change in water extracted carbohydrate



- ➢ CWECH from 147-471 mg kg^{-1}, lower than HWECH from 550-630 mg kg^{-1}.
- ➢ Post-burning decreased CWECH (p<0.001), but not HWECH (**Figure 1**)

***Figure 1**. WECH by hot water and cold water extraction*

2.3. Pairwise correlation among the parameters

- ➢ HWECH and CWECH contents have positive correlation with SOC and TN but no significant despite of high correlation (R ranged from 0.58-0.75) (**Table 2**).
- ➢ HWECH and CWECH have positive significant with NH_4^+ and negative relationship with NO_3^- (P<0.001).

➔WECH could be good indicator to reflect the soil quality, especially available inorganic nitrogen

***Table 2**. The pairwise correlation between the two extraction methods. (*P<0.05, **P<0.01, ***P<0.001)*

	SOC	TN	NH_4^+	NO_3^-	pH	HWECH	CWECH
SOC	1.00						
TN	0.98***	1.00					
NH_4^+	0.760	0.70	1.00				
NO_3^-	-0.360	-0.260	-0.87*	1.00			
pH	-0.490	-0.40	-0.560	0.490	1.00		
HWECH	0.750	0.660	0.98***	-0.88*	-0.60	1.00	
CWECH	0.650	0.580	0.98***	-0.93**	-0.510	0.96**	1.00

III. Conclusion

- ✓ Burning rice straw in the paddy field did not alter the content of SOC/TN of bulk soil but rather changes in extracted carbohydrates.
- ✓ ECH contribute 1.1-4.4% of SOC, and significant correlated with inorganic N(P<0.05). It is recommended to be a promised soil quality indicator.

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Impact of aerobic yeast fermentation on the nutrient content of cassava root pulp

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** Department of Livestock, Champasack University

Abstract

Abstract This study investigated the impact of aerobic yeast fermentation of cassava root pulp (CRP) on the nutrient content of the pulp. The experiment was arranged in a 4 x 3 factorial design with 2 replicates per treatment where CRP was aerobically fermented with different yeast sources at different nitrogen (N) addition rates. The factors were yeast source (*Schwanniomyces occidentalis, Rhodotorula toruloides, Saccharomyces cerevisiae* and Lao alcohol yeast) and N rate (0, 1.25 and 2.5 % N in dry matter (DM)). Ammonium sulphate was used as the N source.

Colony-forming units (cfu) increased from day 0 to day 2 for all yeast sources, with no treatment differences within yeast source. From day 2 onwards, the cfu pattern differed between yeast sources and there was a decline in cfu counts after 8-10 days of fermentation. The DM content increased with fermentation for R. *toruloides*, while there was a reduction in DM content for the other yeast sources. Lao alcohol yeast showed the greatest reduction in DM content. The pH at start (day 0) was around 7.1 for all yeast sources and N treatments, while the pH at day 14 ranged between 3.2 and 3.9. The content of crude protein (CP), true protein (TP), neutral detergent fibre (NDF), starch and ash differed between yeast sources and N treatments at day 0 and 14. At day 0, the CP content increased linearly with N addition for all yeast sources. The CP and ash content increased and the starch content decreased during fermentation for all yeast sources and all levels of N addition. The greatest increase in CP and ash content during the fermentation period was observed for the Lao alcohol yeast. The greatest decrease in starch content was found for Lao alcohol yeast, followed by *S. occidentalis, S. cerevisiae* and *R. toruloides*.

It appears likely that the changes in nutrient content in CRP occurring during aerobic yeast fermentation will affect the protein and energy value of the product when used in the diet of pigs and other livestock.

Keywords: by-products, crude protein, enrichment, animal feed

Introduction

Cassava *(Manihot esculenta Crantz*) is widely grown in tropical regions. The majority of the cassava root produced is used for human consumption. In addition, some cassava root is used as animal feed and for starch production and other industrial applications. Cassava root pulp (CRP), which is the residue after starch extraction of the cassava root, is a cheap product with potential for use as a feed ingredient by smallholder farmers.

In the present study, based in Lao PDR, the aim was to investigate the potential of some different yeast sources to improve the nutrient content of CRP through fermentation. One was a locally available yeast source that we called 'Lao alcohol yeast' and which is commonly used in southern Lao PDR to produce rice wine. We also included the yeast species *Saccharomyces cerevisiae, Rhodotorula toruloides* and *Schwanniomyces occidentalis. Saccharomyces cerevisiae* is commonly used world-wide for bread making (aerobic) and alcohol production (anaerobic) through fermentation of sugars. It possesses strong fermentative activity and can reproduce rapidly even under limited nutrient supply. However, S. cerevisiae does not possess amylolytic activity and has to rely on a supply of sugars for fermentation. *Rhodotorula toruloides* (formerly *Rhodosporidium toruloides*) is a oleaginous yeast that can efficiently convert lignocellulose-based sugars into lipids. Lipid production requires medium with excess sugars or similar compounds (e.g. glycerol, polysaccharides)

Objective: To investigated the impact of aerobic yeast fermentation of CRP on the nutrient content of fermented CRP

Materials and methods

Experimental design

The experiment was arranged in a 4 x 3 factorial design with 2 replicates per treatment where CRP was aerobically fermented with different yeast sources at different N addition rates (Table 1). The factors were yeast source (Y1: *Schwanniomyces occidentalis*; Y2: *Rhodotorula toruloides*; Y3: bakers' yeast, *Saccharomyces cerevisiae*; Y4: Lao alcohol yeast) and nitrogen (N) addition rate (0, 1.25 and 2.5 % N in dry matter (DM)). Treatments Y1, Y2 and Y3 were inoculated with 105 yeast cells/g DM CRP. Treatment Y4 was inoculated with 4 mg Lao alcohol yeast dry powder/g DM CRP (corresponding to 4 g dry powder/kg DM). In treatment Y3, α-amylase (EC 3.2.1.1) in the form of termamyl (0.2 mL/g DM CRP) was added after steaming of the CRP and prior to addition of the yeast, in order to hydrolyse starch. Ammonium-sulphate [(NH4)2 SO4; mol. wt. 132.14 mol/g; 21.2% N] was used as the N source

Chemical

analyses Samples collected at the start (day 0) of CRP fermentation and at the end (day 14) were analysed for DM, ash, total N, true protein (TP), starch and neutral detergent fibre (NDF). Samples were analysed for DM by drying at 103°C for 16 h and for ash after ignition at 600°C for 3 h. Total N content was determined and crude protein (CP) was calculated as N x 6.25. The TP content was analysed

Results

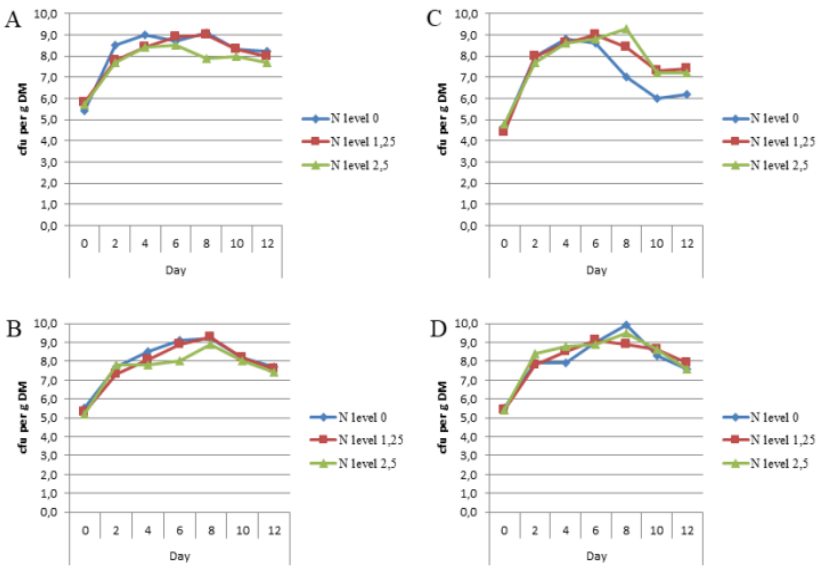

Figure 1. Colony forming units (cfu/g) pattern during yeast fermentation of cassava root pulp. Panel A, Lao alcohol yeast; panel B, *Rhodotorula toruloides*; panel C, *Saccharomyces cerevisae*; panel D, *Schwanniomyces occidentalis*.

Conclusion

Cassava root pulp can be successfully fermented aerobically with yeast, reaching pH values of 3.2 to 3.9 after 14 days of fermentation. The growth of spoilage bacteria is inhibited at these pH levels, enabling longer storage times with maintained quality. 6 The nutrient content in CRP changes during aerobic yeast fermentation, resulting in an increase in CP, TP, NDF and ash content, and a decrease in starch content. As a consequence, the protein value and energy value of fermented CRP in pig diets differ from those of the unfermented material. Moreover, the yeast source used for fermentation influences both the protein content and the energy value of the fermented product.

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Non-destructive method for classifying soon-deteriorated strawberry (*Fragaria × ananassa*) using fluorescence image in an early stage

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* Laboratory of Biosensing Engineering, Graduate School of Agriculture, Kyoto University ** JSPS International Research Fellow

Background

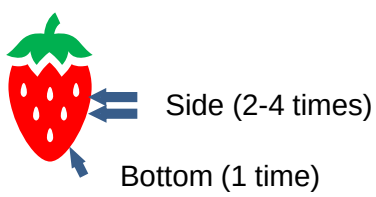
Strawberry (*Fragaria* × *ananassa* Duch.) is a popular fruit worldwide. During the ripening period, the weight and anthocyanin content of strawberries will increase rapidly, while the firmness of the fruit will decrease, which means that due to this rapid softening and deterioration, their postharvest life is limited. Soon deteriorated fruit may not only be harmful to eating, but it may also threaten the reputation of farmers. In addition, the mold on deteriorated fruits can infect other healthy fruits and cause a lot of food loss. Therefore, it is important to distinguish between fruit that spoils quickly and healthy fruit early after harvest.

Fig. An example of spoiled strawberry

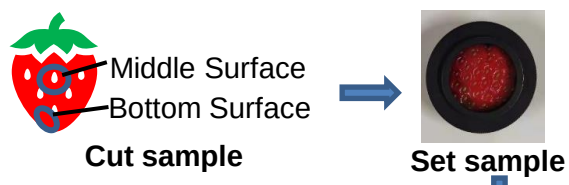
Methodology

Firmness measurement

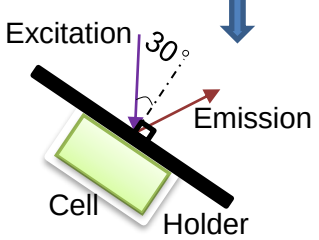
Firmness[1] is a general index related to strawberry senescence. In this experiment, a penetrometer designed specifically for strawberries (KM-1, 1 kg/cm^2, Fujiwara Scientific Co., Ltd, Japan) was used.



Excitation Emission Matrix (EEM)



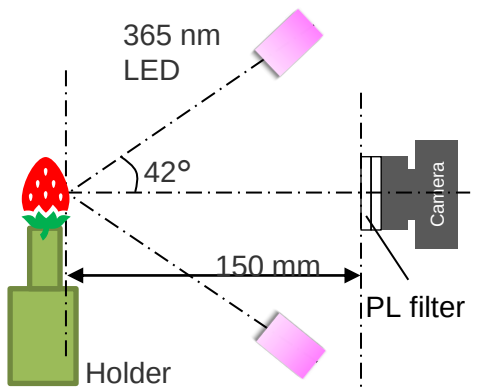
Time series EEM-data for constructing optimum imaging system using a spectrofluorometer (FP-8300, Jasco).



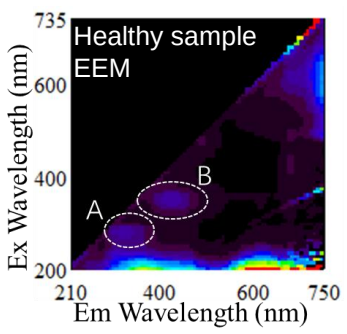
Front-Face measurement

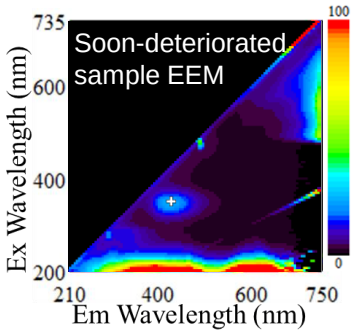
Fluorescence imaging system

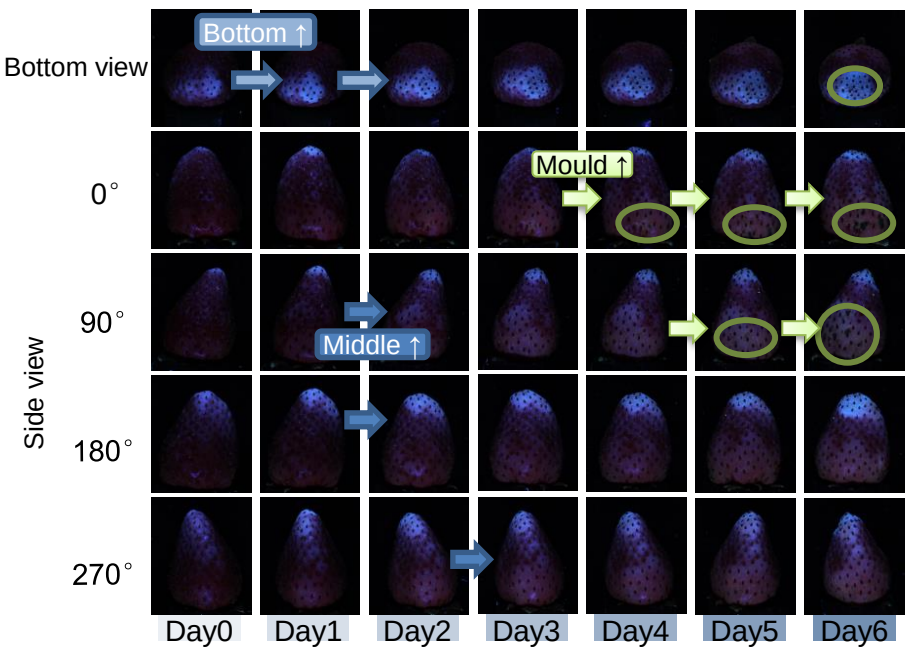
Proposed machine vision system used 365 nm ultraviolet light.



Results and discussion







EEM :
Area A: excitation from 250-300 nm, emissions ranged from 300-400 nm.
Possible compound: amino acids.

Area B: excitation from 310-395 nm, emissions ranged from 370-565 nm.
Possible compound: coumaric acid and its glycosides [2].

Fluorescence imaging :

- Left figures were spoiled strawberry with 0.24 kg/cm^2 firmness.
- From Day0, the whitish area of the spoiled strawberry increased at the bottom part. The middle part of the strawberry became brighter from Day1.

The whitish color increase was caused by the fluorescence compound increased during storage. The soon-spoiled fruit has more fluorescence compound than other healthy fruits, which can be an index to classify the soon deteriorated strawberry [3].

Reference

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Rediscovering the Essence of University Museum while Surviving the Pandemic: Experience from Museum of Zoology of ITB (MZI) Indonesia

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[2] Museum of Zoology, Institut Teknologi Bandung, Jl. Let. Jend. Purn. Dr. (HC) Mashudi 1, Jatinangor 45363, Indonesia

Context

- University museums have played pivotal roles within the educational institution, despite limitations it may face (Cahyadi et al. 2020).
- Especially in Indonesia, the limitations can substantially challenge the capability of the institution to perform optimally.

Roles of University Museum

- Curating historical and working collections
- Aiding formal higher educational activities
- Serving students and local communities with educational tours

Challenges

General in Indonesia

- Limited human resources
- Limited facilities

Case Specific for MZI

- Incomplete cataloguing system
- Incomplete administrative records
- Lack of digital database
- Collection damage and extra workload due to relocation

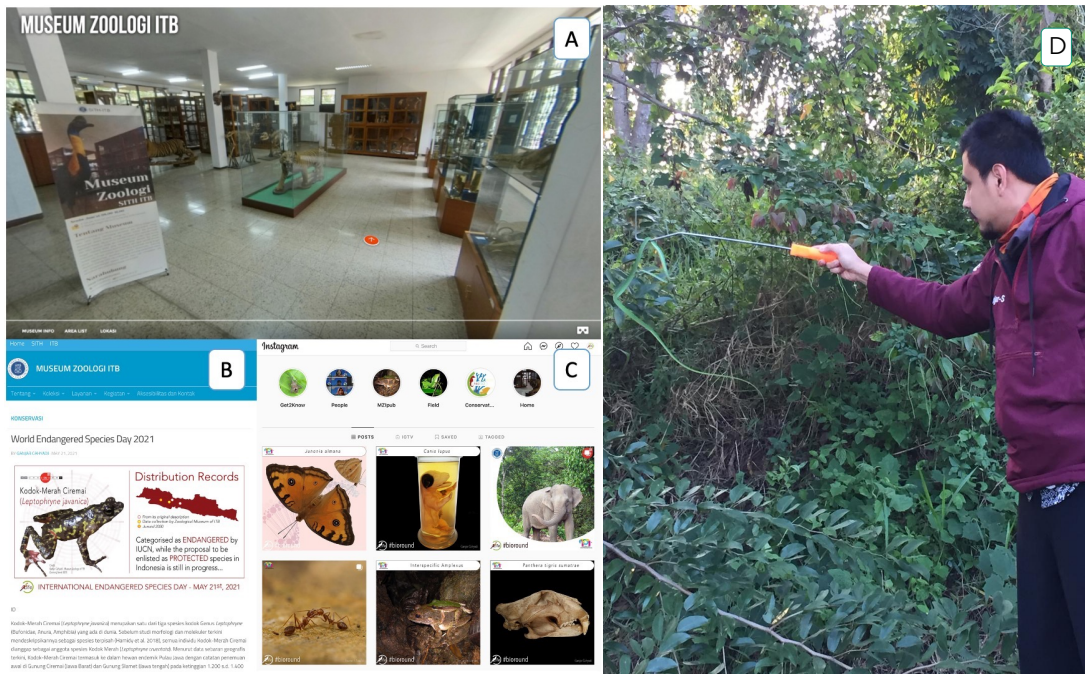
Covid-19 & University Museum

- Covid-19 pandemic has impacted university museum.
- In the case of Museum of Zoology of ITB (MZI), Covid-19 pandemic later dealt a major blow, complementing previous limitations with which almost completely paralyzed the museum.

- The curator was required to work mainly from home,
- No physical visitation allowed
- Almost no digital collection available for online exhibition/events

Rediscovery & Future Plan

- Rebranding the public image
- Reorganising relevant programs/events
- Restoring public engagement using online platform
- Undertake developable pilot projects



A. Virtual tour of the museum. B. Revitalizing the museum's website. C. Actively using social media. D. Trying out urban inventory & urban ecology

Future Plan

Developing national and international networking to optimize the museum's contributioon more to science, institution, and society as whole.

Reference:
Cahyadi, Ganjar & Rasyidi, Rahman & Permadi, Dikdik. (2020). Lighthouses for biodiversity: prospects and challenges for zoological university museum in Indonesia. BIO Web of Conferences. 19. 00003. 10.1051/bioconf/20201900003.

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RESEARCH FOR DETERMINATION OF PLANT SPECIES IN THE WASTE DISPOSAL AREA OF DA NANG CITY

Authors: Pham Thi Kim Thoa*, Mai Thi Thuy Duong*, Hoang Ngoc An**, Vuong Duy Hung**

* Graduate School of Global Environmental Studies, Kyoto University
** Department of Natural Resources and Environment, The University of Danang - University of Science and Technology

1. Background

Khanh Son waste disposal area includes: existing landfill, closed landfill have potential risks of environmental pollution, affecting public health.

The ecological approach to the problem brings long-term and sustainable results. The right types of crops both help improve soil and restore native ecosystems, as well as a shield to reduce air pollution for the city.

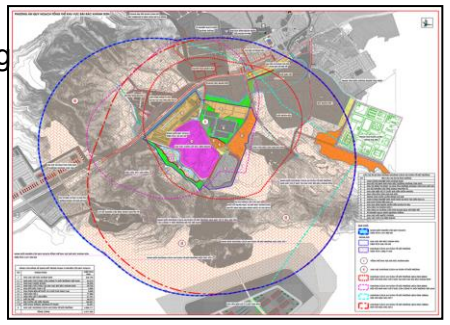


Figure 1: Master plan map of Khanh Son Landfill– Da Nang city

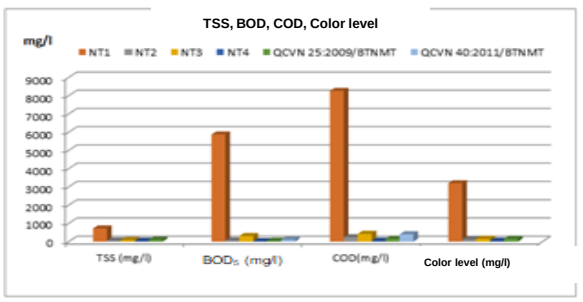
2. Methodology

(1) Monitoring methods
(2) Community survey and Consult experts
(3) Standard plot
(4) Multi-criteria quantitative analysis techniques

List of analyzed species VS Set of criteria (4) → Suitable species

3. Results

3.1. The state of the environment in the area of Khanh Son landfill - Da Nang city



QCVN

Higher Vietnam standard

Figure 2: Monitoring results of wastewater quality

3.2. Plant species which can help to reduce environmental pollution in the landfilling site of Da Nang city

SI=(2x49)/(182+61)=0,403=40,3%
The flora in the 2 landfills has about 40% similarity.

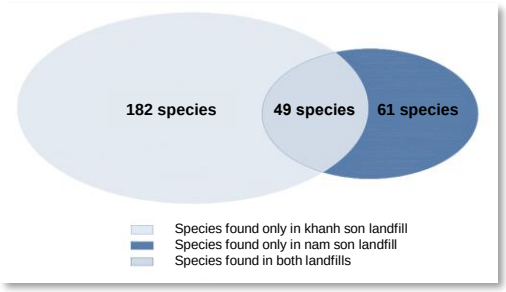
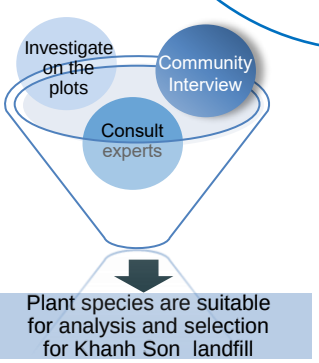


Figure 3: Species similarity at 2 landfills



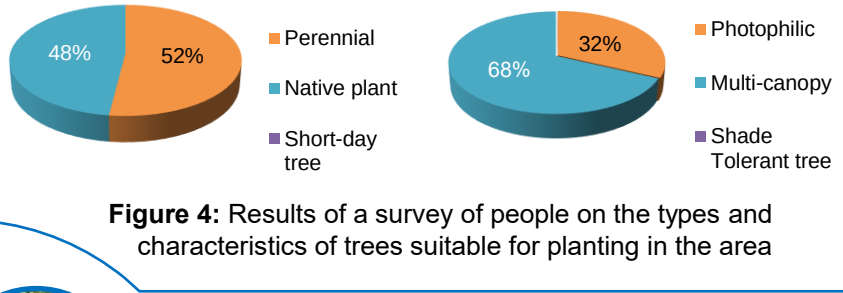
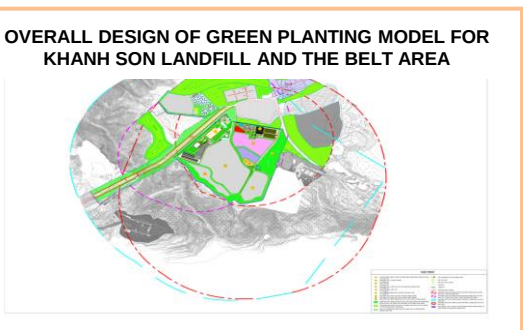


Figure 4: Results of a survey of people on the types and characteristics of trees suitable for planting in the area

Implementation process of the multi-criteria method:

1	2	3	4
Determine the weight of criteria	Quantification of criteria	Standardize the criteria according to the opposite method	Using multi-criteria quantitative analysis technique

3.3. Planting model (including isolated green belt area)



4. Discussion

- Most of the monitoring indicators at Khanh Son landfill are in the allowable limits, except for some indicators such as dust, ammonium, BOD; The input wastewater contaminated which are higher Vietnam standard (QCVN).Acidic and nutrient-poor soil
- Recorded founding: 292 plant species belonging to 83 families in both of landfilling areas; 231 plant species belonging to 72 families at Khanh Son landfill. Selection of 26 species of trees which would help to controll environmental pollution in Khanh Son landfill area.
- The project has designed a model of planting trees for 3 areas: Existing landfill, closed landfill and surrounding land belt.. Alternately planting large trees, small trees and shrubs in the perimeter areas is aim to to improve the effectiveness of odor suppression.

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Shifting of Paddy *(Oryza sativa)* Production Under Climate Change Scenario: A Study Case in Subang District, Indonesia

Andrian Perdana*, Perdinan**, Bara Taufik Pribadi***, Tri Atmaja****, Gilang Mahardika*****, Shalsa Nurhasanah*****

*Graduate School of Agriculture, Kyoto University, **SEAMEO BIOTROP-IPB University, ***Department Geophysics and Meteorology, IPB University, ****Department of Urban Engineering, The University of Tokyo, *****Generasi Hijau Indonesia

Introduction

Crop growth and development are controlled by climate fluctuation and availability of land areas.

- **Climate variability** contribute about 32-39% of the observed yield globally (Springmann et al., 2016). FAO (2016) reported that climate extremes associated with El Niño in 2015 dropped by about 25% of planting areas for paddy in Indonesia.
- **The agricultural land** in Subang, the one of the largest contributors to rice production and national food supplier of Indonesia, was converted into residential, industrial, toll road or other facilities. As for the climate impacts, the climate extreme events associated with drought and floods affected by about 2864 ha in 2015 (Adji, 2015) and 1212 ha in 2017 (Adji, 2017), respectively.

By 2050, there will be 9 billion people to feed on earth, and the agricultural products must be increased by 50-70%. This evaluation can be utilized as inputs to devise climate change adaptation strategies for crop production and contributed to the master plan of agricultural development of Subang District.

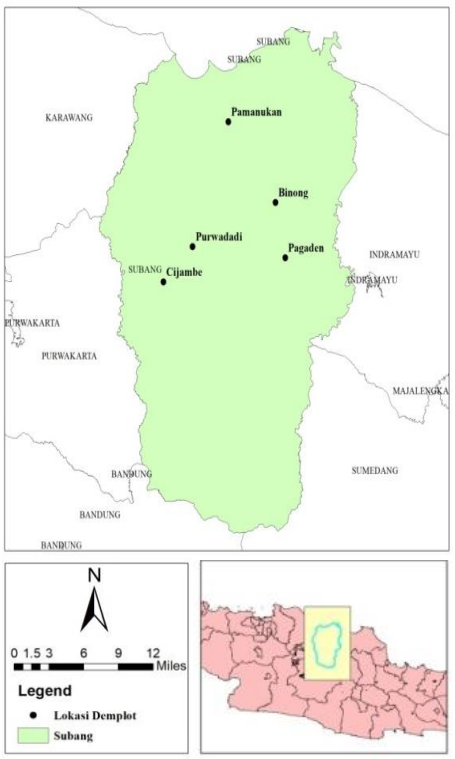

Fig.1. Subang district and study location

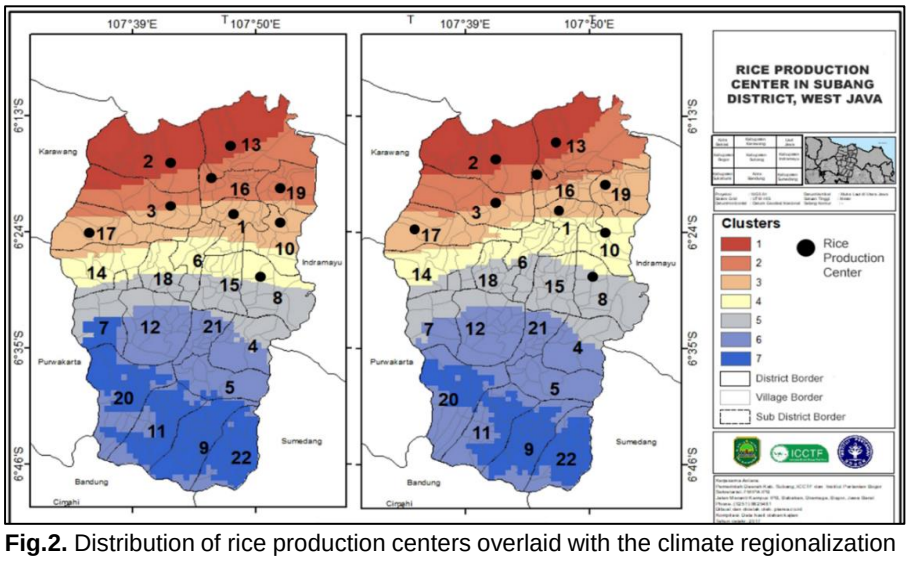

Fig.2. Distribution of rice production centers overlaid with the climate regionalization of the seven clusters

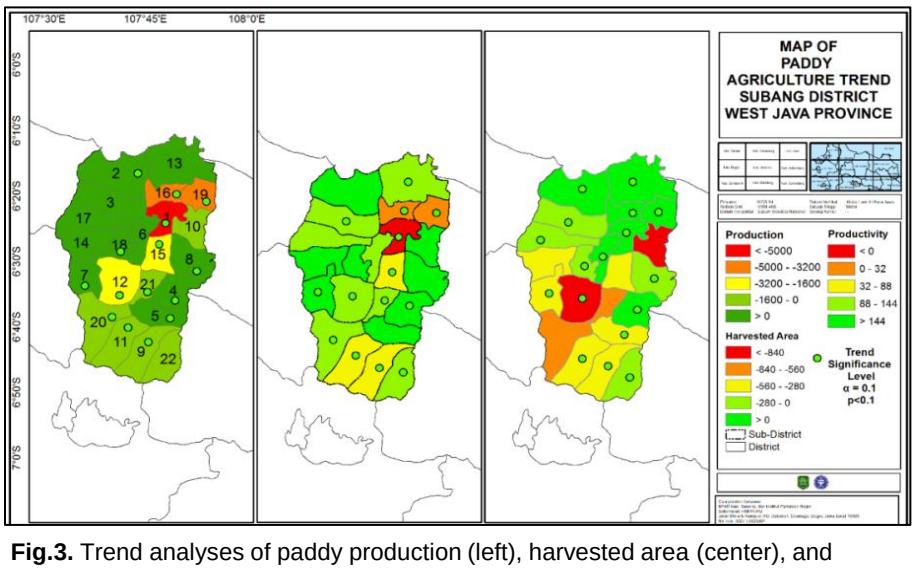

Fig.3. Trend analyses of paddy production (left), harvested area (center), and paddy productivity (right) for Subang District from 2003-2015

Methodology

- The regional climate over the district was analyzed using **cluster analysis** of hierarchical and non-hierarchical (K-Means) applied to gridded climate data of the **WorldClim**.
- Evaluation of paddy production, productivity, and the planted area was performed using **trend analysis** and **Location Quotient (LQ).**
- Further analysis using the **ENSO** (*i.e.*, El Niño and La Nina) towards the impacts on rice productivity.
- To further evaluate the threat on crop production in the centers, Decision Support System for Agrotechnology Transfer (**DSSAT**) was used to assess the potential impacts of climate variability and change.

Results and Discussion

- The climate regionalization revealed that the climate regions can be distinguised into **seven clusters**.
- The result of LQ analysis showed that the production centers (black dotted) are located in the sub-districts of Binong (1), Blanakan (2), Ciasem (3), Cipunagara (8), Compreng (10), Legonkulon (13), Pamanukan (16), Patokbeusi (17), and Pusakanagara (19). The sustainability of the production centers located in Binong, Pamanukan and Pusakanagara are **threathened** because it showed decreasing trend in paddy production and harvested area due to air temperature increase, rainfall decrease, drought, flood, and land conversion.
- The impacts of a decrease in production appears to be greater in **El Niño** condition than those for **La Nina** condition. The decline in La Nina production averaged 1.81% and El Niño 6.20% compared to normal conditions. El Niño effects in 5 Sub-District by decreasing average more than 2% on crop production. It means water shortages (El Niño) can have an impact on larger production cuts.
- The highest average potential rice productivity is in the planting windows of October–January, whereas the lowest on April–August.

Conclusion

- There are 9 production centers which 3 of them are **threatened** due to decreasing trends in paddy production and harvested area. El Niño and La Nina will have negative impacts on all production centers.
- The agricultural development plan should devise proper strategy for managing **water allocation** through water harvesting and distribution channels (*i.e.*, irrigation) in anticipating rainfall change in the future as a consequence of global climate change affected the Subang disctrict.

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Stressors and Measures on Mangrove Risks in Indonesia

Authors: Raden Eliasar Prabowo Tjahjono[1*], Perdinan[2] ,Delta Yova Dwi Infrawan[1],Suvanny Aprilia[3], Ryco Farisca Adi[3] Arif Wibowo[4], Kardono[4], Andrian Perdana[5]

[1]Kresa Rumah Sains [2]SEAMEO BIOTROP-IPB University, [3]PIAREA Environment and Technology, [4]Climate Change Adaptation, Ministry Of Environment and Forestry, [5]Graduate School of Agriculture, Kyoto University

BACKGROUND

Climate change is indicated by phenomena such as warming temperatures (i.e., sea and air levels), sea-level rise, and variations in rainfall patterns. Changes in climatic conditions are expected to have an impact on life in coastal waters and oceans. Mangroves as a resource in coastal areas play several functions, including water purification, water storage, processing of carbon and other nutrients, stabilization of coastlines, and support for plants and animals.

Aspects of climate change risk consist of hazard, exposure, and vulnerability components. Risk assessment is carried out to see the condition of negative impacts in the current and future periods based on the forming factors. The level of vulnerability and risk of mangrove ecosystems is also influenced by the adaptability of mangrove forests.

Conceptually, the impact of the occurrence of a type of climate-related hazard that is the focus of the mangrove ecosystem area does not only depend on the potential for these hazards. The severity depends not only on the characteristics of the hazard but also on the level of exposure and vulnerability due to environmental and community or community pressures. Therefore, it is necessary to include climate factors in understanding the incidence of potential climate risks, to provide an overview in identifying climate change adaptation measures in the mangrove ecosystem area.

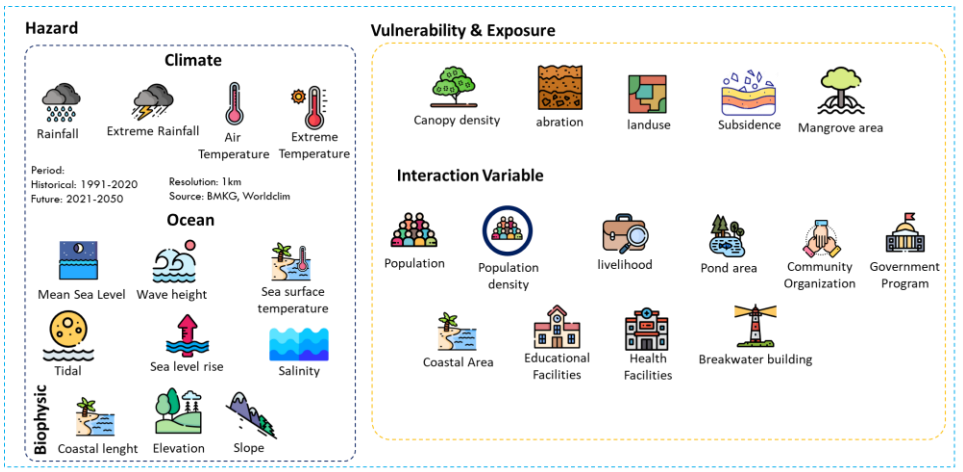
The output of the study is expected to provide current results and future potential that can be used to assist stakeholders in identifying high-risk areas and determining adaptation strategies in mangrove areas. Furthermore, the factors that contribute to the level of vulnerability of the area can be identified, so that local specific adaptation measures can be drawn up and adapted to the development program plan.

METHOD

The critical status was assessed based on the standard criteria for mangrove damage (heavy and damaged) based on the mangrove canopy density level analyzed using the Normal Density Value Index (NDVI). We expand this analysis by adding stressors or indicators associated with human, biophysical, and climate to measure the vulnerability of mangroves under future climate change. The indicators were classified into distinctive groups of hazards, exposures, and vulnerability which composed of sensitivity and capacity.

The indicators (Figure 1) are then defined with regards to the existence of mangrove as an individual (vegetation), habitat, and ecosystem, and a set of parameters to measure stressors on socio-economics, biophysics, and climate that were determined with regards to the data availability and requirements.

Measures on mangrove risks in Indonesia using IPCC AR-5 vulnerability and risk assessment approach where risk is a function of hazard (H), vulnerability (V) and exposure (E) (Figure 2).



Source: Literature Study Compilation 2021

Figure 1 Mangroves risks arranged indicators

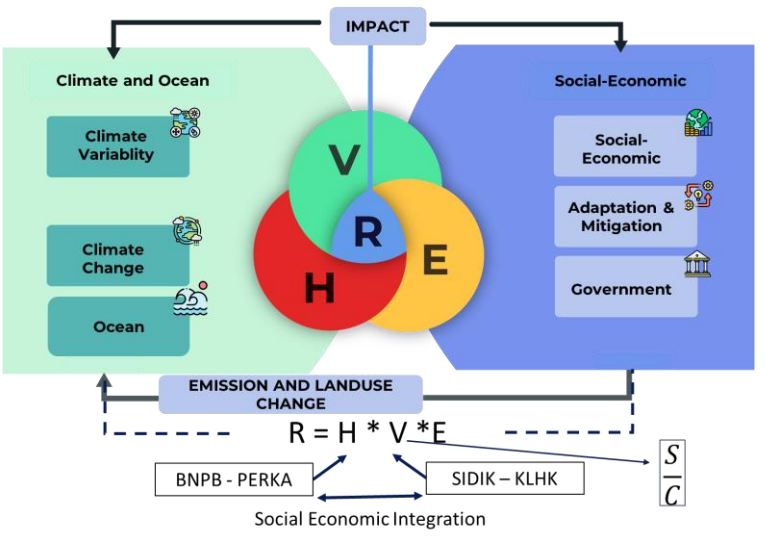
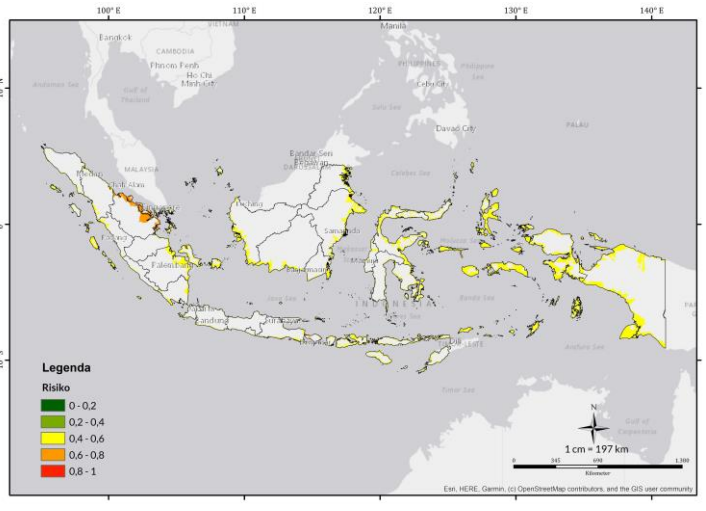


Figure 2 Risks assessment approach IPCC AR 5 model



Provinsi	Kerentanan	Risiko				
	Historis	Historis	Future RCP 4.5		Future RCP 8.5	
			CSIRO	MIROC	CSIRO	MIROC
ACEH	0,53	0,62	0,62	0,65	0,63	0,64
BALI	0,52	0,63	0,63	0,64	0,63	0,63
BANTEN	0,58	0,55	0,56	0,58	0,57	0,59
BENGKULU	0,25	0,54	0,54	0,54	0,55	0,54
DAERAH ISTIMEWA YOGYAKARTA	0,52	0,36	0,36	0,41	0,38	0,39
DKI JAKARTA	1,00	0,68	0,68	0,68	0,68	0,69
GORONTALO	0,00	0,43	0,43	0,45	0,44	0,45
JAMBI	0,52	0,61	0,61	0,63	0,62	0,64
JAWA BARAT	0,85	0,64	0,64	0,72	0,70	0,71
JAWA TENGAH	0,95	0,67	0,67	0,71	0,69	0,71
JAWA TIMUR	0,87	0,64	0,64	0,70	0,68	0,70
KALIMANTAN BARAT	0,39	0,60	0,64	0,64	0,65	0,65
KALIMANTAN SELATAN	0,38	0,54	0,55	0,59	0,59	0,60
KALIMANTAN TENGAH	0,40	0,56	0,59	0,58	0,60	0,59
KALIMANTAN TIMUR	0,41	0,56	0,58	0,60	0,61	0,61
KALIMANTAN UTARA	0,02	0,47	0,49	0,49	0,50	0,51
KEPULAUAN BANGKA BELITUNG	0,13	0,40	0,40	0,41	0,41	0,41
KEPULAUAN RIAU	0,18	0,51	0,52	0,53	0,53	0,54
LAMPUNG	0,65	0,67	0,68	0,68	0,67	0,68
MALUKU	0,12	0,50	0,50	0,51	0,52	0,51
MALUKU UTARA	0,04	0,46	0,47	0,48	0,47	0,48
NUSA TENGGARA BARAT	0,45	0,60	0,59	0,60	0,60	0,60
NUSA TENGGARA TIMUR	0,51	0,62	0,63	0,64	0,63	0,63
PAPUA	0,52	0,62	0,63	0,65	0,64	0,65
PAPUA BARAT	0,33	0,55	0,56	0,55	0,54	0,55
RIAU	0,56	0,64	0,65	0,66	0,64	0,64
SULAWESI BARAT	0,05	0,45	0,46	0,46	0,46	0,47
SULAWESI SELATAN	0,53	0,64	0,64	0,64	0,63	0,64
SULAWESI TENGAH	0,33	0,54	0,55	0,56	0,56	0,56
SULAWESI TENGGARA	0,20	0,53	0,53	0,53	0,52	0,53
SULAWESI UTARA	0,16	0,47	0,49	0,51	0,51	0,51
SUMATERA BARAT	0,50	0,58	0,61	0,61	0,61	0,61
SUMATERA SELATAN	0,60	0,61	0,63	0,64	0,63	0,64
SUMATERA UTARA	0,57	0,59	0,62	0,63	0,61	0,62

RESULTS

Historically (1991-2020), the Indonesia mangrove areas for the provinces of Aceh, Bali, DKI Jakarta, Jambi, West Java, Central Java, East Java, West Kalimantan, Lampung, East Nusa Tenggara, Papua, Riau, South Sulawesi, and South Sumatra are included in the category "*High*". Under climate scenario of RCP 4.5 and 8.5 projected future climates for the period of 2021-2050, the projected climates will expand the high-risk category of mangrove areas. The additions are the Provinces of West Sumatra, North Sumatra, West Nusa Tenggara (RCP 4.5) and East Kalimantan (RCP 4.5).

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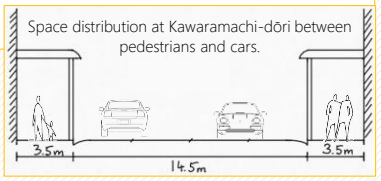
A study on the impact of traditional Japanese shopping streets “Shōtengai” on the walkability of Japanese cities

Authors: Maximilian Prutsch*, Izuru Saizen*
* Graduate School of Global Environmental Studies, Kyoto University

Background

- Decades of **car centric urban planning** in cities all around the world has **neglected pedestrians** and walking as a transport mode.
- The negative side effects are becoming more apparent as **people live less healthy lifestyles.**
- **Climate change** is advancing and cities as well as citizens suffer from **high maintenance costs, less liveable space** and **less effective** public and private **transport**.
- Since the start of COVID-19, we learned that **cities simply have not set aside enough space for pedestrians.**
- While urban spaces in most western cities try to adapt and create temporary pedestrian zones, people in Japanese cities can already use exiting **Shōtengai** infrastructure, to commute, shop, or simply spend time outside, **save from car traffic** and in a **visually stimulating, human scale environment.**

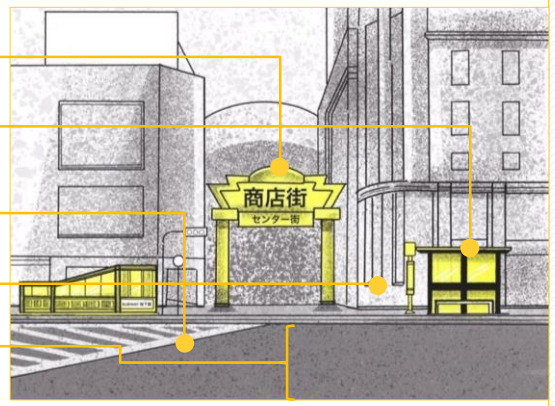
In my research I try to find out what makes traditional Japanese shopping streets so pedestrian friendly and compare it to best practice planning principles of the newest literature.

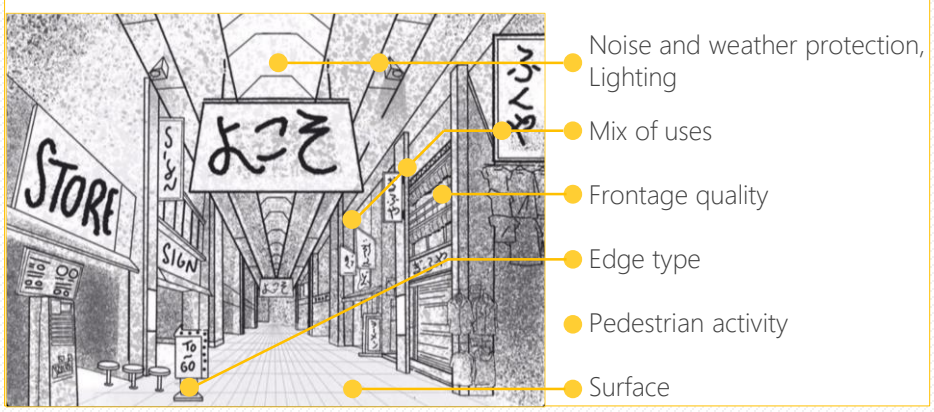


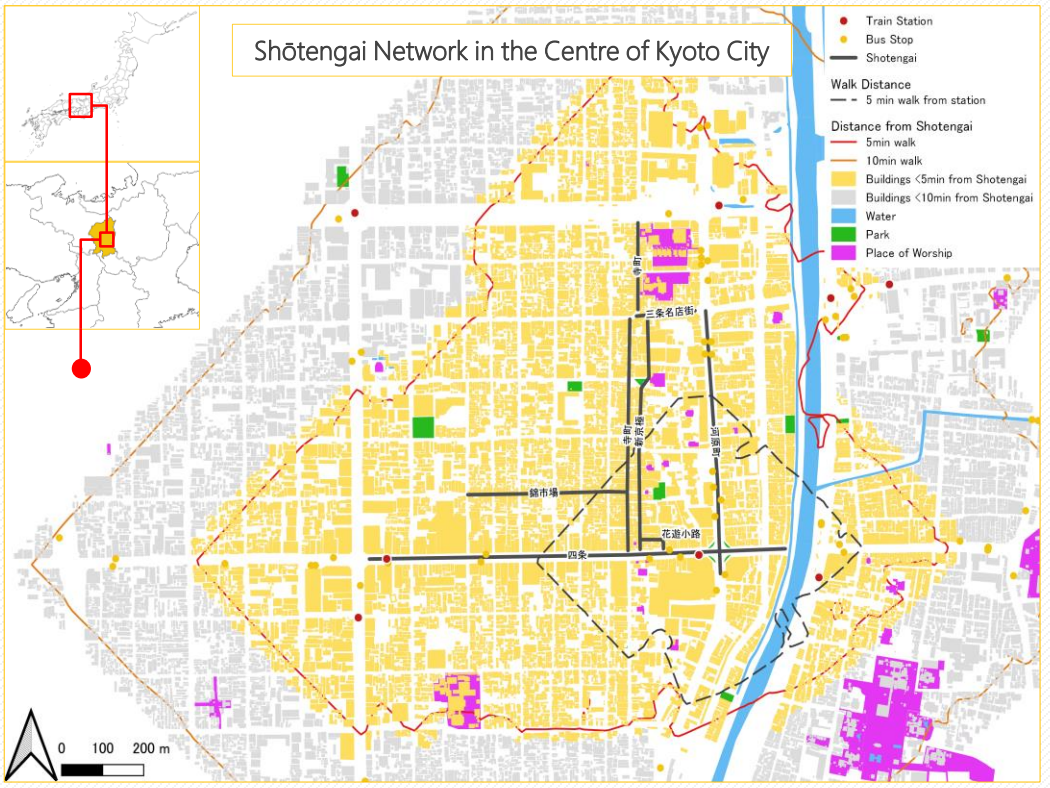
Methodology

- To study the effect of Shōtengai on the pedestrian environment, both **large scale and small scale Shōtengai in Kyoto**, **Osaka** and **Kobe** were selected.
- Through literature review, **50 walkability factors**, that are common to most theories, were compiled and are now, through an ongoing field study, being analysed and verified.

- Those **factors include**:







Results

- First results from the field work show that **Shōtengai** offer a pedestrian **environment** that **matches best practice urban planning.**
- They provide a walkable space, that is **useful** (mix use), **safe** (traffic and crime), **comfortable** (sense experiences) and **interesting** (soft edges, high frontage quality, design).
- Shōtengai also do very well according to the planning principles of Jan Gehl, in that they accomplish to **create short paths between large numbers of people and their destinations** (e.g. connection between train station and places of interest), **mix uses**, are **designed to invite pedestrians** and **create soft edges** between private and public space.
- Shōtengai also **fulfil most of the 12 quality criteria for public space, creating a high quality street for pedestrians** and increasing the likelihood people will choose to walk for their daily tasks. This effect can be observed when compared to other Streets, for example Teramachi Kyogoku Shōtengai and its side streets.



Conclusion

- The urban design form of **Shōtengai offers an ideal solution for creating a 5-minute neighbourhood or 15-minute city**, both concepts of new urbanism.
- By strategically placing or supporting Shōtengai around the city, the **walking distance and willingness to walk can be increased**.
- The map of the Shōtengai network in the centre of Kyoto City shows, in theory, how much the walking distance can be increased through the Shōtengai network, compared to the 5 minute walk (average walking distance before other transport method is chosen) from the station in a normal city environment.

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Adapting Traditions to make them sustainable: A meta-analysis of the traditional Samoan Fale Tele architecture evolution (and its driving factors)

Authors: Celine Jamin*, Ayako Fujieda**, Mari Miyaji*** and Hirohide Kobayashi*

* Graduate School of Global Environmental Studies, Kyoto University ** Faculty of Global Culture, Kyoto Seika University
***Department of Architecture, Faculty of Environmental and Urban Engineering Kansai University

INTRODUCTION : Background and Methodology

INTRODUCTION : This study investigates the factors and impacts of changes performed in the construction of the vernacular traditional Samoan Fale Tele spanning from the 19th century colonial era to our 21st century contemporary times. **The study was conducted with special focus on the physical transformations (material & technical) and their impacts on the safeguarding of the endangered vernacular and traditional architectural craftmanship.** It analyses the various evolutional factors, and their impacts on the long-term sustainability of the Samoan *Fale tele* building culture, from both the cultural and ecological stand points.

METODOLOGY : Data for the research were collected and analyzed from: Meta-analyses of relevant scientific literature, On-site Field surveys of the Samoan Fale Tele built for the *Little World Museum of Man* (LWMM) in Japan (built by Samoan Traditional builders) conducted between November 2020 and February 2021. Expert interviews were also conducted with Samoan Conservation professionals and Samoan traditional master builders who conducted the conservation work.

RESULTS

Throught the analysis of the data, **3 types of changes** were identified:
1) Materials, 2) Techniques, and 3) Forms.
Within those evolutions two distinctive categories of changes could be clearly recognized.
The first **category A)** Could be defined as a **"natural" evolution**, that characterizes vernacular architecture as "an architecture of the people and for the people" while preserving the cultural essence and the main traditional and/or vernacular knowledge related to the architecture.
The second **category B)** are the **ones that change the nature of the architecture**, (sometimes leading to a new architectural type), forgoing its cultural legacy or techniques associated with construction process.
When considering not only the safeguarding but also sustainable development of the crafts and traditional knowledge related to the vernacular architecture, it is necessary to recognize and correctly understand the factors leading those changes in our contemporary world.

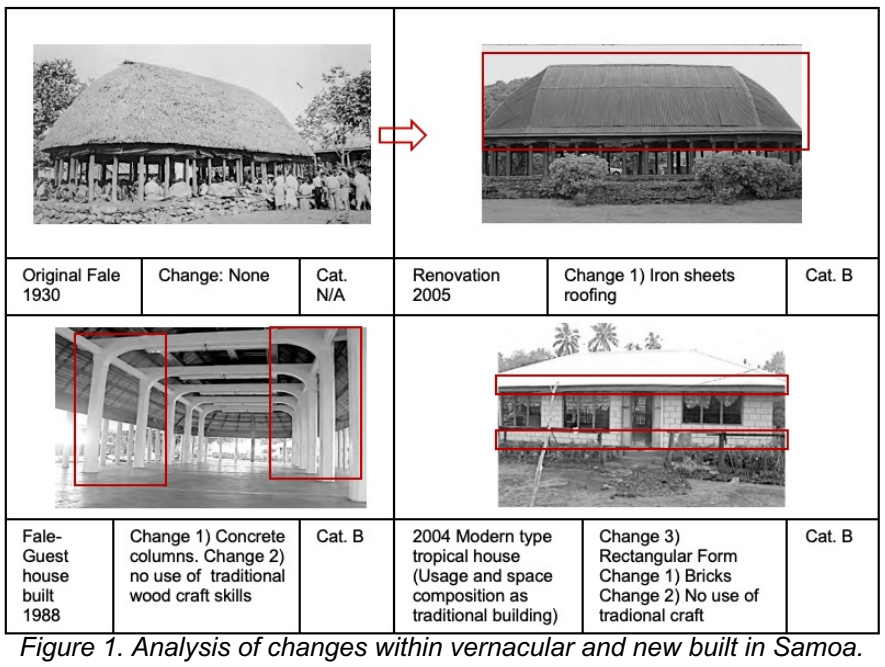
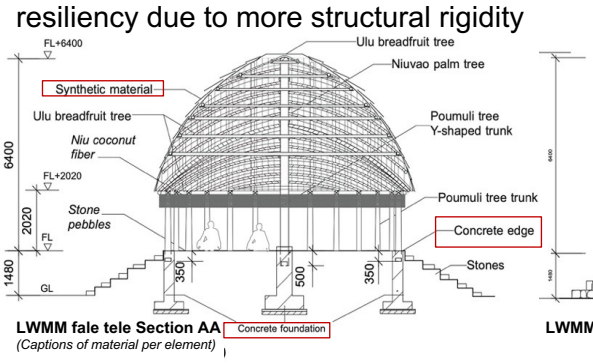
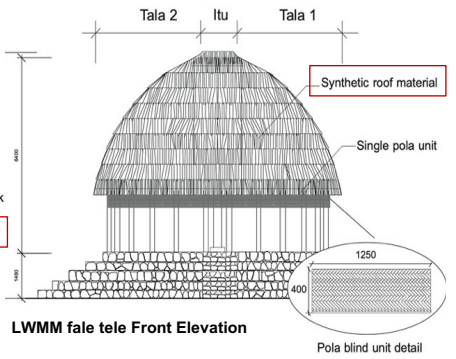


Figure 1. Analysis of changes within vernacular and new built in Samoa. (Modified from Van Der Ryn, 2012)

Regarding the changes within the LWMM project, some directly reflect the evolution commonly happening in Samoa such as the introduction of concrete foundations, which allow for me durability and concrete edge rings, that protect against wind deterioration.

Such changes **seem beneficial** and **aid in the work preservation** of the architecture. However **future monitoring** would be necessary to **investigate detrimental potential effect** such as less strong wind resiliency due to more structural rigidity





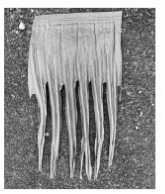
Change	Cat.	Electrical tools	B	Concrete foundation	A	Concrete pilar edge	A	Synthetic roofing	B
									
Type	Factor	2)	Temporal	1)	Durability	1)	Durability	1) 2)	Durability Cost
Sustainability Impact +		Convivence, Work speed		Stronger, more durable		Resistance to wind		Last longer & resist to water.	
Sustainability Impact −		Loose of adzes making knowledge		Potential loss of flexibility		Visual change from original		Loss of thatching technics	

Figure 2. Analysis of changes within the LWMM conservation project (Drawings and photographies by author)

DISCUSSION :

Results of this research work are **presenting the various sustainable aspects but also cautions about the detrimental impacts of certain changes brought about within the contemporary evolutions of Fale Tele construction process**. From the **understanding** of the intrinsically changing nature of Vernacular architecture, this research ultimately advocates for the need to acknowledge certain changes that are necessary for **the long-term sustainability** of the traditional building culture, while **proposing methodical approach, on how to dissociate them from the inappropriate changes that** not only do not benefit the long-term sustainability but also alter the nature and essence of the traditional building.

FURTHER WORK : Continuous recording, monitoring and analysis of such conservation experiences are necessary and should provide in time a solid basis for more holistic approach of vernacular traditional architecture conservation evolution, that could lead the way to **re-integration** of those architecture types as integral part of the contemporary times beyond the museum state, and **back into a sustainable daily usage one.**

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Assessment of personal exposure to fine particulate matters ($PM_{2.5}$) in the city of Bamako-Mali

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* Graduate School of Global Environmental Studies, Kyoto University

** Regional Environment Conservation Division, National Institute for Environmental Studies, Ibaraki, Japan

*** Department Molecular Biology, Bamako University

SCAN ME

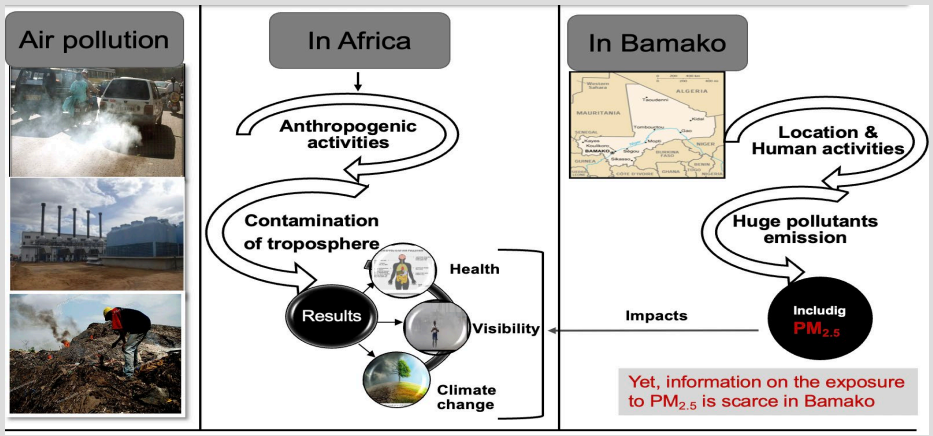
1- Background

- $PM_{2.5}$ are one of the air pollutants highly affecting the urban life.
- The emission sources can change from an urban area to another depending on many factors.[1]

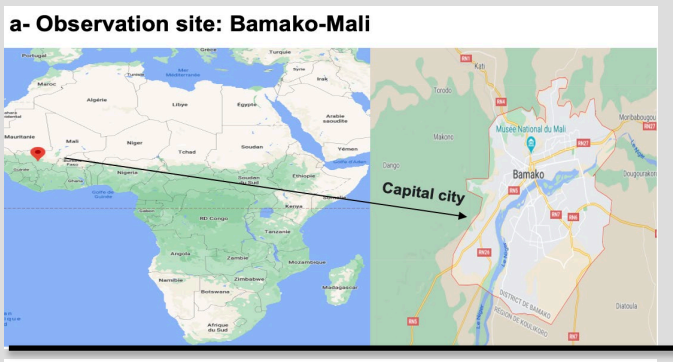
Questions:

1 - What is the personal exposure's level to $PM_{2.5}$ in the city of Bamako?

2 - What are the main exposure sources?



2- Methodology



Bamako

↕

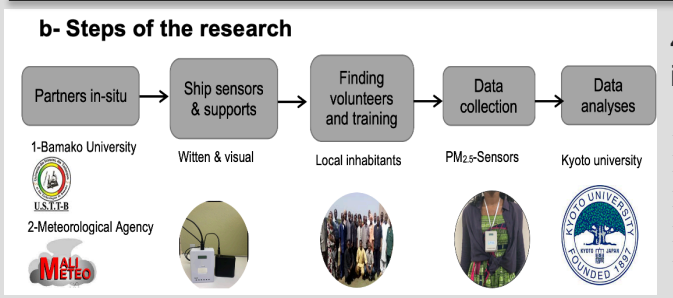
Capital of **Mali**

↕

Area of **245 km²**

↕

3 millions of inhabitants [2]



4 groups of inhabitants

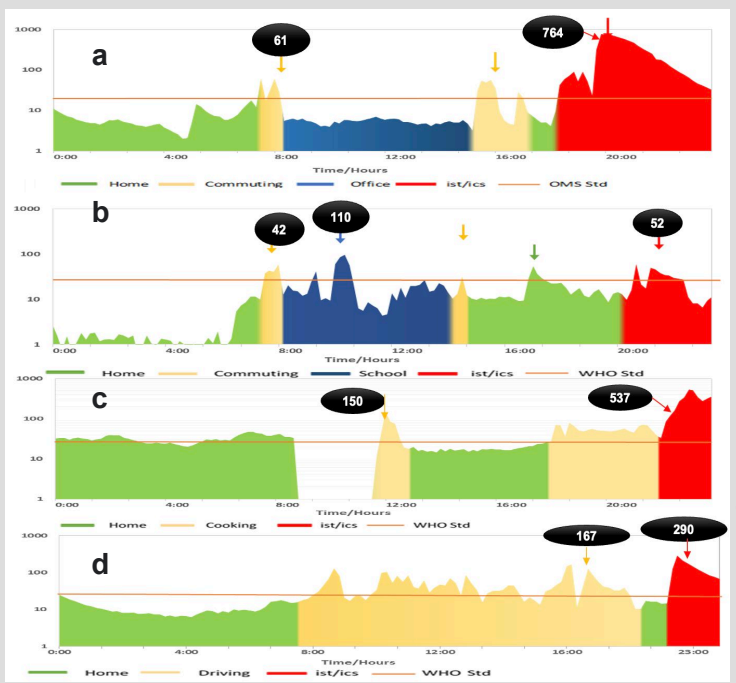
↓

- Office workers (**OW**)
- Students (**STD**)
- Drivers (**Drv**)
- Cooks (**Ck**)

- Palm size optical $PM_{2.5}$ gives the mass concentration of particules based on the distributions light scaterring intensities from single particles [3].

3- Results

Different colors ➔ different activities/microenvironments. Arrows ➔ high peaks. Values in black circles ➔ high concentrations in µg/m³.



Insecticide & Incense

Classroom & School yard

Cooking Charcoal & Wood

Traffic & Rush hours

Figure 1: Daily time series (µg/m³). (a): OW; (b): STD; (c): Ck; (d): Drv. ist/ics: **insecticide & incense.**

Pictures on the right side show the real life situation during the samplings.

3- Results

Activities/ $PM_{2.5}$ concentration µg/m³					
Indoor	Bedtime (insecticide)	267	Outdoor	Cooking	41
	Bedtime (no insecticide)	7		2 hours after cooking	30
	Home (incense)	75		Market	25
	Home (no incense)	11		Yard	22
	School	18		Driving	39
	office	19		Walking neighborhood	9
Others					24

Table 1: Average concentration for different daily activities indoor and outdoor.

With no anthropogenic; activities indoor & outdoor $PM_{2.5} \geq 11$ µg/m³

↓

High $PM_{2.5}$ in Bamako is related to human activities.

4- Conclusion

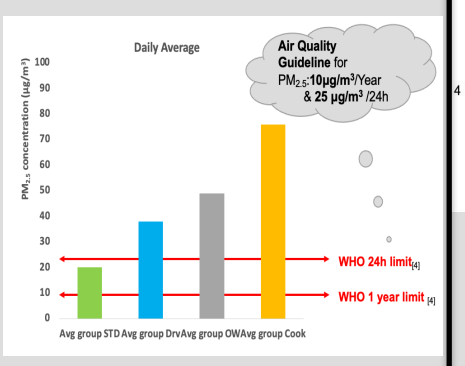
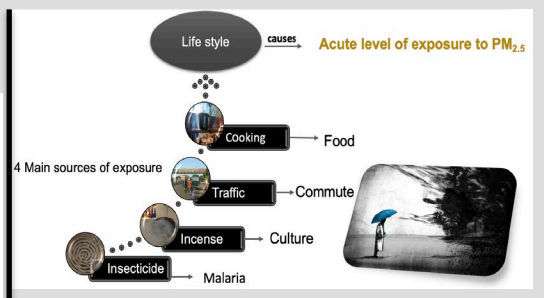


Figure 2: Daily average exposure concentration to $PM_{2.5}$ (µg/m³).



- The main emission sources are related to lifestyle & culture.
- $PM_{2.5}$concentrations > WHO exposure limits indoor & outdoor.
- Mitigation startegies should be promptely elaborated & applied.

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[1] Han L., et al., nature., 2015, 5:12467 | DOI:10.1038/srep12467

[2] Population Data.net., 2021

[3] Nakayama T., et al, AS&T, 2018, 52, NO. 1, 2–12 https://doi.org/10.1080/02786826.2017.137

[4] WHO., 2005 https://www.euro.who.int/__data/assets/pdf_file/0005/78638/E90038.pdf

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Counter-cartographic activism in peripheral territories: contestation and collaboration practices for rights enforcement

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BACKGROUND: In recent years, the *territory* has been increasingly mobilized in **social fights by historically subalternized subjects**. This mobilization is marked by the **plurality of forms of contesting power and collaborations** – among marginalized groups, social movements, universities and technical-community advisory groups, such as NGOs, etc. – in which frontiers of knowledge are often diluted.

Informal settlements, spatial expression of the excluding and unequal urbanization process, are **often excluded from systematic cartography** and even from maps of zoning laws and master plans, denying housing rights. This erasure in the cartographic process is often accompanied by the physical erasure of the community through the construction of walls and barriers that seek, in many cases, **to make invisible that reality**.

Mapping is not just a scientific practice and it is not neutral. The **creation of narratives from maps hide certain intentions**, support operations of hegemonic institutions (increasingly guided by urban entrepreneurship discourse), **justifying violent evictions**, and, especially in terms of urban development (for example, land use and occupation), influence how the future is known, considered and prioritized

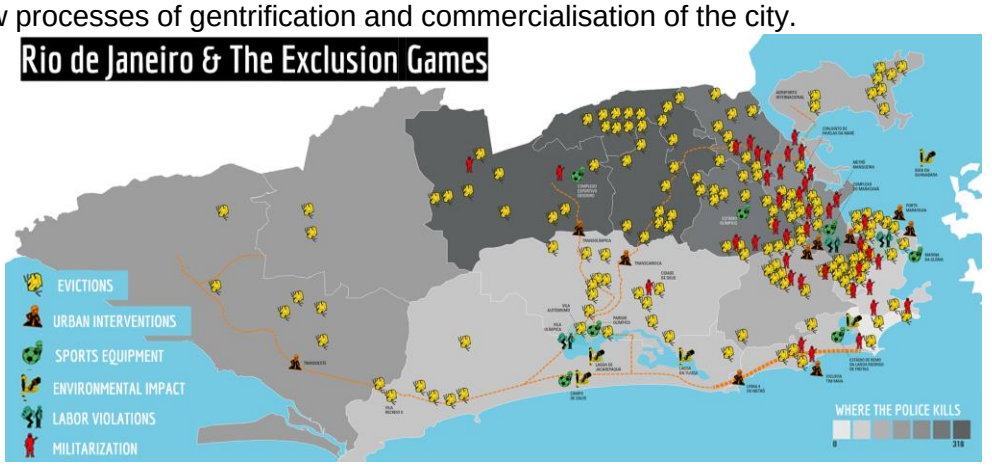
The fight against the invisibility of such subjects of rights has thus taken many forms of resistance: one of the most recent and powerful is the **counter-cartographic activism in peripheries**, seeking to collectively produce representations of territories, cultures, histories, and traditionally silenced desires, and challenging power relations supported by vertically hierarchical approaches to traditional cartography.

METHODOLOGY: This study is based on the researcher's cluster of experiences in technical-community advisory services along with social movements and universities, and some data collections and discussions of ongoing research.

PURPOSE: The work seeks to build up the relevance of counter-cartographic experiences in the **context of housing rights and socio-environmental justice**, presenting possibilities of technical action within the scope of the participatory elaboration of community/popular plans and counter-cartography (as insurgent, counter-hegemonic, community-based, alternative, etc.).

RESULTS & DISCUSSION: Counter-cartographic practices present themselves as **alternatives to official policies**, especially when these impose forced and violent eviction processes. This form of activism is a political process that technically present alternatives to displacements and official projects, **proposing instruments and strategies** that could be adopted by the government itself, but guaranteeing the permanence of families and the qualification of settlements, thus becoming important **technopolitical support** for alternative projects from below.

RIO 2016 OLYMPIC GAMES: Within three months of the Olympic announcement in 2009, the City of Rio notified that **119 favelas would be removed.** For Rio alone, **around 77 thousand people were evicted.** The **Exclusion Games** map was made in this context by the World Cup and Olympics Popular Committee of Rio de Janeiro. The work unmasks a series of rights violations, during Rio 2016, related to the privatization of public spaces, forced displacements, disrespect of environmental legislation and new processes of gentrification and commercialisation of the city.



BANHADO COMMUNITY: The work was carried out in 2019 in collaboration among technical advisors, universities and dwellers, aiming at the design of an alternative urbanism project and the construction of a popular plan and a counter-map (which was awarded by the Institute of Architects of Brazil) to **support the fight for land regularization and environmental justice**.

Banhado community, in São José dos Campos, Brazil, erased from the official map and from the postcard image of the city.

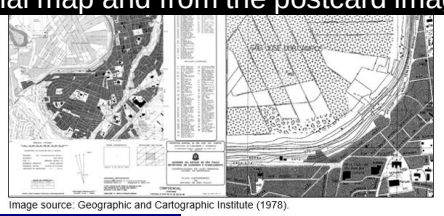
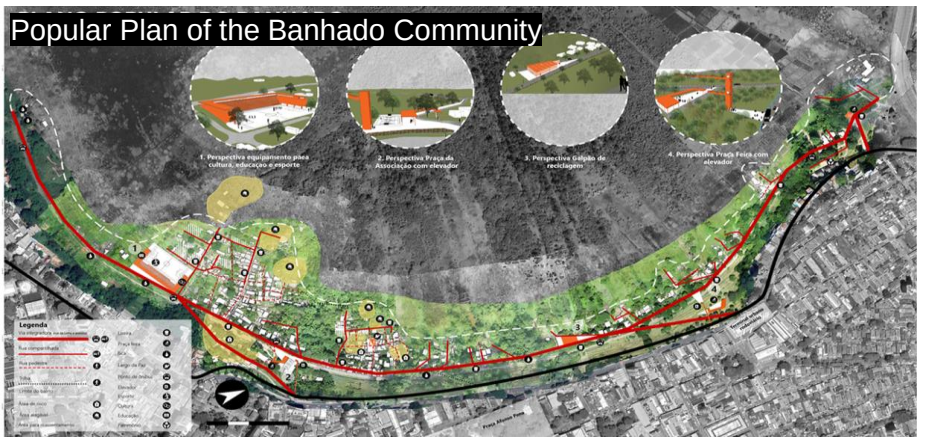


Image source: Geographic and Cartographic Institute (1978).


Image source: São José dos Campos - local government website



CONCLUSION: Especially in the current context of facing **Covid-19 crisis**, which **further reinforced the differences** in a variety of peripheral territories around the world and **displacements continued**, and in some countries even intensified, multiple popular/community initiatives of resistance and permanence, and of spatial data organization has shown that such mobilizations carry a collective and more horizontal quality in their approach, often emerging from networks of solidarity and activism that are built between communities in their territories and other social actors who advise their fights, **deconstructing the narrative that the periphery is disorganized and passive**. It is from this and so many other important experiences, of technical appropriation by communities and reflection on the place of popular knowledge that this work is inserted.

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Dispersed urban green contributes to biodiversity and ecosystem services

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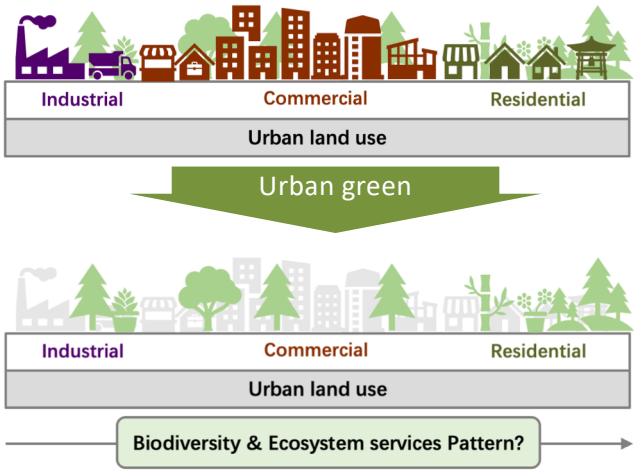
** US Forest Service/The Davey Tree Expert Company

Background

- Urban biodiversity is a part of global conservation
- Urban forest provide ecosystem services for urban residents
- Land use is main path we modify our cities

Research Topic

- Urban biodiversity & Ecosystem services across land use in Kyoto city



Method

Field Survey

175 quadrat across land use types

Land Use Type		Number of plots
Com	Commercial area	14
Com-neigh	Neighborhood commercial area	10
R-low	Exclusively low-rise residential area	38
R-high	Mid/high-rise oriented residential area	41
R-other	Other and quasi-residential area	43
Ind	Industrial area	29

Collect data: Species, number, size …

Compare Biodiversity

- Across land use
- At different scales

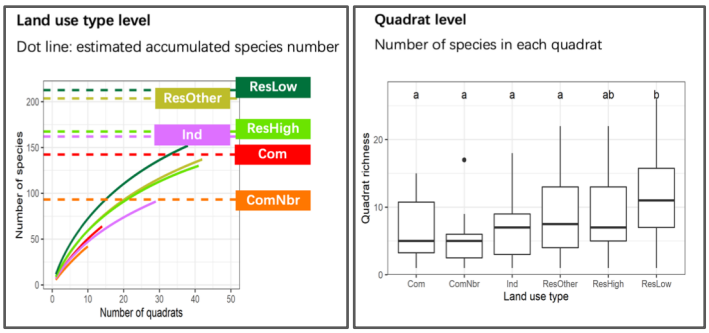
Ecosystem services

- Across land use
- At different scales

Results: Biodiversity

- 223 species – 77 families recorded:

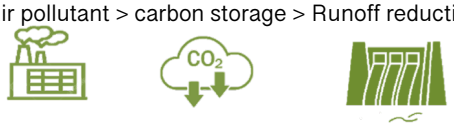
- Biodiversity across land use:
  Residential areas have higher richness (number of species) at land use type and quadrat level
  Commercial area has higher evenness



- Species composition: commercial area differs from residential areas

Results: Ecosystem services

- Ecosystem services monetary value:
  Air pollutant > carbon storage > Runoff reduction



- Quadrat level:
  No significant difference for all the services
- Single-tree level:
  Residential areas have higher ecosystem services

Welcome contact!

- Urban biodiversity and ecosystem services; citizen science
- Email: kangjf1943@gmail.com

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Housing Vulnerability in Earthquake Prone Areas: A study on Rural Housing in Puebla, Mexico on the Earthquake of 2017/09/19

Authors: María Isabel Pérez Rodríguez*
*Graduate School Of Global Environmental Studies, Kyoto University

BACKGROUND, SITE & METHODOLOGY

On September 19th, 2017, a strong seismic event of magnitude 7.1 on the Richter scale occurred in the center of Mexico. The earthquake provoked severe damages to infrastructure and 191 574 buildings were reported with damages. These events, mostly reflected on housing, left a total of 726 798 affected victims, and more than 180 000 houses were seriously damaged.

Rural areas with higher percentages of poverty were among the most affected ones after the event. Alpanocan in Tochimilco and **Pilcaya in Chiautla,** located in **Puebla**, Were selected to study the vulnerability of rural housing in earthquake prone areas. **Alpanocan** (fig.1)**:** With a population of 3267 people, located in the foothills of Popocatepetl Volcano, 45km away from the epicenter, with vegetation conformed mostly by forest. **Pilcaya** (fig.2)**:** With a population of 1129 people, located in the southwestern region, 49 km away from the epicenter, warm semi-humid weather with jungle vegetation. As a result, **this study tries to summarize the post-disaster effects and the responses found after the event.**

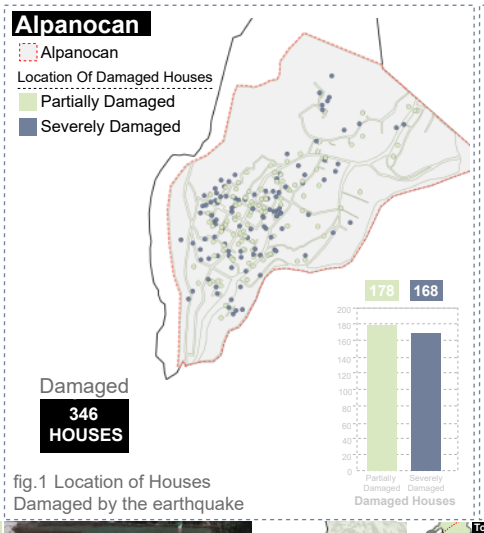


fig.1 Location of Houses Damaged by the earthquake

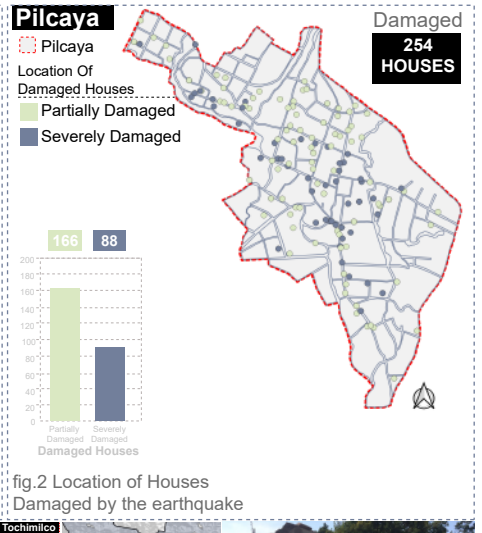
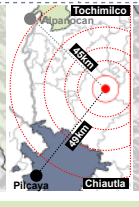


fig.2 Location of Houses Damaged by the earthquake

Literary review on the earthquake of 2017/09/17, the vulnerability of rural areas in Puebla; the connection between poverty and how it reflects in the damages caused by earthquakes and the materials commonly used in rural housing. **Official data from the National Center for Disaster Prevention** on the affected study area is used to further the analysis with GIS tools.



FINDINGS: POST-DISASTER EFFECTS

Diverse problems in rural areas are affecting the design and functionality of housing, leading to higher vulnerability. Subjects such as the lack of regulation in construction, non-engineered housing, the location of houses in risk-prone terrains, the lack of infrastructure, combined with socio economic problems like poverty, migration, cultural detachment from local roots and the seek for replacing the local for the modern at all cost may contribute to vulnerability.

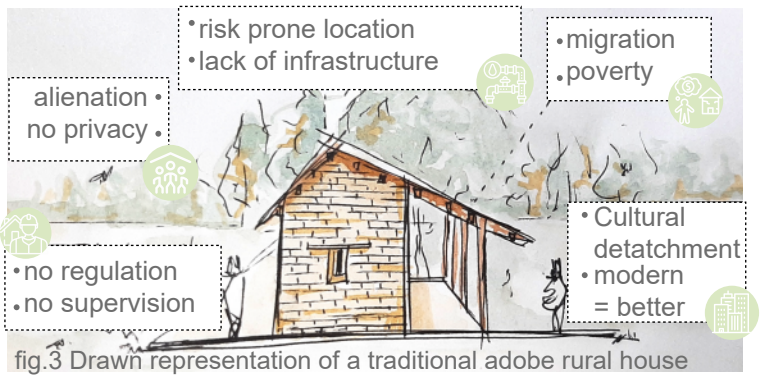
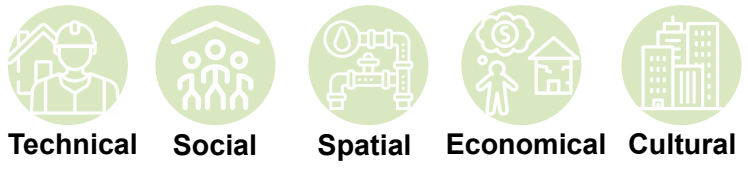
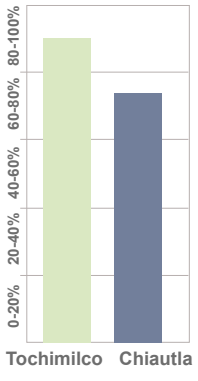


fig.3 Drawn representation of a traditional adobe rural house



Range of Poverty according to PATP*
*Official Platform for the Territorial Analysis on Poverty.
(Fig 4. Charts made with data from CENAPRED, 2015-2019).



Chiautla and Tochimilco are inside the **highest ranges in poverty** (fig. 4) According to the PATP*, a series of parameters which determine the range of poverty in the Mexican population. The highest parameters were: Population in poverty (84% Tochimilco, 69% Chiautla), Population with at least one social scarcity (98% Tochimilco, 85% Chiautla). Scarcity for access to social security (88% Tochimilco, 71% Chiautla) and Line of Poverty per income (85% Tochimilco, 75% Chiautla).

DISCUSSION: POST-DISASTER RESPONSE

Common Materials in both regions are similar in general, being the most common adobe and concrete blocks, but other materials can be found.

Confined Masonry	Adobe	Wood	Synthetic Materials Steel, other Metals
Mostly with concrete blocks. Confined masonry with bricks can also be found.	Sun-dried earth and straw bricks, traditional technique from these regions.	Beams, trunks, non treated wood,construction residue. For roofing, fences.	Plastic, fibers, rubber, threated rods, construction residue, plates.

fig.5 Concrete blocks

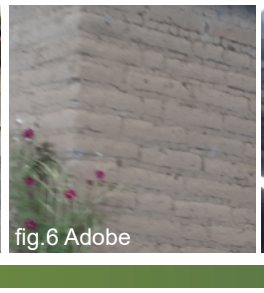


fig.6 Adobe

fig.7 wood, bamboo

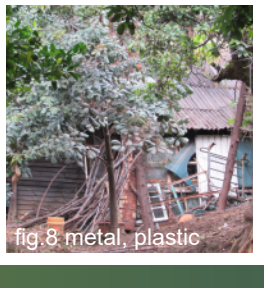


fig.8 metal, plastic

3 post-disaster design proposals found in both communities were analyzed based on materials, functionality and costs.

Post Disaster housing prototype - **bamboo**	Prototype for construction-**bahareque**	House-**prefabricated Polystyrene panels**
Bamboo frames and sliced bamboo panes, synthetic fabric roof.	Timber frame, bamboo roof, sheet roof, small diameter cane and clay cover.	W panels, steel-wires 3d structure with polystyrene core, cement-mortar cover.
cons: Cold at Night, Temporary / pros: Fast Construction, Low Cost	cons: More Workforce, Temporary / pros: Local Materials, Low Cost	cons: City Materials, Transportation / pros: Fast Construction, Spatious

fig. 9 Pilcaya, 2017

fig. 10 Pilcaya, 2017

fig. 11 Alpanoncan, 2018

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Impact of cyclone *Aila* on educational institutions in southwestern Bangladesh: Extent of loss, damage and recovery

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BACKGROUND

On 25 May 2009, cyclone *Aila* struck in 14 coastal districts, when the affected people were trying to restore their normal lives and livelihoods from the loss and damage of the super-cyclone *Sidr* in 2007. The cyclone caused significant damage to coastal communities. Cyclone *Aila* damaged and washed away more than 5,033 institutions including schools.

A number of studies conducted on the impacts and post-disaster recovery of cyclone *Aila*. However, after a decade of this cyclone, lack of studies focused on the damage and loss of cyclone *Aila* in the education sector; for which further research on this issue was considered imperative. Therefore, the aim of this study is to minimise this research gap with an empirical evidence from cyclone *Aila* affected coastal communities in Bangladesh.

OBJECTIVES OF THE STUDY

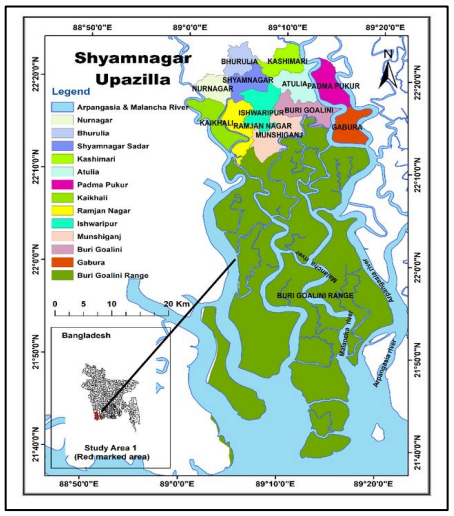
1. To estimate the cyclone *Aila* induced structural and non-structural loss and damage to the primary schools in the study area.
2. To what extent the educational institutions have recovered from loss and damage.

METHODOLOGY

Study area

The study was conducted in coastal Shyamnagar Upazila (subdistrict) of Satkhira District in southwestern Bangladesh. Shyamnaga has an area of 1,968.24 sq km, with 3,13,781 population (159 per sq km). Agriculture is the main source of income of 64.98% population. Average literacy rate is 39.69%.

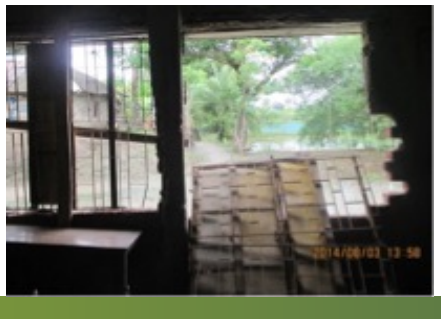
The subdistrict comprises of 12 Unions (the lowest administrative entity); among those Gabura and Padmapukur Unions were chosen as the study area.



Map: Location map of the study area, Shyamnagar Upazila.

Children are going to damaged school using a damaged earthen road,

A partially recovered school-cum-cyclone shelter



This study was financially supported by JSPS KAKENHI (grant number 21H03727)

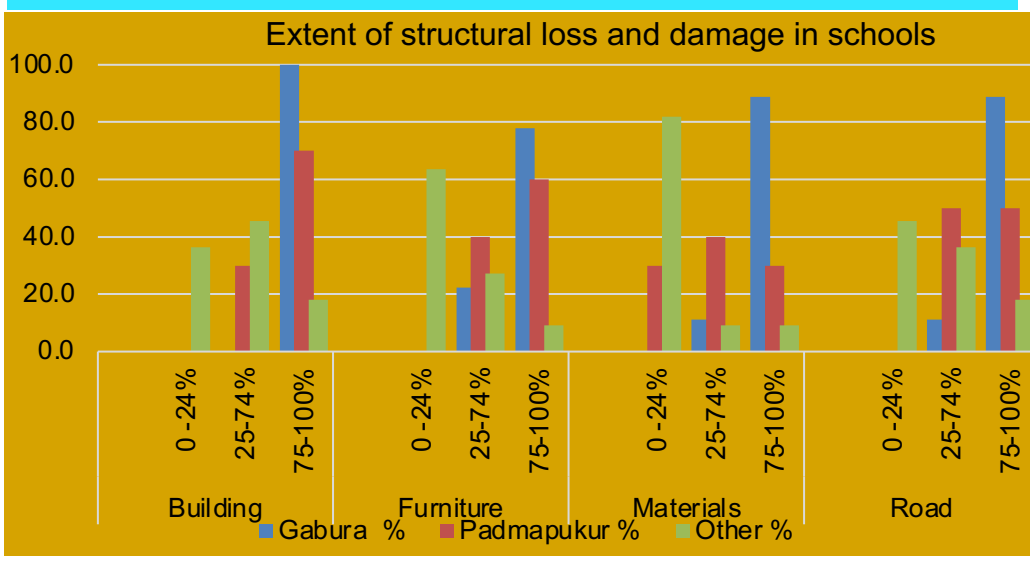
Survey methods

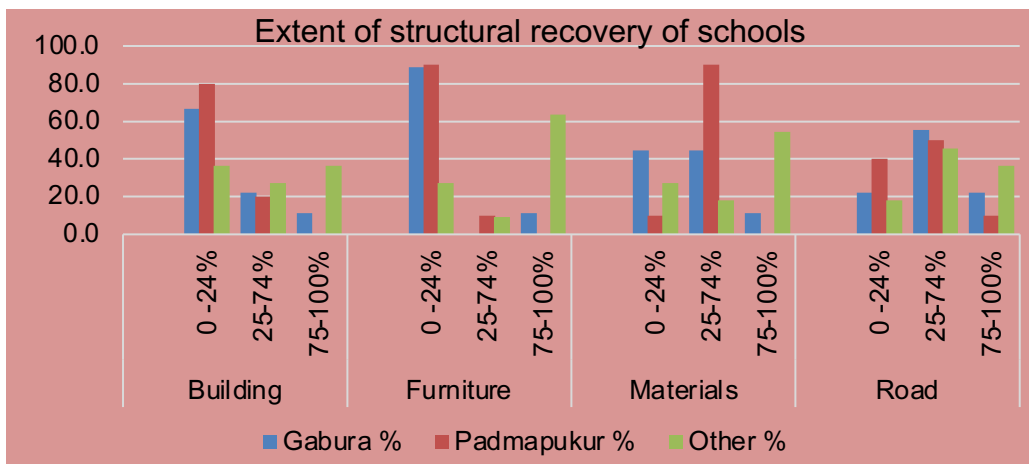
Data were obtained through a series of field visits using survey and various participatory approaches.

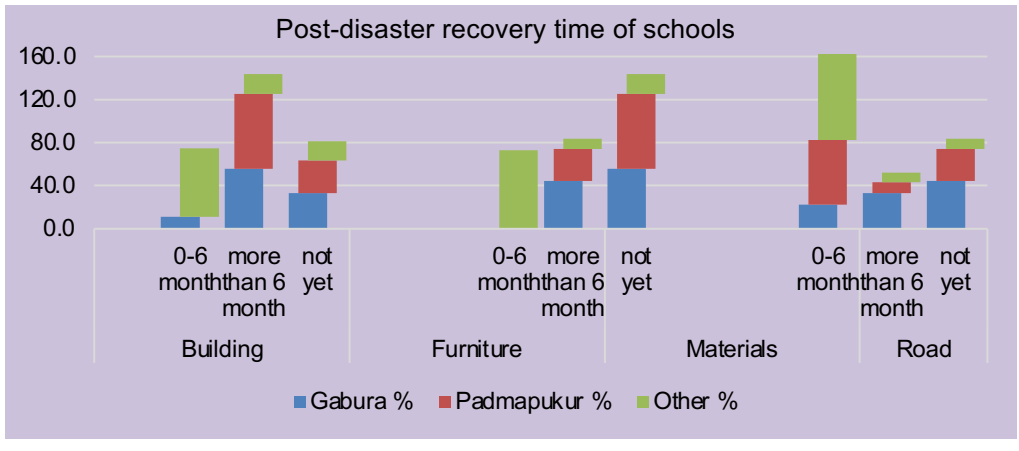
- 19 primary schools from highly damaged area and 11 primary schools from semi-damaged area were selected for the study.
- Headteachers of each school were the key informer for this study.
- A structured questionnaire was used for data collection.

RESULTS

Structural loss, damage and recovery from cyclone *Aila*







CONCLUSION

- All the studied schools were severely damaged during cyclone *Aila,* about 9 months were closed, and 27 students/school were dropped-out.
- After one decade, one-fourth of the schools could not fully recovered.

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Investigating The Impact of Movement Restriction on Land Surface Temperature in Three Epicenters Cities of COVID 19 in Indonesia

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1 INTRODUCTION

Land Surface Temperature (LST) is the radioactive skin temperature of the land surface, as measured in the direction of the remote sensor. LST changes are influenced by population activities. The increasing of population activity will be followed by many development processes. In this development process, vegetated land will be converted into non-vegetated land, which is used as a place to live. As a result the land surface temperature will be increase because there is no vegetation to absorb heat.

LST change as an impact of ***climate change*** event can lead to the ***increasing number of some diseases*** which is susceptible to temperature changes (CDC's Climate and Health Program, 2014).
In Indonesia, diseases such as tuberculosis, malaria, and dengue fever are diseases that ***associate with temperature change which*** has become a rising concern to the Indonesian government.

Nowadays, ***COVID 19*** is a disease that has become a highlight in all countries in the last 2 years which causes infection in the human respiratory tract.

Due to the very fast and massive human-to-human transmission of the epidemic throughout the world, World Health Organization ***(WHO) set Covid-19 as a pandemic*** on March 11, 2020 (Jun, Yo, & Lee, 2021).

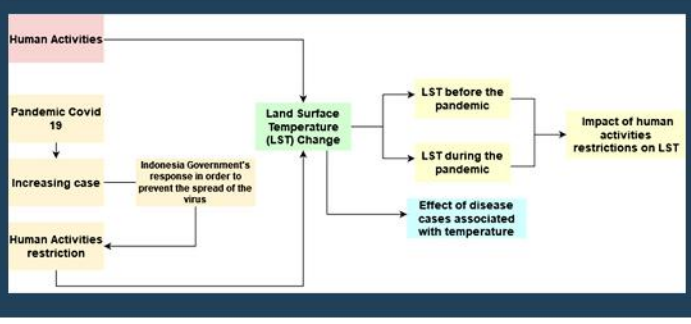
Yet, based on the WHO (2020), currently there is no conclusive evidence that either weather or climate have a strong influence on COVID-19 transmission. However, community behavior due to COVID-19 can affect land surface temperature through movement restrictions where mobility is an important component that affects LST.

The first case of Covid-19 in Indonesia was reported on March 2, 2020. According to the Republic of Indonesia's COVID-19 Handling Task Force, the number of confirmed Covid-19 cases has reached 4,066,404 with number of death attained 131,372 people and the most cases was found in Jakarta, the national capital of Indonesia by 856.006 cases. In response to the increasingly rapid spread of Covid-19, Indonesia Government ***declared restrictions on human activities in places of education, at work, and in other public facilities***. According to Muhammad, Long, & Salman (2020), the implementation of policies to restrict activities and large-scale community movements had a ***positive impact on the environment***, such as reduce the temperature and air pollution.

THE AIMS OF THIS STUDY

*To identify the impact mobility restrictions as a result of **Covid-19 pandemic** on **land surface temperature** in three epicenters of COVID 19 in Indonesia such as **Jakarta, Surabaya and Makasar** which has a dense population activity*

To analyze a deeper understanding of LST conditions between during and before the emergence of COVID-19, the investigating should not only compare LST variation between before and during the implementation of lockdown in one season but also compare to the LST in the previous years where covid 19 hasn't happened yet (Hadibasyir, 2020).



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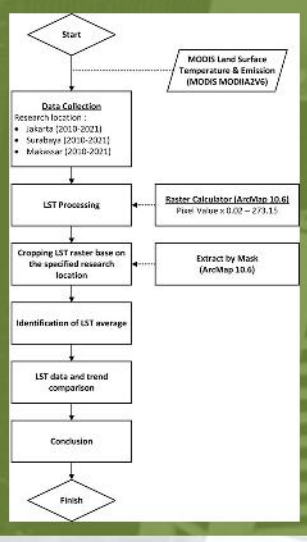
2 METHODOLOGY

LST ANALYSIS

In this study, data were obtained through ***secondary surveys*** and ***remote sensing approaches.*** The time of acquisition of MODIS data is in the range of ***August-September*** which is included in the dry season, thus avoiding bias due to seasonal differences. In addition, research materials used include data for MODIS Land Surface Temperature & Emissivity 8 Day Global 1 km (MODIS MOD11A2 V6) ***DKI Jakarta, Surabaya City, and Makassar City 2010-2021*** as well as administrative boundaries of DKI Jakarta, Surabaya City, and Makassar City.



3 RESULT AND DISCUSSION

Year	DKI Jakarta					Surabaya					Makasar				
	Min	Max	Average	LST Diefference	Prediction	Min	Max	Average	LST Diefference	Prediction	Min	Max	Average	LST Diefference	Prediction
2010	31.41	40.89	36.98	-		28.73	40.97	37.54	-		30.09	40.79	36.17	-	
2011	30.87	40.97	38.14	1.16		33.95	42.71	39.95	2.41		31.13	42.05	38.70	2.53	
2012	31.61	44.65	39.80	1.66		33.91	43.27	40.64	0.69		32.99	43.63	39.28	0.58	
2013	32.83	44.51	39.61	-0.19		30.01	43.15	39.10	-1.54		32.49	42.33	38.17	-1.11	
2014	33.20	43.83	39.90	0.29		31.41	42.45	39.50	0.40		32.77	43.33	39.68	1.51	
2015	33.23	45.27	41.93	2.03	-	33.45	42.91	40.31	0.81	-	33.07	43.37	40.49	0.81	-
2016	31.07	45.05	39.62	-2.31		29.79	40.95	37.37	-2.94		33.03	42.77	39.47	-1.02	
2017	31.33	43.47	39.25	-0.37		33.55	42.89	39.88	2.51		30.95	41.17	37.88	-1.59	
2018	31.99	41.47	38.57	-0.68		29.97	41.51	39.02	-0.86		32.43	41.29	38.22	0.34	
2019	32.55	43.11	38.67	0.10		31.57	41.99	39.16	0.14		32.99	43.69	39.88	1.66	
2020*	31.41	41.25	38.20	-0.47	38.88	31.13	42.31	38.86	-0.30	39.38	32.75	42.55	39.10	-0.78	40.34
2021*	30.91	40.81	36.82	-1.38	39.09	28.51	37.77	35.57	-3.29	39.60	27.87	41.97	36.24	-2.86	40.80

Table 1 shows the fluctuating LST conditions in each study area in the 2010-2021 period

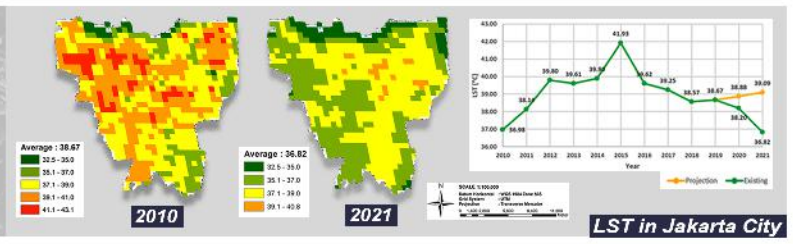
Jakarta, Surabaya, and Makasar areas are metropolitan cities that have been designated as part of the ***national strategic area*** (Government Regulation No. 13 of 2017). The determination of an area as a national strategic area has an impact on increasing urban development and community movement activities.

During 1993-2013, there was an increase in the area of asphalt material which can represent city development by 97.69% in Surabaya (Kurniati & Nitivattananon, 2016).

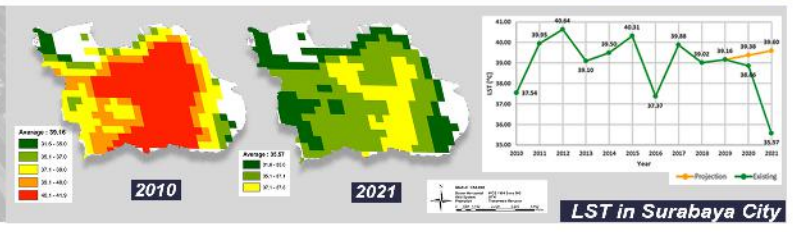
During 2001-2014 in DKI Jakarta increased built-up land by 13% following by decrease of vegetation land area by 5.1%. Therefore, surface temperature was increase by 2-4°C (Ramdhoni, Rushayati, & Bu, 2016).

While Makasar city in the period of 1999-2019, the built-up area has rose by 13.1% followed by a decrease in the vegetation area by 8.6% which lead an increase in the surface temperature range of 0.39° C (Liong, Nasrullah, & Sulistyantara, 2021).

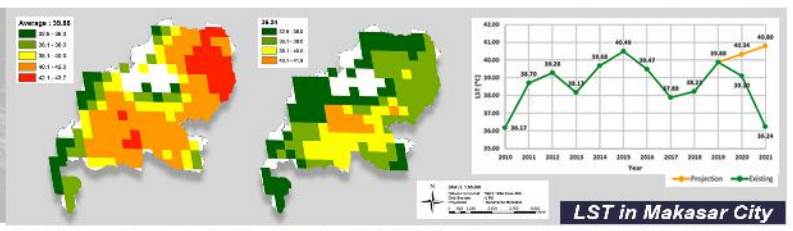
DKI Jakarta
Has an average LST range of 36.69°C to 41.93°C and an annual LST change range of 0.1°C to 2.31°C



Surabaya
The average LST ranges from 35.57°C to 40.64°C and the annual LST changes range from 0.14°C - 3.29°C



Makassar
The average LST is in the range of 36.17°C – 40.49°C and the annual LST change ranges from 0.34°C – 2.86°C



In addition, there are similarities in the pattern of decreasing LST between before the pandemic (2010-2020) and during the pandemic (2020-2021). The decreasing trend of LST in each study area at the same time as the implementation of the policy of movement restriction.

Interestingly, the potential for diseases related to surface temperature has also decreased, such as dengue fever. It can be seen from the number of dengue cases in three city from 2010 to 2019 which tends to decrease.

Jakarta is an endemic area for dengue fever and has a fluctuating number of dengue fever cases every year. From 2010-2015 cases of dengue fever decreased from 19521 to 5028. However, entering 2016 the cases of dengue fever increased dramatically to 20432 but two months later, cases fell drastically to 2850 (2018). Until 2021, dengue fever cases tend to decline (Jakarta Health office, 2020).

Surabaya is observed to have decreased dengue fever cases in the past 5 years (Surabaya Health Office,2020). A quite drastic decrease occurred in 2020 by 73 cases where in the previous year there were 277 cases.

Makasar Health Office declared that the number of dengue fever cases until 2021 is still under control because it has not increased compared to 2019 which reached 268. Therefore, dengue fever cases in Makasar are observed to tend to decline.

According to the research conducted by Guzman (2015), climatic factors that influence the occurrence of dengue cases include temperature, rainfall, and humidity. At high temperatures around 25-27°C mosquito breeding will increase resulting in increased dengue cases. As we already know that Indonesia has a tropical climate which is very suitable for the growth of mosquitoes. Dengue fever is one of the public health problems in Indonesia where the number of sufferers is increasing.

4 CONCLUSION

It is known that movement restrictions in order to reduce the rate of virus spread can decrease LST, as evidenced by LST in three major cities in Indonesia which has decreased during the pandemic.

The decrease in LST tends to be followed by a decrease in cases of diseases associated with temperature, such as Dengue Fever, which is seen based on annual case data in three major cities.

This research can be a trigger for further research to identify what is the specific human activities restrictions that have a greater impact on decreasing LST

This research can also inspire the government to make regulations as an effort to improve the environment which usually tends to be difficult to do.

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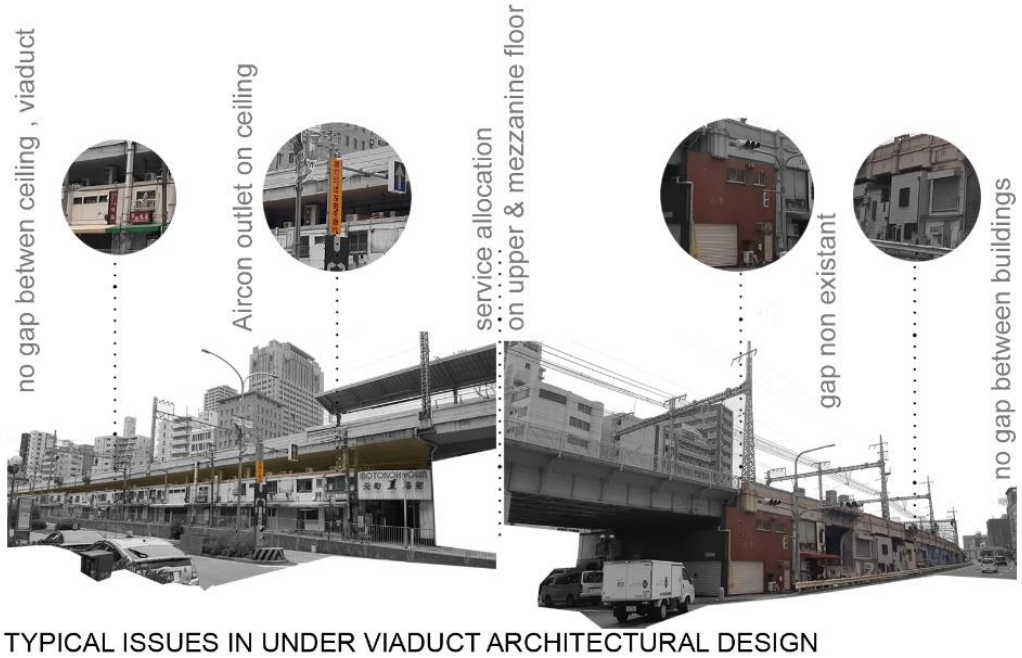
Living (With+On) Infrastructure:

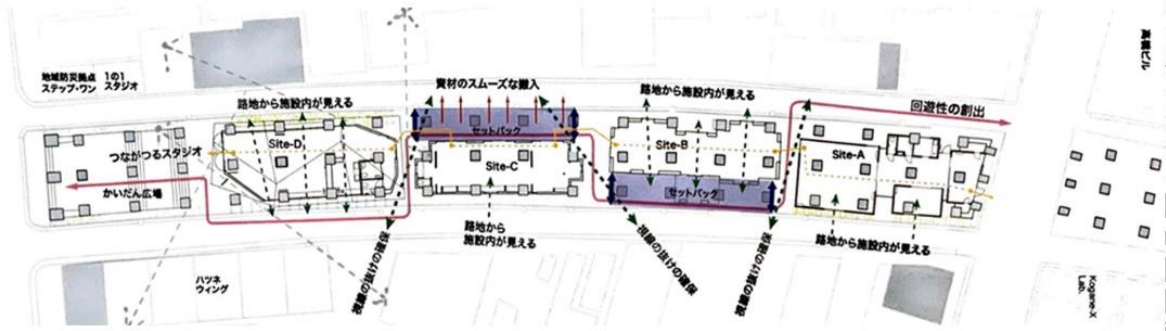
Design strategies of Post Infrastructural Urban Context of NPO KAMC , Yokohama , Japan

Authors: Barua Srijon *, Hirohide Kobayashi*,
* Graduate School of Global Environmental Studies, Kyoto University



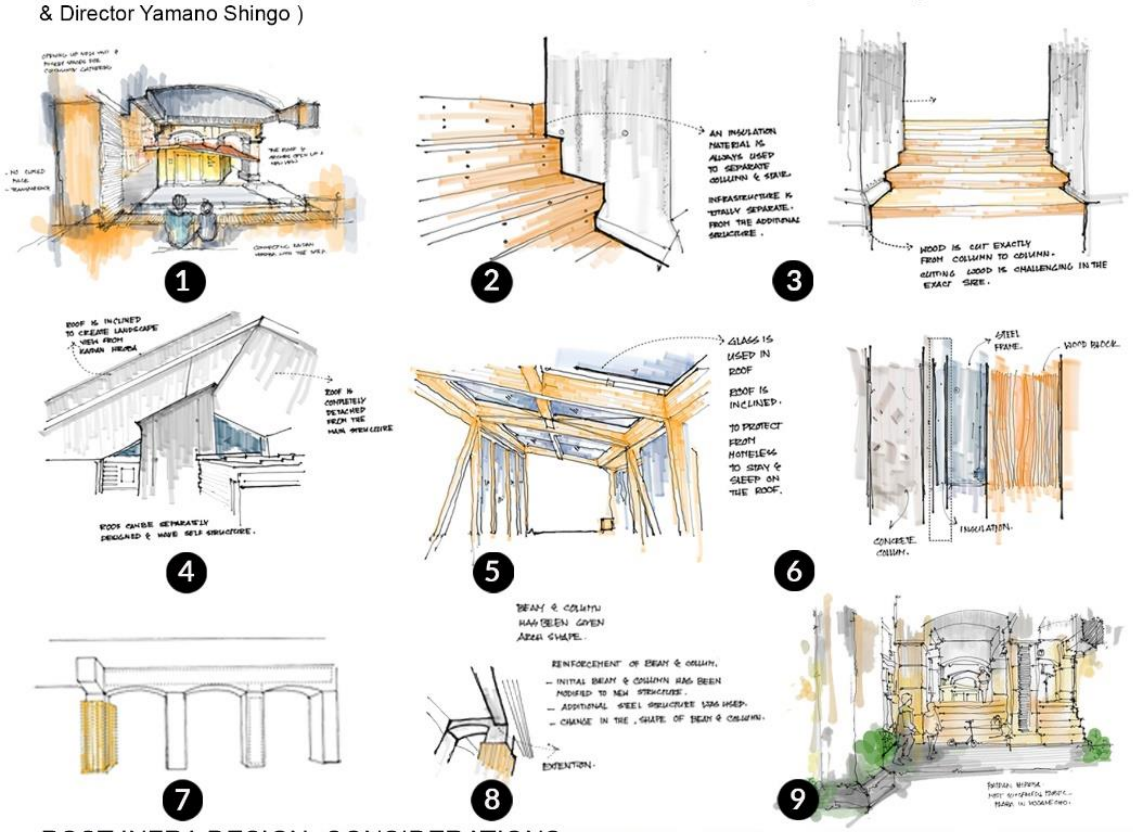
TYPICAL ISSUES IN UNDER VIADUCT ARCHITECTURAL DESIGN

(Environmental issues like heat , noise , damage , circulation , friction etc due to non existant gap between infrastructure and new construction are typically not addressed in design considerations : Image : Osaka Loop line)



UNDER VIADUCT DEVELOPMENT PLANNING CODES

(Reference : Courtesy of koganecho area management center planning code guide book & interview session with Masano Ueno, Nishikura Kiyoshi, Suzuki Nobuharu, Yoshihiko Iida , Mashashi Sogabe, Yanagisawa Jun & Director Yamano Shingo)



POST INFRA DESIGN CONSIDERATIONS

(Sketches & information structure by presenter , interview outcomes of discussion session with architects of koganecho area management center , yokohama , Japan)

TOPIC INTRODUCTION

The increasing connection between urban space and transportation infrastructure creates new potential for the infrastructure to be used as an urban element. NPO Koganecho Area Management Center, Yokohama Japan since 2000 has set an example of utilizing infrastructure as an urban entity , by improving the under railway space of Keikyu line in KoganeCho , HinodeCho area of yokohama. Here , history , place and people are given new values & purpose through the use of urban planning , new typology of architectural design under elevated railways. Architectural and urban planning codes , construction strategies are collected , sketched out and presented in this poster study.

SITE & METHODS

The information collection part of the study was done during the internship of GSGES environmental management masters course by the presenter at NPO KoganeCho Area Management Center , Yokohama , Japan in October 2020. Following information was collected through the interview and discussion with architects, planners and director general of the project and NPO.

FINDINGS: URBAN CODES

[Code1] : Opening up both faces of the structure with large window
[Code2] : Increasing walkability and direct circulation through the structures under the railway
[Code3] : Creating connection between each module of studios through entrance and exit sides
[Code4] : Scale of the building should be inviting for the community people and their surrounding
[Code5] : creating small pocket spaces for people to gather
[Code6] : Transparency of the gallery spaces by putting see through materials like glass
[Code7] : Security and light at night in Building block design
[Code8] : Diagonal line restriction from the road and building height information should be maintained like regular building codes
[Code9] : Image for the town by creating community space and connecting communities , railways and city (respecting specific site context , fire codes disaster codes)

FINDINGS : DESIGN DETAILS

1 VIEW CORRIDOR

Creating view from various eye levels that gets open due to the height restrictions of infrastructure viaduct. Changing various levels can help create attractive roof and ceiling design potential.

2 6 MATERIAL & INSULATION JOINTS

Insulation of soft materials , flexibility of construction plan is needed to ensure that the existing structure and newly placed materials are prevented from mutual friction , damaging the railway infrastructure .

3 CONSTRUCTION TECHNIQUE

Wood needs to be cut exactly same length from column to column. This kind of construction technique calls for on site preparation. Prefabricated materials might not be right fit for most of the cases

4 5 ROOF TREATMENT

Roof as separate structure can be considered free from the main building structure. Prevention of dark space through transparent roof can be done as its under another roof which is infrastructure itself. To protect the roof from homeless or vandals , ceilings of the new structure can be tilted or sloped.

7 8 REINFORCEMENT OF BEAM AND COLUMN

Original Infrastructure can be reinforced further into arch shaped reinforcement to provide array aesthetic

9 HEIGHT RESTRICTIONS

Separation of infrastructure and post infrastructural construction gap of 50-100 cm for maintenance work of original infrastructure , electric and water services.

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Potential of incremental approach in community-led housing: A case in Yangon, Myanmar

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Issues in community-led housing

Recent urbanization in Yangon has brought an urgent need of affordable housings in the city. To address the issue, the local NGO introduced the community-led housing for the poor and until 2020, 11 projects had implemented and provided accommodations for nearly 900 households. For better future planning, the residents' satisfaction survey was conducted to analyze the performances of the housings. It is observed that the residents had high satisfactions on social and economic aspects but were unsatisfied with the physical conditions of the housings. As shown in Fig.1, the residents were unsatisfied more on the site facilities which were related to the lack of open spaces and the sanitation issues. Both sites had water logging under their houses from lack of drainage system for wastewater. Nearly one-third of the residents complained about the house qualities and their major concern was on the indoor environmental discomfort such as high indoor temperature, poor ventilation and noise. Other issues included the qualities of building materials and workmanship, and the limited space and weak structural system which put challenges on the housing extensions or modifications to meet the changing needs and preferences of the households over the time.

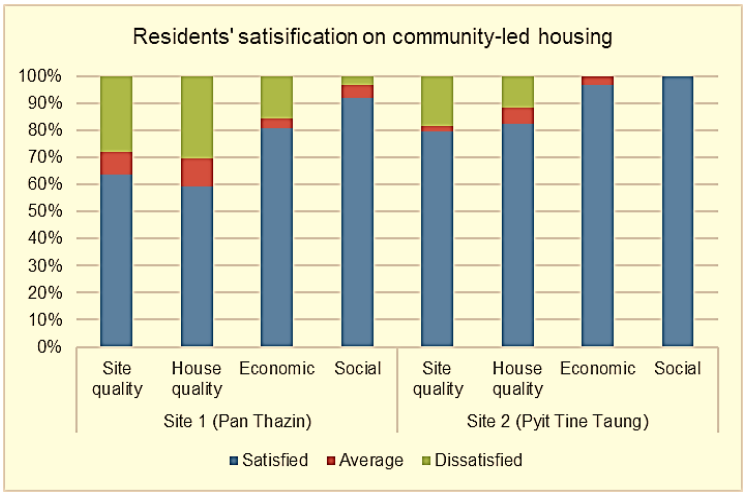
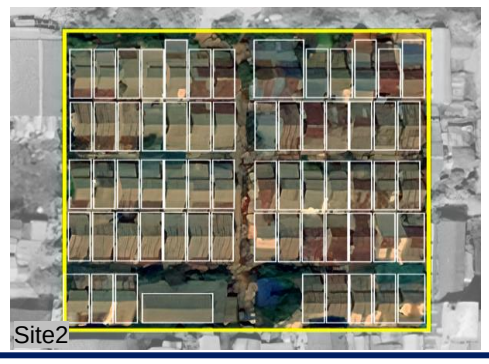


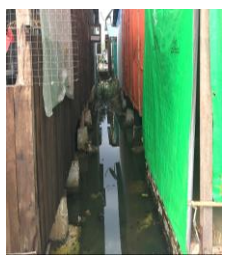
Fig 1. Residents' satisfactions in sites 1 and 2


Site1

Aerial view of sites 1 and 2 (showing the limited land flexibility for extension)


Site2

Limited indoor space with crowded condition



Water logging under houses

Potential application of incremental approach

The incremental housing approach provides an alternative process of housing construction and financing. As shown in Fig 2, most of the existing houses were extended at front and back at the first place and this activity resulted the loss of semi-outdoor space at front which was important in providing the houseowners a sense of security, including the opportunity to engage with others and the connection between inside and outside. Moreover, in some houses, the still crowded indoor space, along with a lack of open land, made the users to extend vertically which required the structural modifications. Therefore, the proposed design incorporates the incremental approach where the house design has considered the flexibility for future transformation through time based on the financial capabilities.

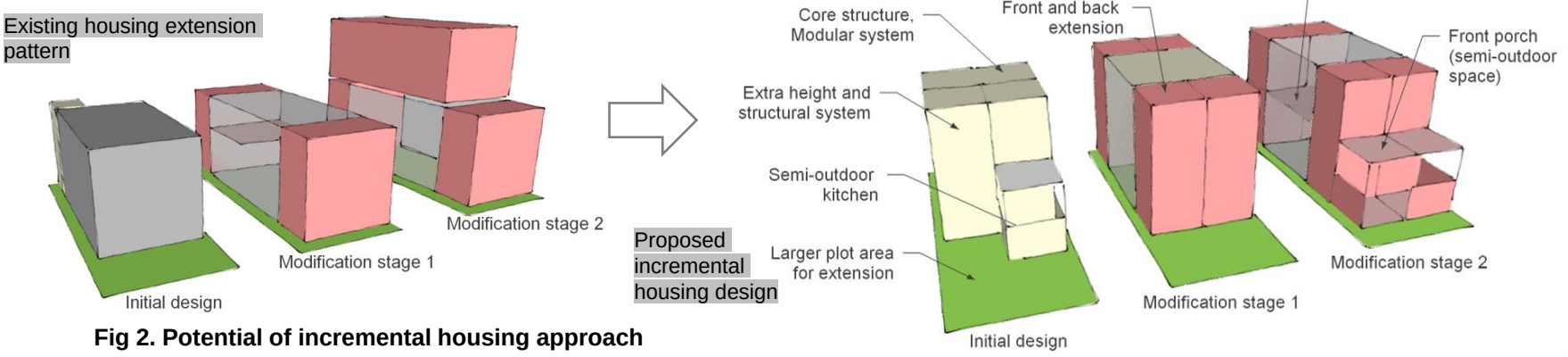


Fig 2. Potential of incremental housing approach

Firstly, the initial design includes only the most basic needs and is constructed in modular form. In this context, a larger land plot (15% larger than existing plot) and extra building height with structural system are proposed for both horizontal and vertical spatial flexibility. The proposed plot size is identified based on different existing plot sizes with costs and the additional cost for a larger land and structural system is balanced by a reduced core house size. This core structure consists of a multi-functional living room with one bedroom while toilet and shower area are separately placed at back and a semi-outdoor kitchen at front according to the users' traditions found in the case study sites. Then, based on the financial capability of the household, the second stage includes the front and back extension where kitchen and bathroom are modified and put together into the core structure. At the final development stage, the mezzanine is built for additional bedroom and the front extension for porch as extra living quarter for family and social building in the community.

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Regional Identity of Tonami Scattered Village: Through the Investigation of the Attitude of the Residents in Goromaru Area

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** Graduate School of Global Environmental Studies, Kyoto University

Background & Objectives

In Tonami scattered Villages, after 70's farmland reallocation, traditional villages and new residential complexes are often seen as dichotomous, but it is important to note that the existence of both and the lifestyles of the residents have created the current landscape. It is necessary to find the regional identity in terms of the space and the consciousness of inhabitants so as to think about the sustainability of the region, and to organize the parts to accept the transformation and the parts to inherit to the future.

Methodology

In order to find out the regional identity in the modern context, we conducted the following three surveys.

A: GIS analysis to capture the transition and current situation of urbanization in Tonami in terms of housing development in the urban scale in cooperation of Tonami City Hall.

B, C: Questionnaire to clarify the activities in the familiar place and perception of landscape elements of the region, targeting residents of a traditional village and two residential complexes in Goromaru Area.

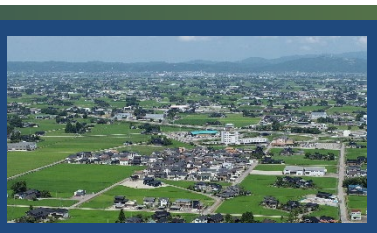

Fig.1: New Residential Area (Photo Taken by Wen WANG)

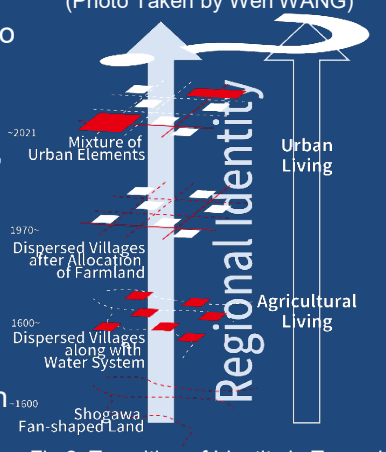

Fig.2: Transition of Identity in Tonami

Results

A) Territorial Analysis

The development proceeded in a sprawling manner from the 70's to the late 80's, and since then, it have become larger and larger in series.(Fig.3)

A regression analysis tells the housing complexes under study in Goromaru area are likely to continue to expand to embrace new residents. (Fig.4)

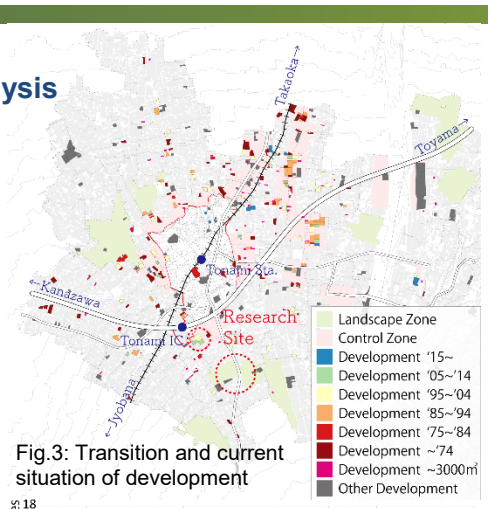

Fig.3: Transition and current situation of development

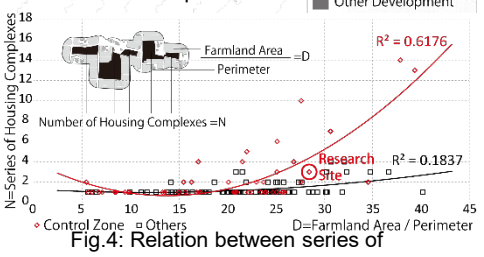

Fig.4: Relation between series of development and farmland area

B) Activities in the Familiar Places

Activities in familiar places in Goromaru area which are extracted from the questionnaire are categorized into three activity stages.(Table.1)

In each familiar place, there are activities that may be attributed to proximity to each community, presence of children, cleaning duty, and other demographic factors. In particular, the shrine showed a wide range of activities by the traditional community residents, and for the ones of the residential complex, it was mainly enjoyed as a personal place.

Table.1: Three Types of Activities In the Familiar Places

Passive Objectives	Daily lives	28	Car	2
			Finance	18
			Daily Life	8
	Work /Study	41	Agriculture	21
			Work	1
			Going School	11
			Study	8
	Cleaning	27	Cleaning	27
Intermediate Objectives	Praying	40	Worship	36
			Temple	4
	Memory	24	Memory	24
	Children	32	Observing Children	10
			Transportation	11
			Play with children	11
	Communication	173	Meetings	94
			Festivals	74
			friends/family	5
Active Objectives	Shopping	24	Shopping	11
			Eating out	13
	Culture	97	Walking	30
			Sports	24
			Bath	21
			Play	12
			Others	10

Traditional Community (Landscape is well maintained)

Housing Complex No.1 (which has independent community)

Housing Complex No.2 (which belongs to traditional community)

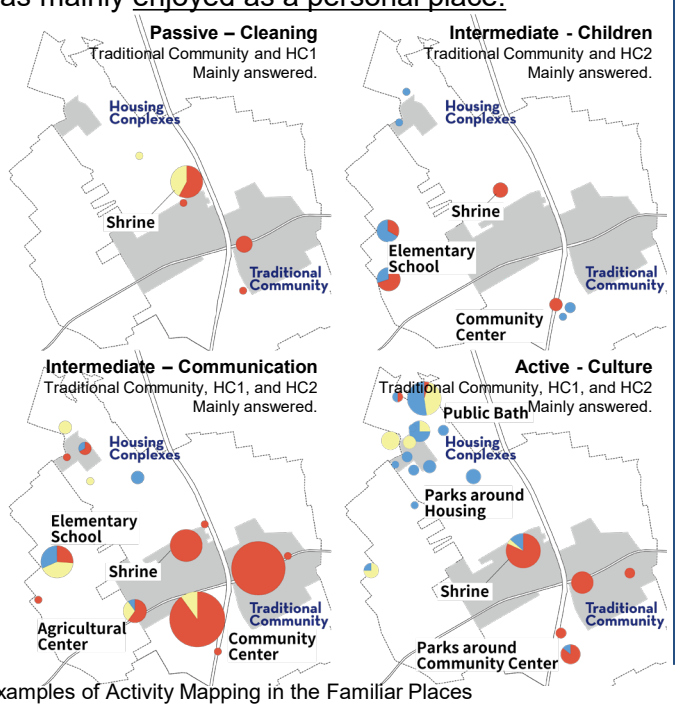

Fig.6: Examples of Activity Mapping in the Familiar Places

C) Evaluation on the Regional Elements

Fig.7 shows that the awareness of "inheritance" toward "shrine" in all communities is higher than other landscape elements. Furthermore, there is a significant difference between the "inheritance" toward "shrines" and "housing complexes" in the shrines and the two housing complexes.

Table.2 shows that the "inheritance" evaluation of the shrine was clustered in the same group(Ward's Method) as "pride," "security," and "comfort" in the traditional community. In housing complex 1, it was the same group as "pride" and "liveliness," and in housing complex 2, it was the same group as "pride".

Fig.9 shows in the all communities, the "Inheritance" rating for shrines is in the highest group when compared to the other indexes.

Table.2: Indexes in the Same Cluster with "Inheritance"

Shrine	Traditional Community	Pride	Security	Comfort
	Housing Complex No.1	Pride	Liveliness	–
	Housing Complex No.2	Pride	–	–

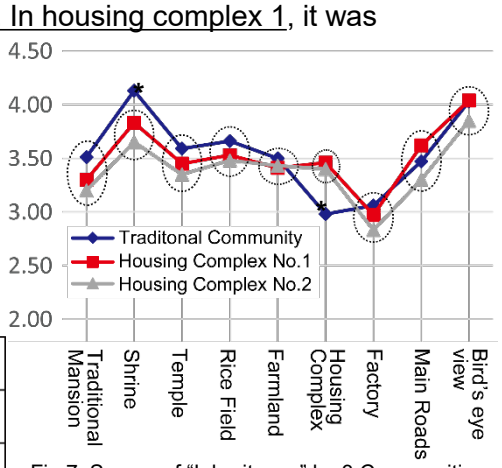

Fig.7: Scores of "Inheritance" by 3 Communities

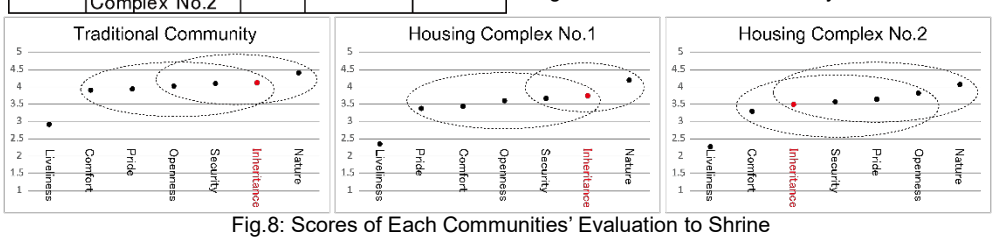

Fig.8: Scores of Each Communities' Evaluation to Shrine

Discussion

From the above, taking one place, "shrine," as an example, we found different communities are involved in different stages of activities, and have the high sense of inheritance to the shrine which is on the different structure of recognition, because of differences in attributes. This relationship among three elements: "place", "activity", and "recognition" (Fig. 9), according to Relf (1975), shapes place identity.

Thus, in the future, we would like to deepen the consideration of place identity with respect to several important places in the region we have already noticed, and clarify a part of the current regional identity of Tonami as a mixture of them.

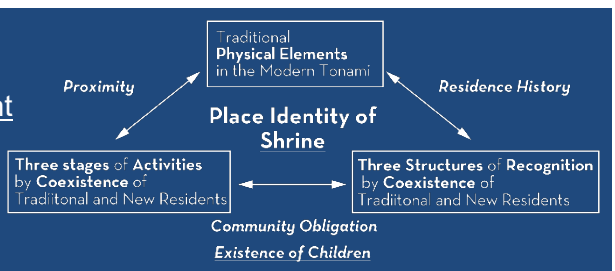

Fig.9: Concept of Place Identity of Goromaru Shrine

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Spatial and Project Planning Characteristic of Post-disaster Settlement: A case Study of Reconstruction After Typhoon Morakot

Authors: SungLun Tsai*, Chiho Ochiai*, ChuanZhong Deng** and MingHui Tseng **

* Graduate School of Global Environmental Studies, Kyoto University
** National Science and Technology Center for Disaster Reduction

I. Background

Natural disaster have increased tremendously in Asia. In Taiwan, more than 80% of the natural disaster are Typhoons. The most destructive Typhoon—the 2009 Typhoo Morakot. The disaster claimed 643 lives and destroyed 1,626 houses. Eventually, under the help of government and major NGOs 160 areas were subjected to relocated and formed 35 post-disaster settlement nationwide. The geographical distribution and the name of the post-disaster settlement is indicated in Figure 1.

II. Objectives and Methodology

Since the spatial aspects and planning aspects in the post-disaster reconstruction (PDR) is considered crucial. This research aimed to clarified the planning aspects and spatial (configuration) aspects of the PDR project after Typhoon Morakot. The methodology including 1. secondary documentation survey 2. drone survey.

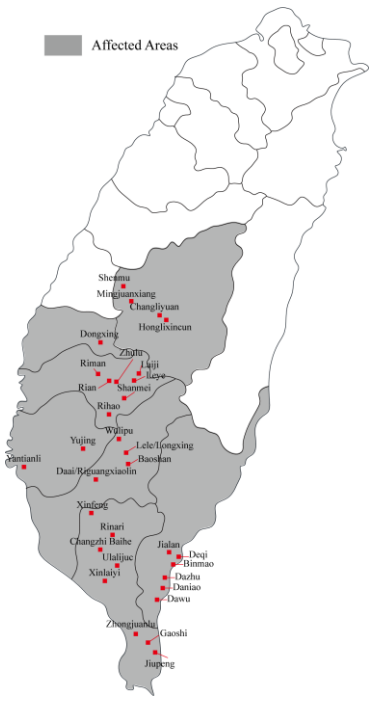


Figure 1. Settlements distribution

III. Results and Conclusion

1. Planning analysis

The relationship of days spent in settlement construction and settlement size (number of the accommodated households) were plotted align with the distribution area and the constructed NGOs (NGOs mainly constructed the settlement after the disaster; Figure 2)

It was clear that the large-scale settlement can spend less days to completed. E.g., Kaohsiung and Pingtung. The NGOs also had distinct characteristic. E.g., Tzu Chi preferred speedy construction while World Vision tended to work with the communities and valuated participatory design.

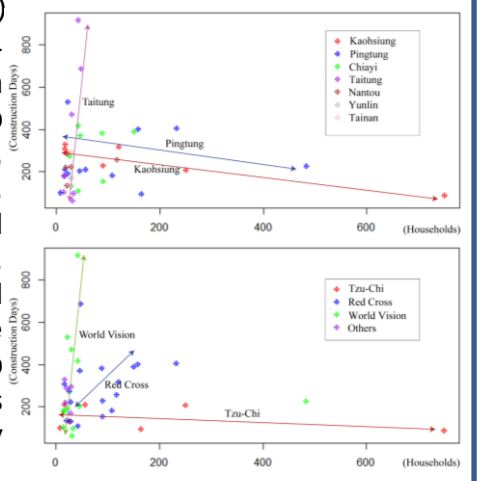


Figure 2. Relationship of days spent constructing and size of settlement

2. Configuration analysis

This research reviewed related literatures and categorized 35 settlements into six types of configuration (Figure 3). The actual configuration was shown in Figure 4. The use of different configurations depended on the local government and NGOs' ideologies, land shape, land sizes and the participation of communities.

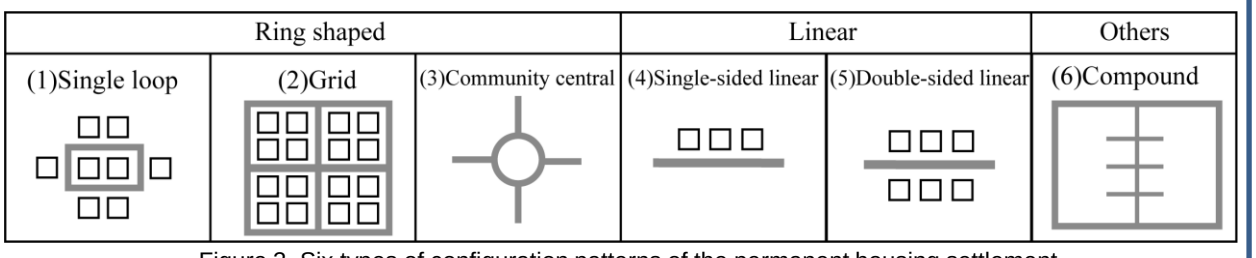
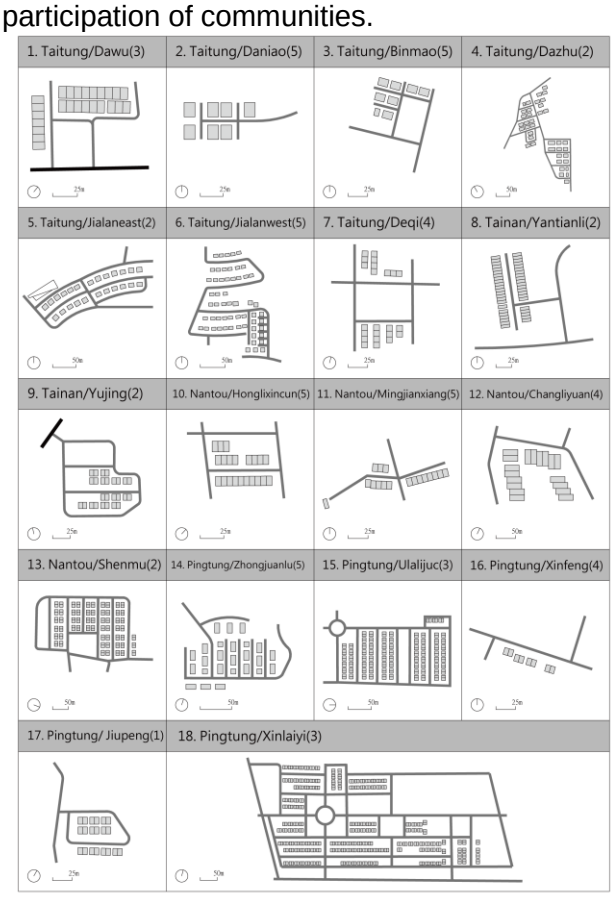
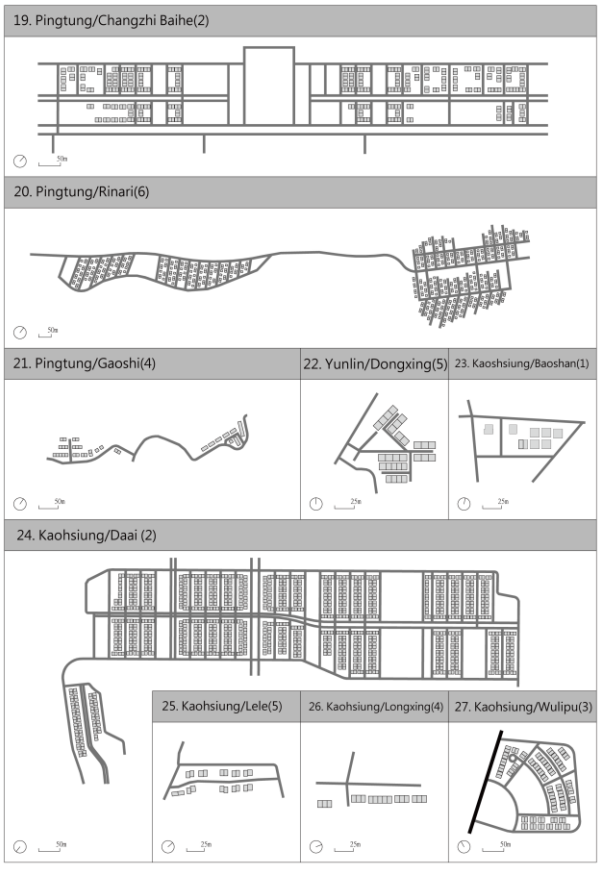


Figure 3. Six types of configuration patterns of the permanent housing settlement





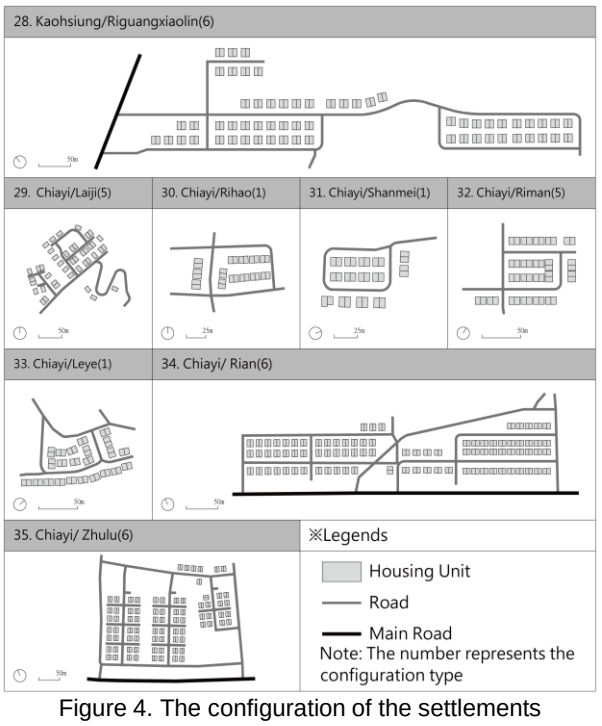


Figure 4. The configuration of the settlements

3. Conclusion

The research indicated that the characteristic of stakeholders can influence the decision-making of the planning and design of the post-disaster settlements. The issues need further explored.

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The Impact of Heritage Tourism on Local Communities from the Perspective of Residents' Perceptions: A Case Study of Pingyao

Authors: Zhang Yuqi*

- Graduate School of Global Environmental Studies, Kyoto University

INTRODUCTION

BACKGROUND

■ Heritage Sites → Popular tourist destinations

• Positive impacts: generating economic and social benefits;

• Negative impacts on local communities: such as disrupting local residents' daily lives and local residents have been marginalized

■ As a primary stakeholder, the local residents' perception cannot be ignored

OBJECTIVE

■ **Ancient City of Ping Yao, China**

• Registered as a World Heritage Site in 1997;

• A popular tourist destination

A typical residential community: Confucian Temple Block

• The area is about 20 hectares;

• A large number of local residents live here.

Fig.1 The Location of Ancient City of Ping Yao in China

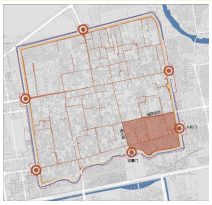

Fig.2 The Location of Confucian Temple Block

PURPOSE

• To investigate the impact of heritage tourism on the place attachment and subjective well-being of residents in heritage communities, and whether it makes an impact on residents' willingness to move and community participation.

• To propose suggestions for sustainable development of heritage communities.

METHODOLOGY

■ Field Research

Current status of the spatial environment in the heritage communities (architecture, street space, transportation, facilities, etc.)

■ Questionnaire Research

A total of 200 valid questionnaires were collected from residents living in the community.

Tab.1 The content of the questionnaire

1. Social attributes of residents	Gender, age, occupation, income, length of residence in the community, etc.	
2. Residents' perception of tourism impact	Economic Impact	
	Social Impact	
	Cultural Impact	
	Environmental impact	
	Impact on Community Participation	
3. Residents' place attachment	Place dependence	
	Place Identity	
4. Residents' subjective well-being	Life satisfaction	Economy
		Housing conditions
		Environment
		Public facilities and services
		Social interaction
	Emotion	
5. Effects of subjective well-being	Residents' willingness to migrate	
	Residents' willingness to community participation	

RESULTS

■ Analysis of the community's physical environment

• Damage of historic buildings, the dilapidation of gardens

• Decline in the quality of streets

• Too many facilities for tourists and not enough for local residents.

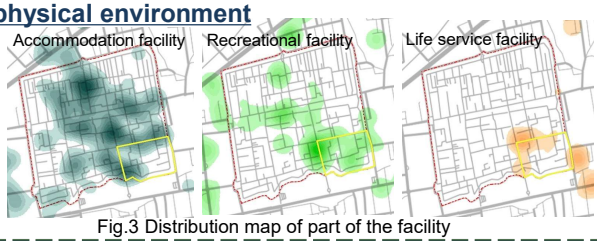

Fig.3 Distribution map of part of the facility

■ Analysis of the impact path of residents' subjective well-being

• Using the method of constructing structural equation model;

• Residents' perceptions of the tourism impact had a negative impact on their subjective well-being, while it had a positive impact on their place attachment.

• As a crucial intermediary, residents' place attachment had a significant positive impact on residents' subjective well-being.

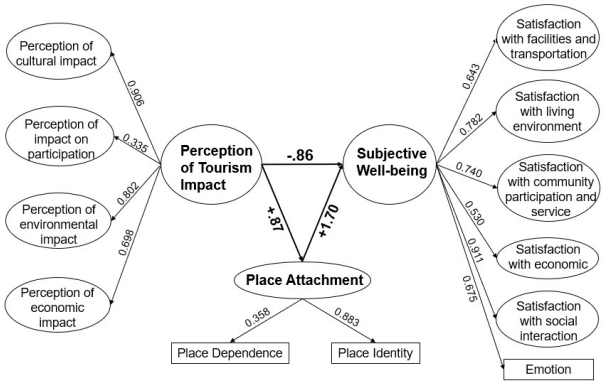

Fig.4 Structural equation model of the impact path

■ Analysis of the influence effect of residents' subjective well-being

• Through the correlation analysis, it is shown that residents with high subjective well-being have a low willingness to migrate.

• Through the logistic regression, it is shown that the improvement of residents' subjective well-being helps promote their participation in community management.

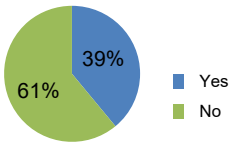

Fig.5 Residents' willingness to migrate

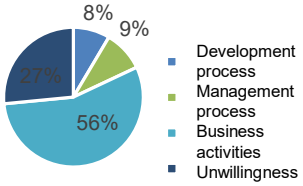

Fig.6 Residents' willingness to participate in the community

CONCLUSION AND DISCUSSION

• Over-commercialization has a negative impact on residents' subjective well-being.

• Suggestions for sustainable development of heritage communities:

1) It is necessary to control the rapid development of tourism and to balance the benefits of tourism and heritage protection; 2) the government should work with community planners and local organizations to undertake community regeneration programmers in terms of facilities and street space to enhance residents' subjective well-being.

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The potential for *Solesolevaki* (community cooperation) in building disaster resilient communities in Fiji

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INTRODUCTION: Background and Methodology

BACKGROUND:

Strengthening communities' resilience is very important in Fiji, as tropical cyclones are expected to intensify. Community resilience in this context is the ability for communities to recover on their own utilizing their resources. *Solesolevaki* means working together for a common good without expecting any individual payment. These acts of cooperation were rooted deeply into Fijian traditional values of *Vakaturaga* qualities (respect, attentive and compliance). From our previous research, we found that villagers cooperate to recover from disasters in Fiji, utilizing their traditional social networks. *Solesolevaki* was a strong element of survival for Fijian tribes and villages where division of labor was a strong factor into how the villages thrived.

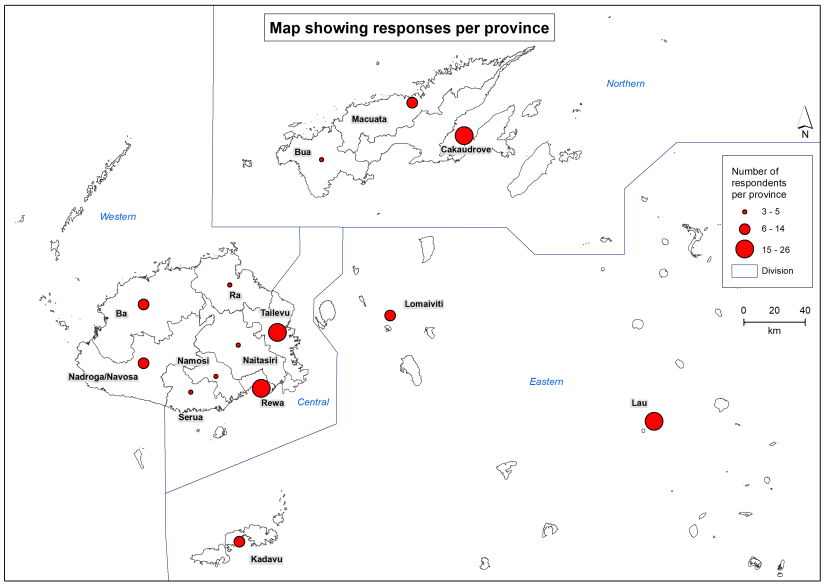

Figure 1: Map of Fiji showing online survey respondants

OBJECTIVE:

The aim of this research is to show how *solesolevaki* is practiced amongst indigenous people in Fiji, during "normal" times and analyze its potential in building community resilience to disasters.

METHODOLOGY:

This study is based on an online survey conducting in July-August 2021 to gauge *Solesolevaki* activities that are conducted in villages in Fiji. To see how these activities are maintained and at what level of the communities.

RESULTS AND DISCUSSIONS: Solesolevaki activities and their potential for building community resilience

Village maintanance & Others

- Village cleaning
- Annual cleaning of burial ground
- Cleaning of water source
- School management
- Village shop or canteen management
- Cooking in school
- Ecotourism management
- Annual traditional fishing (Yavirau)
- Traditional boat building/seafaring
- Footpath making
- Fundraising for school activities
- Church obligations
- Church annual event
- Masi (tapa) making
- Visiting those in prisons
- Visiting those in hospital
- Hosting provincial meetings
- Hosting rugby games
- Handicraft making
- Visiting widow and widowers

Life- time events

- Baby gift/visiting
- Childs christening
- Childs first visit to the mothers village
- Boys circumsition
- Girls first menstruation
- 21st birthdays
- Asking girls hand for marrige
- Wedding ceremony
- Burial of the hatchet (for eloping)
- Preparation of wedding house
- Funeral processes (reguregu, suka ni cegu, tuva ni ulu)
- Sending someone overseas
- Welcoming back from first trip abroad
- Gift for someone's new car/boat

Agricultural activities

- Planting yam
- Harvest yam
- Plant yaqona
- Harvest yaqona
- Hunting wild boar
- Livestock farming
- Fencing farms
- First harvest (sevu)
- Construction of village piggery farm
- Cutting sugarcane
- Fishing- village freezer
- Coka taki doko (feast that is done after the first yam harvest)

Housing activities

- Bure building
- House construction
- Church building
- Village hall building
- Share timber to reinforce houses- before cyclone

Figure 2: Solesolevaki activities and catergories

- 51 acitvities collected from the survey are catergorised into 4 main groups (Figure 2). *Solesolevaki* is practiced in all levels in the villages in Fiji (Village, Clan, Sub-clan and family). Lifetime events, agricultural actitities and housing activities (Figure 3), all start at the household level and depending on the need can be addressed at higher community levels. Village maintanace is usually managed by the leaders with collaboration form the villagers.
- The maintenance of these activities, strengthens family ties and encourages bonding within the villages. However, some practices are lost in certain villages (eg, traditional house building and yam planting) due to the lack of knowledge and practices. *Solesolevaki* can also take away time from individuals to focus on their family. Despite the loss of time and certain knowledges, the practice will strengthen community cohesion, economic capital, physical capital, cultural capital and social capital thus, increasing communities' resilience to any disaster. *Solesolevaki* will also encourage effective and good governance in the village through the management of these activities.

Figure 3: *Solesolevaki* in traditinal house building

CONCLUSION

The national DRR policy in Fiji focuses on increasing community resilience to achieve strategies put in place aligned with the Sendai framework and the Pacific's Framework for Resilience Development (FRDP). Traditional values and practices are still maintained in the villages, because of the strong governance system in place and the Fijian value of respect and compliance (*Vakaturagataki).* This also includes those that live outside of the villages. Communities' capacities to adapt to changes and be resilience can be achieved by utilizing with the capacities they already have.

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Water management in a high-altitude desert region: Traditional systems and local innovations in Ladakh, India

Authors: Kumar Tusharkanti*, Izuru Saizen*
* Graduate School of Global Environmental Studies, Kyoto University

Background

- Ladakh lies in the **rain shadow region** in the Himalayas, precipitation is less- water is a scarce resource
- Availability of water depends mainly on the snowfall in the upper mountains during winter months
- The region mainly depends on **glacial melt water**
- Availability of water in these glacial streams **varies through the seasons**

Fig 1: Location map of Ladakh in India

1. What are **traditional water management practices** in the region?
2. What are the **pressures** being faced by the system?
3. What are the **locally developed solutions** to counter these pressures?

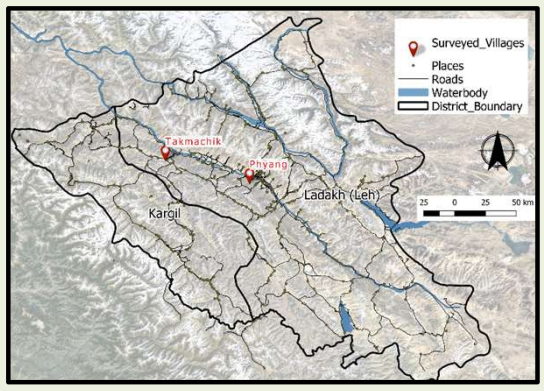

Fig 2: Location of surveyed villages in Ladakh

Methodology

Survey Period:
October – November '21
Villages surveyed:
1. Phyang 2. Takmachik

- Semi-structured questionnaires were used for surveys
- Field observations – under supervision of village head

Literature Review
- Socio-cultural practices
- Water resources management

Questionnaire Surveys
- Household surveys (38 No.)
- Expert Opinion Surveys (12 No.)

Discussion, Observations
- Group discussion with village assembly members
- Photographic documentation

Results & Discussion

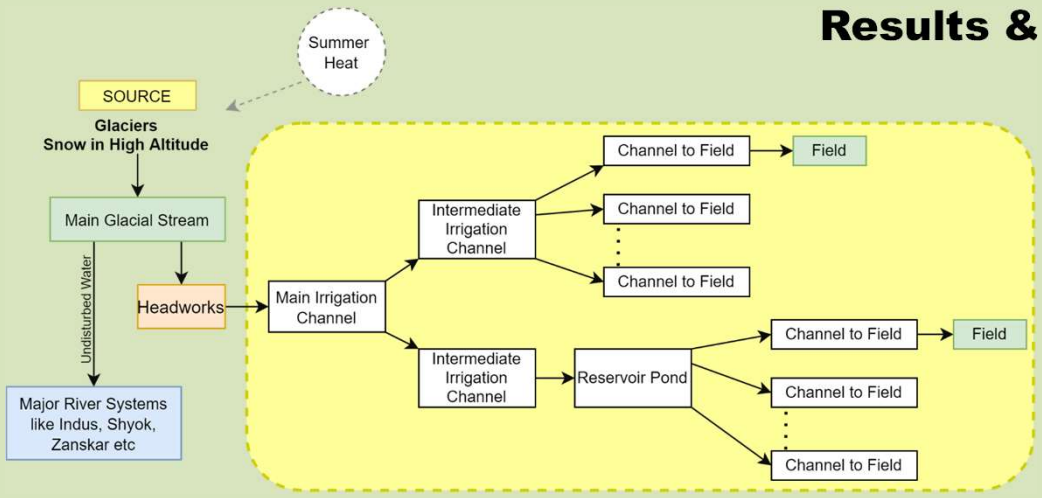

Fig 3: Traditional Water Management System

Conceptual representation of irrigation networks as observed in both villages

Perceived main pressures by locals detected through the household surveys:
- Reduction and uncertainty in winter snowfall
- Irregularity in precipitation patterns since the past few years
- Scarcity at the beginning of the farming season
- Not enough flow in the main glacial stream

"During my childhood we used to witness waist-high snow in the village. Now it is like a thin cover of snow which melts within a day"
– *Takmachik village elder (78 yrs old)*

"*rgun-zyik ma-kar-na yar-zyik mi sngo*"
-If winter is not white, summer won't be green
– Ladakhi proverb

Artificial Glacier Techniques

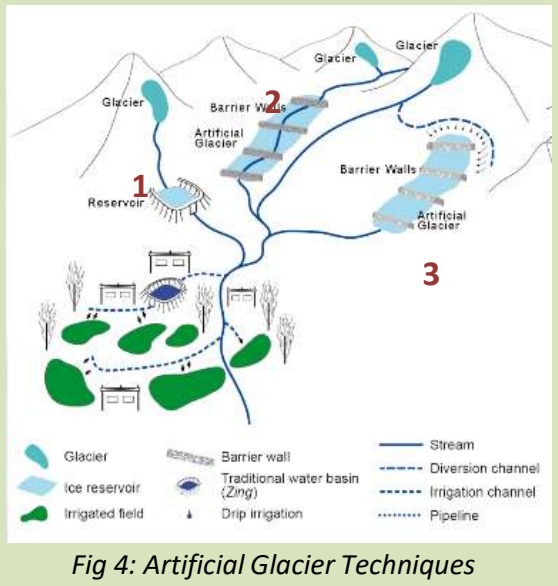

Fig 4: Artificial Glacier Techniques
(Developed by Er. Chewang Norphel)

1 Storing in a reservoir
2 When the glacial stream is wide
3 When the glacial stream is narrow

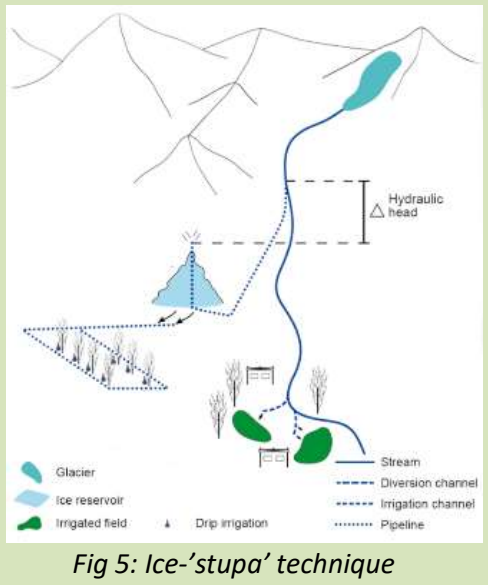

Fig 5: Ice-'stupa' technique

Strengths of Artificial Glacier Techniques

- Feeds to the existing traditional water system
- Involvement of community in building & management

Fig 6: Ice-'stupa' in Phyang village

Inferences

- Provides timely and adequate irrigation water during the beginning of the agricultural season → Increase in the sown area and additional tree plantations can be achieved
- Recharges underground aquifers and increases ground water table
- Increased water availability → reduces disputes among locals
- The socio-hydrological system is based on values of partnership and cooperation
- Increasing water scarcity in the region makes it essential to look for sustainable solutions for the future
- Locally developed solutions in the form of artificial glaciers provide a sustainable water management model through community involvement

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Young villager migration intention: comparison between the peri-urban village and remote village of Indonesia

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** Department of Regional and Urban Planning, Universitas Brawijaya

INTRODUCTION

- Indonesia has the most extensive agricultural land and facing agricultural labor shortage.
- Young villagers prefer working at non-agriculture businesses and emigrating to urban areas.
- Studies found that place attachment and flow information affect rural emigration. However, rural areas have diverse characteristic each others.
- There is no evidence yet comparing place attachment and information flow in migration intention.
- This study aims to compare peri-urban village and remote village.

Method

Variables:

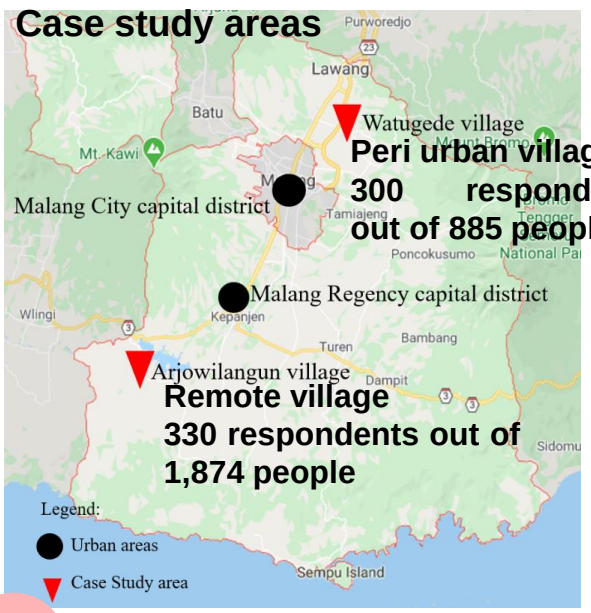
- Place attachment: degree of attachment (a single question approach)
- Information : number of source information to obtain information regarding destination from internet and non internet
- Migration intention: degree of intention and firm plan availability

Data collection:

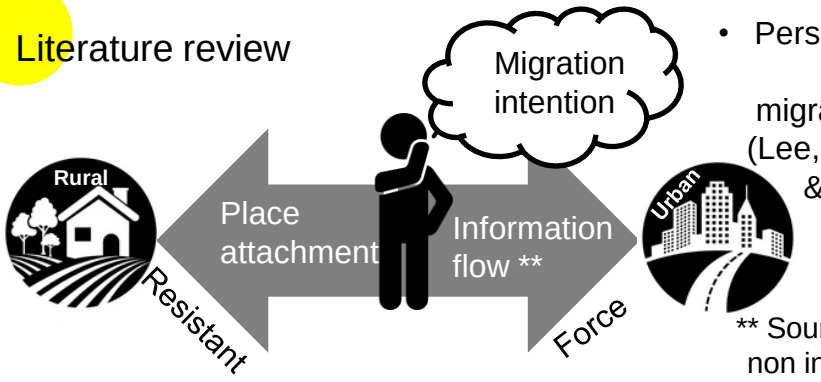
- Tools: questionnaire (100% return rate)
- Method: random sampling 15 to 24 years old villagers

Analysis

- Group comparison 2 village (Mann-Whitney U test)
- Structural equation modeling – partial least square (investigate interaction between degree of place attachment and total information sources of 5 type of information to migration intention)



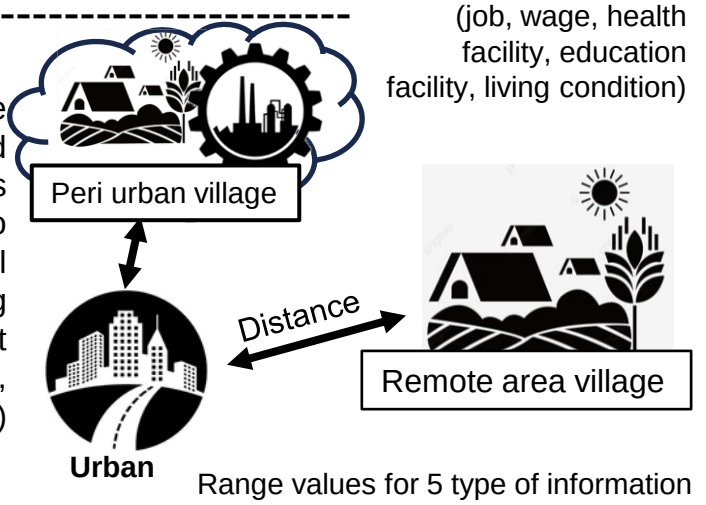
Literature review



- Personal aspect in developing migration intention (Lee, 1966; Barcus & Brunn, 2009, 2009)

** Source (internet and non internet) and type (job, wage, health facility, education facility, living condition)

- Diversity of village characteristic and activities
- Distance rural to urban affects rural condition including place attachment (Gieling et al., 2019)



yes/no question
Internet : 2 sources
Non internet : 6 sources

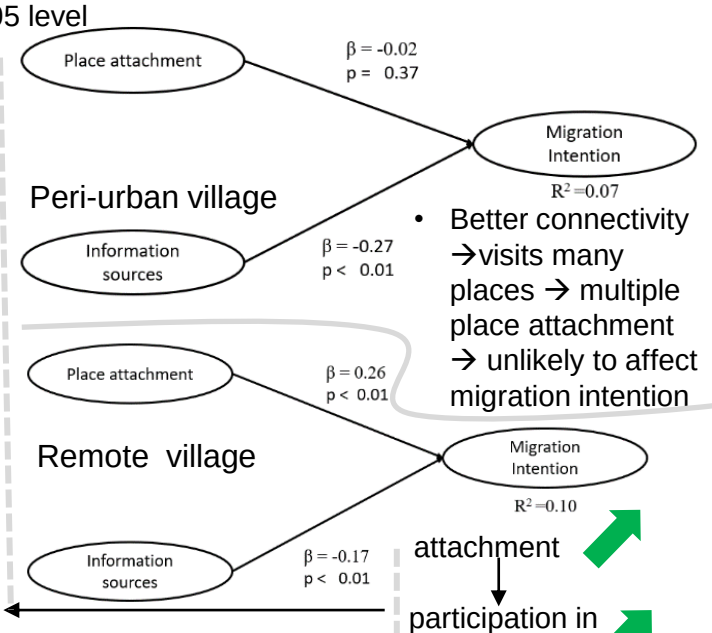
Range values for 5 type of information

Result and Discussion

	Peri-urban village		Remote village		U value
	Mean	s.d.	Mean	s.d.	
Place attachment	2.95	0.626	4.04	0.794	15,911.0*
Migration intention	3.03	0.669	3.61	1.233	34,572.0*
Type of information (Internet)	-	0.329 - 0.401	-	0.403 - 0.672	31.642* - 956.408*
Type of information (non internet)	-	0.589 - 0.687	-	0.451 - 0.913	131.121* - 773.482*

* Significant at 0.05 level

- Peri urban village emigration intention is affected by information sources.
- increasing attachment affects to increasing migration intention of young remote villager



- Better connectivity →visits many places → multiple place attachment → unlikely to affect migration intention

attachment → participation in environment conservation

Conclusion

The effect of place attachment and information sources on rural emigration are diverse and increase with distance rural to urban area

- A novel finding: emigrate → remittance → increase capability to develop the village

References

Barcus, H. R., & Brunn, S. D. (2009). https://doi.org/10.2307/4144681
Lee, E. S. (1966). A Theory of Migration. Demography, 3(1), 47–57
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A Study on the Relocation and Reconstruction of Kumano Hongu Taisha Shrine in the Meiji Period

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** Graduate School of Global Environmental Studies, Kyoto University

INTRODUCTION

1. BACKGROUND

Kumano Hongu Taisha, the head shrine of the Kumano Shrines, which number more than 3,000 nationwide, is located in Wakayama Prefecture. The present shrine was relocated and rebuilt in a short period of one year and seven months without the use of construction machinery after the great Totsukawa flood that occurred on August 19, 1889. At present, only this fact is mentioned, but the details of the relocation and reconstruction have not been clarified.

Fig.1 The main shrine of Kumano Hongu Taisha

Fig.2 Old and Present Shrine Site

2. OBJECTIVE & METHODOLOGY

Based on information obtained from deciphering the shrine's archives and interviewing shrine officials and local residents, we will examine the factors behind the early relocation and reconstruction from multiple perspectives by clarifying the legal system of the time, the scale of reconstruction, the actual use of old materials, and even the construction process and people involved.

RESULTS

1. Financial support system from the government

A) Provision of 22,200 yen* for relocation and reconstruction from the national budget leaded **the Immediate access to funds.**

B) The scale restrictions on the new buildings leaded the reduction of special repair expenses.

*** 1 yen then was equivalent to 10,000 yen today.**

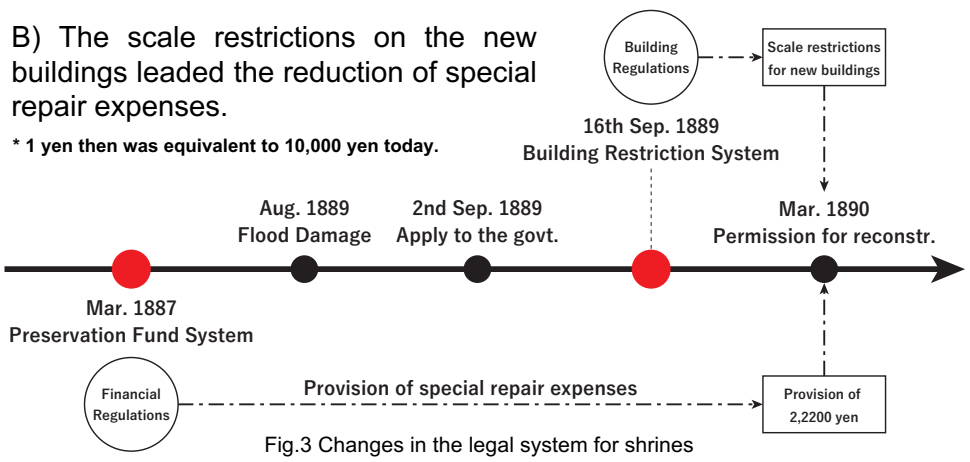

Fig.3 Changes in the legal system for shrines

2. Scale down and diversion of old materials

A) **the new buildings were reconstructed on a smaller scale than before the relocation**. (Fig.5 The Worship Hall : 135㎡ → 50㎡)

B) Due to the method of relocation and dismantling of the main shrine, **the percentage of old materials used is high**. Moreover, in other new buildings, old materials have been used for major components.

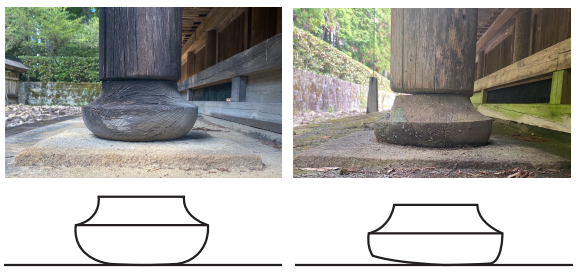

Fig.4 the shape of the main shrine foundation

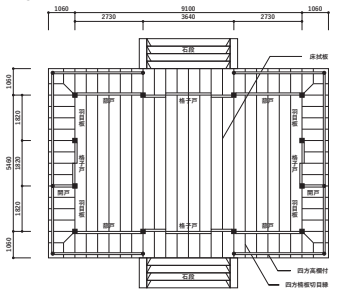

Fig.5 Floor Plan of the Worship Hall

3. Financial support system from the government

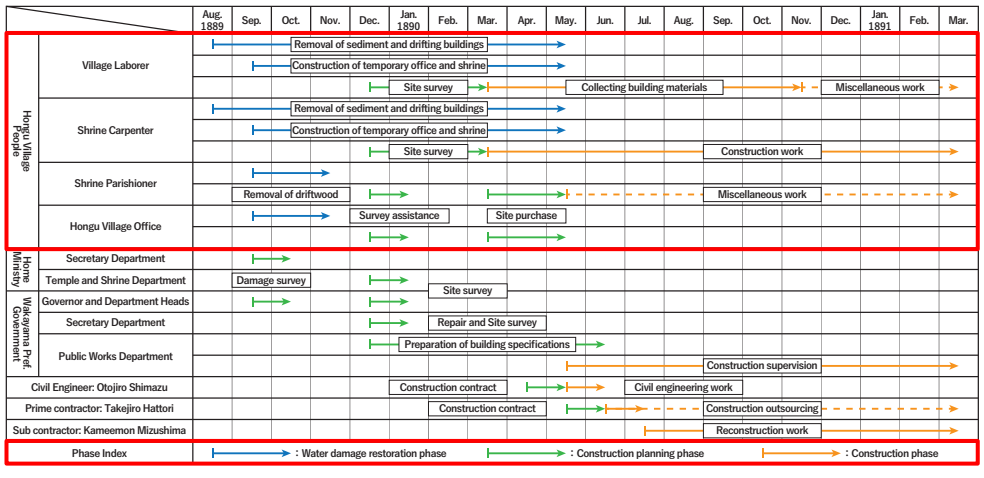

Table.1 Process for each construction party

A) The process of the relocation and reconstruction can be roughly divided into three phases: the flood damage restoration phase, the construction planning phase, and the construction phase. the Table.1 show the process for each of the parties involved. From this table, we can see that **Hongu village people cooperated in all phases of the relocation and reconstruction and got money from the shrine.**

B) In the flood damage restoration phase, they engaged in the work including the construction of a temporary shrine office and **the removal of sediment and driftwood**. In the construction planning stage, they contributed to the plan by **providing measurement services and accommodation during site surveys, as well as selling and donating site**. In the construction phase, they were involved in the relocation and reconstruction of the shrine building by collecting the shrine materials and helping the carpenters.

DISCUSSION

1) The financial support system from the state contributed greatly to shortening the fundraising period.

2) The reduction in the scale of reconstruction and the diversion of old materials will lead to savings in reconstruction materials and a reduction in procurement time.

3) During the relocation and reconstruction, **there was a mutually supportive relationship between the shrine and the Hongu village people**. We could guess that it was because of this relationship that the restoration and reconstruction activities of the shrine were able to be carried out simultaneously immediately after the flood disaster.

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Building Community-Based Resilient Housing in Thua Thien Hue, Vietnam

Authors: Le Ngoc Van Anh*, Truong Hong Truong*, Nguyen Ngoc Tung*, Nguyen Trong Vinh*, Dinh Ba Vinh**, Ma Thao Huong**

* Architecture Faculty, University of Sciences, Hue University
** Foundation for Supporting and Development of Sustainable Living Community (Sống Foundation)

BACKGROUND & OBJECTIVE

Disadvantaged people are the most vulnerable community when facing natural disasters, because they lack many resources for self-healing. The Resilient Housing Program (RHP) was created to support community development by providing technical and financial supports for disadvantaged households to build safe houses, thereby mitigating the adverse impacts of natural disasters such as storm, flood, climate change…on their daily lives. RHP has been implemented since 2013 under the auspices of Foundation for Supporting and Development of Sustainable Living Community (Sống Foundation) in many provinces in Vietnam.

In 2021, this Foundation implements RHP for the first time in Thua Thien Hue province. In that spirit, RHP supports disadvantaged households in 2 communes of Quang An and Quang Tho to build safe houses with architectural and technical support from the Faculty of Architecture, Hue University of Sciences. Therefore, within this poster, we will focus on introducing the houses built in these 2 communes.

Fig.1. Building safe house for beneficiaries

APPROACH

The project's approach is based on building and maintaining a strong relationship between beneficiaries, local authorities, RHP and other supporters such as construction providers, volunteer networks.

Fig.2. Participatory approach of Resilient Housing program

IMPLEMENTATION PROCESS

RHP examines and supports the most in-need households with 7 selection criteria as following:

- •Families living in areas affected by natural disasters or impacts from climate change;
- •Families who have both need and motivation to build safe housing;
- •Families who are poor, near-poor, or families with other difficulties;
- •Families having multiple children;
- •Families having legal ownership of their land with no disputes and not in areas planned for government required relocation;
- •Families committed to deep involvement in the design process and comply with project requirements;
- •Families capable of contributing financially to the house construction (at least 50% of the construction cost, roughly VND 45 - 50 million).

Fig.3. Meeting with beneficiaries

Based on 07 criteria to select households to support building safe houses. We hold meetings, conduct field surveys, understand about the circumstances and impacts of storms and floods on their lives. Then we co-design and discuss the construction plan with the landlord. After that, the construction process was carried out under the close supervision of RHP, Faculty of Architecture and local authorities.

Fig.4. field surveys and construction process supervision

Faculty of Architecture has come up with plans to ensure both saving and safety based on reciprocal ability of families. Accordingly, all permanent houses have attic floors to avoid floods, with construction costs under 220 million Vietnam dong.

Fig.5. Archirectural drawing of safe house in Quang An

RESULTS

Thua Thien Hue is the new operating area in 2021 of RHP in the Central region. Despite many difficulties like Covid-19, we support the survey, co-design, construction and completion of 7 safe houses in Quang An and Quang Tho . These finished houses are gifts right before the stormy season for households.

Fig.6. 07 completed houses in Q.A &Q.T

ARCHITECTURE FACULTY & SỐNG FOUDATION

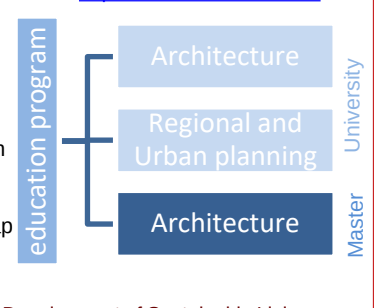
Architecture Faculty – University of Sciences – Hue University (Established since 1995)
Address:77 Nguyen Hue st.,Hue city, Vietnam - Phone: +84 234.3833530
Email: khoakientruc_dhkh@emaildodo.com I Website: http://huearch.husc.edu.vn/
Facebook: www.facebook.com/khoakientruc

Organizational structure

Dean of Faculty: Dr.Arch.Nguyen Ngoc Tung
The affiliated department:

- ❖ Department of Interior Architecture and Construction Technology
- ❖ Department of Civil and Industrial Architecture
- ❖ Department of Planning, Conservation and Landscap

Lecturers: 24 (7 doctors, 2 PhD students, 11 masters, 2 engineers & 01 bachelor).



Foundation for Supporting and Development of Sustainable Living Community (Sống Foundation)
Address: Floor 6th,No. 67 Ly Chinh Thang st.,Vo Thi Sau Ward,District 3, Ho Chi Minh
Email: info@song.org.vn I Website: https://song.org.vn/
Facebook: https://www.facebook.com/songfoundation

Organizational Structure

(1) The Resilient Housing program - supporting disadvantaged families and communities in planning and building safe, climate-resilient houses
(2) The Green Happiness program - afforestation and human connection with nature.
(3) The RiverOi program - raising awareness and enhancing human capacity.

Acknowledgement: the research is support by Sống Foundation

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Energy-Saving Technologies and Environmental Impacts of Residential Buildings in Thailand: A Review

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1. BACKGROUND

The residential buildings in Thailand have consumed large amount of energy; whilst also caused various environmental impacts. This issue emerges from growing demands of 'housing' and 'electricity'. The former, in lifecycle view, promotes material manufacturing, transportation, construction activities, and wastes; thus, causing embodied impacts. Likewise, the latter promotes the use of fossil fuel in electricity generation; thus, causing operational impacts. This issue also implies that the technologies and strategies used in the residential buildings are inadequate, and in need of further improvement to ensure that the nation can achieve the UNFCCC's 2030 and 2050 goals [1,2]

2. OBJECTIVES

1. To identify how technologies and strategies used in residential buildings can be improved based on suggestions from Thailand's Rating of Energy and Environmental Sustainability (TREES)
2. To identify major factors that can improve the efficiency of technologies and strategies

3. METHODOLOGY

i. TREES [3] is reviewed to acquire the suggested technologies and strategies.
ii. The technologies and strategies used to reduce operational energy and impacts from Thailand's residential buildings are reviewed from Thailand 20-Year Energy Efficiency Development Plan (EEDP) and Alternative Energy Development Plan (AEDP). [1,4] Also, Thailand's design code [5] is reviewed, because the code is directly linked to the embodied impacts.
iii. Peer-reviewed studies on life cycle assessment of buildings [6-22] are reviewed to evaluate the environmental impact of a building with-and-without technology and strategies by TREES.
iv. The current used technologies and strategies in residential building; as well as, the factors that can affect performances of technologies and strategies will be unveiled. This will then allow the improvement to be highlighted.

4. RESULTS AND DISCUSSION

Table 1 depicts the suggested technologies and strategies from TREES.

Building Phases	Technologies and Strategies to reduce environmental impact from each phase suggested by TREES
Material Manufacturing (MM)	1 use recyclable materials 10%; 2 use low-carbon materials 10%; 3 use green labeled materials 10%; 4 use materials that disclose the environmental impacts 10%
Transportation (T)	1 use locally acquired materials; 2 use bio-diesel
Construction (C)	1 reduce and prevent the water, air, and terrestrial pollutions
Building Operation (BO)	Active measure: 1 use LED; 2 air-condition with EER >13; 3 solar water heater heat-pump; 4 Use solar cells; 5 no use of CFC Passive measure: 1 use low U-value building envelop (wall, roof, window); 2 plant trees to reduce heat gain; 3 use sun shade; 4 design a building to gain maximum wind; 5 design a building to avoid sun
End-of-Life (EOL)	1 Manage Construction Wastes to recycling process

Table 2 unveils the currently used strategies and technologies in residential building stated in EEDP, AEDP, design code, and previous studies.

Phase	EEDP	AEDP	Design Code	Previous studies
MM	-	-	1 2	1 2 3
T	-	-	-	2
C	-	-	1	1
BO	1 2 3	1 2 3	-	1 2 3 4 1 3
EOL	-	-	-	1

Peer-reviewed studies show that success in reducing operational emissions leads the embodied emissions to become dominant. However, the EEDP and AEDP neglect the embodied emissions; while, TREES and the design code only allow small portion of environmentally-friendly materials to be used in a design. Thus, the first improvement is to reduce the embodied emissions by employing lighter structure (such as hollow-core structure) in a residential design.

The review unveils that EEDP and AEDP relies on the use of active retrofit, and often regards residential behavior as a fixed factor. Therefore, the second improvement is to lessen the operational emissions by tailoring a wide range of retrofits based on each residential behavior.

There is no study confirming that Thailand's residential sector can achieve the UNFCCC's targets. Thus, the third improvement is to develop a framework ,that can quantify emissions from the sector, to ensure that the sector will achieve the 2030 and 2050 UNFCCC's targets ultimately.

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THE SIMILARITIES AND DIFFERENCES OF ARCHITECTURAL FACTORS BETWEEN QUOC HOC AND HAI BA TRUNG HIGH SCHOOL

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1. Scientific background and objectives

Background: Quoc Hoc and Hai Ba Trung high Schools are two critical schools in Hue city. Located in an essential position on Le Loi street and the city's western quarter, they have witnessed many historical periods. The province recognised these two constructions as typical structures. Furthermore, Quoc Hoc High School has been a remarkable national relic. From a personal perspective, the two constructions are related; however, there has been no in-depth research on how different and similar.

Objectives: Quoc Hoc High School for the Gifted and Hai Ba Trung High School. (from 1981 to the present).

Quoc Hoc High School

Places on Google Map

Hai Ba Trung High school

2. Methodology

Secondary documents:. Collecting documents and previous research such as articles magazines, current pictures, records, drawings of two schools in the city

Primary documents: Conduct field survey, measure the current status of the building blocks of the two schools. These figures are digitized through technology applications such as AutoCAD, Sketchup and Revit.

3. Results and discussion

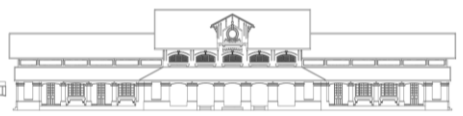
Compare two schools according to their history

School/Criteria	Quoc Hoc high school	Hai Ba Trung high school
Date of establishment	October 23, 1896 According to the decree of Emperor Thanh Thai and the Decree of the Governor-General of Indochina - A. Rousseau on November 18, 1896	July 15, 1917 In the presence of King Khai Dinh and Governor-General of Indochina Albert Sarraut, ambassador to Trung Ky J.E Charles, acting nuncio to Tonkin J. Le Galler
Pre-existing construction	Toanh doanh Thủy sư (used to be a naval training site at that time)	Used to be an empty lot without any previous construction.
Construction process	1896 – Constructed, consisting of 2 symmetrical rows, the left is the classroom, the right is the principal's house, the teacher's room and the dormitory 1897 – Built more Rector's houses (three compartments and two wings) 1899 – Built two more serial houses, first for primary school, then for supplementary class 1902: Burned down entirely and rebuilt according to the old model 1911: Burned again; rebuilt with bricks May 1915: Foreman Leroy rebuilt buildings in the French style 1917: Completed construction of bricks and tiles	1917 – Constructed 1919- Constructed completely
Rename process	Pháp tự Quốc học đường (The National School of France) (1896-1915) Collège Quốc Học (Quoc Hoc college) (1915) Trường Trung học Khải Định (Lycée Khải Định) (Khai Dinh High School (Lycée Khai Dinh)) (1936-1955) Trường Trung học Ngô Đình Diệm (Ngo Dinh Diem High School) (1956-1957) Trường Trung học Quốc Học (Quoc Hoc High School) (1957-1975) Trường Trung học Phổ thông Chuyên Quốc Học (Quoc Hoc High School for the Gifted) (từ 2009 to the present)	Trường cao đẳng Tiểu học Đồng Khánh (Dong Khanh Primary College) (1917-1954) Trường Nữ trung học Đồng Khánh (Dong Khanh Girls' High School) (1955- 1975) Trường cấp III Trưng Trắc (Trung Trac High School) (1975-1975) Trường Trung học phổ thông Hai Bà Trưng (Hai Ba Trung High School) (1978 to the present)
Original Curriculum	Only for boys – the children of mandarins and royalty.	For a few women who are children of mandarins and royal lineage. It is the only school that teaches all subjects of Literature - Physical – Aesthetic - Virtuous and technical labour.

Compare the central block of the two schools

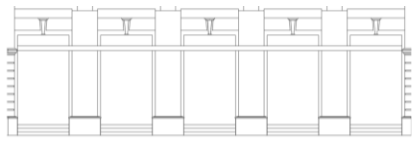
School/Criteria	Quoc Hoc high school	Hai Ba Trung high school
Dimensions	32 x 18 m	63 x 18 m
Structure	Wall structure, bearing columns, thick walls, and windows are small. The two-story structure, the first and second floors, are both halls	Wall structure, bearing columns, thick walls, and windows are small. The one-story structure; above is the windows to take in the sun and wind.
Utilities	Only used for the purpose of the hall and community activities.	In addition to being used as a hall and community activities, this block also has additional blocks of auxiliary classrooms.
Decorative details	Bump, blow a lot. Classic style decoration.	There are few moulding details. There are many details in the Vietnamese style.
The roof	The roof does not come out; there is a consol system to support rain. There is a roof system located in the block space; the roof system falls forward. No roof windows.	The roof comes out a lot. There are many roof systems above, below, front and back. There are roof windows.
Symmetry	Axis symmetry. Symmetrical both front and side. The front and back are the same.	Axis symmetry. Symmetrical front only, side is asymmetrical. The front and back are different.
Architectural style	The French style and classical style form.	There is French influence, but there is a mix and influence of Vietnamese architecture more.

Symmetry - neoclassical



Symmetry - French local architectural style

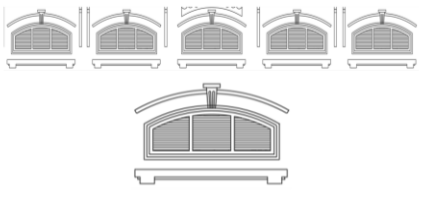
Roof windows



5 entrances, rectangular doors

5 entrances, gourd arches

Window details



Window details

4. Conclusion and recommendation

The Quoc Hoc high school and the Hai Ba Trung high school are two typical educational works for French culture during the colonial period. The two buildings have similarities and differences in the history of formation and the construction process. In terms of architectural style, there are many similarities and differences in form and architectural details.

The government needs to find a solution, make a relic profile for Hai Ba Trung school. There needs to be more research on the unique architectural features of the two schools, thereby creating a basis for preserving and developing the architectural value of the two schools.

5. Acknowledgments

The research results are extracted from the Master thesis of architect Ton That Hieu Khoa in October 2021.

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A Study on the Features of Nishimura Kahei's Stone Lantern Rengeji and Okunoin

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Background

Stone lanterns were introduced to Japan with Buddhism and became an important component of private gardens with the prosperity of tea ceremonies. The three generations of Nishimura Kahei based in Minamikomatsu Village of Shiga Prefecture were well known stonemasons from Meiji to early Showa period. Different from other gray and rough granite in the Hira Mountains, the texture and color of the stone quarried from Kahei's moutain was light brownish, with fine texture and higher hardness, which have made Kahei's work highly valued by stone traders and landscape architects in Shiga and Kyoto prefectures. However, there were neither qualitative studies nor quantitative studies to examine the value yet.

Objectives and Methodology

This study aims to clarify the characteristics of Kahei's stone lanterns and evaluate the masonry techniques of Kahei with quantitative data. In addition to reviewing the Kahei's sales record from 1912 to 1960, 8 times field surveys to Higashiomishi City, Nagahama City, Hikone City, Minamikomatsu village of Otsu City, and Kyoto City were conducted. 47 pieces of stone works in 34 locations were investigated, 20 Rengeji and 9 Okunoin were selected as study objects. The stone materials, shape features, and carving skills were first examined, and AutoCAD drawings were made for detailed analysis of size, proportion, and carving patterns.

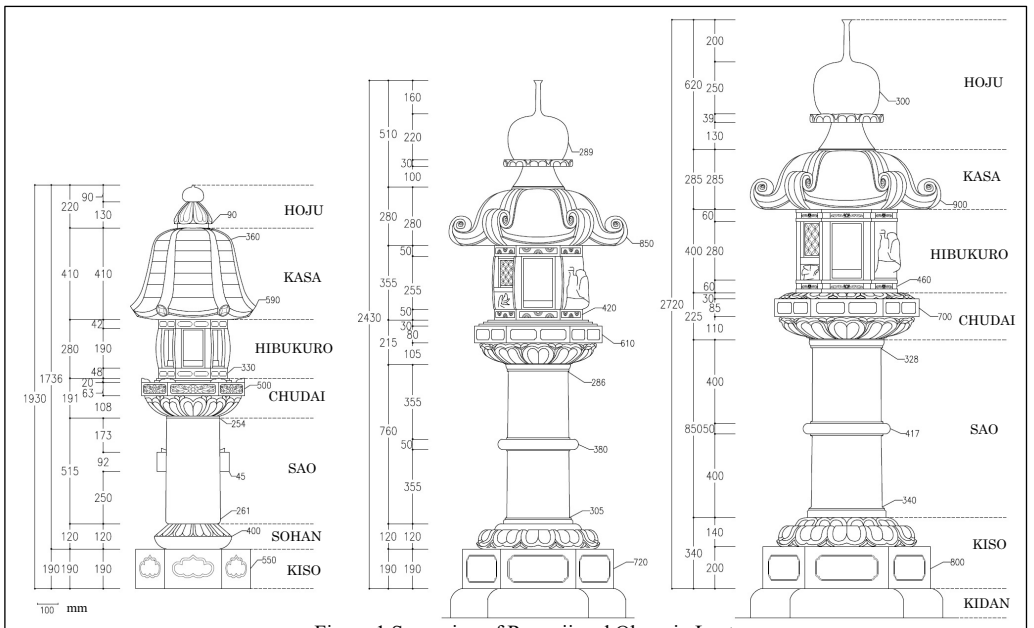

Figure 1 Surveying of Rengeji and Okunoin Lantern

Table1 Proportion of Rengeji Lanterns

Component	Diameter		Height	
	Size	Proportion	Size	Proportion
Hoju	9 ~ 10.8	14% ~ 17%	19.5 ~ 24	31% ~ 39%
Kasa	59 ~ 64	100%	40 ~ 42	62% ~ 69%
Hibukuro	32 ~ 35	52% ~ 56%	27 ~ 29.5	42% ~ 48%
Chudai	49 ~ 52	78% ~ 85%	16 ~ 19	25% ~ 32%
Sao	26 ~27.3	41% ~ 45%	50.5 ~ 52	78% ~87%
Sohan	40 ~ 42.6	65% ~ 69%	11 ~ 15	18% ~ 24%
Kiso	53 ~ 55	89% ~ 93%	19 ~ 22	31% ~ 37%

Table 2 Proportion of Okunoin Lanterns

Component	Diameter		Height	
	Size	Proportion	Size	Proportion
Hoju	23 ~ 38	33% ~ 34%	40 ~ 67	58% ~ 69%
Kasa	63 ~ 115	100%	20 ~ 32	28% ~ 33%
Hibukuro	31 ~ 60	48% ~ 52%	27 ~ 53	42% ~ 46%
Chudai	48 ~ 91	72% ~ 79%	16.5 ~ 33	25% ~ 29%
Sao	22.6 ~ 44.5	35% ~ 39%	55 ~ 114	84% ~ 99%
Kiso	54 ~ 103	85% ~ 90%	22.5 ~ 41.5	35% ~ 38%

Table 3 Location, Stone Texture, Size and Pattern of Rengeji Lanterns

Location	Code	Property	Stone	Height	Hibukuro Width	Size	Chudai Pattern	Kiso Pattern
Higashiomishi	H-1	Stone Store	White/Brownish	162	17	6-Shaku	Phoenix and Clouds	Kozama
	H-2	House	Brownish	167	17	6-Shaku	Chrysanthemum	Kozama
	H-3	Stone Store	Brownish	167	17.5	6-Shaku	Phoenix and Clouds	Kozama
	H-4-1	House	Brownish	167	16	6-Shaku	Phoenix and Clouds	Kozama
	H-4-2		Brownish	168	17	6-Shaku	Chrysanthemum	Kozama
	H-5	House	Brownish	162	16.5	6-Shaku	Chrysanthemum	Unknown*
	H-6	House	Brownish	164	17	6-Shaku	Phoenix and Clouds	Kozama
	H-7	House	Brownish	170	17	6-Shaku	Chrysanthemum	Kozama
	H-8	House	Brownish	174	16.5	6-Shaku	Chrysanthemum	Kozama
	H-9	House	Brownish	173	17	6-Shaku	Phoenix and Clouds	Kozama
	H-10	House	Brownish	177	17	6-Shaku	Phoenix and Clouds	Unknown*
	H-11	House	Brownish	174	17	6-Shaku	Rhombus Flower	Kozama
	H-12	House	Brownish	173	17	6-Shaku	Chrysanthemum	Kozama
	H-13	House	Brownish	180	17	6-Shaku	Chrysanthemum	Kozama
	H-14	House	White/Brownish	176	17	6-Shaku	Chrysanthemum	Kozama
	H-16-1	House	Brownish	179	16.5	6-Shaku	Lotus arabesque	Unknown*
	H-16-2		Brownish	169	17	6-Shaku	Chrysanthemum	Kozama
Minamikomatsu	M-1	House	Brownish	177	17	6-Shaku	Chrysanthemum	Kozama
Nagahama	N-1	Hotel	White/Brownish	171	17	6-Shaku	Phoenix and Clouds	Kozama
Hikone	HK-1	Stone Store	Brownish	176	16.5	6-Shaku	Chrysanthemum	Kozama

Figure 2 Each Detailed Design of Rengeji Lantern

Table 4 Location, Stone Texture, Size and Pattern of Okunoin Lanterns

Location	Code	Property	Width(Hibukuro)	Height	Size	Stone	Hibukuro	Chudai Pattern	Kiso Pattern
Higashiomishi	H-4	House	17	196	6-Shaku	Brownish	Curved	Ju-nishi	Kozama
	H-9	House	15.5	181	5.5-Shaku	Brownish	Curved	Ju-nishi	Rabbit & Wave 1, Wave 5
	H-15	House	20	230	7-Shaku	Brownish	Curved	Ju-nishi	Rabbit & Wave 1, Wave 3
	H-16	House	23.5	270	8-Shaku	Brownish	Curved	Ju-nishi	Rabbit & Wave 3, Wave 3
Kyoto	K-1	Hotel	30	345	10-Shaku	Brownish	Straight	Ju-nishi	Rabbit & Wave 6
	K-2	Stone Store	25.5	Unknown*	9-Shaku	Brownish	Straight	Ju-nishi	Rabbit & Wave 1, Wave 5
Minamikomatsu	M-1	House	20.5	239	7-Shaku	Brownish	Curved	Ju-nishi	Rabbit & Wave 3, Wave 3
	M-2	House	21	243	7-Shaku	Brownish	Curved	Ju-nishi	Rabbit & Wave 1, Wave 5
Nagahama	N-1	Hotel	23	272	8-Shaku	Brownish	Straight	Ju-nishi	Rabbit & Wave 3, Wave 3

Figure 3 Each Detailed Design of Okunoin Lantern

Results and Discussion

Most of the Kahei's Rengeji lanterns used light brownish hard granite and only 3 Rengeji lanterns were in typical white Hira granite (Table 3&4). All of the 20 Rengeji lanterns were designed as 6-Shaku (180cm Height) and the proportion are all similar to each other. "*Kasa*" is rounded and gradually expanding downwards to the edges, with the edge of the six corners decorated by Rengemon. "*Nuki*" is made from one single piece of stone of "*Sao*" and at the right middle height of "*Sao*". "*Hibukuro*" is six directions opened and arch-shaped. In addition, there are four patterns for "*Chudai*" while all the "Kiso" are all decorated with "*Kozama*" (Fig. 2).

On the other hand, all the Okunoin lanterns is made by brownish stone. There were 6 different sizes, but interestingly the proportions are basically two kinds of Sao height (Table 2&4). "*Hoju*" is tall and slender, strengthening the vertical visual effect with superb skills. Besides the extremely thin thickness of the Kasa's edge, "*Warabite*" is in swirling shape and scrolling inward, with deep carving and leaving only small interspace from the main body. There are straight and curved designs for "*Hibukuro"*. The "*Chudai"* patterns are all exquisite Chinese Zodiac and the "*Kiso*" pattern referred to the Japanese myth of The White Hare of Inaba (Fig. 3).

The Rengeji and Okunoin lanterns have shown Kahei's superb masonry techniques and the pursuit of beauty. It is also confirmed that Kahei's works were highly evaluated by stonemasons, landscape architects and owners during Meiji to early Showa in Shiga prefecture and Kyoto city.

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A Systematic Study of Water-Energy-Food Security Nexus : Case study in South Korea

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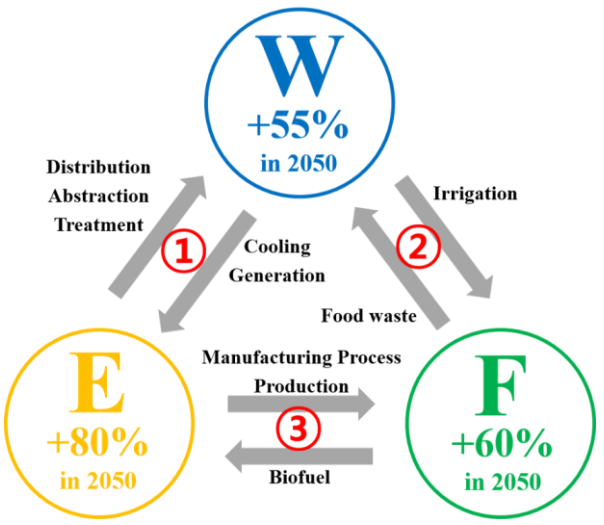
I. Introduction

1. Background

- Water, energy and food are essential resources for humankind, and demand for these resources is expected to increase by more than 50% by 2050
- Water-Energy-Food (WEF) nexus emerged to overcome the problem of resource security, and it is a holistic framework for analyzing the interactions (trade-off and synergy) between water, energy and food in order to enhance the resource security (Fig 1)
- The nexus approach aims to maximize synergies and minimize trade-offs

2. Challenges and gaps

- South Korea is a resource-poor and high resource consumption country
- No studies have been conducted to analyze the interaction between WEF security nexus in South Korea
- Previous studies of the WEF security nexus using social science method at national levels are limited



[Fig 1] Framework of WEF nexus

3. Research Objectives

- To explore a quantitative analysis of synergies and trade-offs as identified among WEF security nexus in South Korea
  - To identify influencing indicators in the WEF security nexus
  - To analyze the interactions of WEF security in the South Korea

II. Methodology

1. Spearman's rank correlation

- Spearman's analysis is used to explore the strength of a relationship between two sets of data and can be expressed as follows:

$$R_s = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

R_s = spearman rank correlation coefficient
d = differences in ranks between paired items
n = number of pairs of observations

- This study analyzes three relationships (Fig 1)
  ① Water-Energy ② Water-Food ③ Energy-Food

2. Data

- Total 30 indicators: 10 indicators for water security, energy security and food security respectively
- These indicators consider the availability, accessibility, affordability, and acceptability aspects of WEF security in South Korea.

III. Results

1) Water-Energy

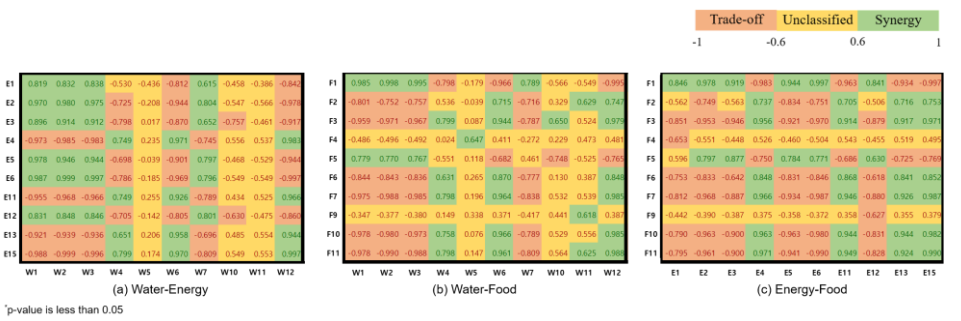
: Non-renewable negatively impacts water security and food security

2) Water-Food

: Food production affected by water quality and water supply fee

3) Energy-Food

: Renewable energy and food security have negative correlation



[Fig 2] Analysis results

IV. Conclusion

- Analysis using indicators related to WEF security revealed that there are interactions of WEF security nexus in South Korea
- WEF security could be improved if interactions (synergies and trade-offs) of WEF security are supplemented

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An Evaluation of Air Pollution Control in Ulaanbaatar

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Background

- Globally, household air pollution caused 3.8 million deaths in 2016, accounting for 7.7% of global mortality[1].
- Air pollution has become a social problem since around 2007 in the city of Ulaanbaatar in Mongolia, the coldest capital in the world.
- 80% of the air pollution is caused by coal stoves used for heating and general kitchen use in the Ger district of the city.
- Since air pollution has become a social problem, the Mongolian Government has improved the situation. The 2018 Government resolution No.62, "Prohibition of the use of raw coal", has been evaluated by the Government as the most effective environmental policy. The resolution banned the use of raw coal and introduced improved fuels instead. The National Committee for Environmental Pollution Reduction is responsible for implementing the resolution.

Research objectives

Through evaluation, *this paper clarifies the effectiveness of each policy and the limits of comprehensive measures based on the causal relationship between the Government's resolution and the activities and results of related programs and the setting of evaluation indicators.* As a means, use a logic model widely used in management and evaluation discussions in the public sector.

Methodology

Step 1. Logic model of air pollution policy regarding improved fuel:
- Extraction of related policies implemented
- Creating a logic model for the Mongolian Government. Resolution No 62 "Prohibit the use of raw coal" policy

Step 2. Index setting for evaluation of each policy
- Setting evaluation index for each policy

Step 3. Collection and results of measured values of each index
- Survey collection of measured values of each index
- Evaluation analysis and graphing of each policy

Step 4. Conduct a comprehensive policy evaluation based on result of each policy

Figure 1. Logic model[2]

Results

Evaluation and analysis of the results of each policy

✓ The above government measures are consistent and comparing of outcomes before and after shows that they are improving.

✓ It is considered that the policy was widely viewed and effective by having a total of 27 places, including each ministry, city hall, and NGO, participate in the National Committee for Environmental Pollution Reduction that promotes the policy.

Comprehensive policy evaluation 1

➢The causal relationship of policy

✓ In implementing Resolution 62 of the Mongolian Government, policies were clarified by the program logic model, and the causal relationship of each policy was verified.

✓ There are nine central policies.

✓ In addition, a wide range of national organizations, local governments, and the private sector participated in the implementation the policy, which well reflected the intentions of various fields.

Comprehensive policy evaluation 2

➢Improvement of air pollution

✓ The total amount of PM2.5, PM10 was reduced to near the standard value, and carbon dioxide was also slightly increased. However, sulfur dioxide increased to 1.5 times the standard value, worsening. (Figure 2)

✓ Sulfur dioxide is also harmful to health, so immediate improvement measures are needed.

Comprehensive policy evaluation 3

➢Improvement of respiratory diseases

✓ In air pollution, sulfur dioxide has increased more than twice the standard value, However, the hospitalization rate for respiratory medical conditions has decreased. (Figure 3)

✓ From now on, it is necessary to carefully watch the harm of sulfur dioxide to the health of citizens.

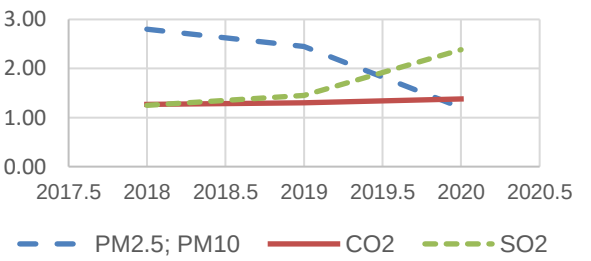

Figure 2. Changes in air pollution[3]

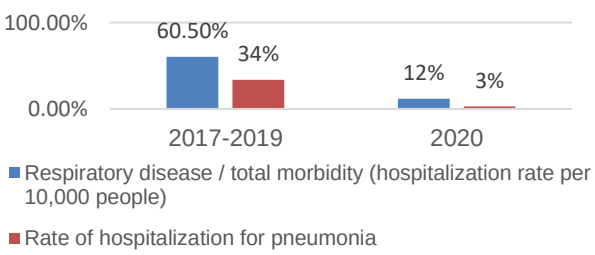

Figure 3. Respiratory diseases[3]

Conclusion

- It is necessary to clearly express the outcomes of each policy and project with measurable numerical values at the time of preparation and prepare policies based on numerical targets at the time of activity.
- As a result of verifying the causal relationship of each policy with a logic model, in Mongolia's air pollution policy, even if the index can represent the effect of the policy. It became clear that it was difficult to set a target value and express it as an achievement rate against it. It is essential to clarify the purpose when formulating a policy and express it in an evaluable numerical value.
- As a measure against poverty, the Mongolian Government tried to promote cost support for improved fuel to low-income households. However, due to the influence of COVID19 Corona, the amount of improved fuel per ton was discounted by 75%. As a result, the amount used has increased, but the current situation is that improved fuel supply companies are paying discounts, and the sustainability of the efforts is poor. The future transition will be watched.
- There is also a need to explore and implement ways to reduce sulfur dioxide in improved fuels.

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Comparison of Single Use Plastic Policies in Asia and Africa

Authors: Omondi Isaac and Asari Misuzu
* Graduate School of Global Environmental Studies, Kyoto University

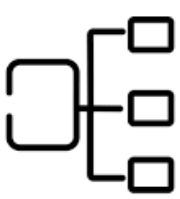
Background

- Various socio-economic and environmental problems are associated with mismanagement of plastic waste.
- Mapping and material flow studies indicate that Asia and Africa are the main sources of plastic pollution due to increased consumption of plastic products, undeveloped waste management systems and illegal waste imports.
- Single use plastic (SUP) composed of packaging, products and microbeads have been established as a major contributor of plastic waste due to one time use or less than a year lifespan.
- SUP and packaging waste make 55% and 47% of plastic waste, respectively. Recently, more items identified as plastic litter are added under SUP policies.

Study Objective: To review the scope and variability in national plastic-specific policies in Asia (ASEAN+3) and Africa as a SUP control mechanism

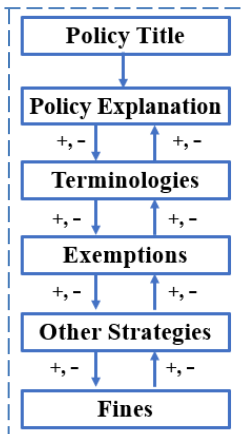
Methodology:

Gap Analysis



(1) Policy Classification (3 Types):
- SUP Policy (All products)
- Packaging Policy
- Product Policy e.g., bag policy

(2) Identification of plastic waste control mechanisms in the policy e.g. Bans, Charges, EPR, Recycling etc

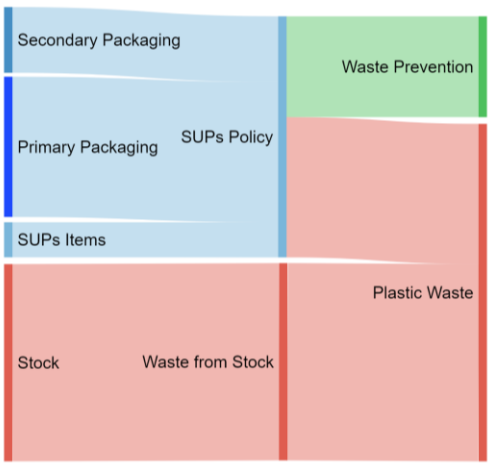


Integrative Propositional Analysis (IPA)

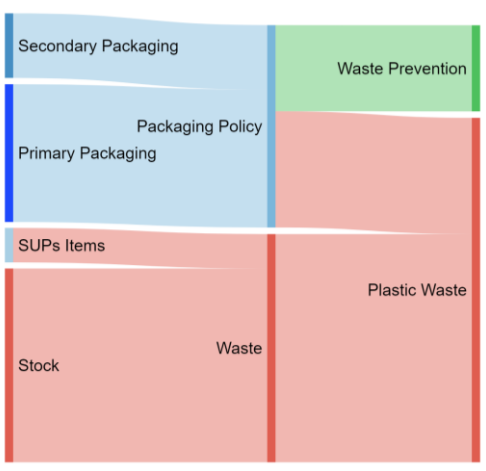
- Text in policy documents is used as data under themes
- The themes form a set of interacting and interrelated propositions
- Such interactions and interrelation either strengthen or weaken a policy
- The design demonstrate qualitatively waste prevention

Results and Discussion

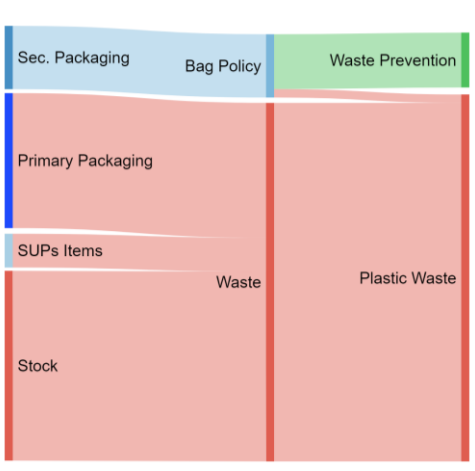
Qualitative Waste Flow from Policies



Waste Flow in SUP Policy



Waste Flow in Packaging Policy



Waste Flow in Product Policy

- SUP and packaging policies almost show the same impact by covering more products **(Strength)**
- The two policies have the largest exemptions and exemption waste from primary packaging **(Weakness)**
- Stocks form a sizeable proportion of plastic waste

- Product policies show targeted prevention
- Also enables more direct generation of plastic waste

SUP & Packaging Policies

ASEAN +3
- India
- Japan
- Malaysia
- Thailand
- Vietnam

Africa
- Rwanda
- Benin
- DRC
- Seychelles
- Cameroon

- Most countries apply outright bans and taxes.
- Rwanda is the only country with a SUP ban.
- Japan has 25% SUP reduction target by 2030.
- Malaysia has a SUP 2018 – 2030 roadmap.
- Plastic bags are the most regulated in the regions

Conclusion

- Lack of alternatives is a challenge in designing plastic waste prevention strategies.
- Prevention tops waste management hierarchy however as it is, recovery and treatment requires equal emphasis to manage plastic pollution.
- More research is also required to establish what constitutes plastic stock stream.

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Implementation of Payment for Forest Environmental Services and its Influence on Local Livelihoods in Thua Thien Hue Province, Vietnam

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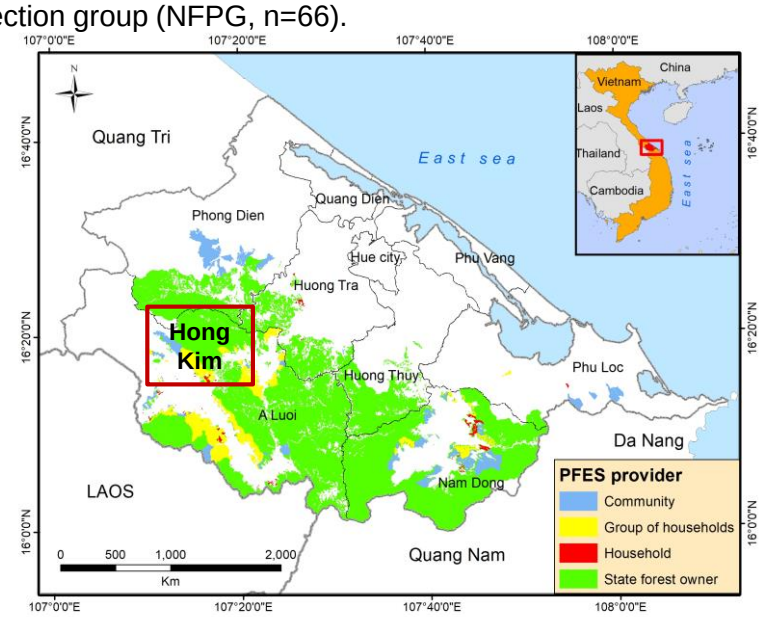
** Graduate School of Global Environmental Studies, Kyoto University

BACKGROUND

In Vietnam, **Payment for Forest Environmental Services (PFES)** is a new policy launched nationwide on January 1st, 2011 to **transfer money** from **service users** to **service providers** who **protect forests** to socialize the forestry sector and contribute to strengthening the role of local communities in forest management and protection. Although this policy is considered to contribute to the reduction of the state budget invested in the forestry sector and poverty reduction, the implementation of this policy still has many shortcomings. The study aims to interpret the PFES implementation in Thua Thien Hue Province, and to assess the influence of the PFES on the livelihood of forest protectors, especially ethnic minorities.

METHODOLOGY

This study combined several methods, such as inheriting secondary data from state offices, focus group discussions, semi-structured interviews, and participatory observations. The household surveys were conducted in Hong Kim commune, divided into two different groups named Forest protection group (FPG, n=67) and Non-forest protection group (NFPG, n=66).

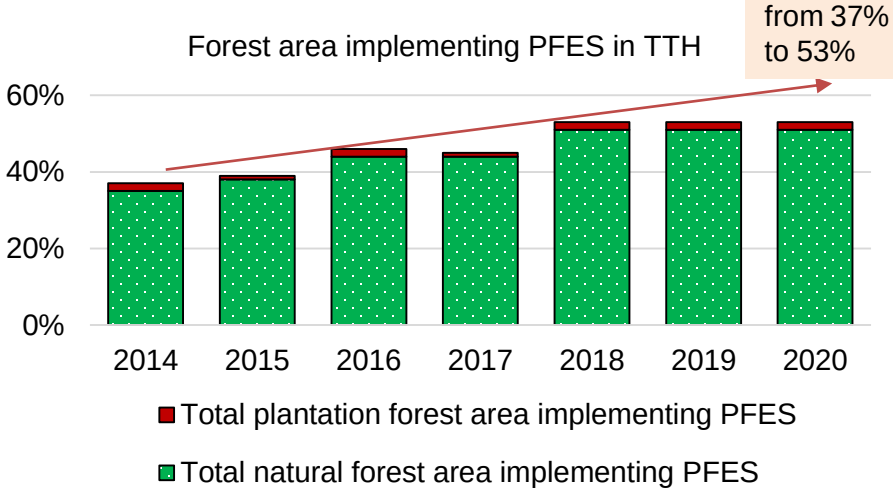


Map of the service providers in Thua Thien Hue province

RESULTS AND DISCUSSION

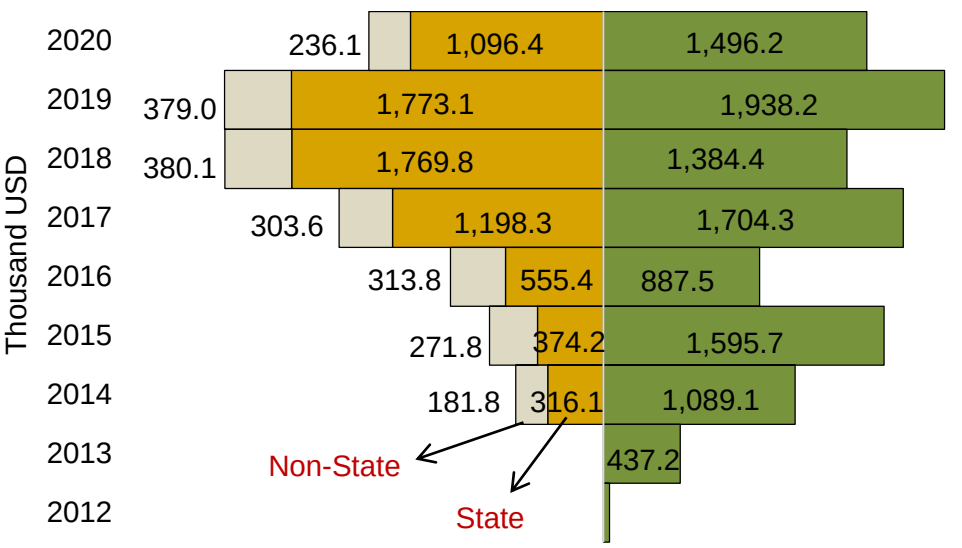
1. Total area receiving payment from PFES

Increased from 37% to 53%



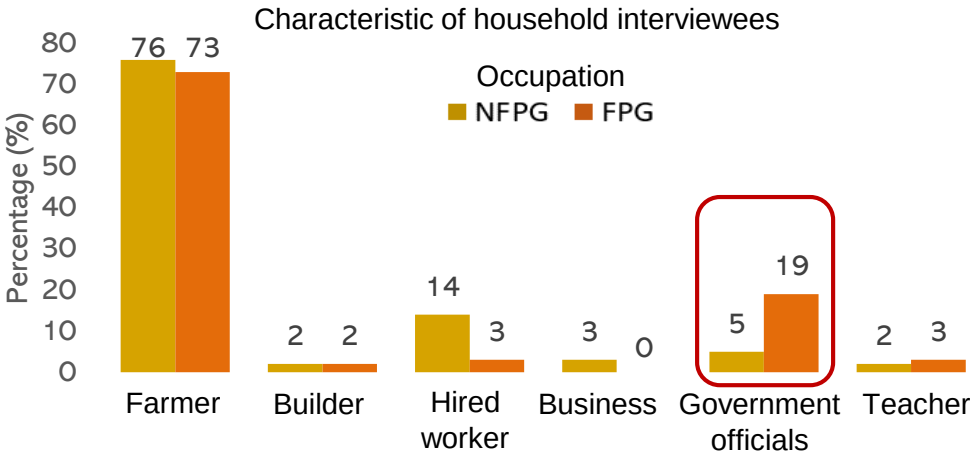
RESULTS AND DISCUSSION

2. Total revenue and distribution payment from PFES (2012-2020)



- **State** obtained **77%** of payment, while **non-state** received only **23%**.
- **Fluctuation of revenue** due to its heavy dependence on limited number of service beneficiaries ➔ The need to expand PFES beneficiaries.

3. Contribution of PFES payment to livelihood income of FPG



Government officials in FPG hold a higher percentage than those of NFPG.

Contribution of PFES income in the total household income

USD	NFPG	FPG	Mann whitney U test
PFES income	0	50.9 ± 13.4	
Total cash income	2,855 ± 1,835	3,179 ± 1,803	0.215

There were no significant differences in the total income of both groups. Additional income from PFES is negligible to FPG's total income.

Conclusion and recommendation

Revenue from PFES is **still fluctuating** from year to year due to their great dependence on limited number of service users. To better PFES implementation, it is necessary to identify and expand PFES beneficiaries.

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Recruiting System of Japanese Spiritual Communities: Environmentalism as a Fishing Hook

Lilia Shahar Griffin
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Introduction

- New religious movements (NRM), which are groups that give new interpretations to existing religions like the Buddhism and Shintoism, emerged in Japan in the 19th century. Some NRM that were established since the 1970s were distinguished by their hybrid teachings and the focus on the individual salvation and were named **Neo-new religions (NNR).**
- Since the 1990s there has been a vast **change in the perception** of religions in Japan, following the **Aum Shinrikyo** attack in 1995. Many Japanese were **reluctant from religion**, and did not want to be affiliated with such groups. In such circumstances, **new spiritual groups had to adjust their definition** to attract new members and provide support in domains which individuals searches solutions for, like environmentalism.
- One such group is **Konohana Family Community** that was founded in 1994 in Fujinomiya, Shizuoka Prefecture. The founding members chose Mt. Fuji since it has a spiritual meaning for their leader, Jiiji, and today the community is operated by 89 members.
- As the community is agriculture-based and claims to be 99% self-sustained, throughout the years it attracted curious individuals who were willing to change their entire lifestyle to improve the environment, yet they claim they stay for other reasons such as **improving their spirituality**, and **listen to the divine**.

Research question:
What is the **system** through which individuals - who are interested in **environmentalism** - change their values and turn to focus on **spirituality** in **communal settings**?

Methodology

This research is based on three months of participant observation in Konohana Family Community. During this time, the author worked with the community (in agriculture, cooking, cleaning, along with other works), held 19 interviews, daily meetings with the community leader, participated in community meetings, and analyzed materials related to the community, such as presentations, personal diaries, movies, songs (as the one right to this text, written and composed by a community member), as well as materials written about the community such as academic articles, news articles, and online information.

この星を天国にするために	*In order to make this planet a heaven*
はじめに雛形として	*First, as a model*
天国になる国があるという	*It is said there is a country to become heaven*
それが大和という国	*That is the country called "Yamato" [Japan]*

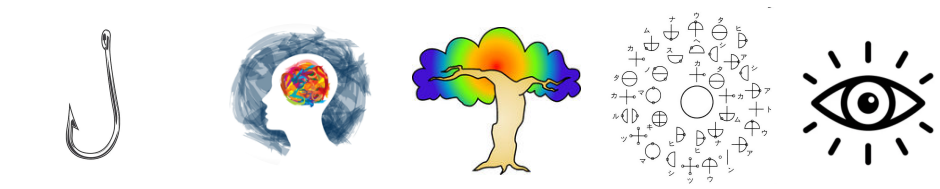
みろくの世
The Age of Miroku

Results

Konohana Family Community encourages spiritual improvement as they believe that by **"getting over the ego"** and **"listening to the divine will"** everything in the world will change for the better, including the environmental aspect.

When members are **not capable** of listening to the divine will, they turn to the only member who has daily communication with the divine: the community's spiritual leader, Jiiji.

Discussion



- **Environmentalism is used as a fishing hook to attract new members.**
- **Once they arrive at Konohana, they are taught about the correlations between nature and spirituality.**
- **The community leader, Jiiji, is the only figure to trust regarding every aspect of life as he has monopoly over spirituality. *"There is no better place."***

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The Effects of Feed-in-Tariff (FiT) on the Residential Retail Price of Electricity among Regions in the Philippines

Veronica I. Castillo* , Asa Jose U. Sajise*, Yolanda T. Garcia*, and Ma. Angeles O. Catelo*

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Background

- The global effect of emission from electricity generation has encouraged the use of renewable energy (RE) in the electricity sector.
- In the Philippines, Feed-in-Tariff (FiT) is one of the mechanisms to incentivize investment in RE technology.
- However, RE promotion through FiT transfers the burden to on-grid end-users by adding the FiT-All rate to the per kwh electricity bill.

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- Thus, this paper analyzed the effects of FiT on residential retail prices of electricity among regions in the Philippines

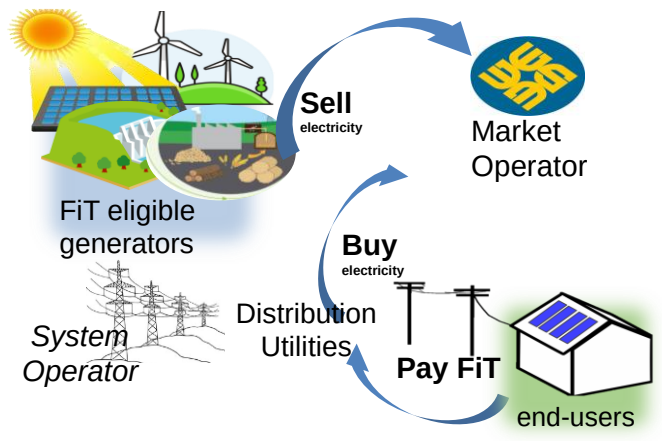

Figure 1. Flow of selling, buying and FiT paying in the electricity market

Methodology

- The study used time-series 2015-2019 monthly data to estimate the price effects of FiT.
- An ordinary least squares regression (OLS) is implemented to estimate the effects of FiT and wholesale electricity prices on the retail electricity price.

$$lnRP_t = \alpha_2\, lnWP_t + \alpha_3\, lnFiT_t + \varepsilon_t$$

Figure 2. OLS regression

- $lnRP_t$ is the log of the retail price of electricity in the current month, t, $lnWP$ is the log of the wholesale electricity price, $lnFiT$ is the log of the actual electricity generation (in MWh) billed to the FiT fund, and $\boldsymbol{\varepsilon_t}$ is the error term.

Results and Discussion

- FiT variably affects the electricity prices in the regions of CAR, Central Luzon, MIMAROPA, Bicol Region, Central Visayas, Western, Northern, and Central Mindanao, Davao Region, and ARMM.
- FiT had led to increases in price only among regions in Mindanao while it has depressed prices among regions in Luzon and Visayas.

Table 1. Results of the regression model on the retail electricity price among regions affected by FiT.

Region	lnFiT	lnWP	Constant	Adj. R^2
CAR	-0.033***	-0.018^{ns}	2.843***	0.298
	(0.005)	(0.011)	(0.130)	
NCR	0.014^{ns}	0.146***	0.904***	0.370
	(0.018)	(0.018)	(0.307)	
Central Luzon	-0.026***	0.003^{ns}	2.454***	0.143
	(0.006)	(0.016)	(0.153)	
MIMAROPA	-0.034***	-0.039***	3.012***	0.413
	(0.006)	(0.008)	(0.102)	
Bicol Region	-0.039***	-0.016^{ns}	2.829***	0.216
	(0.011)	(0.013)	(0.172)	
Central Visayas	-0.046***	0.010^{ns}	2.952***	0.247
	(0.008)	(0.013)	(0.164)	
Western Mindanao	0.070***	0.050***	0.920***	0.377
	(0.009)	(0.017)	(0.199)	
Northern Mindanao	0.188***	0.226***	-1.514***	0.635
	(0.024)	(0.027)	(0.355)	
Davao Region	0.097***	0.133***	-0.021***	0.518
	(0.013)	(0.021)	(0.254)	
Central Mindanao	0.064***	0.073***	0.922***	0.416
	(0.010)	(0.015)	(0.163)	
ARMM	0.055***	0.069***	0.947***	0.590
	(0.006)	(0.009)	(0.120)	

Notes: VIF values are all less than 10. Robust standard errors are in parentheses. Asterisks denote significance of p-values: 'ns' for p-value >0.10, and "***" for p-value < 0.01.

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The Soft Edge of Climate Stewardship: How Climate Action Will Turn Soft Power

Authors: Roberto Nisi

Graduate School of Global Environmental Studies, Kyoto University

1 - BACKGROUND

As a general background reference, according to the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), if we do not radically shift humanity's business model, a bleaker future is the very least we can expect. Already in 2014, this report had highlighted that, without deep GHG emission cuts, the earth would have "likely (66% - 100% probability rate)" crossed the threshold of 2° C above pre-industrial levels as early as 2050.
Given the urgency conveyed above, how can social sciences contribute to accelerating toward a green transition? By researching how a public perceives one's efforts in terms of climate action, in order to define the right incentives is the answer sought in this study.
Soft power — the ability to shape the preferences of others via means of persuasion — primes on framings and images, and, as such, it can be used as an instrument to advance climate action. Nowadays, showcasing the correct climate-mindful posture has become so instrumental to those nations wishing to peacefully sustain or advance their stance in foreign affairs — as it has for those striving to tackle climate change — that any reference to how the reputation of certain countries has raised or fallen since the Paris Agreement (CoP21) sounds almost futile. For instance, if we take the US and the SoftPower30 Index, the label government downgraded from #12 in 2017 to #24 in 2019. Notably, 2017 was when former President Trump withdrew from the Paris Agreement and escalated his crusade against climate action.

2 - THEORETICAL FRAMEWORK

A striking standard that stands to validate, the considerations I have thus far asserted, is found in a relatively young white paper known as the Ambition Loop. Published by United Nations Global Compact (UNGC), the We Mean Business Coalition, and the World Resources Institute (WRI), the Loop addresses the nexus between top-down climate incentives and bottom-up environmental initiatives in which public and private sectors virtuously drive one another toward implementing bolder climate action by scaling-up their commitments.
However, while an undoubtedly sophisticated framework, the Loop overlooks all potential soft power gains for any state and foreign policy agent that positively frames its image while addressing environmental concerns on the global stage.
Therefore, to overcome the limits of this model, we must investigate what perceptions globalized societies nurture about climate action.
In order to do so, we shall verge toward a three-layered structure of political analysis, modeled by an institutional top-layer accounting for climate policies & public diplomacy; a middle-level framing the market; and a civic-basis built upon cultural relations & public advocacy.

3 - CASE-STUDY

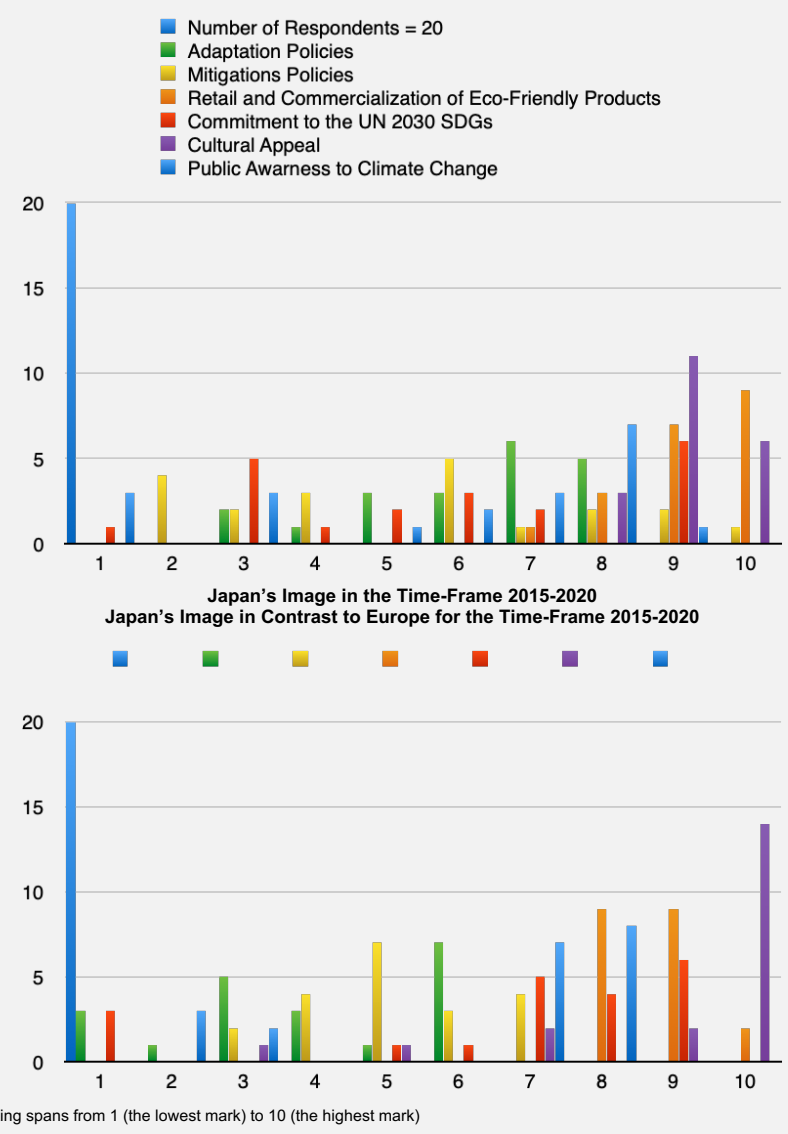
In these terms, Japan presents itself as the perfect case-study.
From a top-layer perspective, it simultaneously possesses a proclaimed interest in both climate action and soft power.
In the middle layer, it is home to an environmentally-dependent business community that also happens to be proudly clinging to cultural hallmarks to barter its trades. And, at the base, Japan has always dealt with a highly cohesive identity, a trait that could enable grassroots to act concurrently.
Suggesting to compare the Archipelago against a European sample is all but accidental, as this unit is by conceptualization the only one vast and diversified enough to work as a reliable benchmark for any single country comparison.
Besides the evident collective stance in climate action — the European Commission itself refers to climate policies, investments, and guidelines with this term — this sample holds fast to a mid-layer comprising a wide array of entrepreneurs all retailing on cultural assets and climate-conscious values, and a base which is broadly acknowledged for its environmental stance, finding in European youths the faces of its loudest advocates.

4 - METHODOLOGY

Referring to SoftPower30 Index, when collecting its polls, the Index addresses independent perceptions and compares countries after compiling the individual metrics. However, perceptions are one of the most volatile aspects to isolate in social sciences, for they may change in relation to our means of comparisons.
To overcome this obstacle, the polling format portrayed here bypasses the issue of relativity by promoting a comparison already at the data collection stage.
However, as the research is only at the initial stage, the only data displayed in this presentation are those from a test sample of twenty European scholars rating exclusively Japan's image and Japan's image in contrast to Europe on a set of categories for the timeframe 2015-2020. No data were collected in this instance concerning exclusively Europe's image on the same categories.
Lastly, still concerning the methodology, it should be noted that the label Cultural Appeal is included in the sample as it is one of the label used in official soft power rankings and primed upon by Japan; used here as a benchmark metric to corroborate further the results.

5 - RESULTS

Sample Quantitative Ranking (Polled-Sample Only / Raw Graph)
Preliminary Testing - Time-Rate of Reply Kept Below 5 Minutes (Longest Time 3.46)



[1] Ranking spans from 1 (the lowest mark) to 10 (the highest mark)

6 - CONSLUSIONS

Given these preliminary statistics, we can spot how the comparison with Europe levels the field in terms of positive replies on multiple categories. For instance, the perception the sample held toward Japanese adaptation policies enterprises went from a consistent set of replies scoring a 7 or an 8 to a lower ranking which involves baseline votes as low as a 1 or a 3 in terms of appreciation. If we consider 5 and 6 as a medium level of appreciation, we can notice how the perception rating moved.
Supposing that a country should primarily care for the second set of replies, as it is there that we can ponder how influential or successful one is perceived in both climate action and soft power terms, we could conclude that the case for a climate action / soft power nexus exists and that further research on this topic will further substantiate these initial answers.
If over the coming years this research could care for a consistent historical framing by focusing on medium-length windows of analysis — e.g. 2005-2010, 2010-2015, 2015-2020 — it is legitimate to imply that by cross-referencing the resulting matrix with historical events, such as policy implementations, corporate pledges, official statements, responses to natural disasters, and so forth and so on, the study could, at last, identify when, how, and why an international stakeholder gains or loses soft power over climate action, while simultaneously showcasing the value for escalating this multi-faced feedback loop into an even more ambitious Ambition Loop.

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The Third Pillar of Climate Policy: Rectifying Loss and Damage

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Background

Phases of climate change
Emissions of GHG, Temperature↑

Sea level rises, floods, abnormal weather events etc.
+ Event attribution study (2004-)

Need for rectification for Loss and Damage (L&D)

International climate policy
Mitigation/Adaptation (UNFCCC 1992)

Call for the mechanism of L&D

Political Deadlock

- ❑ The Warsaw International Mechanism (2013)
  - ✓ No provisions for liability or compensation but 'dialogue'
- ❑ The Paris Agreement (2015)
  - ✓ adds 'loss and damage', but denies a basis for any liability or compensation

Climate change litigation
Reduction of CO_2

Seek compensation for damage

Legal Hurdle

- ✓ Difficulties to be a plaintiff against a foreign entity (the carbon majors)
- ✓ Difficulties to establish the causation of harm

Due to the difficulties, possibilities of climate compensation have not been adequately investigated. We need to shift from the policy and principle that the literature have focused.

Policy: Mitigation and adaptation ➡ L&D
Principle: Distributive justice
➡ Corrective/ reparative justice
✓Compensation is different from distributing rights in that it presupposes a prior wrong.

Research Objectives

1 Investigate grounds for compensation or reparations for climate damage so that the study leads to the consideration of L&D as the third pillar of climate policy despite current political/legal hurdles.

2 Clarify the relationship between L&D and other policies so as to provide a comprehensive vision of the third climate policy under the UNFCC's scheme.

Judicial Approach

The *Human rights* Approach (HRA) can.....
✓ preferentially target the most vulnerable.
✓ oblige others to ensure the minimum threshold to respect other's rights.

The *Torts* Approach can.....
✓ attribute liability to the carbon majors for their greenwashing, intentional large emissions, misinformation of climate science.

Limitations

⇦ HRA may not be effective to rescue the victims who are *not* in acute danger but endangered due to slow-onset events such as sea level rises.
⇦ HRA does not primarily presuppose post-violation remediation, and distract from envisioning a political programme which allows more flexible forms of compensation.
⇦ Even though the torts approach succeeds, those who receive damages are limited to the legal claimants.

Alternative Approach

A political programme, which departs from the judicial scheme, is preferable for rectification.
✓ It starts from the investigation of the nature of L&D, and then the measures are examined, not *vice versa*.
✓ It includes reparatory measures that is offered by a liable party, and considers the victims' satisfaction regarding a past wrong.

Currently Discussed Measures Examined

IPCC's Definition of L&D
'Loss' is irreplaceable, while 'damage' is replaceable.

Measures discussed in the UNFCC' scheme

	Measures for economic L&D	Measures for non-economic L&D
Extreme Events (heat wave, floods etc.)	•Risk reduction •Risk transfer (insurance) •Technology transfer •National/international disaster funds	•Recognition of loss (property, life) •Active remembrance •Know-how to overcome loss
Slow-onset events (sea level rise etc.)	• Risk reduction • Technology transfer • Risk transfer via catastrophe bonds	•Alternative livelihoods provision •Recognition of loss (land, culture, community) •Creating museum, monument, education

Modifications

- IPCC's distinction is not a categorical one; it should be regarded as being relative to each other so as to avoid a bias that damage is replaceable.
- The category of "economic L&D" does not consider the meaning of incalculable personal attachment. However, it is useful to categorise the measures as economic and non-economic.

Proposal

- Introducing the distinction of reparation by a liable party and compensation by non-liable parties.
- For the reparation for eternal loss of land be successful, recognition of loss and the guarantees of non-repetition are required in addition to alternative livelihoods provision.
- The viewpoint of victims should be incorporated for the arrangement of active remembrance of L&D.

Alternative basic categorization

	Economic measures	Non-economic measures	
		Recognition of loss	Grantees of non-repetition
Liable party	Reparations	•Official recognition •Active remembrance	•Investigation into the truth •Accelerating mitigation
Non-liable party	Compensation		

Conclusion

1 Compensation or reparations for L&D is justified by corrective considerations and should be realized as a political programme rather than judicial forms.
2 The third climate policy is interrelated with the other two policies in ways that
a. preventing L&D is a prior task to adaptation, and
b. regarding the commitment of non-repetition as a distinctive rectificatory measures gives an additional reason to fortify the mitigation policy.

November 29 – November 30, 2021, Online symposium

Kyoto University International ONLINE Symposium 2021 on Education and Research in Global Environmental Studies in Asia

Understanding water use behavior in communities of four Southeast Asian countries through water use flow diagrams

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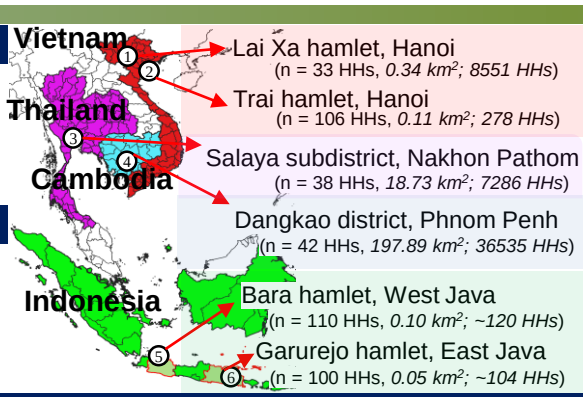
Background

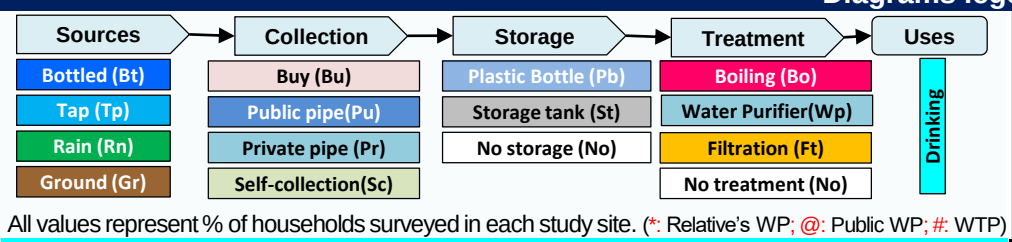
- Access to **safe water and sanitation** is still a challenge for many communities in Southeast Asia. Households have to adopt different strategies to meet their daily needs.
- **Flow diagrams** visualizing the practices of households from sources to end-uses/destinations would provide a clearer image for a better understanding of household water and sanitation practices.

Objective & Method

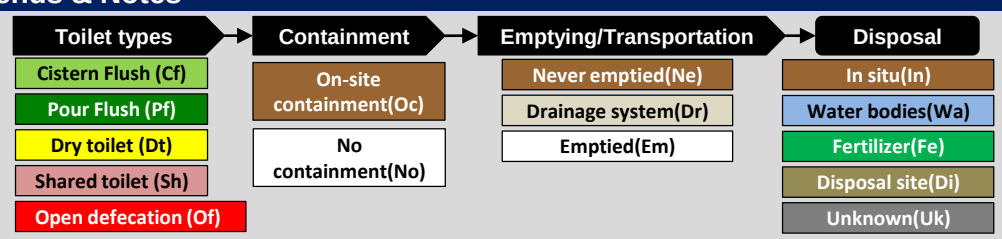
- **To assess water use behavior of households** in 6 peri-urban and rural communities in Vietnam, Thailand, Cambodia and Indonesia through drinking water flow diagrams and blackwater flow diagrams.
- The diagrams were manually constructed based on the results from **interviewed based-questionnaire surveys** which were conducted with the total of 426 households over the period of 2018 – 2021.



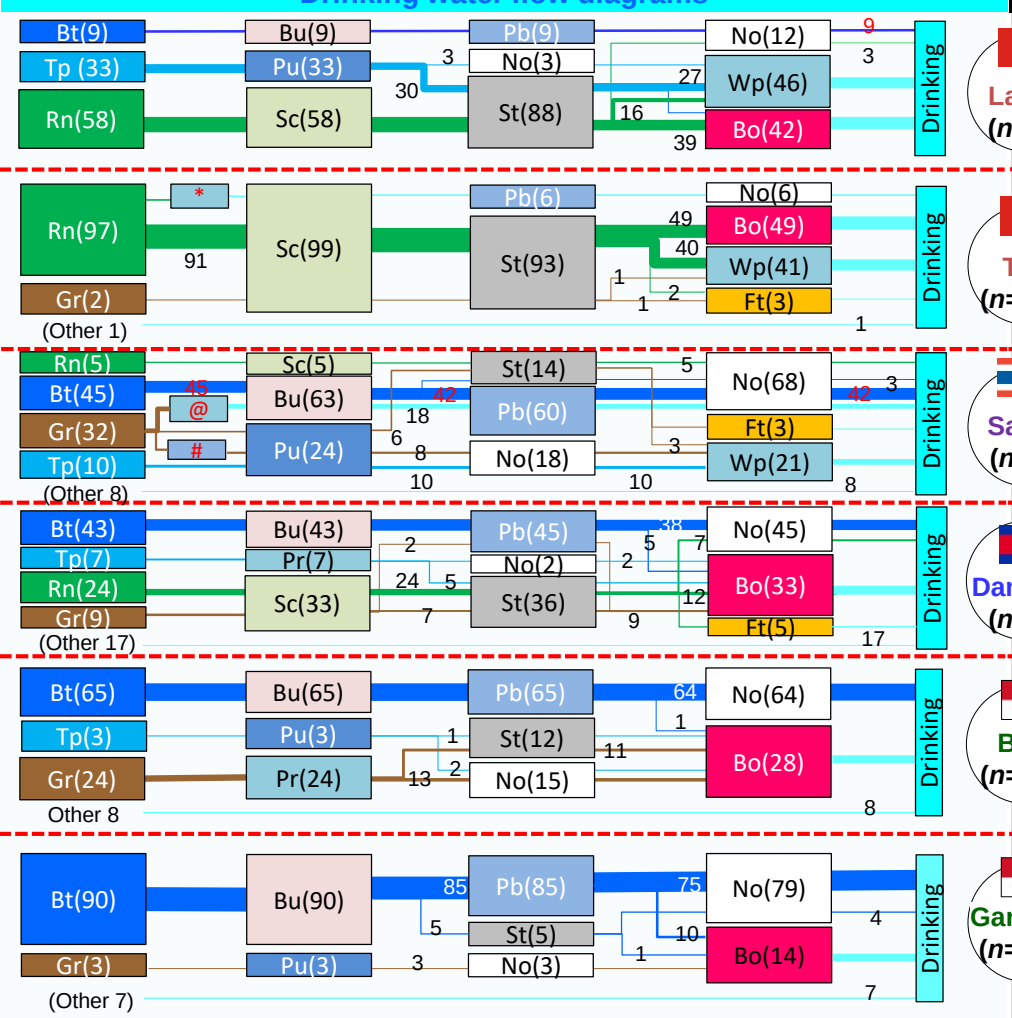
Diagrams legends & Notes



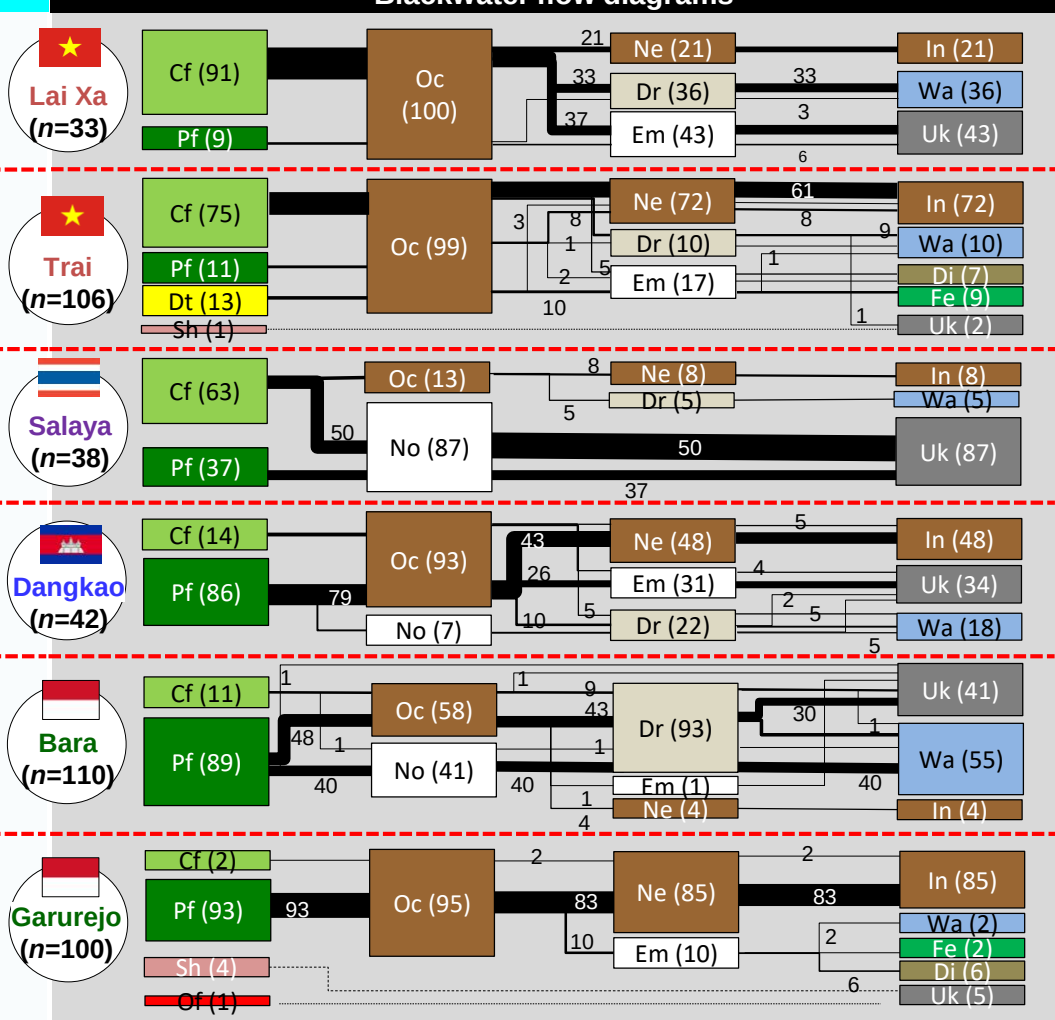
All values represent % of households surveyed in each study site. (*: Relative's WP; @: Public WP; #: WTP)



Drinking water flow diagrams



Blackwater flow diagrams



Finding & Conclusion

Water usages for drinking purpose:

- Four communities in **Thailand, Cambodia, and Indonesia** relied heavily on **bottled water** while in **Vietnam**, households tended to drink from **boiled or RO-purified rainwater**.
- Overall, regardless of sources, households were more likely to collect the already treated or the self-treated water before drinking → **more awareness on safe water and one's health**.

Practices regarding sanitation management:

- Majority of households had **toilets connected to the on-site containments**, but mainly those blackwater were **not well treated** and just **disposed to the open environment**.
- Several households reported of not knowing about where their wastewater go → **low awareness about sanitation issue**.

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What are the clean energy and decarbonization strategies of ExxonMobil, Chevron, BP, and Shell?

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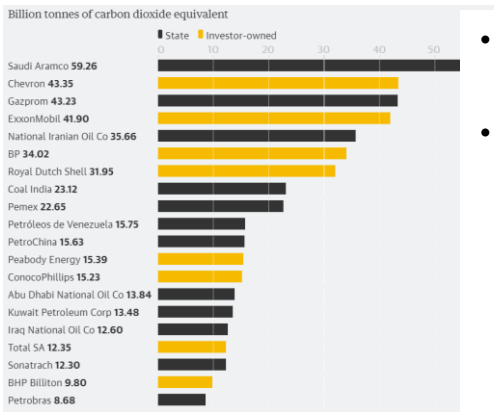
Background

- 20 fossil fuel companies have contributed to 480bn t-CO2e since 1965
- The products of four energy giants account for more than **10%** of global carbon emissions since 1965 (Kenner and Heede, 2021)
- Demand for FF is decreasing, jeopardizing business models of oil majors

⇒ A need for oil majors to shift away from fossil fuels

The top 20 companies carbon emissions since 1965



Source: Revealed: the 20 firms behind a third of all carbon emissions https://www.theguardian.com/environment/2019/oct/09/revealed-20-firms-third-carbon-emissions

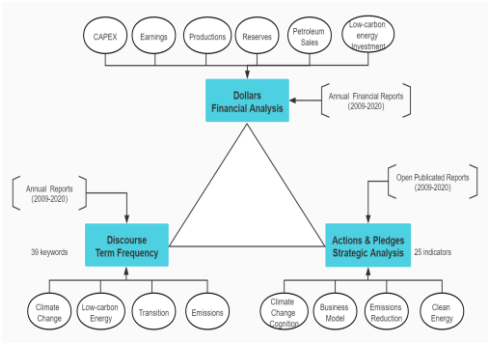
Literature Review

- Decarbonization claims bee critiqued as "greenwashing"
- Previous literature has evaluated oil major actions from following perspectives:
  - societal accountability
  - climate disinformation
  - lobbying
  - emissions reductions
  - renewables investment

Gap

- Most focus on a single year.
- Most focus on public statements or a narrow range of business strategies

Methodology



Objective

To what extent are the four oil majors transforming their business models and shifting away from fossil fuels?

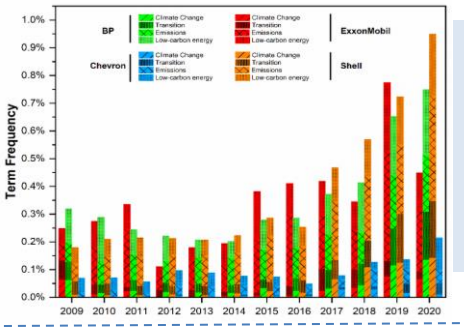
- Three perspectives: Discourse, Actions & Pledges, Dollars
- Analysis of data from 2009 to 2020

Data source: Publicly available reports (e.g. Annual reports)

Results

Discourse

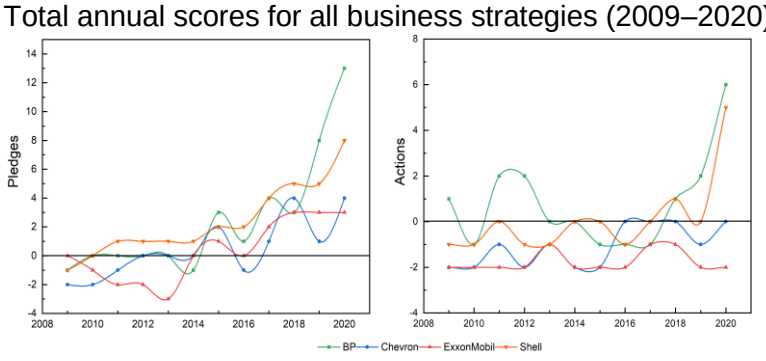
Green disclosure (2009-2020)



- Words frequency increased
  - climate change
  - low- carbon energy
- European majors lead the American ones

Actions & Pledges

Total annual scores for all business strategies (2009–2020)



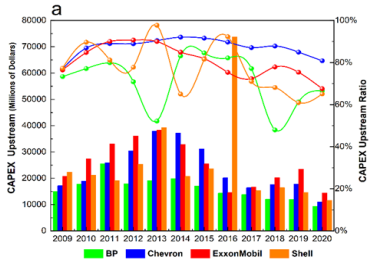
- Points are mostly from pledges rather than actions
  Regressive actions include:
  - Refusal to curb fossil-fuel production and exploration
  - No strategies for net-zero or scope 3 emissions
  - No investments in clean energy
- European majors lead over the US ones

Dollars

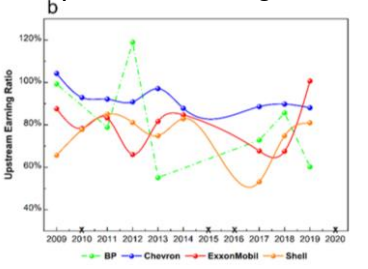
Oil and gas remain the pillar business

- >50% CAPEX spend in upstream
- >60% earnings come from upstream

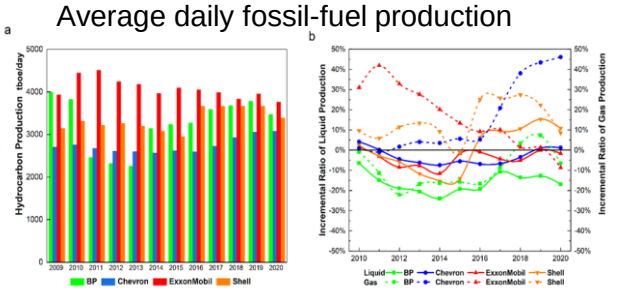
Upstream CAPEX



Upstream earnings ratio

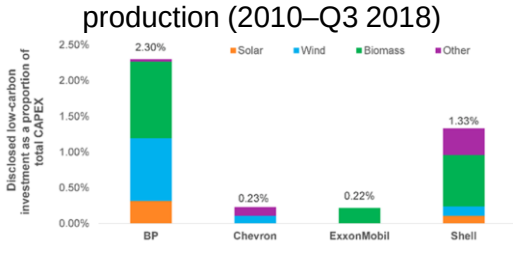


Average daily fossil-fuel production



No major has consistently decreased total hydrocarbon production over the study period

Investment in low-carbon energy production (2010–Q3 2018)



Source: CDP Investor Research

Low-carbon energy investment far below CAPEX of upstream fossil fuel

Transition to clean energy business models is not occurring

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Youth's Awareness on Climate Change: The Case of Fridays For Future Japan

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Background

- ✓ Low seriousness of the risk of climate change in Japan
- ✓ Low efficacy that Japanese youth believe they can change the country and society

Youth activists gathering in Fridays For Future (FFF) Japan pursue climate justice and act in solidarity to revolutionize the social structure.

Challenges

✓ Most studies on Japanese cases on factor analysis of environmental behavior mainly focus on individual environmental behavior.

✓ Only a few studies on overseas cases use both quantitative and qualitative methods to examine the factors that lead to the environmental movement.

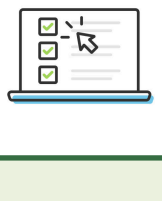
Objectives

1. What are the factors of intention to participate in environmental movements in Japan?

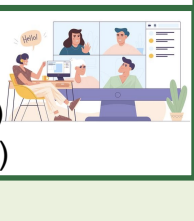
2. What is the background of awareness of those who participate in the environmental movement belonging to FFF Japan?

Methodology

Questionnaire survey (N=209)
- FFF Japan (n=42)
- Kyoto University students (n=67)
- Respondents of the online panel (n=100)



Participant observation
-From June 2020 to November 2021
- Meeting on every Friday at FFF Kyoto (n≒10)
- Meeting on every month at FFF Japan (n≒15)



Results

Latent class analysis

	Cluster 1 (n=91)	Cluster 2 (n=61)	Cluster 3 (n=57)
Affiliation			
FFF Japan	0.03	0.64	0.00
Others	0.97	0.36	1.00




	Cluster 1(n=91)					Cluster 2(n=61)					Cluster 3(n=57)				
	Strongly disagree	Disagree a little	Neutral	Agree a little	Strongly agree	Strongly disagree	Disagree a little	Neutral	Agree a little	Strongly agree	Strongly disagree	Disagree a little	Neutral	Agree a little	Strongly agree
Intention															
Placard	0.12	0.45	0.37	0.03	0.02	0.03	0.13	0.13	0.30	0.41	0.96	0.04	0.00	0.00	0.00
Boycott	0.00	0.25	0.46	0.29	0.00	0.03	0.03	0.08	0.34	0.51	0.95	0.00	0.02	0.02	0.02
Hashtag	0.01	0.24	0.44	0.21	0.10	0.03	0.02	0.05	0.43	0.48	0.77	0.04	0.11	0.07	0.02
Online Signature	0.01	0.19	0.41	0.35	0.04	0.03	0.03	0.02	0.36	0.56	0.74	0.05	0.12	0.07	0.02

	Intermidiate(n=91)					Positive(n=61)					Negative(n=57)				
	Strongly disagree	Disagree a little	Neutral	Agree a little	Strongly agree	Strongly disagree	Disagree a little	Neutral	Agree a little	Strongly agree	Strongly disagree	Disagree a little	Neutral	Agree a little	Strongly agree
Seriousness of risk	0.00	0.07	0.22	0.41	0.31	0.00	0.02	0.02	0.18	0.79	0.19	0.11	0.14	0.47	0.09
Injustice	0.01	0.08	0.34	0.26	0.31	0.03	0.00	0.10	0.08	0.79	0.21	0.07	0.23	0.28	0.21
Moral conviction	0.01	0.10	0.19	0.30	0.41	0.02	0.00	0.02	0.11	0.85	0.18	0.05	0.16	0.33	0.28
Group efficacy	0.00	0.12	0.30	0.34	0.24	0.00	0.02	0.08	0.25	0.66	0.18	0.16	0.26	0.26	0.14
Individual efficacy *	0.04	0.19	0.47	0.26	0.03	0.28	0.30	0.21	0.15	0.07	0.18	0.19	0.30	0.11	0.23
Policy evaluation	0.12	0.35	0.42	0.09	0.02	0.62	0.28	0.02	0.05	0.03	0.28	0.37	0.18	0.14	0.04
Anger	0.03	0.14	0.38	0.29	0.04	0.00	0.05	0.18	0.23	0.48	0.19	0.14	0.37	0.09	0.04
Guilty	0.01	0.12	0.40	0.27	0.20	0.05	0.08	0.15	0.23	0.49	0.23	0.19	0.30	0.21	0.07
Personal norm	0.02	0.14	0.32	0.26	0.25	0.02	0.03	0.03	0.26	0.66	0.26	0.19	0.33	0.09	0.12
Avoidance by personal action	0.11	0.23	0.26	0.30	0.10	0.44	0.26	0.08	0.15	0.07	0.25	0.26	0.21	0.21	0.07
Improving quality of life	0.07	0.16	0.44	0.26	0.07	0.02	0.07	0.25	0.39	0.28	0.30	0.14	0.40	0.12	0.04

*Individual efficacy is a reversal item.

Participant observation

Before joining FFF
- Know the seriousness of climate change and intergenerational and interregional injustices through Greta's speech and books
- Want someone to talk about climate change issues together
- Want to act with others rather than alone
- Find FFF through friends and Instagram of FFF

After joining FFF
- Tell citizens to take action together in a positive way
- Strategically control emotions that propagate outwards
- Struggle that they might not be able to influence the government decisions
- Feel burdens on keep acting

Discussions

✓ Negative motives are more strongly associated with the participation intention in the environmental movements in this study. In contrast, some previous overseas studies show that positive motives such as efficacy are factors.

✓ Activists communicate in a positive way to make it acceptable to many people in Japan. For example, activists feel angry toward Japan's climate change measures but do not reveal anger so much as a mobilization strategy.

✓ Activists have a strong passion for protesting, but at the same time, they feel conflicts in their minds.