GLEC Ibaraki University

Southeast Asia Research-based Network on Climate Change Adaptation Science (SARNCCAR)

INTERNATIONAL SEMINAR FOR CLIMATE CHANGE ADAPTATION PROGRAM 2020

Sharing Interlocal Adaptation Lessons: Climate change adaptations and development in East and Southeast Asia

ABSTRACTS

November 17, 2020

茨城大学 Ibaraki University

VJU Vietnam Japan University VNU since 1906

JSPS

INTERNATIONAL SEMINAR FOR CLIMATE CHANGE ADAPTATION PROGRAM

November 17th, 2020

1. Name of the seminar:

Southeast Asia Research-based Network on Climate Change Adaptation Science (SARNCCAR)

2. Theme of the seminar:

Sharing interlocal adaptation lessons: Climate Change Adaptations and Development in East and Southeast Asia

3. Time and place of organization

- Time: 17 November 2020 (Academic workshop)
- Venue: Ibaraki University (2-1-1 Bunkyo Mito City, Ibaraki, Japan) and Vietnam Institute of Economics (1B, Lieu Giai Str, Ba Dinh District, Hanoi City, Vietnam)

4. Organizer

Organizer: Global and Local Environment Co-creation Institute (GLEC), Ibaraki University
Co-organizer: Masters' program in Climate Change and Development of Vietnam Japan University (VJU MCCD)
Vietnam Institute of Economics (VIE), Vietnam Academy of Social Sciences (VASS)

5. Meeting method

-Remote conference system (zoom) (Help desk: glec-anet@ml.ibaraki.ac.jp)

Morning session and Room 1 Meeting ID: 953 6701 2140, Passcode: 212813
https://zoom.us/j/95367012140?pwd=dVZ3aFd6ZHhjcmN2cEhXcmRJZ0I5dz09

Room 2 Meeting ID: 472 614 2206, Passcode: 207461
https://zoom.us/j/4726142206?pwd=MjhieWJaM0xpb0t1TlhVcXZSU0RlZz09

Room 3 Meeting ID: 460 792 8281, Passcode: 159559
https://zoom.us/j/4607928281?pwd=OHgycFBIUFBIc1l3eE9vcE1GTDZXQT09

International seminar program: Morning session (Symposium)

Time (Vietnam)	Time (Japan)	Contents	Authors/Responsibilities
07:30-08:00	***09:30-10:00***	***Registration***	
		Morning Session: Symposium	
08:00-08:30	***10:00-10:30***	***Welcome session***	
08:00-08:05	*10:00-10:05*	1. Opening declaration and introducing delegates	Prof Ito (GLEC)
08:05-08:10	*10:05-10:10*	2. Welcome speech from VIE, VASS	Prof Nguyen Chien Thang - VIE
08:10-08:15	*10:10-10:15*	3. Introduction of GLEC, Ibaraki University	Prof Hasui (GLEC)
08:15-10:00	***10:15-12:00***	***Keynote speech (20min + 10min Q&A)*** ***Chair: Assos Prof Tamura***	
08:15-08:45	*10:15-10:45*	1. Keynote speech from Philippine	Prof Pulhin & Dr Garcia (Philippine)
08:45-09:15	*10:45-11:15*	2. Keynote speech from Indonesia	Prof Bengen (Indonesia)
09:15-09:45	*11:15-11:45*	3. Keynote speech from Vietnam	Prof Nguyen– (Vietnam)
09:45-10:00	*11:45-12:00*	Report on disaster mitigation and adaptation in the coastal zone in Hoi An, Vietnam	Dr Hoang, Dr Nguyen Van Quang, Dr Kotera (MCCD, VJU)
10:00-11:40	***12:00-13:40***	***Lunch break***	

International seminar program: Afternoon session (Workshop)

	Afternoon session: Workshop						
Time (Vietnam)	**Time (Japan)**		**Contents**				
10:00-11:40	***12:00-13:40***		***Lunch break***				
11:40-12:00	***13:40-14:00***		***Special Event: Broadcast the fieldwork live (with MCCD students at Quang Nam, Vietnam)***				
	Room 1 (Ibaraki University) *Sharing interlocal adaptation lessons*		*Room 2 (VIE)* *Climate Finance*		*Room 3 (Ibaraki U and VIE)* *Asian young researchers network*		
	Chair: Assoc Prof Tamura (8)		***Chair: Prof Nguyen Chien Thang (5)***		***Chair: Dr Ishikawa (15)*** ***Co-chair: Dong Bich Ngoc***		
Time (Vietnam) ***12:00-15:30***	***Time (Japan)*** 14:00-16:10 (15 min per person) (10 min presentation and 5 min for Q&A)	1 YASUHARA Kazuya (Ibaraki U) 2 VONGTANABOON Sukanya (Phuket Rajabhat U, Thai) 3 KITA Kazuyuki (Ibaraki U) 4 CHEN Bixia (U Ryukyus, Japan) & SAKAGAMI Nobuo (Ibaraki U) 5 BALDERAMA Fernando Orlando (Isabela State U, Philippine) 6 FURUYA Jun (JIRCAS, Japan) 7 OKTARINA Desta Sachnaz (Indonesian Oil Palm Research Institute, Indonesia) 8 NGUYEN Van Quang (VJU, Vietnam)	***Time (Vietnam)*** 12:00-15:30 (30 min per person (20 presentation and 10 for Q&A)	1 PHAM Quy Nhan (HUNRE) 2 TRAN Ngat Thi Thanh (MONRE) 3 TRAN Thi Thanh Tu (UEB) 4 NGUYEN Phuong Bac (Bac Ninh ISDS) 5 VU Quoc Huy (VIE)	***Time (Japan)*** 14:00-16:45 165 min (**7** min per person + 15 min break)	1 DAO Thi Thu Hang (IAE) 2 JANNAT Arifa et al. (U Tsukuba) 3 DO Duy Tung (VJU) 4 Mai Ei (Myanmar) 5 DO Thi Nhinh (VJU) 6 SUZUKI Yuhei (Ibaraki U) 7 TRAN Huyen Chi (VJU) 8 BUI Thi Hoa (VJU) 9 VU Kim Duyen (VJU) 10 VU Thuan Yen (VJU) 11 NGUYEN Thi Hong Duong (VJU) 12 DUONG Huong Giang (VJU M2) 13 NGUYEN Thi Thuy Dung et al. (VJU M2) 14 BUI Thi Lan et al. (VJU M2) 15 NGUYEN Thi Hoa et al. (VJU M2)

	16:10-16:30	Break			16:45-17:00	Break
	16:30-17:30	Discussion: Sharing interlocal adaptation lessons			17:00-17:30	Discussion & wrap up
15:30-16:00	***17:30-18:00***		***Overall discussion & Wrap up (from each session) (Assoc Prof Tamura)***			
16:00-16:10	***18:00-18:10***		***Closing remarks (Prof Ito)***			
16:10-17:00	***18:10-19:00***		***Online social gathering (Option)***			

Morning session, 10:00-12:05 (Japan Time), 8:00-10:05 (Vietnam Time)

https://zoom.us/j/95367012140?pwd=dVZ3aFd6ZHhjcmN2cEhXcmRJZ0I5dz09
Meeting ID: 953 6701 2140
Passcode: 212813

Symposium

Welcome session

10:00-10:30 (Japan Time), 8:00-8:30 (Vietnam Time)

10:00-10:05 (Japan Time), 8:00-8:05 (Vietnam Time)

M1-1. Opening declaration and introducing delegates

ITO Tetsuji
Ibaraki University

10:05-10:10 (Japan Time), 8:05-8:10 (Vietnam Time)

M1-2. Welcome speech from VIE, VASS

NGUYEN Chien Thang
Vietnam Institute of Economics, Vietnam Academy of Social Sciences

10:10-10:15 (Japan Time), 8:15-8:20 (Vietnam Time)

M1-4. Introduction of GLEC

HASUI Seiichiro
Ibaraki University

Keynote speech

10:15-12:00 (Japan Time), 8:15-10:00 (Vietnam Time)

10:15-10:45 (Japan Time), 8:15-8:45 (Vietnam Time)

M2-1. Keynote speech from Philippine

Participatory Climate Change Adaptation Using Watershed Management Approach: Processes and Emerging Lessons

PULHIN Juan Magboo ＆ GARCIA Josephine Encisa
University of the Philippines Los Banos

10:45-11:15 (Japan Time), 8:45-9:15 (Vietnam Time)

M2-2. Keynote speech from Indonesia

Zoning Planning for Coastal and Small Islands Areas as a Strategy for Adaptation to Climate Change

BENGEN Dietriech G.
IPB University, Indonesia

11:15-11:45 (Japan Time), 9:15-9:45 (Vietnam Time)

M2-3. Keynote speech from Vietnam

NGUYEN Chien Thang
Vietnam Institute of Economics, Vietnam

Fieldwork live broadcast

11:45-12:00 (Japan Time), 9:45-10:00 (Vietnam Time)

Report on disaster mitigation and adaptation in the coastal zone in Hoi An, Vietnam

12:00-13:40 (Japan Time), 10:00-11:40 (Vietnam Time)

LUNCH BREAK

Room 1, 12:00-15:30 (Vietnam Time), 14:00-17:30 (Japan Time)

https://zoom.us/j/95367012140?pwd=dVZ3aFd6ZHhjcmN2cEhXcmRJZ0I5dz09
Meeting ID: 953 6701 2140
Passcode: 212813

Sharing interlocal adaptation lessons

Chair: Assoc Prof Tamura

12:00-12:15 (Vietnam Time), 14:00-14:15 (Japan Time),

S1-1. Increasing the Inter-local Resilience against Climate Change-Associated Geo-Disaster Risks

YASUHARA Kazuya
Ibaraki University, Japan

12:15-12:30 (Vietnam Time), 14:15-14:30 (Japan Time),

S1-2. Coastal Change Assessment in Sirinath National Park, Thalang District, Phuket Province

VONGTANABOON Sukanya[*], HANCHAROEN Wanida[*], HOMYA Suthathong[*], KURUKODT Jurairat[**]
[*]Phuket Rajabhat University, Thailand, [**]Maha Sarakham University, Thailand

12:30-12:45 (Vietnam Time), 14:30-14:45 (Japan Time),

S1-3. SLCP Observation at Hanoi to Study Contribution of Regional Sources

KITA Kazuyuki[*], DO Duy Tung[**], KOTERA Akihiko[**]
[*]Ibaraki University, Japan, [**]Vietnam Japan University, Vietnam

12:45-13:00 (Vietnam Time), 14:45-15:00 (Japan Time),

S1-4. Platform Building for Achieving Sustainable Development Goals in the Tropical and Subtropical Agriculture

CHEN Bixia[*] & SAKAGAMI Nobuo[*]
[*]University of the Ryukyus, Japan & [**]Ibaraki University, Japan

13:00-13:10 (Vietnam Time), 15:00-15:10 (Japan Time),

BREAK

13:10-13:25 (Vietnam Time), 15:10-15:25 (Japan Time),

S1-5. Practical Uses of Crop Simulation Model for Climate Adaptation and Resiliency of Corn Farmers in the Philippines

BALDERAMA Fernando Orlando
Isabela State University, The Philippines

13:25-13:40 (Vietnam Time), 15:25-15:40 (Japan Time),

S1-6. Effects of Introducing A Measure to Climate Change on Food Supply in Asian Countries: A World Food Model Analysis

FURUYA Jun
Japan International Research Center for Agricultural Sciences, Japan

13:40-13:55 (Vietnam Time), 15:40-15:55 (Japan Time),

S1-7. Stakeholder Perception and Empirical Evidence: Oil Palm Biomass Utilization as Climate-Smart Smallholder Practice

OKTARINA Desta Sachnaz, NURKHOIRY Ratnawati, AMALIA Rizki, NASUTION Zulfi Prima Sani
Indonesian Oil Palm Research Institute, Indonesia

13:55-14:10 (Vietnam Time), 15:55-16:10 (Japan Time),

S1-8. The Effect of Climate Change and Natural Disasters on Mangrove Forests in Xuan Thuy National Park: Proposed Adaptation Solutions for Mangrove Forests

NGUYEN Van Quang
Vietnam Japan University, Vietnam

14:10-14:30 (Vietnam Time), 16:10-16:30 (Japan Time)
BREAK

14:30-15:30 (Vietnam Time), 16:30-17:30 (Japan Time)
DISCUSSION: Sharing Interlocal Adaptation Lessons

Room 2, 12:00-15:30 (Vietnam Time), 14:00-17:30 (Japan Time)
https://zoom.us/j/4726142206?pwd=MjhieWJaM0xpb0t1TlhVcXZSU0RlZz09
Meeting ID: 472 614 2206
Passcode: 207461

Climate Finance

Chair: Prof NGUYEN Chien Thang

12:00-12:30 (Vietnam Time), 14:00-14:30 (Japan Time),

S2-1. Assessment of Saltwater Intrusion Vulnerability of Coastal Aquifers in Context of Climate Change in the Central Coastal Plains, Vietnam
PHAM Quy Nhan, Ta Thi Thoang, Tran Thanh Le
Hanoi University of Natural Resources and Environment (HUNRE), Vietnam

12:30-13:00 (Vietnam Time), 14:30-15:00 (Japan Time),

S2-2. Private Sector's Adaptation to Climate Change and CC Finance
TRAN Thanh Nga
Ministry of Natural Resources and Environment (MONRE), Vietnam

13:00-13:30 (Vietnam Time), 15:00-15:30 (Japan Time),
BREAK

13:30-13:55 (Vietnam Time), 15:30-15:55 (Japan Time),

S2-3. Green Banking Development in Vietnam
TRAN Thi Thanh Tu
University of Economics and Business

13:55-14:20 (Vietnam Time), 15:55-16:20 (Japan Time),

S2-4. Promoting Local Funds to Support Adaptation to Climate Change: Bac Ninh Experiences
NGUYEN Phuong Bac
Bac Ninh Institute of Social Development, Vietnam

14:20-14:45 (Vietnam Time), 16:20-16:45 (Japan Time)

S2-5. Enabling SME Access to Green Credit. A Policy Review and Perspectives
VU Quoc Huy
Vietnam Institute of Economics, Vietnam

14:45-15:00 (Vietnam Time), 16:45-17:00 (Japan Time)

BREAK

15:00-15:30 (Vietnam Time), 17:00-17:30 (Japan Time)
WRAP UP

Room 3, 14:00-17:30 (Japan Time), 12:00-15:30 (Vietnam Time)
https://zoom.us/j/4607928281?pwd=OHgycFBIUFBIc1l3eE9vcE1GTDZXQT09
Meeting ID: 460 792 8281
Passcode: 159559

Asian Young Researchers Network Session

Chair: Dr ISHIKAWA-ISHIWATA Yuki
Co-chair: Ms. NGOC Bich Dong

14:00-14:40 (Japan Time), 12:00-12:40 (Vietnam Time)

S3-1. Climate-smart Agriculture Opportunities for Mitigating Greenhouse Gas Emission from Paddy Rice in Quang Nam Province – Vietnam
DAO Thi Thu Hang
Vietnam Japan University, Vietnam

S3-2. Examining the Effects of Climate Variability on Potato Yield: An Evidence from Bangladesh
JANNAT Arifa[*], ISHIKAWA-ISHIWATA Yuki[**], FURUYA Jun[***]
[*]University of Tsukuba, Japan, [**]Ibaraki University, Japan, [***]Japan International Research Center for Agricultural Sciences, Japan

S3-3. Study on Short-lived Climate Pollutants in Hanoi
DO Duy Tung
Vietnam Japan University, Vietnam

S3-4. Climate Change Adaptation in Myanmar: Case Study in Wet Te Ku Group of Villages
MAI Ei Ngwe Zin
Vietnam Japan University, Vietnam

S3-5. Is Vietnam a Real Transition Country in Terms of Forest Cover? A Case Study in Nghe An Province
DO Thi Nhinh
Vietnam Japan University, Vietnam

14:40-15:00 (Japan Time), 12:40-13:00 (Vietnam Time)

BREAK

15:00-15:40 (Japan Time), 13:00-13:40 (Vietnam Time)

S3-6. Development of Bio-aerosol Sampler Onboard UAV (Drone)
SUZUKI Yuhei, KITA Kazuyuki
Ibaraki University, Japan

S3-7. Effects of Vegetation on the Urban Thermal Environment: A Case Study in Hanoi
TRAN Huyen Chi

Vietnam Japan University, Vietnam

S3-8. Climate Security in Vietnam from Policy's Perspective
BUI Thi Hoa
Vietnam Japan University, Vietnam

S3-9. Students' Perception on Climate Change Mitigation
VU Kim Duyen.
Vietnam Japan University, Vietnam

S3-10. A Perspective of Heatwave in Vietnam for Decades (1980-2018)
VU Thuan Yen
Vietnam Japan University, Vietnam

15:40-16:00 (Japan Time), 13:40-14:00 (Vietnam Time)

BREAK

16:00-16:50 (Japan Time), 14:00-14:50 (Vietnam Time)

S3-11. Innovative Approach in Developing a Disaster Preparedness Plan for Primary Schools in Da Nang City in the Context of Climate Change
NGUYEN Thi Hong Duong
Vietnam Japan University, Vietnam

S3-12. Indicators for Comprehensive School Safety in Response to Climate Change for Lower Secondary Schools in Coastal Areas, Vietnam
DUONG Huong Giang
Vietnam Japan University, Vietnam

S3-13. Whether Climate Change is Really Affecting on Land Use Land Change in Xuan Thuy National Park?
NGUYEN Thi Thuy Dung, VU Thi Hai Ha, NGUYEN Van Duong*, THAMMAVOGSA Piya, KOTERA Akihiko
Vietnam Japan University, Vietnam *Corresponding author

S3-14. Awareness of Local People on Cost-benefit of Mangrove Forest Conservation in Climate Change Adaptation in Xuan Thuy National Park, Nam Dinh Province
BUI Thi Lan[*], LE Thi Ngoc Diep[*], NGUYEN Duc Tam[*], NGUYEN Thanh Hai[*], OKEH Bernard[*], ISHIKAWA-ISHIWATA Yuki[**], HOANG Thi Thu Duyen[*]
[*]Vietnam Japan University, Vietnam, [**]Ibaraki University, Japan

S3-15. Climate Change and Disaster Management for Sustainable Livelihood in Xuan Thuy National Park
NGUYEN Thi Hoa[*], NGUYEN Ha My[*], DUONG Huong Giang[*], NAW Khu Khu Sann [*], PHAN Thi Lan Anh[*], ITO Tetsuji[**], NGUYEN Van Quang[*]
[*]Vietnam Japan University, Vietnam, [**]Ibaraki University, Japan

16:50-17:00 (Japan Time), 14:50-15:00 (Vietnam Time)
BREAK

17:00-17:30 (Japan Time), 15:00-15:30 (Vietnam Time)
WRAP UP

Thank you for participating in the international seminar of the Southeast Asia Research-based Network on Climate Change Adaptation Science. On behalf of the organizers, I would like to say a few words.

This international seminar was scheduled to be held at Ibaraki University, Japan, in 2020—the year of the Tokyo Olympics. We were planning to host several researchers in Japan and conduct insightful face-to-face discussions.

I don't think anyone foresaw this a year ago. I never imagined that the spread of COVID-19 would have such a profound impact on our world. Some have pointed out that the grave effects of climate change on ecosystems may have given rise to these unknown viruses.

The truth of the matter must be scientifically verified, but the term "climate change" is insufficient to describe contemporary global conditions. Instead, the term "climate crisis" offers a more comprehensive description. This crisis not only alters the natural environment, but also affects the social environment and deeply impacts our culture and customs.

What should we do? More importantly, what can we do? A single individual does not bear significant power, but there is still something that can be done. We are researchers. We have the wisdom to make connections across countries and disciplines. Even if each person possesses marginal power, I believe that through consolidating our connections and becoming a network, we can facilitate visible change.

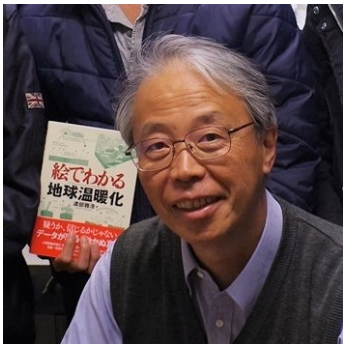
In recent years, when the world has had to come together to tackle such global issues, the emergence of ultra-nationalism has fostered the notion that global warming is a hoax, which is a narrative that was designed to divide people. We should not give credence to this idea, but combat it instead in solidarity with each other.

I have planted a peach tree in my home's garden. It also served as a memorial to the birth of my second child. However, someone cut the tree and it was rendered incapable of reproducing, which was quite saddening. However, this event inspired me to become a "tree planter," not a "tree cuter." Let's plant the trees of hope together.

We are all citizens of this planet. Let's act responsibly, share our wisdom, and cooperate to safeguard the future of the generations to come. GLEC, the Global and Local Environment Co-creation Institute of Ibaraki University also wants to do such work to "create a healthy environment together."

May our little action eventually become a big wave. Let's use today's discussions as the foundation upon which we build together.

Thank you for your attention.



Prof. Dr. ITO Tetsuji
Ibaraki University, Japan

Background

- Impacts of climate change are serious and diverse in southeast Asia.
- However, lack of perception and inadequate countermeasures.
- Science-based adaptation such as impact assessment and projections has not been fully utilized.
- Indigenous knowledge should be developed interlocally.
- GLEC has been collaborating with Vietnam, Thailand, Indonesia and Philippines.
- Vietnam Japan University started MCCD program from Sep. 2018. Hanoi can be the hub among southeastern countries.

Southeast Asia research-based network on climate change adaptation science

- Headquarter
- Impact of CC and adaptation
- Exchange information

China

IMU for natinalities

Leadership

GLEC, Ibaraki Univ.

Vietnam

VJU

Hanoi

Hue

HCMC

Phuket

PKRU

Thailand

Exchange of researchers

Hub for interlocal dialogues
（2018-19 @Hanoi, 2020 @online, 2021@ibaraki）

- Scientific accumulation and sharing of climate change.
- Students involvement
=> Co-evolution of research and education.
- Fostering young researchers

Philippines

U.P.

Joint research & Joint seminars

Field survey, Data sharing

IPB

Bogor

Bali

Indonesia

Expected outcome

1. Development of innovative adaptation science based on localities of southeast Asia
   Tans-disciplinary and interlocal approaches
2. Suggestion of practical adaptation which can distribute each countries and regions
   e.g., Costal management, Disaster risk management based on their socio-cultural backgrounds
3. Capacity development of young researchers and research network.

Building a more unique research center for climate change adaptation

Distinguished Participants,
Ladies and Gentlemen,

On behalf of Vietnam Institute of Economics, let me warmly welcome you all here today for the Opening Ceremony of International Conference "Sharing interlocal adaptation lessons: Climate Change Adaptations and Development in East and Southeast Asia."

The world we are living in is facing more than ever-increasing disasters and changes, including climate change, Covid-19, and economic crisis ahead. Climate change happens even more quickly than we can imagine with a terrifying scale of destruction and devastation. Damages caused by climate change can destroy all fruits of development that humankind has achieved for centuries. The human need to stand together and learning and sharing is vital for us to address our common thread.

On the other hand, promoting local adaptation to climate change is strongly recognized through national strategies on climate change response and disaster preparedness and prevention. Of which, learning and sharing are highlighted as a practical and resource-saving approach to climate change adaption and disaster risk reduction.

Accordingly, the purpose of the workshop is to exchange and share scientific results, research experiences and academic expertise with domestic and foreign scientists in the field of climate change adaption and disaster response.

The conference focuses on two main themes, including (1) local climate change adaptation, which shall include case studies, tools, resources, and services in the field of vulnerability assessment, planning, implementing, monitoring and evaluation activities to support local communities' climate adaption initiatives; and (2) green finance toward green growth and climate change adaptation, which shall include the latest legal framework development for green finance in Vietnam, the climate risk assessment and disclosure for corporations and their impact on credit analysis, local experiences in implementing green transformation of the economics, private initiatives for green financing solutions, significant challenges for SMEs in mobilizing financial resources for green transformation.

The workshop will be organized with the participation of more than 30 leading experts in the field of natural resources and climate change from prestigious universities in the world such as Ibaraki University (Japan), Yonsei University (South Korea), Philippines University, Phuket Rajabhat University of Thailand, Bogor Agricultural University of Indonesia, and other organizations and sponsors.

Ladies and Gentlemen,

I do hope that the conference will provide an excellent international forum for managers, scientists, researchers, lecturers and students to share their research findings with global experts and to discuss and provide new advanced and innovative ideas for local climate change adaptation towards sustainable development.

On this occasion, I would like to express our most sincere thankfulness to various partners, especially the Global and Local Environment Co-creation Institute (GLEC), Ibaraki University, Japan through the project of "Southeast Asia Research Base Network on Climate Change Adaptation Science."

Thank you all, and I wish you a very successful conference today!

Assoc Prof Nguyen Chien Thang
Vietnam Institute of Economics, Vietnam Academy of Social Sciences

Participatory Climate Change Adaptation Using Watershed Management Approach: Processes and Lessons from the Philippines

Juan M. Pulhin and Josephine E. Garcia

University of the Philippines Los Baños, Philippines

ABSTRACT

Climate change adaptation needs to be integrated into spatial and community planning to empower communities and local government units (LGUs) to respond to the risks of climate change. While the formulation of adaptation strategies may appear a straightforward task, the crafting of strategies that actually works, with acceptance of and active support from stakeholders, and considers the well-being of communities and ecosystems across a watershed presents a huge challenge for operationalization and implementation. This paper addresses this critical gap on participatory planning and climate change adaptations using watershed management approach by looking into adaptation as a process. It identified and documented effective institutional, participatory and collaborative processes for designing community-based adaptation in the context of watershed management at the provincial and municipal levels in La Union and Davao del Norte provinces in the Philippines. The methodology involved rigorous ecosystem assessments, stakeholder engagement, cross-sectoral collaborations, and even in-depth interviews with important actors in adaptation planning, in conjunction with careful capturing of lessons learned and best practices.

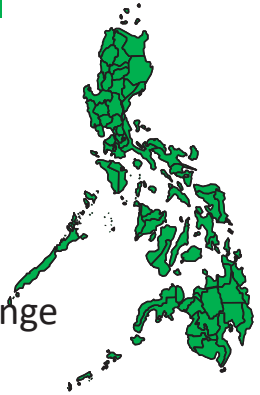
Watershed management and climate change adaptation both entail collective action. This requires commitment of different stakeholders, a deep understanding of the opportunities, risks and tradeoffs involved, and effective leadership to champion the cause. The results highlighted that bottom-up and top-bottom interactions need to be strengthened for the development of integrated adaptation strategies across different scales of a watershed. Overall, community-based adaptation in the context of watershed management cannot operate on its own. It needs to be linked with the higher scales of governance at the municipality and provincial levels (or even the regional and national levels) for effective mobilization and implementation towards achieving the goal of resilient communities and ecosystems.

Participatory Climate Change Adaptation Using Watershed Approach: Processes and Lessons from the Philippines

J.M. Pulhin, M.A.T. Villamayor, J.E. Garcia, C.C. De Luna, R. V. O. Cruz, F.B. Pulhin, M.A.M. Ramirez
University of the Philippines Los Banos

International Seminar for Climate Change Adaptation Program
Remote Conference System, 17 November 2020

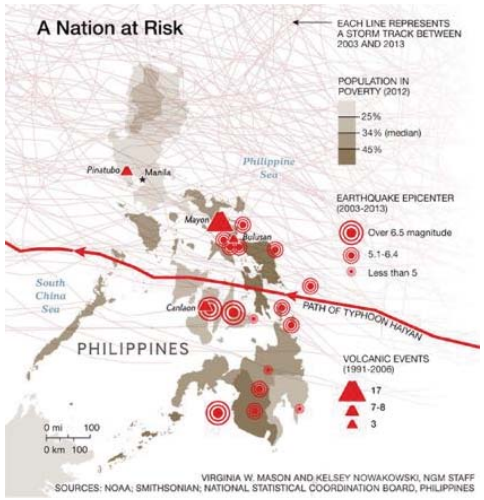
Overview of Presentation

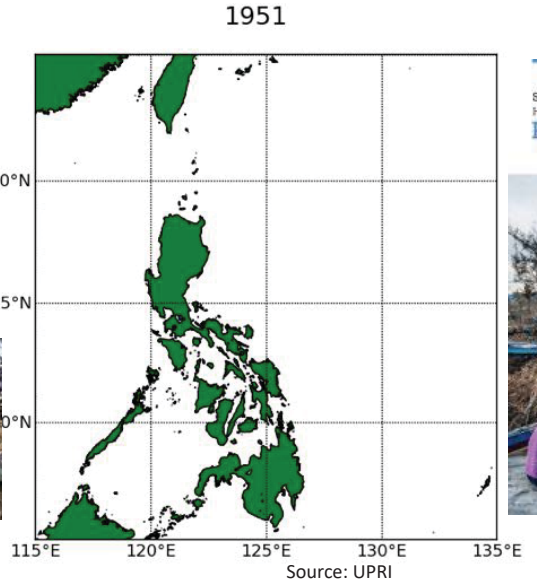


- The Philippine Context
- Planning for Resilience: An Integrated Approach
- Adaptation as a Process
- Demystifying Participation
- A Protocol for Participatory Climate Change Adaptation Using Watershed Approach
- Lessons Learned

The Philippine Context

- Philippines - one of the most disaster prone countries in the world.
- Ranked first in the 2015 Global Climate Risk Index among > 190 countries that suffered most from weather-related loss events in 2013
- Ranked fifth among the most affected by climate disasters in 1994-2013, (with Honduras, Myanmar, Haiti and Nicaragua topping the list)

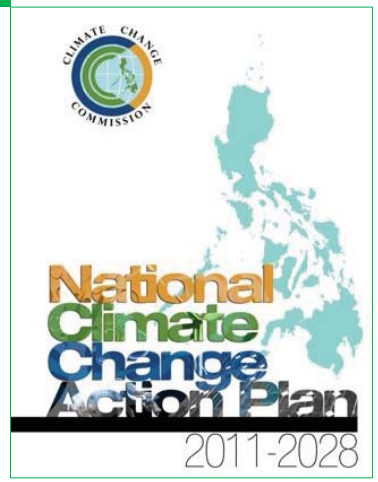




Source: UPRI

The Philippine Context

- **Philippine's NCCAP Goal**: Building the **adaptive capacity of local communities** and **increasing the resilience of ecosystems** to climate change to promote climate risk-resilience
- Requires anticipating the conditions of a socio-ecological system considering climate change, and maintaining its integrity through **adaptation**

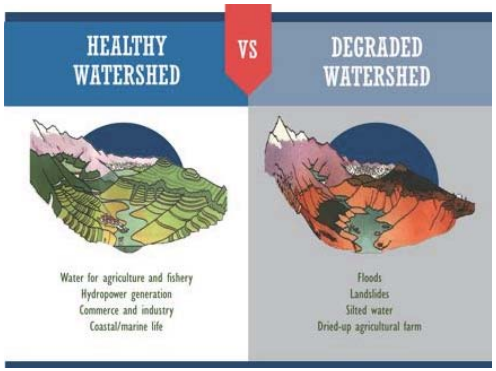


Planning for Resilience: An Integrated Approach

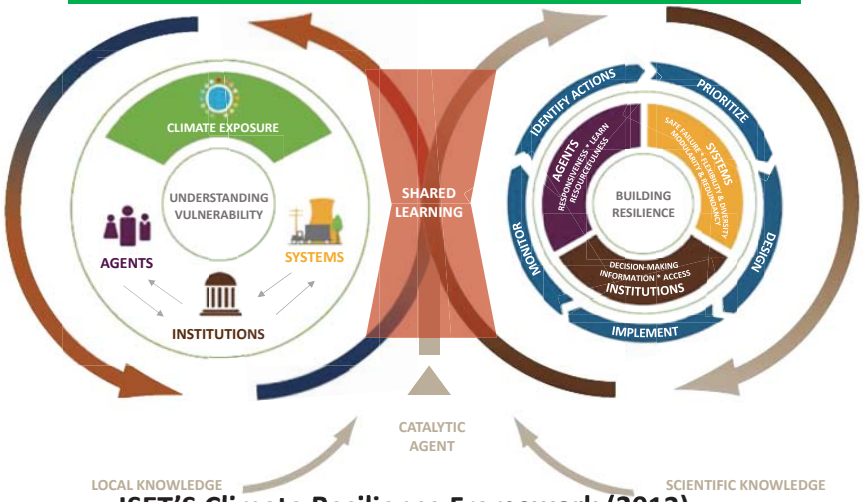
- CC is a complex problem and the goal of resilience requires a **holistic perspective**
- Managing of risks associated with climate-related events benefit from an **integrated systems approach** (IPCC SREX 2012).
- Building resilience happens in the context of a **coupled socio-ecological system**, as represented by a **watershed**

Planning for Resilience: An Integrated Approach

- Watershed approach ensures **holistic way** to manage ecosystems using **watershed as a planning unit**
- Designing strategies on how **communities** can effectively adapt to the changing climate through **participatory watershed management** constitutes an important step towards building resilience



Planning Resilience: An Integrated Approach

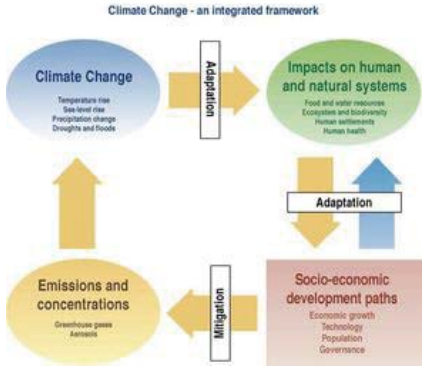


ISET'S Climate Resilience Framework (2013)

Adaptation as a Process

Adaptation:

- Human systems - the **process of adjustment** to **actual or expected climate stimuli** and its **effects** in order to **moderate harm or exploit beneficial benefits.**
- Natural systems, the process of adjustment to actual climate and its effects; **human intervention** may **facilitate adjustment** to expected climate.
- Implemented at **various scales and levels** - **implementation** differs depending on the **context**, such as **resources**, **values** and **needs**.

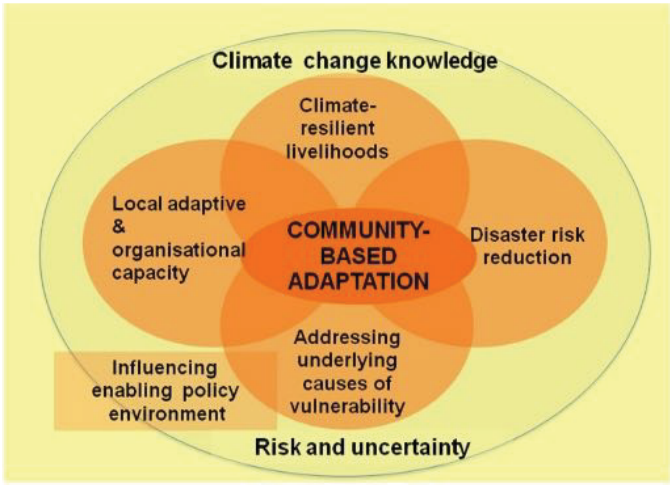


https://www.mrgscience.com/uploads/2/0/7/9/20796234/published/integrert.jpg?1556545581

Adaptation as a Process

Adaptation:

- Need for robust assessments in adaptation
- All responses to climate change rely on information about risk and vulnerability.
- Communities at the forefront of adaptation



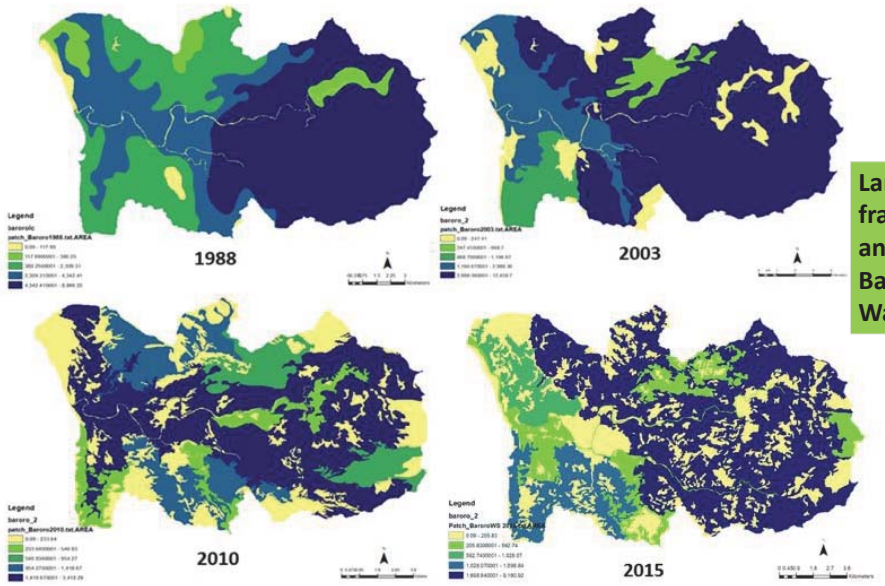
CARE's CBA Framework

https://www.weadapt.org/sites/weadapt.org/files/u9466/cba_framework1.jpg

Protocol on Participatory Climate Change Using Watershed Approach

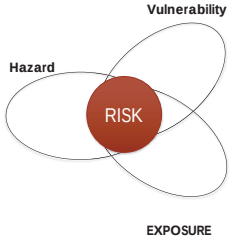
Step1: Biophysical and socioeconomic assessment

- Consultation and coordination meetings
- Watershed characterization
  - Focus group discussions
  - Key informant interviews
  - Socioeconomic surveys and profiling
  - Collection of water samples
  - Institutional survey
- Analysis of data/information
  - GIS, socio and cultural analysis
  - Carbon stocks assessment
- Vulnerability and risk assessment



Land use and fragmentation analysis of Baroro Watershed

Risk Assessment of Households



HAZARD

- ✓ ***Typhoon-*** *surface run-off, overland flow, overflow of river systems, damaged houses/infrastructures/ establishments/road networks, pollution (land & water)*
- ✓ ***Flood-*** *increase of vector, air, and water-borne diseases, casualties/injuries, destroyed properties, public lands/areas submerged in floodwater*
- ✓ ***Drought-*** *pest outbreak, destroyed crops/plantations, scarce water supply/irrigation*
- ✓ ***Landside-*** *destroyed/buried properties and houses, blocked road networks*

VULNERABILITY

- ✓ *Limited sources of alternative livelihood*
- ✓ *Limited social networks/ connections/ resources*
- ✓ *Old age; gender; Limited educational (mostly HS level)*
- ✓ *Low income per capita*
- ✓ *House material & number of floors*
- ✓ *Dependent on natural resources for livelihood (land & water)*
- ✓ *Agricultural practices (monocropping)*
- ✓ *Forest degradation; siltation*
- ✓ *Lack of infrastructures (drainage system, canals, ripraps, etc)*

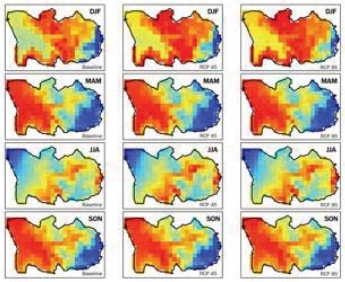
EXPOSURE

- ✓ ***Watershed gradient-***
- ➢ *upstream (landslide and drought)*
- ➢ *midstream (typhoon and flood)*
- ➢ *downstream (typhoon and flood)*

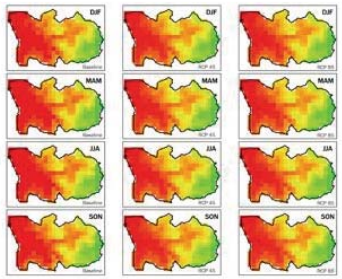
Step 2: Participatory risk and institutional capacity assessment

- Participatory Scenario Development Workshop
  - Overview of the Project
  - Overview of the Watershed
  - Presentation of the Preliminary Results of the Project
    - Global Circulation Models (GCMs)
    - Soil and Water Assessment Tool (SWAT)
    - Climate Change Scenarios

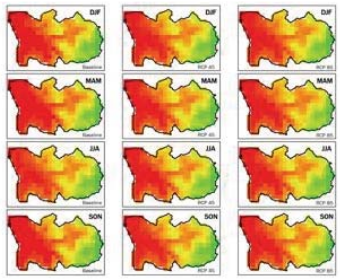
Climate Scenarios in Baroro Watershed Using HadGEM2-ES model



Rainfall scenario 2050



Minimum Temperature Scenario 2050



Maximum Temperature Scenario 2050

- Limited manpower (One-person office, JO & casual employees)
- Limited budget (Augmented by BUB & funds raised by the Mayor)
- Limited equipment (vehicles, computers)
- Sufficient trainings

Access Rights & Entitlements

Information Flows

- Regular meeting to identify priority needs
- Access to information an issue, especially the inter-operability of different offices

INSTITUTIONS

Baroro Watershed

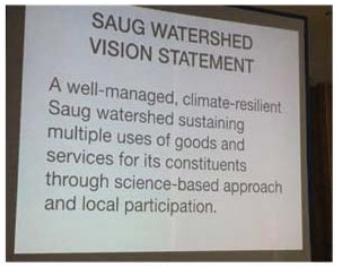
Application of New Knowledge

- Limited knowledge on watershed approach
- Watershed approach to planning and management yet to be operationalized

Decision-Making Processes

- Involves planning, taking into consideration needs of constituents
- Budget depends on agreed plans and programs
- Mayor/council decides, with recommendation from municipal/city officers
- Decision-making sometimes delegated by the Mayor

Step 3: Visioning



We envision Baroro Watershed to be sustainable and climate-resilient source of water, sufficient livelihood and an ecotourism destination in La Union

Step 4: Strategy building

- Actual strategies formulated by different stakeholders to respond to the issues and problems in the assessment, considering climate change, as well as to achieve the vision for the watershed
  - Communicating assessment results to stakeholders and key decision-makers
  - Mobilizing stakeholders for broader support
  - Linking local communities to higher levels of governance
  - Continuing capacity development of local communities
  - Resource generation for sustainability

Step 5: Action planning

- To develop a detailed community-based adaptation plan for the target barangays/s in the watershed (upper, midstream, downstream)
- To seek commitment from the Local Government Units for the effective and efficient implementation of the proposed adaptation plan in collaboration with the different stakeholders
- Local communities identified specific actions that will help reverse the current state of the watershed into a previous productive state

Ceremonial signing of Memorandum of Agreement among the three Municipal Mayors, Vice mayor , Provincial Office of La Union and University of the Philippines Los Baños,. From left to right: Dr. Juan M. Pulhin, SP Francisco C. Ortega, Mayor Herminigildo M. Velasco of San Gabriel, Mayor Arturo P. Valdriz of San Juan, Mayor Francisco Angelito L. Fontanilla of Bacnotan , Ms. Mary Jane C. Ortega and Bacnotan Vice Mayor Minda Fontanilla.

Baroro Watershed

Institutionalization of pilot communities and plans for scaling up through signing of MOA/MOU with the LGUs

Saug Watershed

Davao del Norte Gov. Anthony del Rosario (middle) signs the memorandum of understanding (MOU) Community-based Climate Change Adaptation for Saug Watershed MOU on Nov. 13 at the Provincial Cooperative Union (PCU) in Tagum City.

Step 6: Implementation (piloting and scaling up)

- Harmonizing community-based participatory actions
  - Identification of different actors to be involved in the project, including enablers and influencers
  - Knowledge enhancement which should lead to realization and acceptance of the problem
  - Integration of livelihood
  - "Branding" to facilitate recognition or ownership of the project

Step 7: Monitoring and Evaluation

- Select a facilitator
- Select M &E team in partnership with the community
- Develop indicators
- Measure baselines
- Finalize the monitoring and evaluation plan, budget and resource allocation

Some Knowledge Products

resources

MDPI

Article

Landscape Fragmentation, Ecosystem Services and Local Knowledge in the Baroro River Watershed, Northern Philippines

Mark Anthony M. Ramirez [1,*], Juan M. Pulhin [2], Josephine E. Garcia [2], Maricel A. Tapia [2], Florencia B. Pulhin [2], Rex Victor O. Cruz [2], Catherine C. De Luna [3] and Makoto Inoue [4]

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Received: 30 June 2019; Accepted: 27 September 2019; Published: 1 October 2019

Policy Brief

Fragmentation, Ecosystem Services and Climate Change: The Case of Baroro Watershed, La Union, Philippines

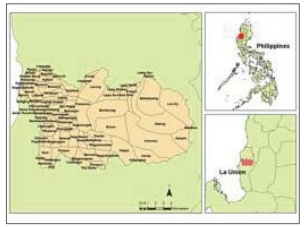
A Policy Brief

Authors: Juan M. Pulhin, Maricel A. Tapia, Josephine E. Garcia, Mark Anthony M. Ramirez
Catherine C. De Luna, Florencia B. Pulhin and Rex Victor O. Cruz

Introduction

"Fragmentation is our enemy and a recipe for disaster." – Peter Holmgren, Director General of Center for International Forestry Research (CIFOR)

Baroro River Watershed, locally know as Lon-oy, is located in the northeastern part of the province of La Union, encompassing the municipalities of San Gabriel, San Juan, Bagulin, Bacnotan and Santol, and the city of San Fernando. It has a total area of 19,486 hectares. The watershed is a main source of water for both irrigation and domestic purposes in all covered municipalities and city, except for Bagulin and Santol. Agriculture is the main source of livelihood in the watershed.



Location map of Baroro (or Lon-oy) Watershed

Oral and poster presentations in international and national conferences

YONSEI UNIVERSITY ICAS NAROSTED

Protocol on Participatory Climate Change Adaptation Using Watershed Approach in the Philippines

Dr. Juan M. Pulhin[1] and Dr. Josephine E. Garcia[2]
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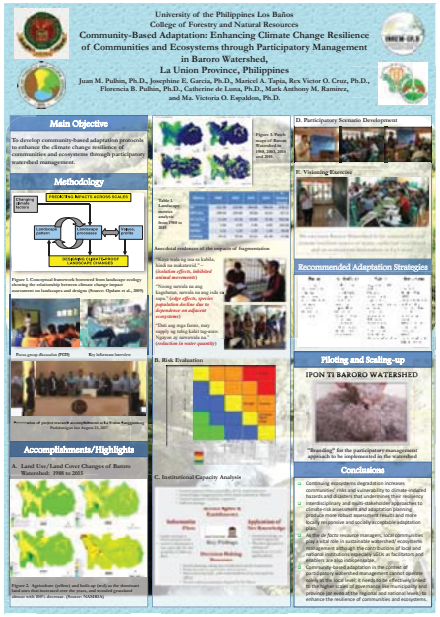


Lessons Learned

- Continuing ecosystems degradation increases communities' risks and vulnerability to climate-induced hazards and disasters that undermines their resiliency
- Recognizing the **different scales in adaptation** through the **watershed approach** (communities, municipal and provincial level) should take into account **each group's processes**—i.e., the **context of their adaptation** (values, resources, needs)
- Importance of **protocol** in **catalyzing collective action** among stakeholders to enhance climate change adaptation

Lessons Learned

- **Solutions-based analysis** that incorporates **local knowledge** will **empower** the community to be more mindful of, prepared and proactive in addressing the potential negative **impacts of climate change** on them, their **livelihood** and the environment.
- Recognizing the roles of **communities** in watershed management **creates a positive effect** to their status hence, **stimulates their creativity in crafting adaptation strategies** that works and brings rehabilitation results .

Lessons Learned

- **Local stakeholders** need **recognition** and **assistance** from **LGUs, national agencies and other organizations** to enable them to perform as **effective watershed stewards**.
- Local communities are willing to **participate in implementing adaptation strategies** that will **conserve the watersheds** as well as **their livelihood**.
- **CBA** in the context of **participatory watershed management** cannot operate solely at the local level; it needs to be **effectively linked to the higher scales of governance** to enhance the resilience of communities and ecosystems.

Zonation Planning of Indonesian Coastal and Small Islands Areas as Strategy for Climate Change Adaptation

BENGEN Geoffrey Dietriech

IPB University, Indonesia

ABSTRACT

Indonesia is the largest archipelagic country globally, with around 16,671 named islands spread over an area of 5.8 million km^2 of the sea (about 75% of Indonesia's territory) from Sabang in the West to Merauke in the East, is known as The world's most immense marine mega biodiversity. This fact is easy to understand because, with thousands of small islands that make up the archipelago, Indonesia has all productive tropical coastal and marine ecosystems ranging from mangrove and seagrasses ecosystems to coral reef ecosystems. Besides, around 60% of Indonesia's population lives in coastal areas and small islands.

Climate strongly links to coastal and marine ecosystems in many ways. Indonesia's coastal and small islands management considers the potential consequences of climate change recently. It is urgent to begin adaptation now concerning the development of coastal and small islands uses. One adaptation strategy to climate change impacts is to develop zonation planning of coastal and small island areas at the province and national levels.

Keywords: coastal zone, small islands, zonation, climate change, adaptation.

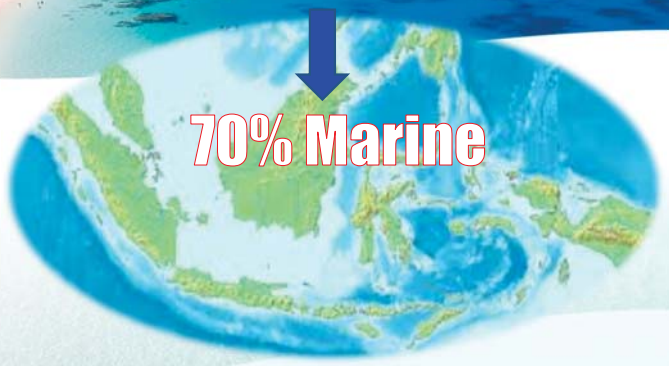
IPB University
Inspiring Innovation with Integrity

ZONING PLAN OF INDONESIAN COASTAL AREAS AND SMALL ISLANDS AS STRATEGY FOR CLIMATE CHANGE ADAPTATION

Prof. Dr. Dietriech Geoffrey Bengen,

INTERNATIONAL SEMINAR FOR CLIMATE CHANGE ADAPTATION PROGRAM
Southeast Asia Research-based Network on Climate Change Adaptation Science (SARNCCAR)
GLEC, VJU, MCCD, VIE, VASS
Online (Zoom), 17 November 2020

The Reality of Indonesia's Coastal Areas and Small Islands



70% Marine

- **The sea area (including Economic Exclusive Zone) is 5.8 million km²**
- **The coastline is approximately 95,181 km long**

The Reality of Indonesia's Coastal Areas and Small Islands

16,671 Named Islands

Big Island	Small island	Very Small Island
Area> 2000 km²	Area> 100km²-≤2000 km²	Area ≤ 100 km²
34 Islands (0,21%)	196 Islands (1,21%)	16.441 Islands (98,57%)

1,766 Populated Islands.

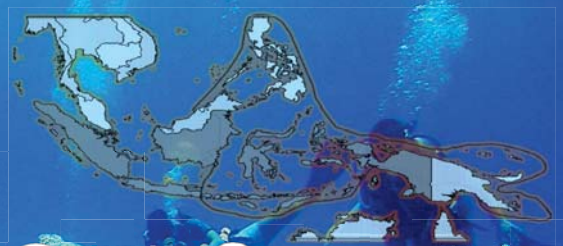
14,905 Uninhabited Islands.

Contribution of Coastal Areas and Small Islands of Indonesia

- **It has a very potential coastal ecosystem (coral reefs, seagrass and mangroves) which supports 90% of shallow marine fish resources**

Contribution of Coastal Areas and Small Islands of Indonesia

- The largest part of the World Coral Triangle:
- 18% of the world's coral reefs
- 23% of the world's mangroves
- 5% of the world's seagrass beds (mapped)



574 Scleractinian Coral Species

45 Mangrove Species

1500 Crustacean Species

2500 Teleostei Fish Species

12 Seagrass Species

2000 Mollusc Species

Veron et al. 2009; Spalding et al. 2010; Allen unpublished data

Contribution of Coastal Areas and Small Islands of Indonesia

Potential for marine tourism development:

- **Scuba Diving: diving tours with scuba equipment**
- **Snorkling (Skin Diving): diving tour with mask & snorkle equipment**
- **Water sports: banana boat, rowing, swimming, fishing ...**

Challenges for Indonesia's Coastal Areas and Small Islands

Overfishing: Illegal, Unreported and Unregulated (IUU) fishing continues to present challenges. Approximately 11-26 million tonnes of fish are lost due to IUU each year which is an average loss of 18% of global fisheries.

Pollution: More than 80% of marine pollution comes from activities on land (industrial, agricultural and residential waste). By 2050 it is predicted that there will be more waste (plastic) than fish in the sea.

Habitat Damage: Decreased biodiversity and SD fish stocks due to environmentally unfriendly fishing practices, and environmental damage due to land conversion and rapid coastal development.

Climate Change: Rapidly impacts already stressed species and ecosystems, resulting in the loss or degradation of 50% of estuaries, 35% of mangroves, 30% of coral reefs and 20% of seagrass.

Consequences of Climate Change for Coastal Areas and Small Islands

- **Warming temperature of air and sea;**
- **Acidification of world's oceans from CO_2 absorbed by the ocean;**
- **Precipitation change;**
- **Sea level rise;**
- **Change of seasonal storm, sea surge and surface water current.**

Impacts of Climate Change on Coastal Areas and Small Islands

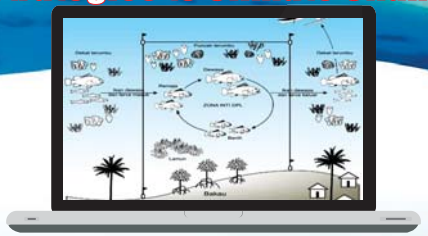
- Shoreline erosion;
- Increased flooding of low lying areas (i.e. coral small islands particularly flatted);
- Increased storm surge effect;
- Increased saline water intrusion into estuaries, embayment, rivers, low lying small island affected by increasing salinity of freshwater already limited;
- Large scale modification to coastal land forms (particularly river deltas);
- Ecological collapse of systems unable to tolerate increased marine environment disturbances, particularly vegetation.

The Importance of Ecosystem Adaptation to the Impact of Climate Change

- Coastal and small island ecosystems, such as mangroves, seagrass beds, coral reefs and estuaries, have an ecological function for humans in dealing with climate change.
- To maintain the ecological function of coastal and small island ecosystems in an optimal and sustainable manner, an adaptation strategy is needed to reduce the impact of climate change.
- Adaptation strategies will increase the ability of coastal and small islands ecosystems to cope with climate change.

Conservation Areas as Adaptation Strategies to Climate Change

One of the efforts to adapt to the impact of climate change on coastal and small island ecosystems is to establish Zoning-based Conservation Areas in Coastal Areas and Small Islands as mandated in the Law of the Republic of Indonesia No. 27 of 2007 Juncto Law No. 1 of 2014 concerning the Management of Coastal Areas and Small Islands.



Conservation Areas in Coastal Areas and Small Islands

CONSERVATION OF COASTAL AREAS AND SMALL ISLANDS: Efforts to protect, conserve and utilize coastal and small island ecosystems to ensure the existence, availability and sustainability of coastal resources and small islands while maintaining and increasing the quality of their value and diversity.

CONSERVATION AREAS IN COASTAL AREAS AND SMALL ISLANDS: parts of coastal areas and small islands that have certain characteristics as an integrated ecosystem that is protected, conserved and/or used sustainably to achieve sustainable management of coastal areas and small islands.

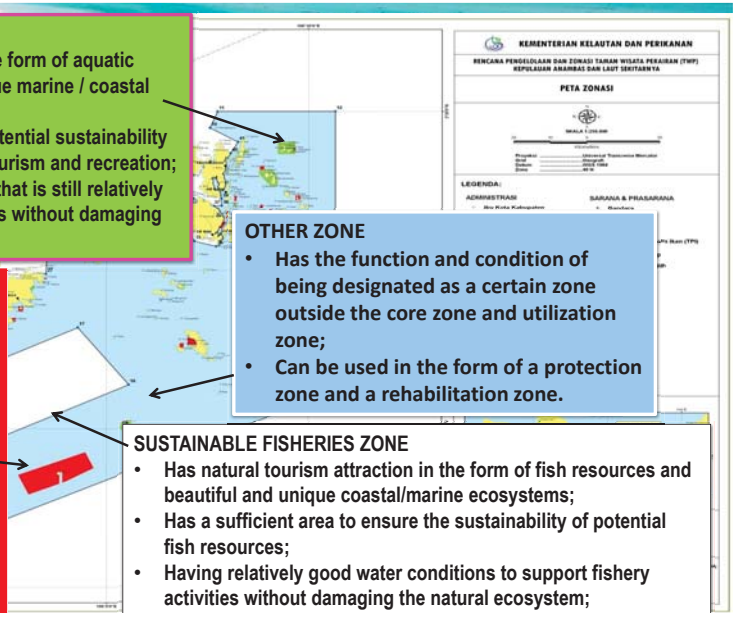
(Minister of Marine Affairs and Fisheries Regulation No. 17/2008)

Zoning of Conservation Areas in Coastal Areas and Small Islands

CATEGORY	Coastal and Small Islands Conservation Areas (KKP3K)	Maritime Conservation Area (KKM)	Marine Protected Areas (KKP)	Beach Buffer Zone
TYPE	1. Coastal sanctuary; 2. Small island sanctuary; 3. Coastal park; and 4. Small island park.	1. Maritime customary protection areas; 2. Maritime cultural protection area..	1. Marine National Park 2. Marine Natural Sanctuary 3. Marine Ecotourism Park 4. Fisheries Sanctuary	Regulated in Presidential Regulation No. 51/2016
ZONE	1. core zone; 2. limited use zone; and / or 3. other zones according to the designation of the area.	1. core zone; 2. sustainable fishing zone; 3. utilization zone; and / or 4. other zones according to the designation of the area.		

UTILIZATION ZONE
- Has natural tourism attraction in the form of aquatic biota along with beautiful and unique marine / coastal ecosystems;
- Has sufficient area to ensure the potential sustainability and attractiveness to be used for tourism and recreation;
- Has a marine ecosystem condition that is still relatively good for various utilization activities without damaging the natural ecosystem.

CORE ZONE
- Certain priority and unique / endemic, rare and / or charismatic habitat of certain aquatic biota;
- Spawning areas, nursery and / or fish habitats;
- Has a characteristic coastal/marine ecosystem that is relatively pristine / natural, and represents the existence of certain pristine biota;
- Has the characteristic of being a source of germplasm for Conservation Areas.



OTHER ZONE
- Has the function and condition of being designated as a certain zone outside the core zone and utilization zone;
- Can be used in the form of a protection zone and a rehabilitation zone.

SUSTAINABLE FISHERIES ZONE
- Has natural tourism attraction in the form of fish resources and beautiful and unique coastal/marine ecosystems;
- Has a sufficient area to ensure the sustainability of potential fish resources;
- Having relatively good water conditions to support fishery activities without damaging the natural ecosystem;

Zoning Objectives for Conservation Areas in Coastal Areas and Small Islands


Seek the species protection and coastal and small island ecosystems.


Restoring the function and integrity of coastal ecosystems and small island ecosystems.


Prevent the decline in marine biodiversity.


Prevent the decline in the quality of coastal and small island ecosystems.


Ensure sustainable use of fish resources.

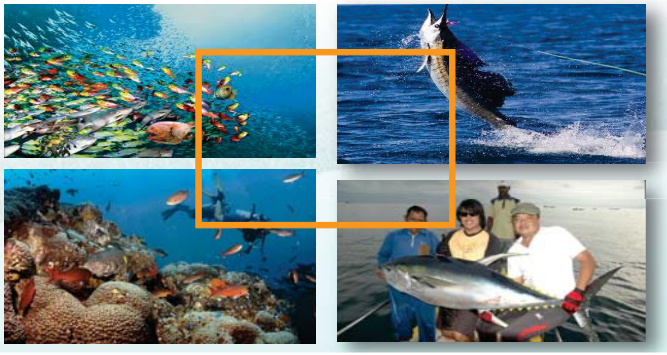
Lesson Learned on the Development of Conservation Areas in Coastal Areas and Small Islands based on Zoning

1) Improvement of the quality of coastal and small island resources and ecosystems (coral reefs and reef fish).
2) Changes in attitudes and behavior of local communities
   - Termination of the use of destructive fishing gear;
   - Make agreements with fishermen from other villages not to fish in the core and buffer zones of the Conservation Area;
   - Increased community involvement in the management of Conservation Areas.

3) Local policy development
   - Mobilizing the unity and cohesiveness of coastal communities;
   - Supervising community-based Conservation Areas;
   - Addressing problems in the management of Conservation Areas.
4) Increased commitment of related government institutions
   - Internalization of Protected Areas into the government's annual program;
   - Community empowerment program development;
   - Development of community based surveillance programs.

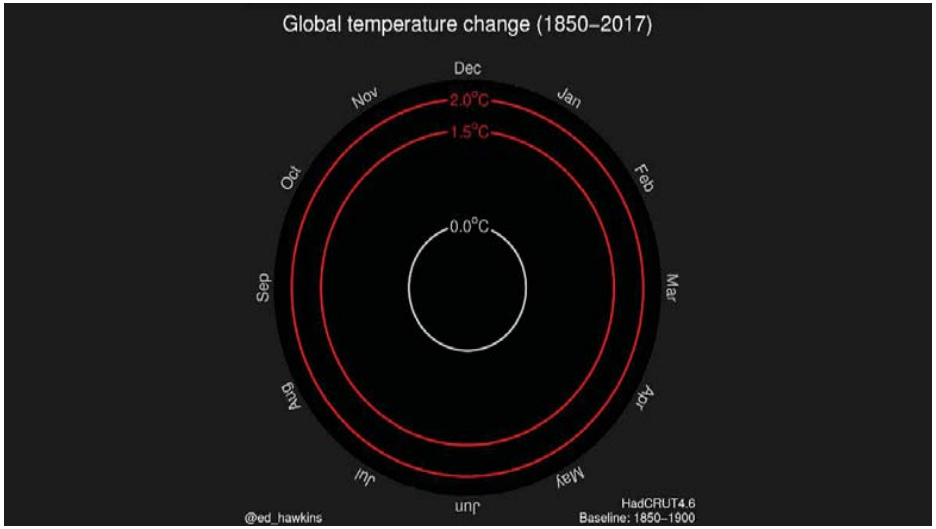
Benefits of Conservation Areas in Coastal Areas and Small Islands Based on Zoning

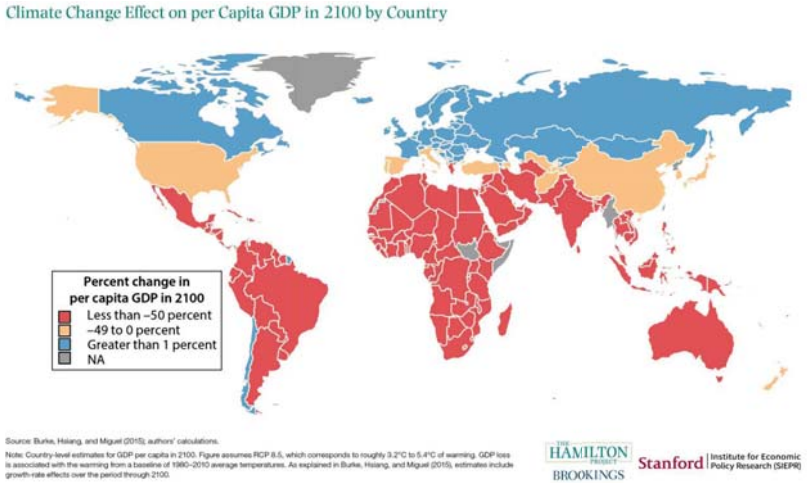
"Healthy coastal and small island ecosystems that can provide a variety of benefits sustainably facing the impacts of climate change at present and in the future"



Climate change response from economic perspective

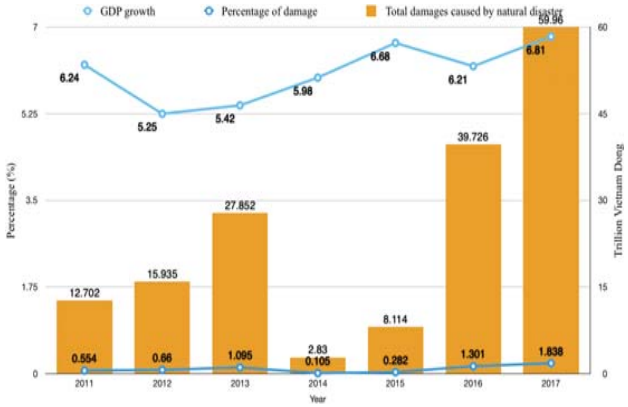
Assoc Prof Nguyen Chien Thang
Director of Competitiveness Studies





Damage caused by climate change and natural disasters in relation to economic develop

- In the period 1995 - 2017, damage caused by natural disasters in Vietnam was about 14 trillion VND/year with an increase in damage of 12.7%/year.
- It is estimated that Vietnam loses an average of 1-1.5% of GDP each year due to natural disasters and climate change *
- The level of economic losses has tended to increase in recent years

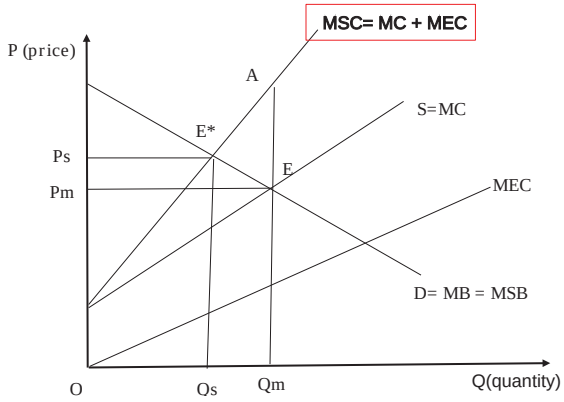


Economic growth and damage caused by climate change and natural disasters from 2011

(Nguồn: Nga N. and Huy N., 2018)
**SREX Việt Nam, 2015*

Climate change is a market failure due to externalitie

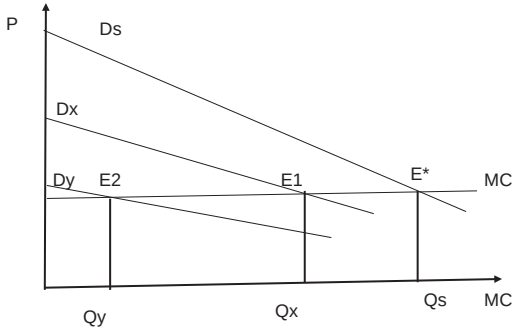
GHG production activities causing climate change



Human-induced climate change from greenhouse gas emissions in production activities makes it impossible for the market to efficiently allocate resources from a social standpoint

Climate change is a market failure due to externalitie

Climate change is a public goods



- **What is the socially efficient level of supply of goods to reduce greenhouse gas emissions?**
- **Can the market provide a socially efficient level of greenhouse gas emission reduction goods?**
- **If the market fails to deliver, what is the appropriate mechanism to address this problem?**

Climate change is one of the biggest global market f

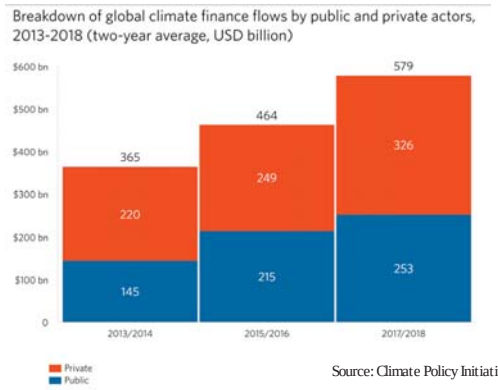
- The breadth, magnitude, and complex nature of the impacts of climate change as well as the costs and benefits of climate change response imply that **a number of ethical perspectives, which focus on welfare, equality and multiplication rights should be considered in economic analysis of climate change** .
- The breadth, magnitude, type, duration of the impacts of climate change and the costs and benefits of responding to climate change are uncertain, so **economic analysis of climate change should consider the risk factor. risk and uncertainty with a conservative approach.**
- The impacts of climate change are long term and increase over time. **The economic analytical framework for climate change needs to assess the benefits and costs of the mitigation and adaptation measures over time**
- Climate change can have large and significant impacts on the global economy if action is not taken to prevent climate change immediately. Therefore, **economic analysis of climate change needs to consider the possibility of large, non - marginal changes to the society, not just marginal changes.**

-> The differences in climate change compared to other types of market failures make economic analysis of climate change more challenging.

→Like any market failure, climate change can only be effectively addressed by government intervention through public policy.

Global climate-related investment - Climate finance

- Paris Climate Agreement, now signed by 195 and ratified by 187 countries around the world
- The rise reflects steady increases in financing across nearly all types of investors
- While climate finance has reached record levels, action still falls far short of what is needed under a 1.5 °C scenario
- Average annual public climate finance totaled USD253 billion in 2017/2018, representing 44% of total commitments.
- Private finance, which reached USD326 billion on average annually in 2017/2018, continues to account for the majority of climate finance, at around 56%



Source: Climate Policy Initiative 2019

Way forward: Response to climate change from economic perspective

- Mobilize finance to respond to climate change
- Technology transfer friendly to climate change
- Building capacity to respond to climate change
- ...

Increasing the Inter-Local Resilience against Climate Change-Associated Geo-Disaster Risks

YASUHARA Kazuya

Ibaraki University, Japan

ABSTRACT

One of the most important issues for increasing the local resilience against compound disasters in the context of climate change is that adaptation philosophy should be changed from the reactive to the proactive measure. As among compound disasters, the author picks up, as an example, the inundation of coastal regions undergoing combination of water level rise with land subsidence. The current paper explores the way how to make the inter-local adaptation successful at the low-lying areas from comparative study both in Vietnam and Japan, and emphasizes that monitoring system and predictive methodology of relative sea-level rise (SLR) considering land subsidence (LS) are essential as the proactive measure.

Increasing the Inter-local Resilience against Climate Change-Associated Geo-Disaster Risks

• Kazuya Yasuhara, Ph. D.

• Professor Emeritus, GLEC, Ibaraki University, Japan

• Representative of Local Resilience Research Institute (LRRI), Japan

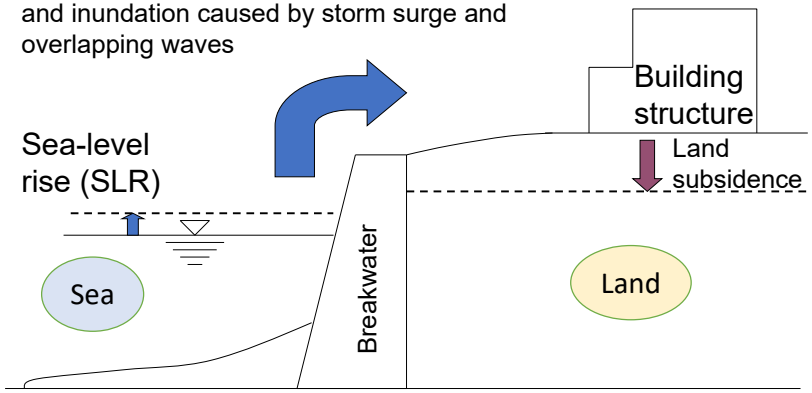
•

November 17, 2020

1. Compound Disaster Important

Sea-Level Rise Combined with Land Subsidence

Susceptible to undergo the impacts of flood and inundation caused by storm surge and overlapping waves

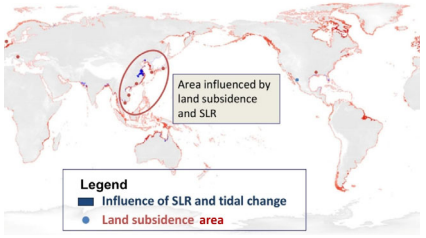


◆Many vulnerable areas

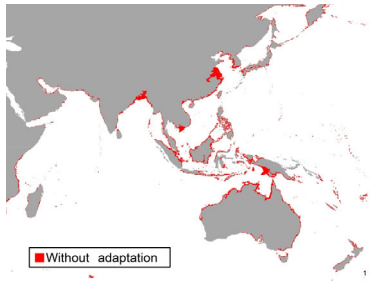
・Mega deltas, such as Mekong Delta

・Highly populated cities, such as Venice (Italy), and New Orleans (USA)

Inundation Caused by SLR Combined with Land Subsidence



Inundation areas combined SLR and tidal change with land subsidence (revised from Maruyama and Mimura, 2010).



Inundation predictions for 2100 for the SRES A1B scenario with coastal protection for 1/100 storm surges (dark areas are inundation areas) (Maruyama and Mimura, 2010; Mimura, 2013).

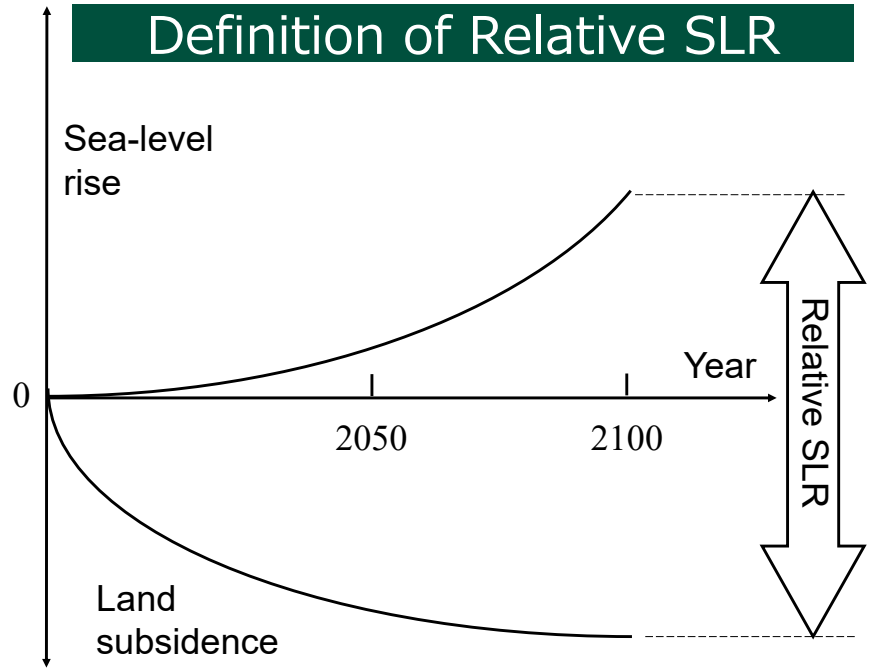
Effects of Sea-Level Rise Combined with Land Subsidence

Niigata in Japan
- Groundwater abstraction
- Natural gas exploitation

in Thailand
- Groundwater abstraction

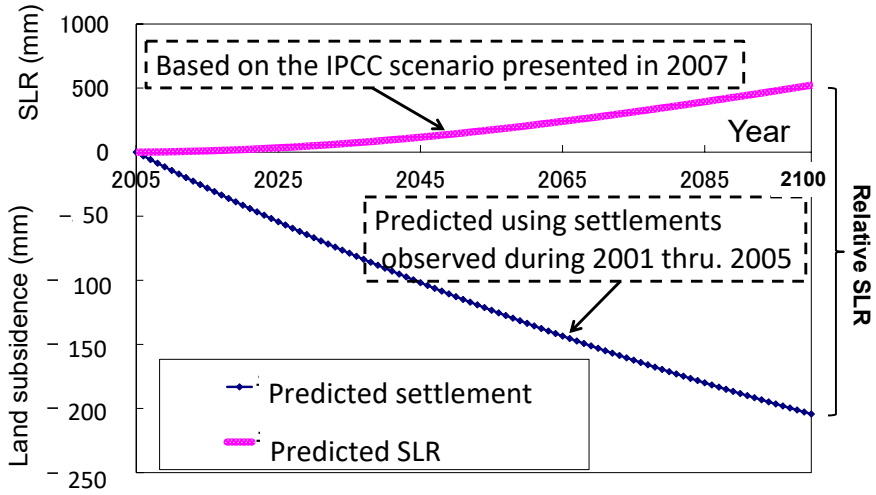
Mekong Delta in Vietnam
- Groundwater abstraction
- Sea level rise
- Dam construction
- Riverbed soil excavation

Definition of Relative SLR

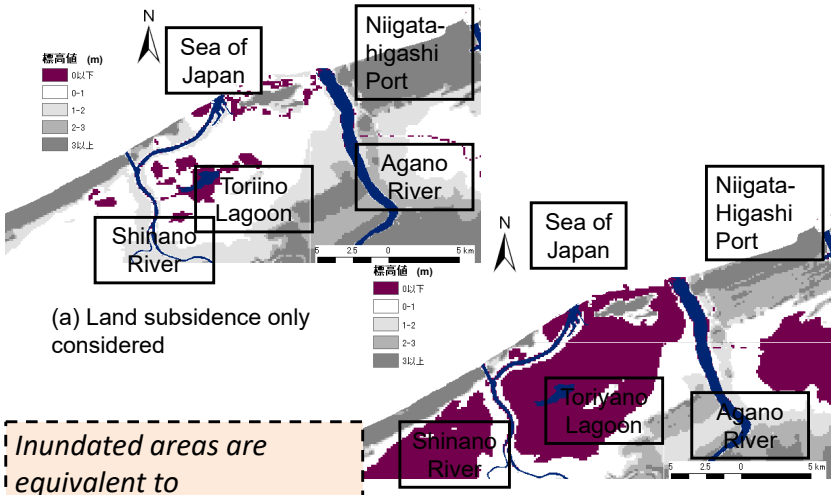


RESULTS - 1

Case of Echigo Plain in Niigata, Japan
(Takei, 2009)



Typical Variation of Relative SLR with Elapsed Time
(from Takei (2009))



Inundated areas are equivalent to 【Altitude – relative SLR】.

Distribution of Predicted Inundation Areas (2100)

RESULTS - 2

Case of Chao Phraya Delta in Thailand (Watanabe, 2008: Murakami and Yasuhara, 2009)

Change of Inundation Areas

(a) Effect of SLR with 59 cm

(b) Combined effect of SLR with expected land subsidence

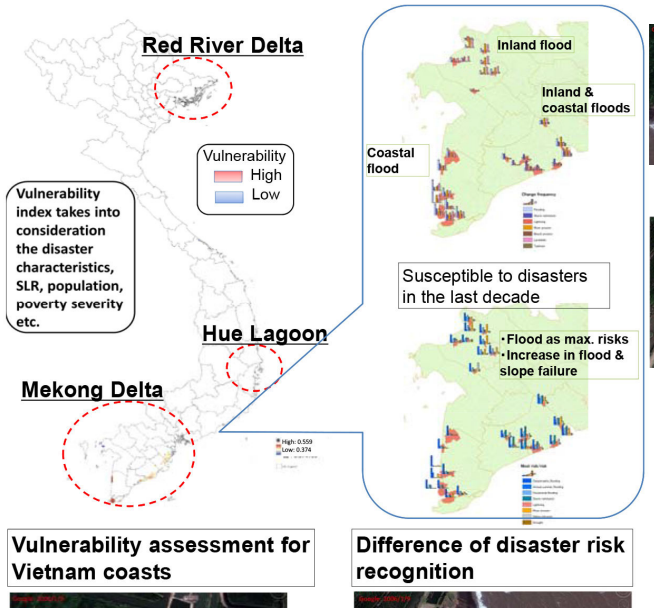
(c) Combined effect of SLR with land subsidence with standard deviation

	(a)	(b)	(c)
Areas of inundation (km^2)	634	779	1269

RESULTS - 3

Case of Mekong Delta, Vietnam

Vulnerability against Coastal Erosion

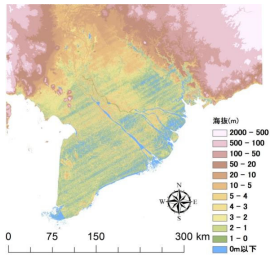


(a) Near the river mouth

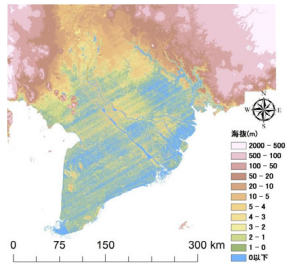
(b) Apart from the river mouth

Coastal lines were retarded approximately 240 m near and 140 m apart from the river mouth, respectively.

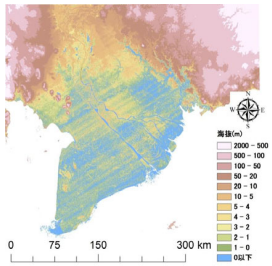
Predicted Inundation Maps in Mekong Delta of Vietnam (Murakami et al., 2011)



(a) Present situation (2007)



(b) Consideration of SLR



(c) Consideration of SLR and land subsidence

Lack of integration of information which has monitored at different locations under different organization for different projects.

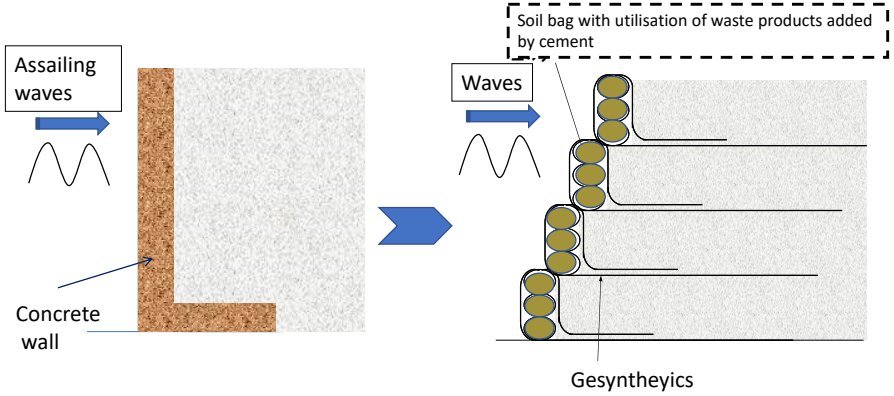
Objective Locations for the Case Studies

Objective location	Country	Cause of land subsidence	Counter- or adaptive measure
Echigo Plain (Niigata Prefecture)	Japan	・Groundwater abstraction, ・Natural gas exploitation	Regulation of abstraction and exploitation
Chao Phraya Delta	Thailand	・Groundwater abstraction	Regulation of abstraction
Mekong Delta	Vietnam	・Groundwater abstraction ・Sea level rise ・Dam construction ・Riverbed soil excavation	・Construction of concrete wall ・Maintenance of mangroves

2. An Example of Engineering Adaptation

From Rigid to Flexible Technical Adaptation

An example of remediation: From rigid to flexible coastal structures

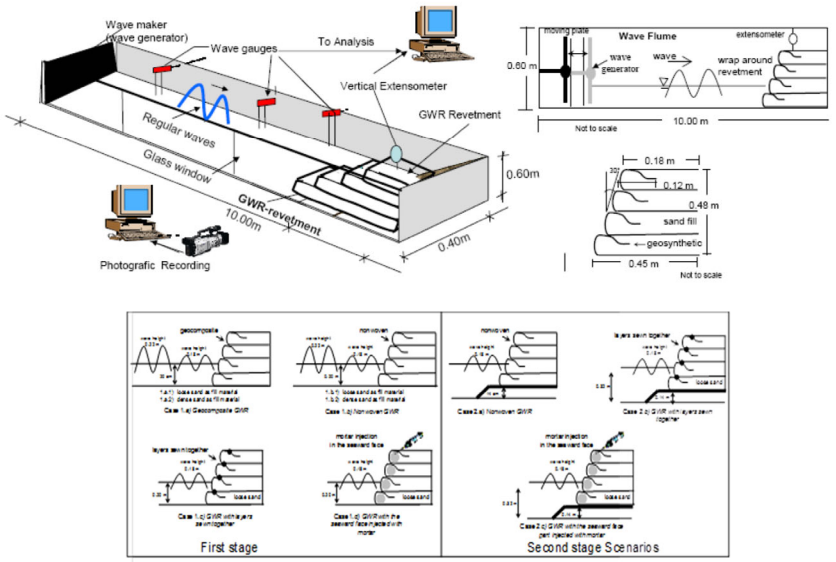


(a) Concrete coastal structure (Rigid structure)

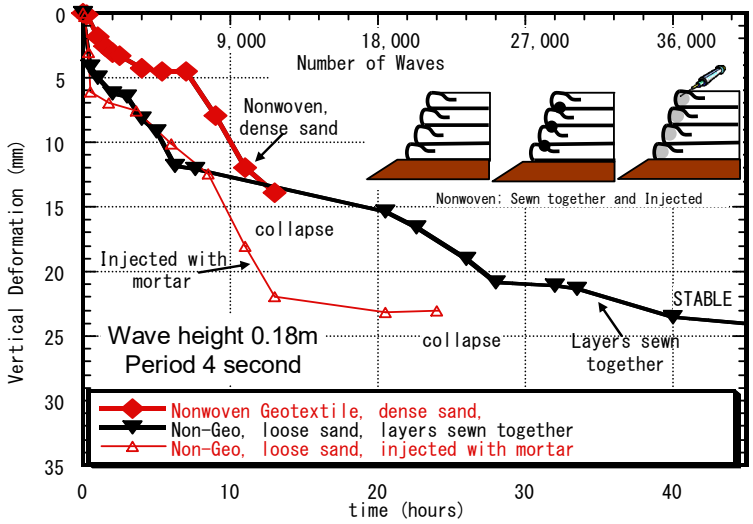
(b) Reinfroced structure with geosynthetcs (Flexible structure)

Resist against external force Absorb energy from external force

Model Tests at Laboratory



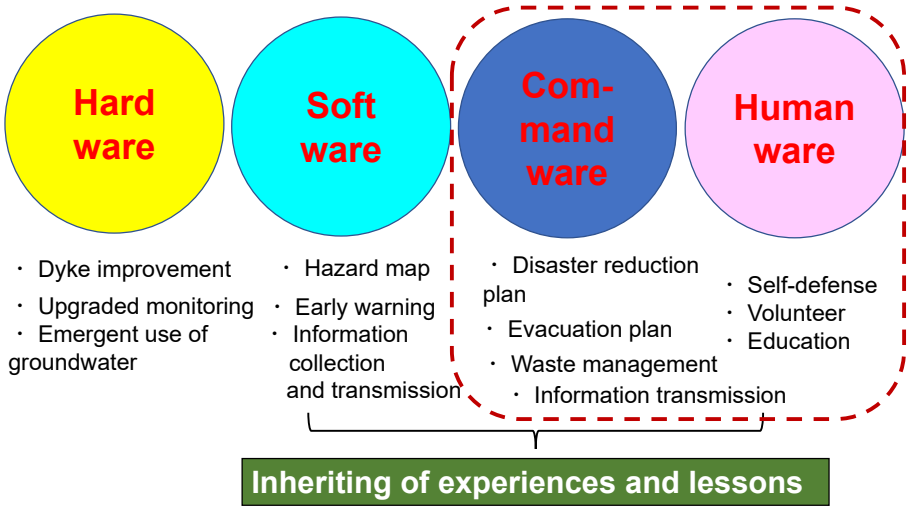
Model Test Results on Flexible Dykes (Yasuhara and Recio, 2007)



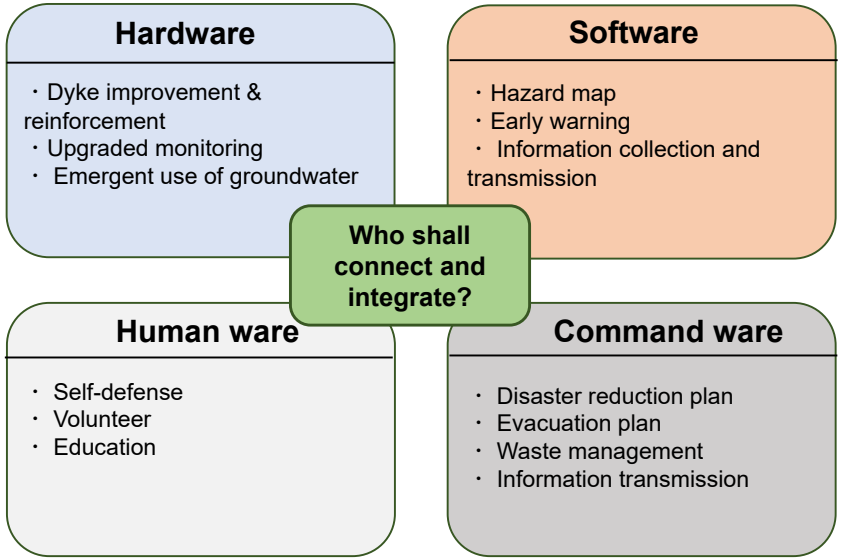
3. Human Aspect in Adaptation

Adaptation for Highly Resilient Community

(i) Damage reduced to minimum
(ii) Early recovery from disasters for a resilient community



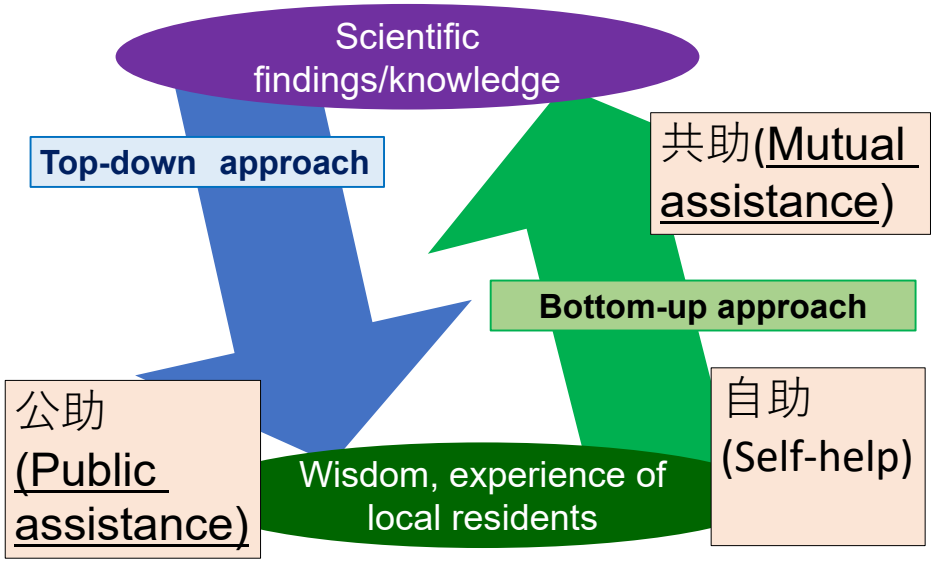
Network of Adaptive Wares



Responsive Measures against Increase of Damage

Aspect	Factor	Responsive measure
Natural Science (Hardware and Software)	Extremity caused by climate change	Data collection and analysis
	Vulnerable dykes	Combination of soil improvement and earth reinforcement
	Vulnerable geomorphological conditions and insufficient land use plans	Clarification of flood disaster impacts
Social Science and Human Science (Social and Human Wares)	Non-development of information transmission method	Development and use of ICT ICRT
	Inadequate disaster mitigation awareness	Collaboration on disaster reduction educational materials
	Poor information transmission systems	Promotion of plans suitable for regional characteristics
Politics (Command Ware)	Inadequate information collection and transmission systems	Proposal and practice for solutions corresponding to regional characteristics
	Inadequate evacuation training	・Collaboration of stakeholders ・Transmission and inheritance of lessons learned
	Shortage of risk communication	Collaboration of community and governments

Jijyo, Kyoujyo and Koujyo in Two approaches : Top-down and bottom-up adaptation



Coastal Change Assessment in Sirinath National Park, Thalang District, Phuket Province

VONGTANABOON Sukanya[1], HANCHAROEN Wanida[1], HOMYA Suthathong[1] , KURUKODT Jurairat[2]

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[2]Maha Sarakham University, Thailand

ABSTRACT

Coastal change in Sirinat National Park, Thalang District, Phuket Province was found at several points. The purposes of coastal change assessment in Sirinath National Park were to examine coastal change, assess the situation of shoreline, and analyze guidelines for coastal erosion prevention and impact reduction in Sirinath National Park. The results showed that between the years 2005 and 2019 the areas of Sirinath National Park were eroded along the coastline in the form of erosion, covering total areas of 96,601.62 square meters, and the change of coastline in the form of accretion areas of 69,688.06 square meters. Comparing the coastline change, it could be seen that the areas where the change occurred in the form of erosion were more than the accretion. The situation of coastal area change was found that the coastal areas of Nai Thon Beach were changing at a steady-state level (0.22 meters per year), while Sai Kaew Beach, Mai Khao Beach and Nai Yang Beach were changing at moderate erosion levels (1.02-1.89 meters per year). In the future, coastal erosion rates tend to increase in areas of Mai Khao Beach, Nai Yang Beach and Nai Thon Beach. Coastal change in the form of erosion had a direct impact on the physical environment of shoreline area as some partial beach areas of Sai Kaew, Nai Yang and Mai Khao were absent and Sea Pines on the beach were eroded by the sea. Therefore, the beach nourishment, sand bypassing, dune nourishment or beach forest afforestation should be appended in the areas of Sirinath National Park to maintain the shoreline from being eroded and preserve the beaches for tourist attraction.

Coastal Change Assessment in Sirinath National Park, Thalang District, Phuket Province

Sukanya Vongtanaboon[1], Wanida Hancharoen[2], Suthathong Homya[1] and Jurairat Kurukodt[3]

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[3] Department of Environmental Education, Faculty of Environment and Resource Studies, Maha Sarakham University, Maha Sarakham, Thailand

Introduction

- Sirinat National Park is in Thalang District, Phuket.
- Marine national park on the northwest coast of Phuket Island.
- 76 percent of the water and 24 percent of the land.
- Natural sea pine forests, beautiful coral reefs and white sandy beaches
- Turtles and sea crabs come to lay their eggs.

Introduction

- Coastal erosion in Sirinat National Park was found at several points, especially on Nai Yang Beach.
- Degradation and death of coral reefs. As coral reefs influence on wave diffraction and sand build-up.
- Without coral reefs, the strength of water that hits the beach becomes more intense, causing erosion and many large pine trees to die.

Introduction

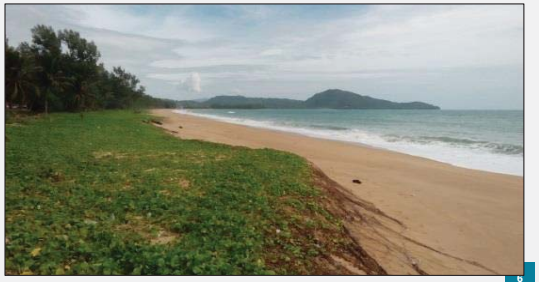
- Change in the direction of fresh water flowing into the sea
- Construction and filling of various swamps which used to be an area to support rainwater or water from other parts, causes those fresh water to flow directly into the coral reef area.
- When large quantities of fresh water flow into the sea, the coral reefs located on the beach get worse and eventually die.

Objectives

To assess coastal change and situation and to analyze guidelines for coastal prevention in Sirinath National Park.

Study area

- Sirinat National Park: area of 90 square kilometers.
- Sai Kaew Beach: 2 kilometres
- Mai Khao Beach: 8 kilometres
- Nai Yang Beach: 5 kilometres
- Naithon Beach: 1 kilometer

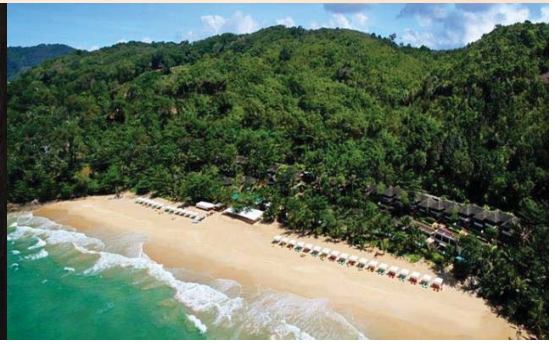


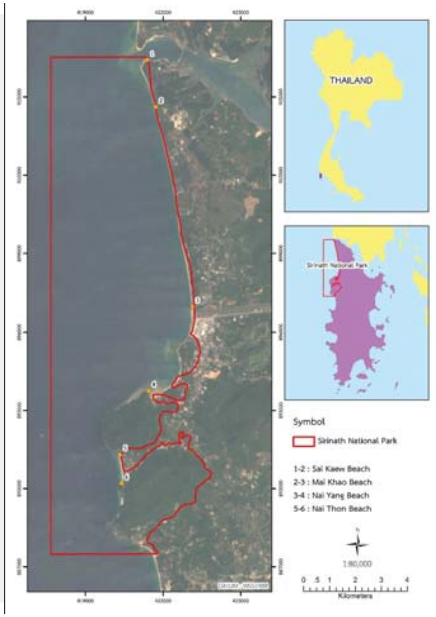
Sai Kaew Beach

Mai Khao Beach

Nai Yang Beach

Naithon Beach





Map of Sirinath National Park

Method

Assessment of coastal change and situation

- Data of the sea coastline in polyline format was performed using a visual interpretation method from satellite images.
- Line between the beach and the line of trees or vegetation from the satellite images in year 2005, 2011, 2017 and 2019 were observed.
- Coastlines at different times were combined to form polygon data and analyze the nature of shoreline shifts.
- Distance of shoreline change was then calculated.
- Average width of the shifted coastlines was divided by time. This gives an idea of the rate and level of shoreline change.

Table 1. Level of coastal change

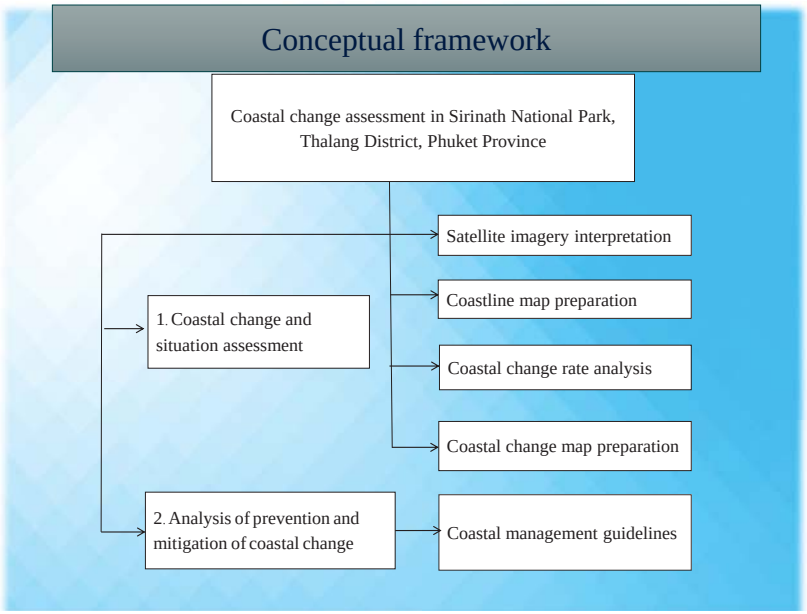
Level of coastal change	
Severe erosion	Erosion rate is more than 5 m/year
Moderate erosion	Erosion rate 1 - 5 m/year
High depositional coast	Deposition rate is more than 5 m/year
Moderate depositional coast	Deposition rate 1 - 5 m/year
Stable coast	Erosion and deposition rate is less than 1 m/year

Method

Analysis of prevention and mitigation of coastal change

From the analysis of shoreline change and assessment of the coastal situation, together with spatial and community survey in Sirinat National Park,

Various erosion prevention methods and management guidelines were analysed to find suitable ways to prevent and mitigate the impacts caused by coastal change in Sirinat National Park.



Results

1. Coastal change and situation in Sirinat National Park

- Shoreline change during the years 2005–2019 was analyzed both in forms of erosion and accumulation.
- Sai Kaew beach: erosion with a distance of 1,563.74 meters, deposition with a distance of 485.00 meters.
- Mai Khao beach: erosion with a distance of 4,073.43 meters, deposition with a distance of 3,757.55 meters.
- Nai Yang beach: erosion with a distance of 2,074.76 meters, deposition with a distance of 2,538.28 meters.
- Naithon beach: erosion with a distance of 141.54 meters, deposition with a distance of 1,035.00 meters.

Table 2. Coastal change in Sirinat National Park, Thalang District, Phuket Province

Coastal change									
Beach	Change Form	2005-2011		2011-2017		2017-2019		2005-2019	
		Distance (m)	Area (sq.m)	Distance (m)	Area (sq.m)	Distance (m)	Area (sq.m)	Distance (m)	Area (sq.m)
Sai Kaew	Erosion	644.06	7,477.66	1,401.89	19,030.45	1,286.91	3,373.64	**1,563.74**	19,992.92
	Deposition	1,296.83	11,928.32	588.16	10,920.35	725.54	2,981.91	**485.00**	15,934.77
Mai Khao	Erosion	3,876.64	19,844.47	4,937.06	37,462.79	4,627.14	5,388.71	**4,073.43**	42,453.73
	Deposition	3,936.71	18,162.95	2,855.93	15,844.17	3,740.81	7,883.43	**3,757.55**	21,376.00
Nai Yang	Erosion	1,999.53	21,419.47	2,579.71	25,535.92	2,418.11	11,803.00	**2,074.76**	33,831.68
	Deposition	2,172.66	32,405.28	1,903.98	11,968.70	2,174.88	6,751.90	**2,538.28**	26,199.21
Naithon	Erosion	491.64	1,217.61	500.02	1,916.22	384.56	971.28	**141.54**	323.29
	Deposition	654.66	3,095.04	645.93	3,101.70	852.84	3,763.19	**1,035.00**	6,178.08
Total	Erosion	7,011.87	49,959.21	9,418.68	83,945.38	8,716.72	21,536.63	7,853.47	96,601.62
	Deposition	8,060.86	65,591.59	5,994.00	41,834.92	7,494.07	21,380.44	7,815.84	69,688.06

Table 3. Coastal situation in Sirinath National Park, Thalang, Phuket

Coastal situation assessment									
Beach	Change form	2005-2011		2011-2017		2017-2019		2005-2019	
		Rate (m/year)	Change Level	Rate (m/year)	Change Level	Rate (m/year)	Change Level	Rate (m/year)	Change Level
Sai Kaew	Erosion	1.92	Moderate	1.81	Moderate	1.40	Moderate	**1.89**	Moderate
	Deposition	3.92	Moderate	2.21	Moderate	1.51	Moderate	**2.79**	Moderate
Mai Khao	Erosion	1.01	Moderate	1.01	Moderate	1.17	Moderate	**1.02**	Moderate
	Deposition	1.17	Moderate	1.04	Moderate	1.10	Moderate	**0.43**	Stable
Nai Yang	Erosion	1.51	Moderate	1.77	Moderate	2.06	Moderate	**1.35**	Moderate
	Deposition	2.47	Moderate	1.16	Moderate	1.29	Moderate	**0.79**	Stable
Naithon	Erosion	0.53	Stable	0.65	Stable	0.85	คงสภาพ	**0.22**	Stable
	Deposition	0.89	Stable	0.86	Stable	1.34	Moderate	**0.37**	Stable

Results

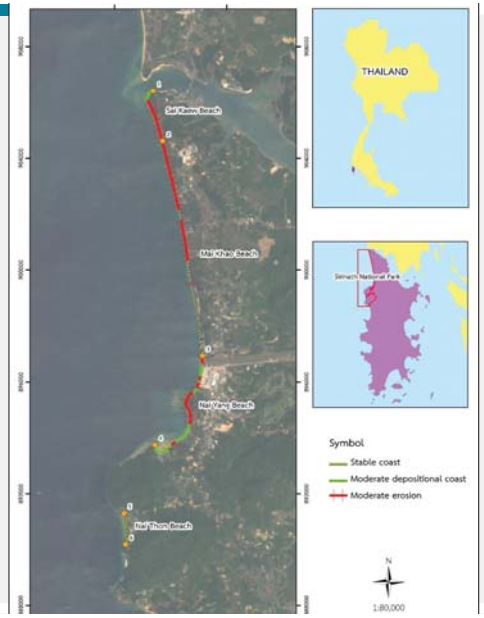
2. Prevention & mitigation approaches for coastal change

As Sirinat National Park had **moderate** coastal erosion (**1.02-1.89 meters per year**), soft structures should be operated in the area to keep the coastline from being eroded such as

-beach nourishment
-sand bypassing
-dune nourishment
-afforestation like mangrove and beach forest

Table 4. Coastal management in Sirinat National Park, Thalang District, Phuket

Beach	Plan	Reposibility
Sai Kaew	Afforestation	-Sirinat National Park - Department of Marine and Coastal Resources - Local government organization - Stakeholders and local community
Mai Khao	Beach nourishment Sand bypassing Dune nourishment Afforestation	
Nai Yang	Beach nourishment Sand bypassing Dune nourishment Afforestation	
Naithon	No Action	-



Map of coastal situation in Sirinath National Park, Thalang, Phuket during the years 2005-2019

Coastal erosion in Sirinath National Park, during the years 2005-2019

Conclusion and discussion

- Coastal area in Sirinat National Park during the years 2005-2019 had changed
- Form of **erosion** with area of 96,601.62 square meters
- Form of **deposition** with area of 69,688.06 square meters.
- Comparison of the coastline, the area that changed in the **erosion pattern was greater** than the area that changed in the accumulation pattern.

Conclusion and discussion

- Sirinat National Park, there was a coastal problem in the form of erosion in many places, especially in Nai Yang beach which has no island as a wave barrier, therefore causing beach erosion.
- For Sai Kaew Beach, Mai Khao Beach and Nai Yang Beach, the coastal situation had changed at a moderate erosion level (1.02 -1.89 meters per year).
- Coastal change was due to the influence of natural causes such as the intensity of the waves, monsoons, currents

Conclusion and discussion

- Caused by human action, as the area around Nai Yang Beach had been developed.
- Development of coastal area to support the tourism industry and invasion of beach forests.
- Construction of resort, breakwater, sandbags, beach front line and the formation of wave barriers.

Conclusion and discussion

- Peats which are the area to retain rainwater or water from other parts had been invaded, causing fresh water to flow directly into the sea.
- Coral reefs at Nai Yang Beach had been degraded and eventually died.
- When the coral reefs that used to slow waves died, the limestone structure collapsed.
- This leaded to the diffraction of the waves and sedimentation of the beach.
- Strength of the wave that hit the beach was more intense and caused erosion.

Conclusion and discussion

- For the coastal accumulation, it was found in Sai Kaew Beach and Nai Yang Beach. Area where the current was not very intense
- Sediments to accumulate in a parallel arc along the coastline.
- Sedimentation and sand accumulation were due to the influence of waves, currents and monsoons.
- Sand sediment that had been blown up on the beach front may also be carried from area where shoreline change had occurred in the form of erosion.

Conclusion and discussion

- Coastal change directly affected the physical environment of coastal area. Erosion had resulted in some area of the beaches at Sai Kaew, Nai Yang, and Mai Khao Beach.
- Many pine trees on the beach were eroded and died. The degradation of coastal ecosystems precisely affected coastal life and biodiversity.
- Change in the coastline on Sai Kaew and Nai Yang beach could be observed in the wide area of shoreline degradation.

Conclusion and discussion

- Changing scenery of the beach made some area no longer visited by tourists, resulting in the area to become a deserted zone.
- Function of the ecosystem was impaired and inefficient.
- Quality of life of people and communities living in the coastal area had also deteriorated.

Conclusion and discussion

- Prevention and mitigation of coastal change
- Soft structures : beach nourishment, sand bypassing, dune nourishment, afforestation like mangrove and beach forest as natural defense barriers.
- Soft structures save the beach for a tourist destination because they do not obscure the beautiful scenery of the coast and do not have the visual aesthetic effects.
- Soft structures do not obstruct the rise of the turtles and sea crabs to lay their eggs on the beach.
- Additional implement: set back without any development

Conclusion

- Due to coastal morphological condition, the rise of sea level and coastal erosion, the coastal area would be severely eroded as a result of more waves and strong winds.
- So the effect of global warming was likely to bring the seriousness of the coastal erosion sooner or later, if the problem was not properly assessed and prevented.

SLCP Observation at Hanoi to Study Contribution of Regional Sources

KITA Kazuyuki

Ibaraki University, Japan

ABSTRACT

Simultaneous observation of black carbon (BC), tropospheric ozone (TO3) and particulate matter 2.5 (PM2.5), which are significant climate forcers, was carried out at Hanoi to clarify the concentrations and variations of Short-lived Climate Pollutants (SLCP) in Hanoi and Northern Vietnam. Observed diurnal variations strongly suggested significant contribution of their local/regional emissions and production of them near Hanoi. The analyses applying the NOAA HYSPLIT trajectory model can distinguish contribution source regions of SLCPs to Hanoi, and showed that a major contribution of sources in coastal area of red river delta region in winter and spring, and significance of sources in south of Hanoi in summertime. These results suggest that reduction of SLCP emissions in Northern Vietnam can improve both air quality and warming influence critically in this region.

SLCP observation at Hanoi to study contribution of regional sources

KITA, Kazuyuki (Ibaraki University/Vietnam-Japan University VNU), Do Duy Tung (Vietnam-Japan University VNU), and KOTERA, Akihiko (JICA/ Vietnam-Japan University VNU)

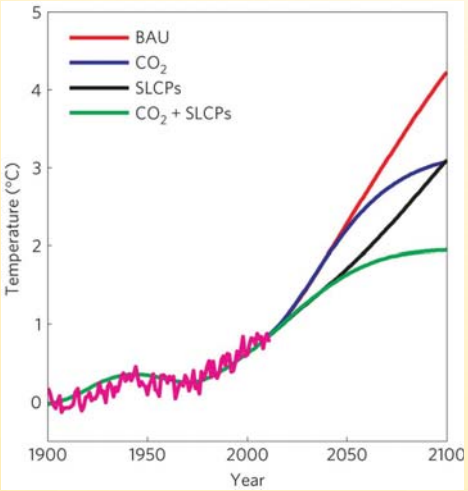
What is SLCP?

Short lived climate pollutants (SLCP) is defined as:

◎ Short lived = atmospheric lifetime < 10 years
◎ Climate = significant climate **(warming)** effect
◎ Pollutant = directly/indirectly harmful for human health

Significant SLCPs are
Black carbon aerosol (BC), **tropospheric ozone**, methane and HCFC.

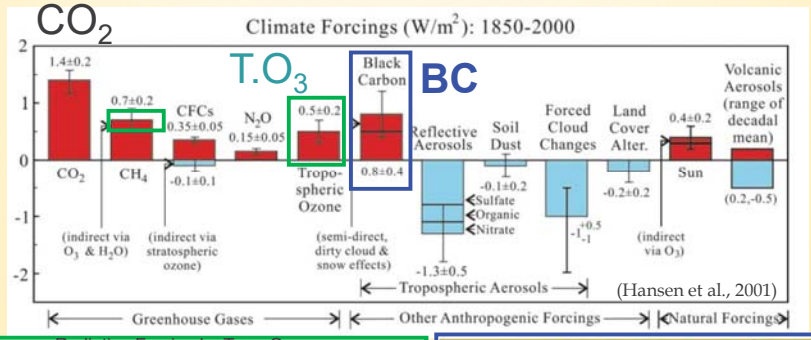
Why is the SLCP important?



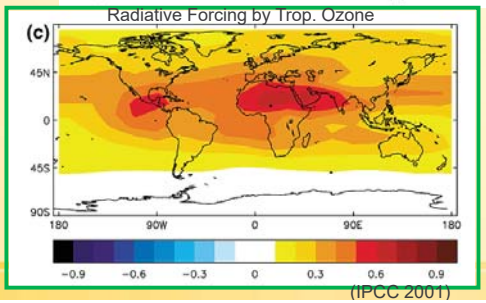
(Hu et al., Nature Climate Change, 2013)

Because CO_2 has a long lifetime, the mitigation measures to reduce it need much time to show its result. On the other hand, if we start to reduce SLCP emission, the result will appear soon.
Both mitigation measures are necessary to control **temperature increase < 2℃**.

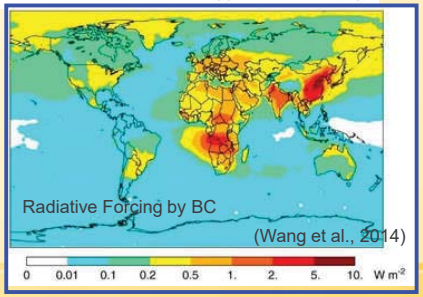
Climate significance of BC and Trop. O_3



(Hansen et al., 2001)



(IPCC 2001)



(Wang et al., 2014)

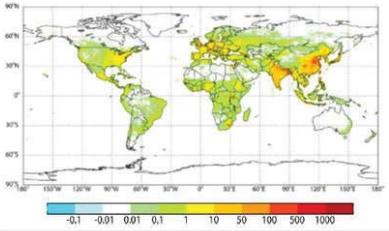
Significance of Trop. O_3 on human health

Breathing ozone can trigger a variety of health problems: respiratory diseases and heart failure.

Global and regional mortality per year

Regions	Total deaths	Deaths per million people (*)
North America	34,400	121
Europe	32,800	96
Former Soviet Union	10,600	66
Middle East	16,200	68
India	118,000	212
East Asia	203,000	230
Southeast Asia	33,300	119
South America	6,970	38
Africa	17,300	73
Australia	469	29
Global	472,000	149

(*) Exposed population (age 30 and older)



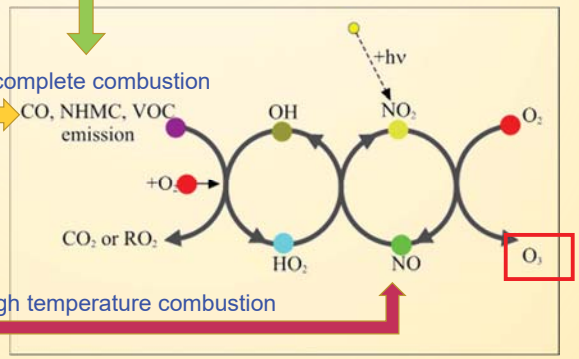
Respiratory mortality , deaths yr^{-1} $(1000\ km^2)^{-1}$, multi-model mean in each grid cell , 14 models

Current premature mortality due to anthropogenic air pollution (2000–1850), in deaths yr^{-1} $(1000\ km^2)^{-1}$, for ozone (respiratory mortality) for mean of 14 models. (Silva et al., 2013)

Source of Tropospheric O_3

Natural/Agricultural CH_4 emission

Incomplete combustion



High temperature combustion

http://elte.prompt.hu/sites/default/files/tananyagok/AtmosphericChemistry/ch08s02.html

Tropospheric ozone is produced by photochemical reactions in the atmosphere from CO, VOC and NO_x.

Source of Black carbon aerosol (BC)

- BC are Light-absorbing particulate matters and their main component is **soot**.
- Major sources of BC are the followings:
  - Burning of biofuel and coal for householding
  - Car exhaust, especially from diesel cars
  - Industrial coal burning
  - Brick kilns
  - Open biomass burning

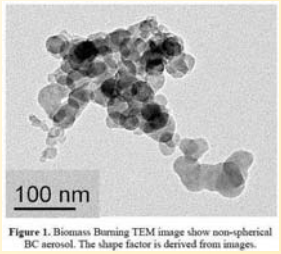


Figure 1. Biomass Burning TEM image show non-spherical BC aerosol. The shape factor is derived from images.

https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.highlight/abstract/9538/report/2014

Climate and Clean Air Coalition (CCAC)

The Climate and Clean Air Coalition is a voluntary partnership of governments, intergovernmental organizations, businesses, scientific institutions and civil society organizations committed to improving air quality and protecting the climate through actions to reduce short-lived climate pollutants.

Vietnam

CCAC partner since 2017

On joining the Coalition, Vietnam said implementing measures to reduce methane from rice production is a meaningful action it would take to reduce short-lived climate pollutants, and that Vietnam's agriculture sector will work to contribute to global greenhouse gas reduction efforts.

Japan

CCAC partner since 2012

Reduction of black carbon and tropospheric ozone in Asia is the key for our challenge to cope with SLCPs globally. Japan has been tackling this issue through providing technical assistance and conducting a large number of projects to improve energy efficiency and reduction of air pollutants in developing countries in Asia. Japan has taken a lead to develop a regional monitoring network of air pollutants in East Asia in which 13 countries

Significance of Monitoring Trop. O_3 and BC in SE Asia and Vietnam

- Their influences on the climate and the human health depend on their local concentrations, which are highly variable with space and time because of their short lifetime (< 1 week) in the atmosphere.
- It is difficult to measure them accurately by remote sensing from satellites.
- Heavy air pollution in mega-city areas.
- Open burning of agricultural wastes is often made.
- Gateway of transboundary pollution from China to the southeast Asia.

Open biomass burning in

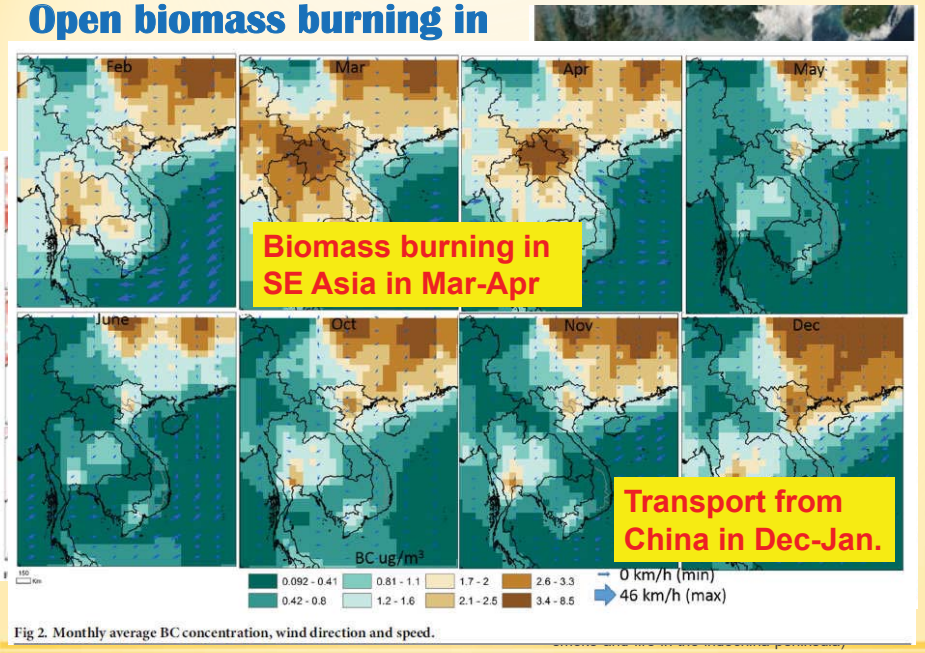
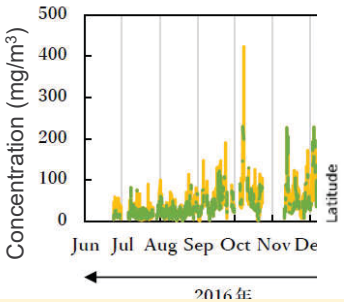
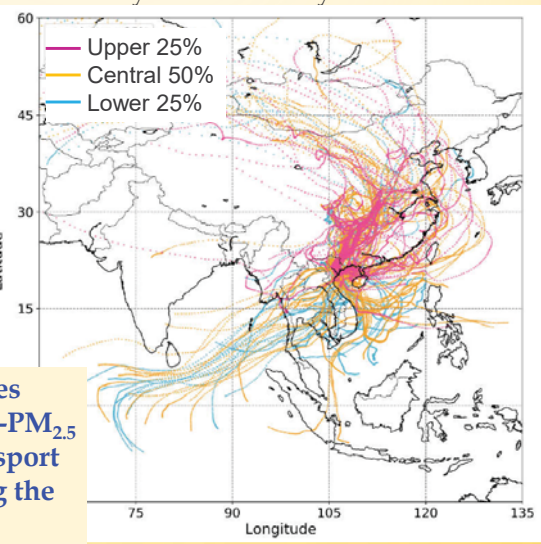


Fig 2. Monthly average BC concentration, wind direction and speed.

$PM_{2.5}$ in Hanoi

PM2.5 concentrations derived by US. Embassy showed a seasonal variation wi

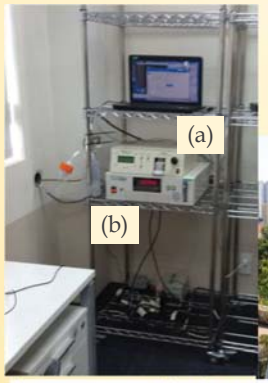


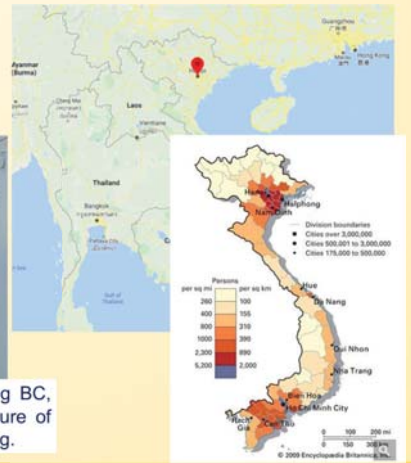


7-day backward trajectories indicate that most of high-$PM_{2.5}$ events occurred with transport from south China or along the southern coast of China.

Observation of SLCP and PM2.5 at Hanoi

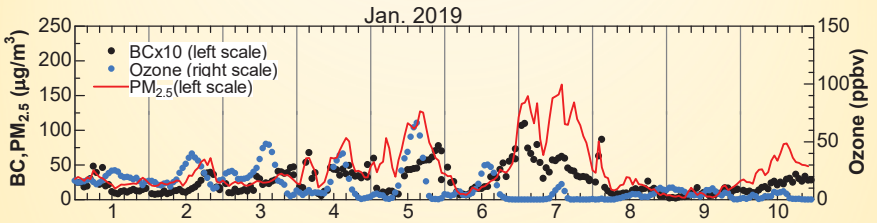
We start the observation of BC, ozone and $PM_{2.5}$ concentrations at Vietnam-Japan University campus at western Hanoi, in northern Vietnam.



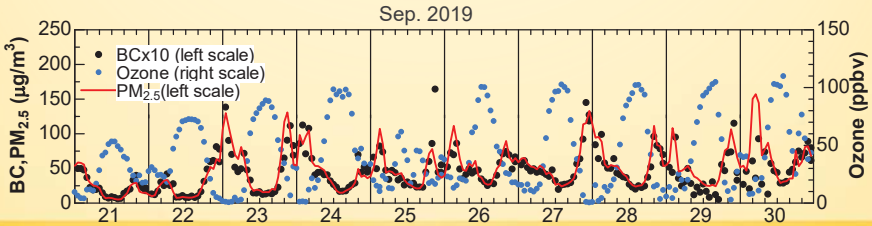


Instruments used in tis study; (a) PSAP for measuring BC, (b) Model1100 ozone photometer, and (c) box enclosure of PM2.5 sensor mounted on the outer wall of VJU building.

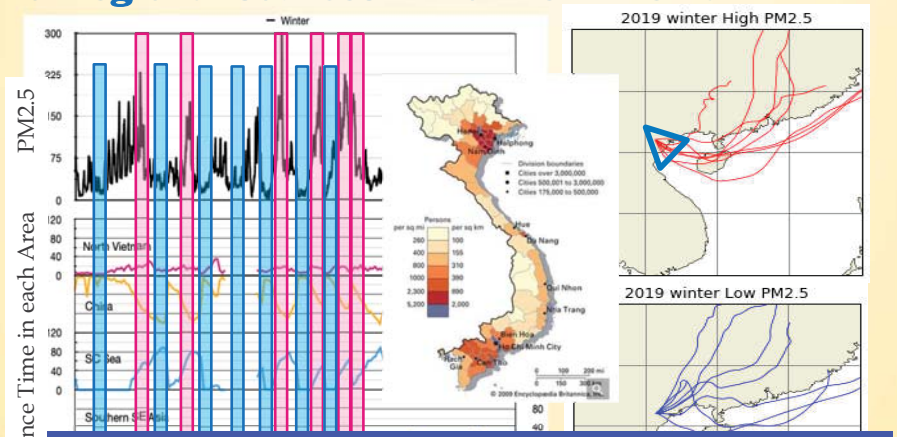
Diurnal Variation of SLCP and PM2.5 at Hanoi



Regular diurnal variation pattern indicates that ozone was produced photochemically in daytime and BC and PM2.5 accumulated during night. Episodes of high BC and PM2.5 was often found in winter.



Backward trajectories indicating significance of regional sources in northern Vietnam



High BC and PM2.5 episodes
did not occur with air from China,
but occurred with air from southeast of Hanoi
→ **larger contribution of regional sources for Hanoi**

Summary

Tropospheric O_3 and BC are significant SLCP, and their reduction is essential to suppress the global warming and for relief of health risk by air pollution.
Trop. O_3 and BC in Vietnam and SE Asia would be affected by:

1. **Fossil fuel and biofuel combustion in large city areas.**
2. **Open biomass burning of agricultural wastes**
3. **Transboundary pollution from south China**

This study indicates significance of reginal sources in northern Vietnam.

Measures to reduce emissions can decrease SLCP and $PM_{2.5}$ in northern Vietnam.

Platform Building for Achieving Sustainable Development Goals in the Tropical and Subtropical Agriculture

CHEN Bixia[1], SAKAGAMI Nobuo[2]

[1] University of the Ryukyu, Japan

[2] Ibaraki University, Japan

ABSTRACT

To combat climate change and achieve Sustainable Development Goals in agriculture in the tropics and subtropics, the Faculty of Agriculture, University of the Ryukyus has been making efforts to build a research exchange program in the past 9 years together with Ibaraki University, and the partner universities in the Southeast and South Asia, Bogor Agricultural University (Indonesia), Khon Kaen University (Thailand), and Ruhuna University (Sri Lanka), Sher-e-Bangla Agricultural University (Bangladesh). Last year, (the University of Veterinary Science, UVS） joined our research exchange network. International Agricultural Program (IAP) has been established in providing master students with internship and short-term research experience in Southeast and South Asia. IAP consists of a summer course and a winter course each year. During the summer vacations, our master students stay in the partnership university campus for about 3 weeks, attending the summer camps, conducting a small research project under the instruction of the professors in our partner universities. In winter vocation, young researchers of master students and faculty members of our partner universities have been invited to attend an international workshop in Okinawa. And, English lessons of conservation and presentation skills have been also provided for our young students. This year, we have encountered an unprecedented pandemic, the summer course has been canceled. Instead, we have planned an online seminar and invited 15 lecturers from 7 countries, and about 100 students from four countries will participate in the lectures. Next January, a young forum will take place and our young researcher will report their ideas regarding the agricultural issues together with other young students from our partner universities.

Practical Uses of Crop Simulation Model for Climate Adaptation and Resiliency of Corn Farmers in the Philippines

BALDERAMA Fernando Orlando

Isabela State University, The Philippines

ABSTRACT

This paper present results of a research undertaking in providing solution to corn farming in coping with climate variability. Methods employed were science tools such as simulation and climate modelling, integration of automated weather station for real-time weather data inputs and Short Messaging System (SMS). Specifically, it aimed to develop a localized corn model; assess future corn production under climate change scenarios and; develop decision support system for corn production.

The model was able to predict the observed data on yield and timing of phenological events from the actual experiments and actual farmers field with high goodness of fit ranging from 91% to 98% for the calibration and 86% to 97% for the validation process. Moreover, applications of the model for climate change assessments indicated that corn yield in northern Philippines would be reduced by up to 35% in 2050 due to changes in rainfall amount and rise in temperature.

The model is automated through SMS to provide customized decision support to farmer's operational decision making, create crop calendar and weather advisories. Initial testing also showed a positive impact of increasing the yield by 24% due to better adaptation measures.

Paper presented at International Conference Southeast Asia Research-based Network on Climate Change Adaptation Science, November 17, 2020

PRACTICAL USES OF CROP SIMULATION MODEL FOR CLIMATE ADAPTATION AND RESILIENCY OF CORN FARMERS IN THE PHILIPPINES

Orlando F. Balderama, Ph.D.
Professor and Vice President
Isabela State University, Echague, Isabela

Project Background

- Cagayan Valley is the biggest river basin in the country with an area of more than 27,000 square kilometres; **top corn producer, second in rice production, declared as the nation's peanut and mungbean capital; other major crops include cassava and sugarcane;**
- However, due to more frequent occurrence of climate anomalies such as El Nino and intermittent drought throughout the year, **rainfed farmers have become more vulnerable and their farming livelihood has become more at risk**;
- An important measure to address this problem is to enhance the capacity of the **farmers** to make smart decisions based on prior knowledge of day to day and long term forecast of weather and the **government** for operational and strategic planning using ICT-based extension modalities

Why climate-smart decisions?

1. Climate controls 33 % of global yield variation. Up to 45 % in some areas of the Philippines (Ray et al. 2015);
2. Understanding climate variability helps produce actionable information for farmers and government;
3. In the long-term, these can become ***services*** for farmers (i.e. climate services)

Use of crop model for climate change impact assessment and climate-smart solutions

- Impact parameters evaluation *(crop production and associated food security) - Government*
- Assessment of variability or risk *(variability in yield or effects of water deficits) - Researchers*
- Develop adaptation strategies *(changes in planting dates and cultivars; different tillage practices or crop rotations) - Farmers*

Adapting to Climate Change – Operating Framework

In addition to knowing when to sow, **You will also know the best cultivar to sow!**

Seasonal climate forecast + Crop models

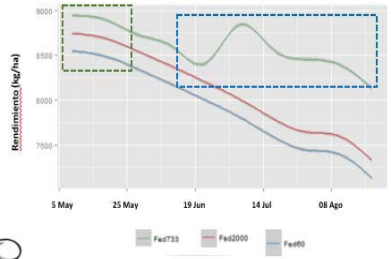
⇩

Selecting the best variety

With sowings by early June, the yield difference between varieties will not exceed 500 kg/ha.

If farmers decide to sow after June 15th, the best choice will be the variety F733.

According to this recommendation, pilot plots were established to validate the agroclimatic forecasts.

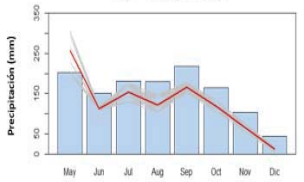


Field results:

Fedearroz 733:	6860 kg/ha PS
Fedearroz 60:	4600 kg/ha PS

Adapting to Climate Change

Decreased monthly rainfall

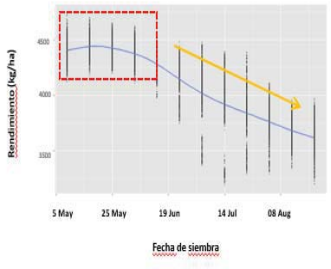


Increased monthly temperatures and solar radiation

If farmers make the decision to plant by June 20, the yield obtained can be around 4500 kg/ha.

Select the best planting date, as a preventive measure.

If the crop sowings are delayed, yields will decrease.



Smart Agriculture

With this measure:

- ✓ Great economic losses to 170 rice farmers were avoided.
- ✓ 1,800 hectares of rice were saved from being destroyed by the intense drought.

Objective

Overall goal of this study is to enable corn farmers and policy makers adapt to climate variability.

Specifically, it aims to:

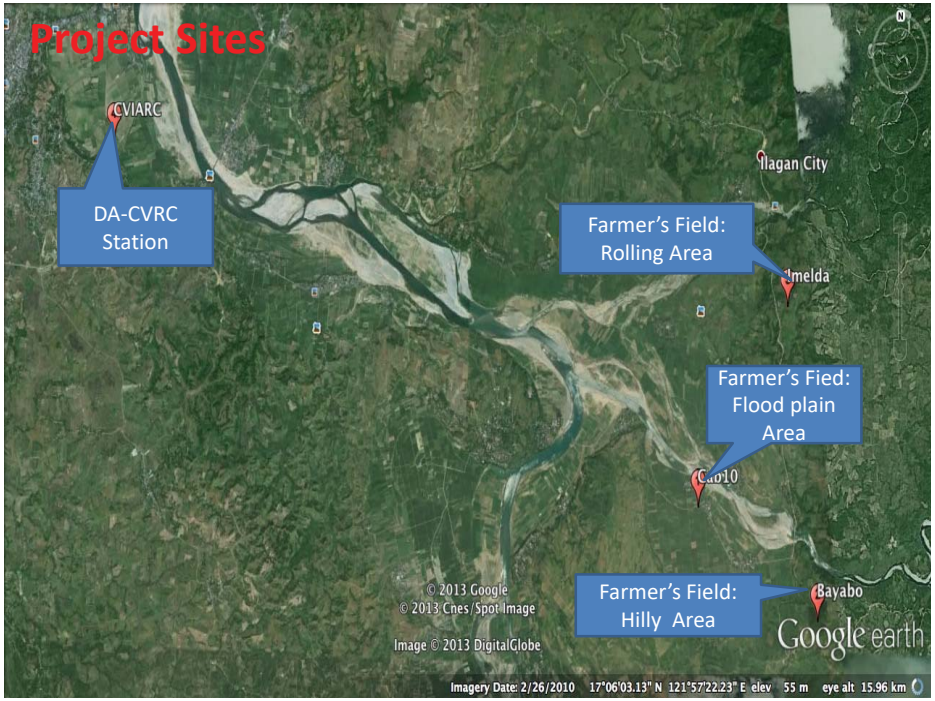
a. Develop a local corn model using DSSAT cropping system model for regional analysis and simulating potential yield of corn under rainfed and ecosystems conditions;

b. Conduct climate change sensitivity analysis for corn production;

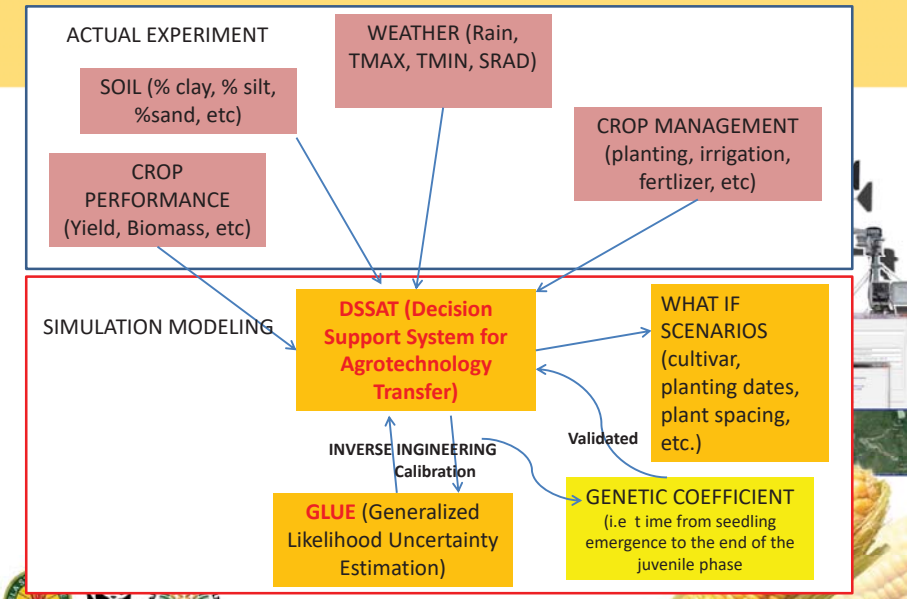
c. Design and test a farmer decision support system for corn farmers

Methodology

- **Site Selection and setting up of field experiment**
- **Soil characterization**
- **Setting up of weather monitoring station**
- **Model Calibration and Validation;**
- **Develop Smart Agriculture Decision Support System;**
- **Pilot Test of FDSS**

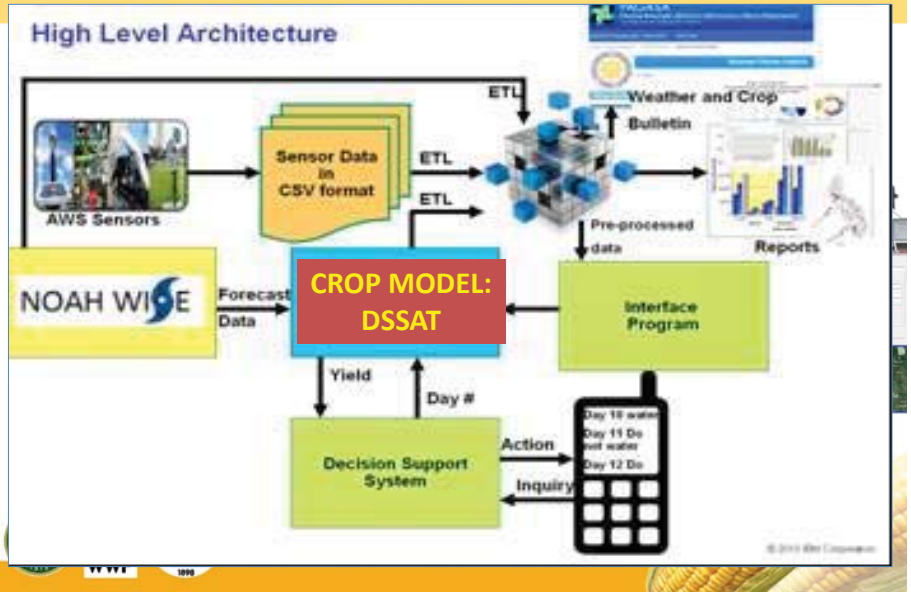


DSSAT PROGRAM OVERVIEW



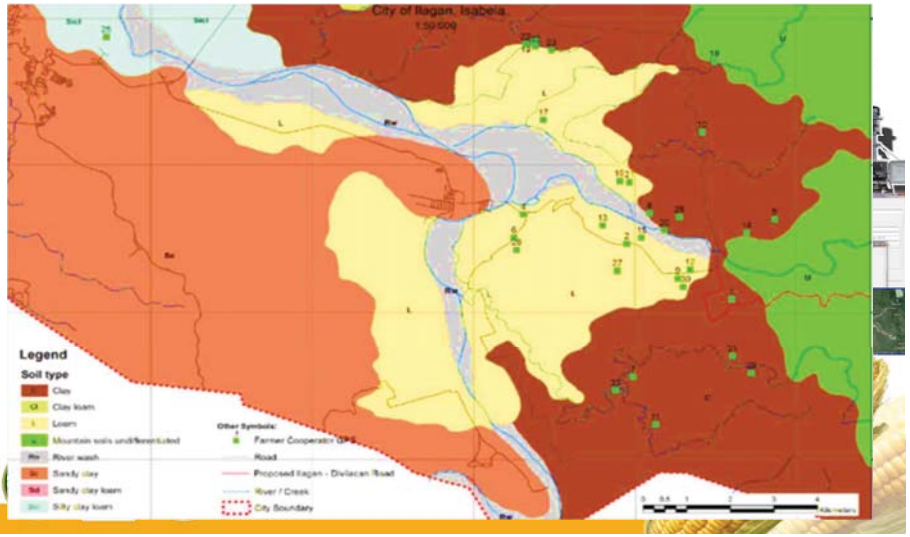
Farmer Decision Support System:

Towards Providing Smarter Agriculture for Farmers

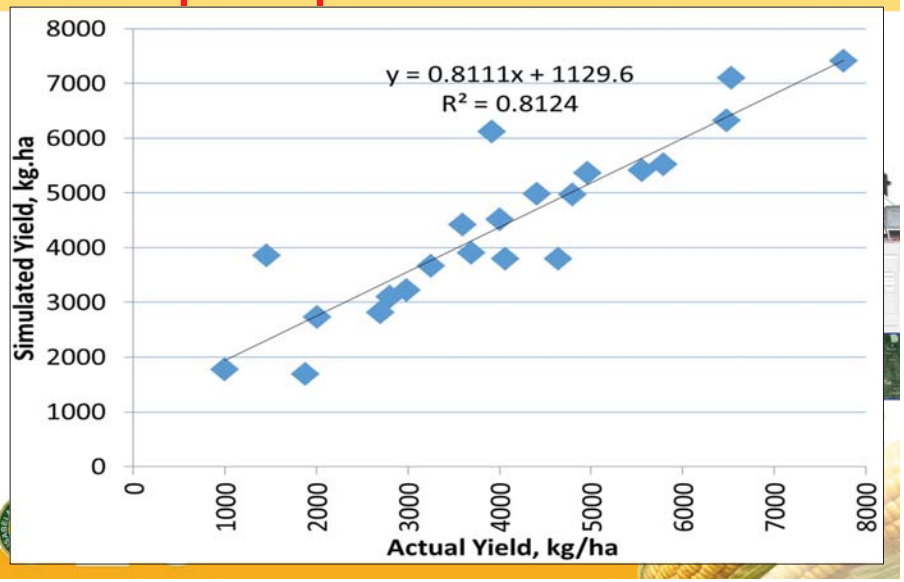


Development and Test Pilot of Smart-Agri Farmer Decision Support System

Location of farms for model validation under various ecosystem and soil type



Simulated vs actual yield of the farmer participants



Impacts of climate change on maize yields and adaptation options.

Baseline (1987-2014)		Value
Growing days, d		110
Tx, mm		125
Wet yield, tons/ha		6.78
Dry yield, tons/ha		7.711
Mean yield, tons/ha		7.25

2050s	Best Case, RCP2.6	Worst Case, RCP8.5
	% change	% change
Growing days, d	103 -7%	101 -8%
Tx, mm	183 46%	175 40%
Wet yield, tons/ha	6.06 -11%	5.96 -12%
Dry yield, tons/ha	3.47 -55%	2.64 -66%
Mean yield, tons/ha	4.77 -34%	4.30 -41%
% mean yield loss/deg	-25%	-23%
Oct 15 planting date, yield	**6.94 -10%**	**6.24 -19%**
With irrigation, yield	**7.60 -1%**	**7.27 -6%**

Conclusion and Recommendation

- Impact of climate change in corn production indicated that corn yield would be reduced by up 35% in 2050 due to changes in rainfall amount and rise in temperature;
- Tested FDSS showed a positive impact of increasing the yield by 24%. DA estimated that 30% increase in yield could be attained by providing appropriate extension services;
- In the future, the FDSS can be rolled out to other farming communities throughout the country and include other crops.

Thank You!!!

Effects of Introducing a Measure to Climate Change on Food Supply in Asian Countries: A World Food Model Analysis

FURUYA Jun

Japan International Research Center for agricultural Sciences, Japan

ABSTRACT

The fifth assessment report of the IPCC reported that the global average air temperature is expected to increase around 4°C by the end of this century. Some counter measures to the higher temperature environment have been developed. Reconnaissance and control of increasing pest damage, finding suitable place for fruits planting, and optimum water control by irrigation models are developed the counter measures. Development of higher temperature tolerant cultivars is one of the adaptation measures to climate change. JIRCAS and NARO have developed this type of rice cultivars based on the major cultivars, IR64. Effect of dissemination of the higher temperature tolerant cultivars in Asian countries is evaluated using the JIRCAS world food model named EMELIA. It is assumed that all the Indica type rice are replaced to the tolerant cultivars and this type of rice is expected to grow under 1°C higher temperature environment. The relation between temperature and rice yield which is invers U-shape is built in the yield functions and the curve is shifted to 1°C right side in the model. Comparing results of the shifted curve case to the baseline, changes in supply of rice and consumer surplus is calculated for Asian countries. The results indicate that the consumer surplus is expected to increase 149 million dollars in Vietnam. Background of the effects of introducing the technology is as follows. Dissemination of the higher temperature tolerant cultivars of rice is expected to increase rice production. In the end, the market price will go down. In response to the lower price, farmers decrease their production. On the other hand, lower international price leads decreasing exports and increasing domestic supply. Decreasing imports in imported country is expected to decrease supply in the country. In the end, the price will go up. The new technology is expected to lead benefit not only to consumers but also to farmers in long-run.

International Seminar for Climate Change Adaptation Program
17th November 2020
online (Ibaraki University)

Effects of introducing a measure to climate change on food supply in Asian countries

A world food model analysis

Japan International Research Center for Agricultural Sciences

Jun Furuya

2020-11-17

Background of this research

- The fifth assessment report of the IPCC reported that the global average air temperature is expected to increase around 4° C by the end of this century.
- Some counter measures to the higher temperature environment have been developed.
- Development of higher temperature tolerant cultivars is one of the adaptation measures to climate change.

Objectives

- Effect of dissemination of the higher temperature tolerant cultivars in Asian countries is evaluated using the JIRCAS world food model named EMELIA.
- Comparing results of baseline to the case of introducing the tolerant cultivars, changes in supply of rice and consumer surplus is calculated for Asian countries.

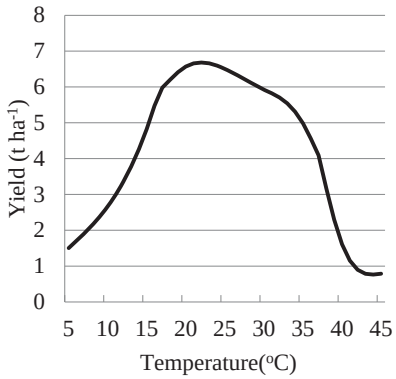
Model: Outline

- No. of countries: 140
- Launchpad data: 2006-2010
- Commodity: 20 goods
  - Cereal: RI, WH, MZ, XG
  - Oil crop: SB, XS
  - Oil & cake OS, OX, CS, CX
  - Meat & Egg: BF, SH, PK, PM, XM, EG
  - Dairy products: MK, SK, BT, CH

Model: Crop model of the GAEZ

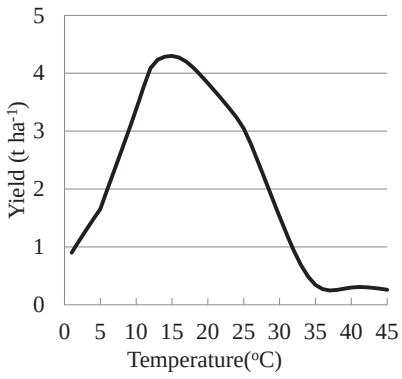
- The crop model of the G-AEZ of FAO
  - Potential yields of 46 crops are shown in Kassam (1977).
  - Temperature, solar radiation, cultivation days, CO_2 exchange rate are the inputs.
- Calculation of elasticities of yield of crops in the world
  - Temperature elasticities of yield of RI, WH, MZ, SB
  - Solar radiation elasticities of yield of RI, WH, MZ, SB

Model: relation between temperature & yield



Japonica rice in wetland

N=165, HI=0.3, LAI=6.0, bo=231, bc=442, Rg=15MJm^{-2}



Winter wheat

N=300, HI=0.2, LAI=4.0, bo=178, bc=353, Rg=14MJm^{-2}

Model: incorporation of temperature & solar radiation elasticities into the yield functions

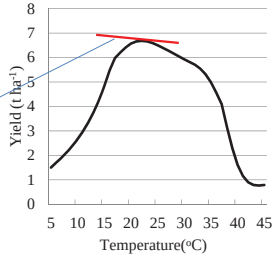
- Linear yield function case

$$Y_{lkt} = Y_{lkt-1} + b_{Tlk}(\ln T_{Lt} - \ln T_{Lt-1})$$

Slope

$$+\frac{1}{2}\left(\frac{\partial \ln Yp_{lkt}}{\partial \ln TP_{lkt}} + \frac{\partial \ln Yp_{lkt-1}}{\partial \ln TP_{lkt-1}}\right)\frac{Y_{lk2010}}{TP_{lk2010}}(TP_{lkt} - TP_{lkt-1})$$

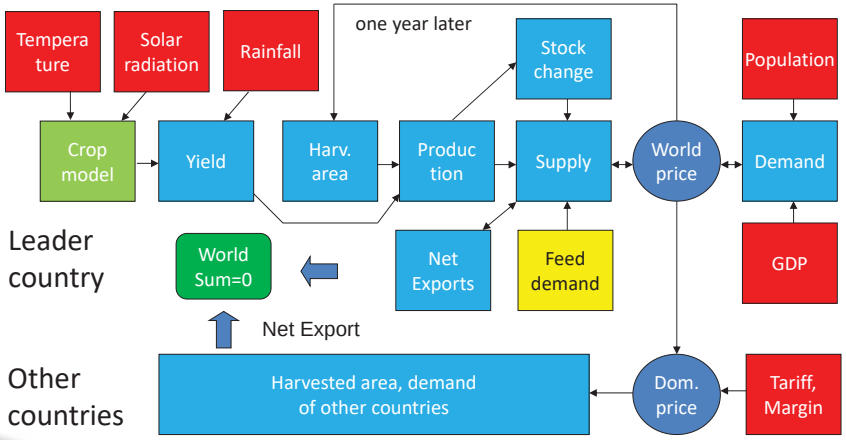
$$+\frac{1}{2}\left(\frac{\partial \ln Yp_{lkt}}{\partial \ln RG_{lkt}} + \frac{\partial \ln Yp_{lkt-1}}{\partial \ln RG_{lkt-1}}\right)\frac{Y_{lk2010}}{RG_{lk2010}}(RG_{lkt} - RG_{lkt-1}) + \beta_{PTlk}(PT_{lkt} - PT_{lkt-1})$$



Japonica rice in wetland

- *Y*: yield, *T*: 1961=1, 1962=2, …, 2050=90, *Yp*: potential yield, *TP*: temperature, *RG*: solar radiation, *PT*: rainfall

Structure of the world food model (Crop sector)



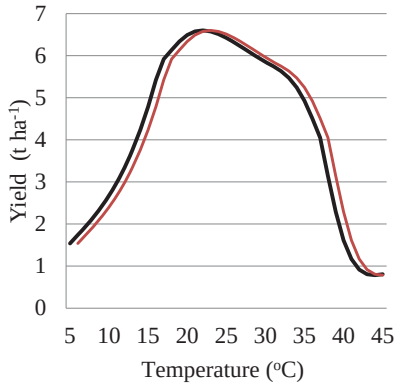
Results: difference in yield of rice between baseline & RCP6.0

- Rice, RCP6.0 2020s
- Rice, RCP6.0 2040s

Decreasing more than 5% | Decreasing less than 5% | Increasing | Out of crop

Effects of introducing high temp tolerant v.: Changes in yield function of rice

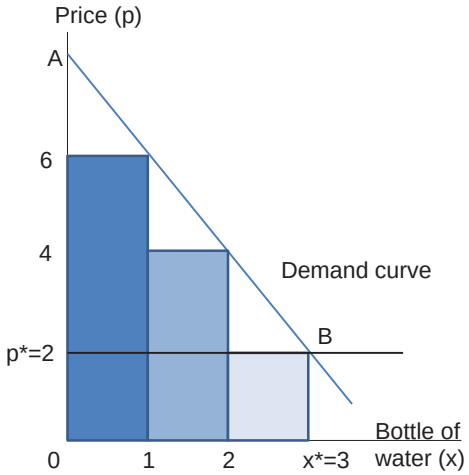
- Assumption
  - High temperature tolerant cultivars of Indica rice are expected to disseminate in the world. This type of rice grow under 1 ºC higher environment.
- Model
  - World Food Model: EMELIA
  - Function of yield and temperature is shifted to 1 ºC higher side



作物モデル上での変更

What is the consumer surplus?

- After a catastrophe, getting water is difficult.
- A consumer can pay to a bottle of water as follows:
  - 1st bottle: $6
  - 2nd bottle: $4
  - 3rd bottle: $2
- Bottles of water are soled $ 2 actually.
- This consumer can pay $6+$4+$2=$12 for the three bottles.
- However, his payment is $2x3=$6.
- Therefore, this consumer gains $6.
- The triangle ABp* over the price p* is called the consumer surplus.



Changes in consumer surplus to dissemination of high temperature tolerant rice cultivars

Changes in consumer surplus in major rice consuming nation in 2040s

	Price		Food supply		Consumer Surplus		Increase amount
Unit	$/t		million t		billion $		million $
Simulation	BAU	Intro.	BAU	Intro.	BAU	Intro.	
China	651.6	642.1	78.3	79.6	29.3	30.1	858
India	645.8	636.3	348.5	344.9	126.2	126.5	334
Bangladesh	493.6	484.1	51.4	51.9	31.7	32.3	521
Indonesia	784.7	775.2	51.8	52.2	27.6	28.1	448
Vietnam	623.8	614.3	23.9	23.9	17.5	17.7	149

Results of simulations of RCP8.5 and SSP3.
In China, production decreases because of price down; however, decreasing exports lead increase in supply.
In India, imports decrease because of decrease in exports in neighbor countries. Therefore, supply decreases.

Summary of results of a simulation of dissemination of high temperature tolerant rice cultivars

- Production is expected to increase by dissemination of the tolerant cultivars.
- As a result, the price goes down.
- In long-run, farmers will decrease their production under the lower price.
- Exporters will decrease exports because of the lower international price. Therefore, the domestic supply is expected to increase.
- On the other hand, importers will decrease their imports because of decrease in amount of trade. Therefore, the domestic supply is expected to decease.
- The changes in price immediately affect consumption. However, this shock affect production after a certain time.
- Adaptation measures to climate change must be realizing stable food supply.

www.jircas.go.jp

Bangladesh, Cyclone disaster area

Stakeholder Perception and Empirical Evidence: Oil Palm Biomass Utilization as Climate-Smart Smallholder Practice

OKTARINA Desta Sachnaz, NURKHOIRY Ratnawati, AMALIA Rizki, NASUTION Zulfi Prima Sani

Indonesian Oil Palm Research Institute, Indonesia

ABSTRACT

A little fact about smallholder perception and adaptation of climate-smart practice has been known. More precisely, for oil palm smallholder plot where it frequently was accused as driving force of ecosystem service depletion. The study to reveal stakeholder perception and its implementation towards biomass utilization was performed in the case study of North Sumatera Province. The Labuhan Batu, Batu Bara, Langkat, and Serdang Bedagai District was selected as the sample cases where the oil palm concessions were highly overlaid. The first phase of the study was conducted by text mining analysis to decode smallholder, practitioner, and expert's perception and sentiment against oil palm biomass products within the SMEs scheme. The next phase of implementation was operated by introducing biomass-driven oil palm products such as empty fruit bunch briquette, oil palm fronds pellet, midrib handicraft, oil palm based-livestock feed, empty fruit bunch oyster mushrooms, oil palm juice brown sugar, oil palm-laminated wood, and empty fruit bunch-compost. The feasibility and preferences among those eight alternatives were then assessed by multi-criteria decision-making tools named Analytical Hierarchy Process (AHP) based on its benefit, opportunity, cost, and risk features.

The text mining analysis discovered that initially, the smallholders were perceived to have a lower interest in making use of biomass products as they presumed that it still marginalize farmers. It was also still unclear whether they realize and understand the potential of biomass utilization to ameliorate nature. After the time of implementation, they were enlightened and chose oil palm midrib handicraft over other alternatives as their pluri-activity. Having said that, it is necessary to keep promoting climate-smart adaptation practices at the local level for the sustainability of people, profit, and the planet.

Keywords: Oil Palm Biomass, climate-smart, Smallholder, Text Mining, SMEs

Stakeholder Perception and Empirical Evidence: Oil Palm Biomass Utilization as Climate-Smart Smallholder Practice

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Indonesian Oil Palm Research Institute (IOPRI)

International Seminar for Climate Change Adaptation Program
Vietnam Japan x Ibaraki University, 17 November 2020

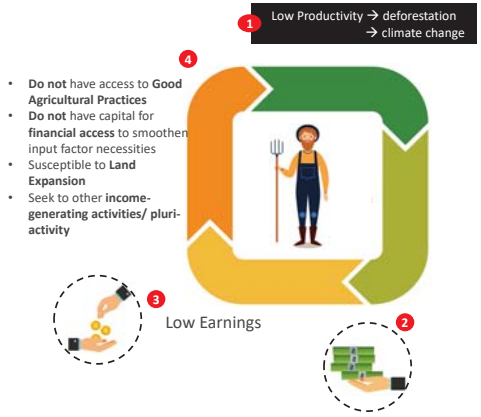
OUTLINE

1. Introduction
2. Methodology
3. Result
4. Conclusion & Acknowledgement

1. INTRODUCTION:

- Background
- Objective

Push Factor: Vicious Cycle of Smallholder



- Longer Value Chain to sell FFB to the designated mills
- Not oriented to downstream industry. for they **only sell** FFB.

Pull Factor: Oil Palm Biomass

Objectives:

- to reveal stakeholder perception towards oil palm biomass utilization as climate-smart agricultural practices
- to examine the prospects of oil palm biomass utilization implementations in the smallholder level.

2. METHODOLOGY

Research Methods

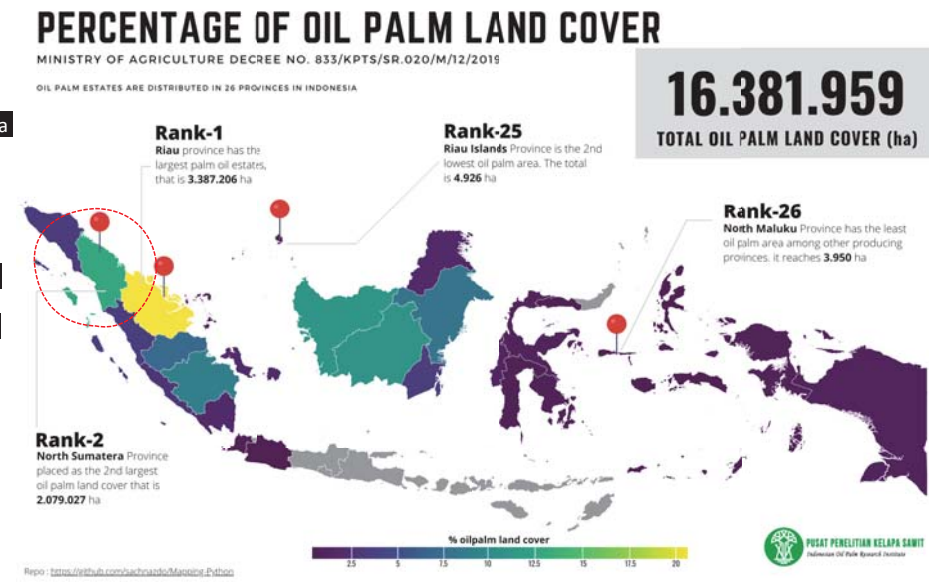
Qualitative Methods

- **Text Mining Analysis:** FGD with oil palm stakeholders (smallholders, practitioners, and experts) to gain initial perspective on biomass utilization
- **Sentiment Analysis :** *Machine Learning* approach to quantify stakeholder's perception (Pang & Lee, 2008)

Quantitative Methods

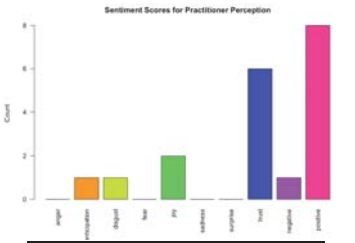
- **Analytical Hierarchy Process (AHP):** Multi-criteria decision-making tools to select the best option in terms of Benefit, Opportunity, Cost, and Risk (BOCR) (Saaty, 2008)
- **Study case in North Sumatera:** Labuhan Batu, Batu Bara, Langkat, and Serdang Bedagai Districts

North Sumatera is among the main palm oil producing provinces. The authors suggested that the biomass utilization may potentially incurred there.

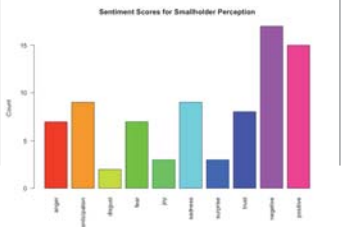


3. RESULT

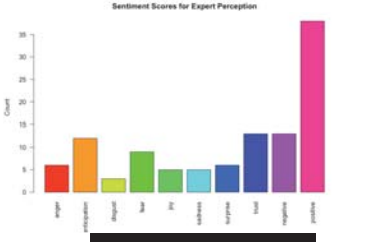
Text Mining Result



Practitioners:
Promote palm oil biomass utilization for the sake of sustainability



Smallholders:
Risk averse, not aware of climate-smart practice



Experts:
Promote and ready to facilitate implementation of biomass utilization

FOCUS GROUP DISCUSSION

RESULT AND OUTCOME

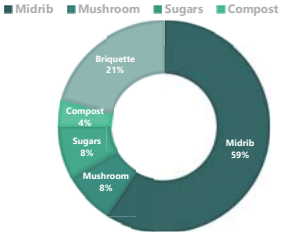
BASIC DESCRIPTION OF OIL PALM BIOMASS UTILIZATION TECHNOLOGY ALTERNATIVES

Criteria	Sub-Criteria	Briquette (EFB) (Cap: 1.500 kg/day)	Midrib Handicraft (Cap 50 pcs sheet/day)	Oyster Mushroom (EFB) (Cap 50kg/day)	Oil Palm Juice Sugars (Cap 4 MT/35 days)	Compost (EFB) (Cap 10 MT/day)
B	Profit	Income: Rp 18 mio/month Selling price: Rp 6.000/Kg	Income: Rp 5 mio/month; Selling price: Rp 8.000/kg	Income: Rp 9 mio/month; Selling price: Rp 18.000/kg	Income: Rp 23,5 mio/month; Selling price: Rp 13.000/kg	Income: Rp 20 mio/month; Selling price: Rp 6.000/kg
	Man Power	3 people	5 people	2 people	4 people	> 10 people
O	Easy to Operate	easy	difficult	easy	difficult	difficult
	Access to Raw Material	5 MT/ha/year	350 kg/ha/year	5 MT/ha/year	7-9 liter juice/tree	5 MT/ha/year
	Market Potential	Domestic use fuel alternative	Home industry product alternative	Nutritious food	Oil palm sugars	Organic fertilizer alternative
C	Investment Cost	Rp 70 mio	Rp 5 mio	Rp 30 mio	Rp 35 mio	Rp 600 mio
	Operational and Maintenance Cost	Rp 18 mio/month	Rp 7,4 mio/month	Rp 4,5 mio/month	Rp 25 mio/month	Rp 40 mio/month
R	Operational failure	low	low	medium	low	low
	Market	high	high	low	low	low
	Environment	low	low	low	low	low

RESULT AND OUTCOME
LABUHAN BATU DISTRICTS

n = 24 smallholders

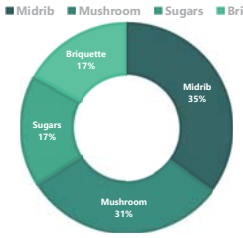
Land Ownership Category	Area (ha)			Income (Rp/month)			Expenditure (Rp/month)		
	range	mean	%	Oil Palm (OP)	Non OP	Total	Food	Non-Food	Total
Low	< 2 ha	1.61	31%	2,553	928	3,482	1,778.57	1,378	3,157
Medium	3 - 4 ha	3.40	23%	3,200	2,000	5,200	2,040	1,300	3,340
Large	> 4 ha	6.66	46%	3,700	-	3,700	900	1,000	1,900



RESULT AND OUTCOME
BATU BARA DISTRICTS

n = 29 smallholders

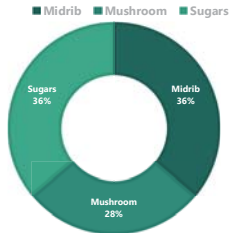
Land Ownership Category	Area (ha)			Income (Rp/month)			Expenditure (Rp/month)		
	range	mean	%	Oil Palm (OP)	Non OP	Total	Food	Non-Food	Total
Low	< 2 ha	1	28%	1,249	1,754	3,003	1,561	1,611	3,173
Medium	2.5-4 ha	4	24%	2,284	2,474	4,758	1,360	550	1,910
Large	> 6 ha	12	48%	10,466	18,283	28,750	2,166	9,333	11,500



RESULT AND OUTCOME
LANGKAT DISTRICTS

n = 14 smallholders

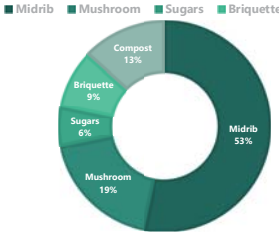
Land Ownership Category	Area (ha)			Income (Rp/month)			Expenditure (Rp/month)		
	range	mean	%	Oil Palm (OP)	Non OP	Total	Food	Non-Food	Total
Low	< 2 ha	1,40	16%	640	590	1,230	820	1,050	1,870
Medium	2.9-4 ha	3,49	24%	1,275	916	2,191	933	1,150	2,083
Large	> 5 ha	18,00	61%	14,733	-	14,733	2,000	6,333	8,333



RESULT AND OUTCOME
SERDANG BEDAGAI DISTRICTS

n = 32 smallholders

Land Ownership Category	Area (ha)			Income (Rp/month)			Expenditure (Rp/month)		
	range	mean	%	Oil Palm (OP)	Non OP	Total	Food	Non-Food	Total
Low	< 2 ha	1,59	25%	1,176	1,603	2,780	1,381	1,472	2,854
Medium	2,5 - 3 ha	2,75	20%	2,928	2,016	4,944	1,391	1,520	2,911
Large	> 8 ha	9,40	56%	7,530	1,740	9,270	1,760	3,480	5,240



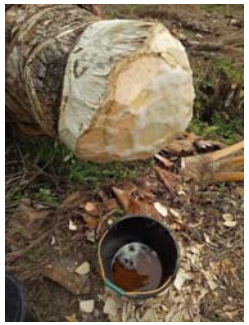
MIDRIB HANDICRAFT
SMALL MEDIUM ENTERPRISES

OYSTER MUSHROOM WITH EFB PLANTING MEDIA





OIL PALM TRUNK JUICE AS TRADITIONAL SUGARS




EFB (EMPTY FRUIT BUNCH) BASED BRIQUETTE





EFB (EMPTY FRUIT BUNCH) BASED COMPOST/ ORGANIC FERTILIZER





1. Smallholders were not familiar that the biomass utilization is part of climate-smart practice
2. Smallholders tend to risk averse their options. They most select the Midrib Handicraft alternative due to its lower investment cost.

3. This work was supported by INSINAS Research Grant 2019 (No: 18/INS-1/PPK/E4/2019)

CONCLUSION & ACKNOWLEDGEMENT

The Effect of Climate Change and Natural Disasters on Mangrove Forests in Xuan Thuy National Park: Proposed Adaptation Solutions for Mangrove Forests

NGUYEN Van Quang

Vietnam Japan University, Vietnam

ABSTRACT

Xuan Thuy National Park (XTNP) is the first Ramsar site in Southeast Asia. Most of core zone of XTNP is mangrove forests, where are homes and habitats of 222 birds, 202 plants, 386 invertebrates, and 154 fishes. Many of these species are listed in the IUCN Red List of Threatened Species. Mangrove forests in XTNP also help to protect the sea dykes and provide livelihoods for thousands of people in the buffer zone of the park. However, due to the impacts of climate change, sea level rise, and other natural disasters, mangrove forests as many areas in XTNP have been degraded. A survey conducted by the lecturers and students of the Master program in Climate Change and Development, Vietnam Japan University in XTNP in October 2020 showed that many mangroves along 7.5 km coastal areas in XTNP were killed by coastal erosion and waves. Another research conducted by Nguyen Van Quang in 2019 indicated that mangrove forests in XTNP could be seriously submerged by 1m or 2m sea level rise. If sea levels increase 1 m and 2 m, submerged mangrove forests could be 21% of total mangrove forests and 52.2% of total mangrove forests, respectively. Some adaptation solutions for protecting mangrove forests in XTNP include: (a) casuarina trees should be planted extensively on sand dunes outside of mangrove forests to protect mangroves and other species from coastal erosion, storms, waves, and sea level rise; (b) mangrove species that are more resistant to the effects of extreme weather and natural disasters should be planted to replace degraded mangrove forests; and (c) long-term strategies and plans prepared by the local government and leaders of XTNP in expanding mangrove forests to high-elevation areas in the park in order to adapt to the effects of sea level rise and other disasters are needed.

The effect of climate change and natural disasters on mangrove forests in Xuan Thuy National Park: Proposed adaptation solutions for mangrove forests



Nguyen Van Quang, Ph.D.
The Master's Program in Climate Change and Development (MCCD),
VNU Vietnam Japan University

Hoi An, November 17, 2020

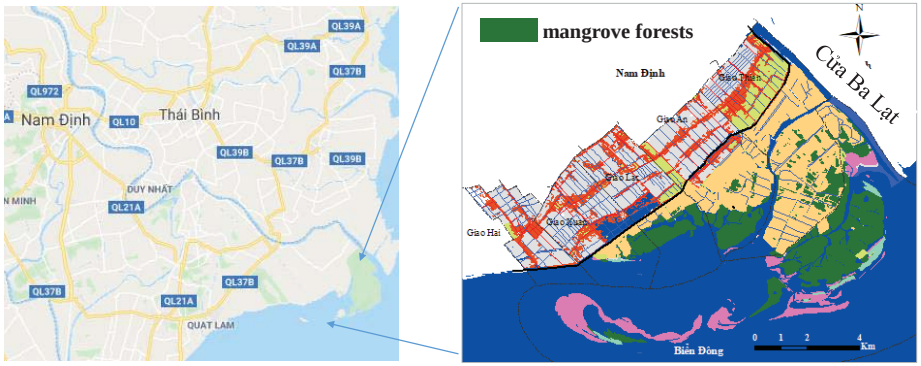
Contents

1. Introduction
2. Impacts of climate change/natural disasters
3. Some adaptations have been done
4. Proposed adaptation solutions for protecting mangrove forests
5. Lesson learnt and conclusions

Introduction

Xuan Thuy National Park:

- Located in Giao Thuy district, Nam Dinh province, Vietnam
- The first Ramsar site in Southeast Asia
- Most of core zone is mangrove forests (25.4 km^2)



High Biodiversity

Mangrove forests are homes, habitats of many species:

Name	Species
Bird	222
Plant	202
Invertebrates	386
Fish	154
Reptile	30
Animal	8

- Many of these species are rare.
- Especially, nine endangered birds, listed in the IUCN Red List of Threatened Species, have been recorded and sighted in XTNP

High Biodiversity

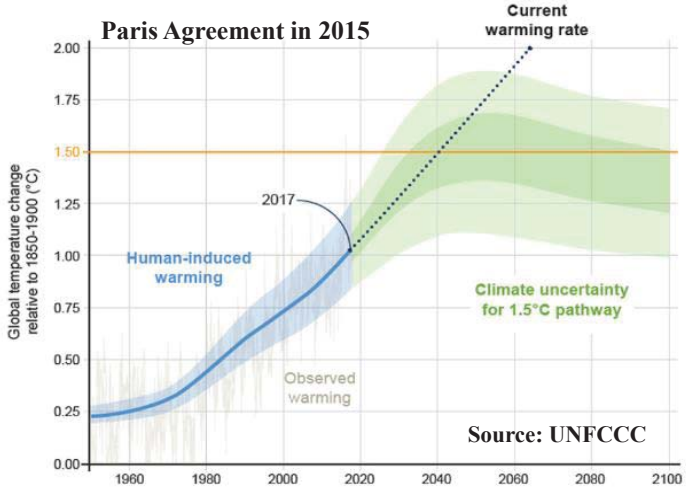
Migratory birds

Mangrove forests

Black-faced Spoonbill

Fieldwork

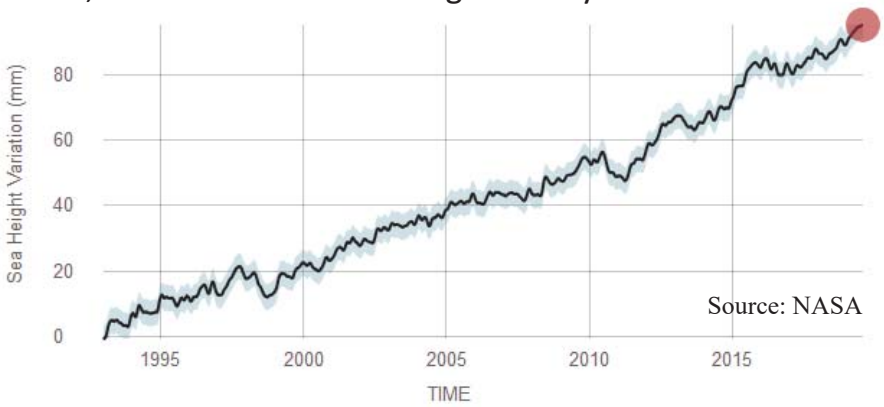
Climate Change/Natural Disaster Challenges



The number and intensity of typhoons and extreme hot days has been increased in recent years in XTNP (Interviews conducted by MCCD)

Sea Level Rise Issue

- Global sea level has increased significantly since 1992
- and, continues to increase significantly in the future



XTNP is located in a low elevation coastal region in Nam Dinh province of Vietnam, so the park is at risk from sea level rise

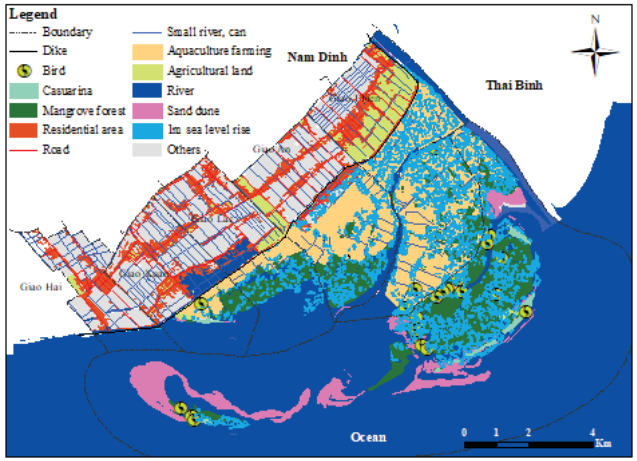
Impacts of Climate Change/Natural Disasters

Due to the impacts of climate change, sea level rise, and other natural disasters, mangrove forests as many areas in XTNP have been degraded

Dead mangroves by coastal erosion and waves

Impacts of Sea Level Rise

1 m Sea level Rise

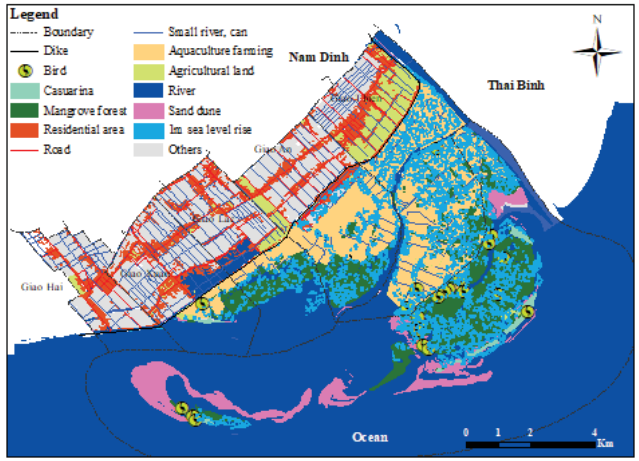


The map made by Nguyen Quang in 2019

Submerged mangrove forests could be (5.3 km^2) or **21%** of total mangrove forests at the end of century.

Impacts of Sea Level Rise

2 m Sea level Rise



The map made by Nguyen Quang in 2019

Submerged mangrove forests could be (13.3 km2) or **52.2%** of total mangrove forests at the end of century.

Some Adaptations and Other Actions Have Been Done

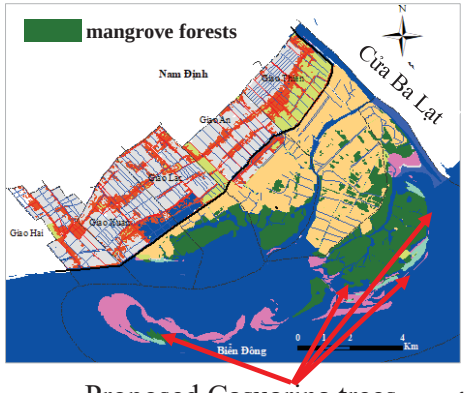
- Mangrove trees have already been **planted** in some areas in the core zone of XTNP

Some Adaptations and Other Actions Have Been Done

- Developed sustainable **livelihood models** (new models of shrimp farms), many local people in the buffer zone have not depended on resources in mangrove forests
- **Raised awareness** of the local people for protecting mangrove forests and reposing climate change/nature disasters

Proposed Adaptation Solutions for Protecting Mangrove Forests in XTNP

- Casuarina trees should be planted extensively on sand dunes outside of mangrove forests to protect mangroves from coastal erosion, storms, waves, and sea level rise



Proposed Casuarina trees

Proposed Adaptation Solutions for Protecting Mangrove Forests in XTNP

- Mangrove species that are **more resistant** to the effects of extreme weather and natural disasters should be planted to replace degraded mangrove forests or planted on bare land

Proposed Adaptation Solutions for Protecting Mangrove Forests in XTNP

- Long-term strategies and plans prepared by the local government and leaders of XTNP in relocating and expanding mangrove forests to high-elevation areas in the park in order to adapt to the effects of sea level rise and other disasters are needed

Lesson Learnt and Conclusions

- Mangrove ecosystems in XTNP are threatened by climate change and natural disasters
- Large areas of mangrove forests could disappear in the future by sea level rise
- Some adaptations and other actions have been done. However more strategies, plans, adaptations, and actions are needed for sustainable development of mangrove forests in XTNP

Thank you very much for your attention!

Q&A

Assessment of Saltwater Intrusion Vulnerability of Coastal Aquifers in Context of Climate Change in the Central Coastal Plains, Vietnam

PHAM Quy Nhan, TA Thi Thoang, TRAN Thanh Le

Ministry of Natural Resources and Environment, Vietnam

ABSTRACT

In context of unpredictable climate change, salt water intrusion is top concern to Vietnam coastal areas in general and central coastal region where there exists extreme climate condition and water supply demand's increase for socio-economic development in particular. Ground water resources with high potential are Quaternary unconsolidated aquifers. In order to clarify the current status of salt intrusion, we applied reviewing method for previous studies, the geophysical method (Vertical Electrical Sounding - VES) in addition with sampling and analyzing water samples from boreholes and dug wells to delineate salt-fresh water interface, GIS and mapping to zone salt intrusion vulnerability. The method GALDIT for assessment of salt intrusion vulnerability is applied in association with determining a weighting of each indicator by Analytical Hierarchical Process (AHP). The results shown that ground water salt intrusion of Quaternary unconsolidated aquifers have changed in recent years. Assessment and zonation of salt intrusion vulnerability of Quaternary aquifers in central coastal region has been clarified. In Northern area, high vulnerability occupies more than a half area of the plain (56.8% about 4,061.8 km2) while in Southern area, high vulnerability occupies almost areas of the plain (63.3%, about 5,724km^2). Based on current status of salt intrusion and zonation of salt intrusion vulnerability of Quaternary aquifers we recommend the some mitigated solutions which were verified for effectiveness and impacts by numerical modeling and analytical solutions. Some mitigated solutions which are recommended are infiltration basin, barrier wall and pumped well discharge optimization.

Keywords: Salt intrusion, Vulnerability, Climate change, Quaternary unconsolidated aquifers, Central coastal plain, Vietnam

Southeast Asia Research-based Network on Climate Change Adaptation Science (SARNCCAR)

INTERNATIONAL SEMINAR FOR CLIMATE CHANGE ADAPTATION PROGRAM

Sharing Interlocal Adaptation Lessons:
Climate change adaptations and development in East and Southeast Asia

Assessment of saltwater intrusion vulnerability of coastal aquifers in context of climate change in the central coastal plains, Vietnam

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Novemeber 17th, 2020

Outline

- Introduction
- Methods
- Results and discussions
- Conclusions and recommendations

Introduction

- Lobo Ferreira, Cabral (1991) and Ferreira (2005):

  Groundwater vulnerability to sea water intrusion to be defined as the sensitivity of groundwater quality to an imposed groundwater pumpage or sea level rise or both in coastal belt, which is determined by the intrinsic characteristics of aquifer

- *Africa:* Detr (1997) và Tony Arnel (1999)
- Ocean: Adrian D. Werner and Craig T. Simmons (2010); Adrian D. Werner, James D.Ward, Leanne K. Morgan, Craig T. Simmons, Neville I. Robinson,và Michael D. Teubner (2011); Morgan. L. K, Werner. A. D, Ivkovic. K. M, Carey. H., Sundaram (2013)
- Assessment method: SWI (Salt Water Intrusion); Strack (1989) and GALDIT method Lobo-Ferreira (2007)

Introduction

Last long from Thanh Hoa to Binh Thuan

Total areas: 16.207 km^2

Population: 10,4 triệu dân sinh sống.

Main aquifers: Pleistocene (qp) and Holocene (qh)

In context of CC and SLR and Socio-Economic developement Saltwater Intrusion in the aquifers have been happening

Introduction

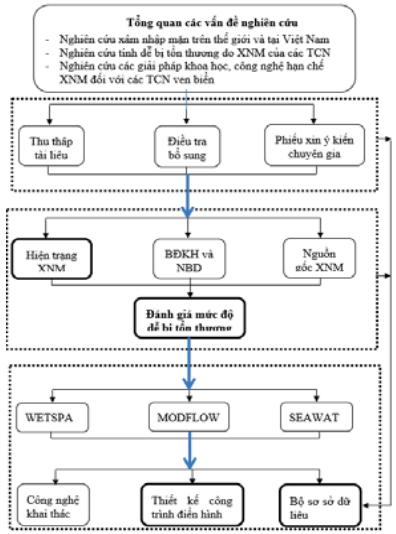
Objectives:

- Assessment of current status of salinity distribution in Pleistocene and Holocene aquifers
- Assessment of saltwater intrusion vulnerability in in Pleistocene and Holocene aquifers in context of CC & SLR and Socio-Economic development
- Suggestion of some engineering measures to mitigate saltwater intrusion in Pleistocene and Holocene aquifers

Methods

- Collections and compilations
- Statistics;
- Field surveys: Sampling, Geophysics, Monitoring, Seepage
- Modeling: SEAWAT, MODFLOW and MT3D
- GIS and RS;
- Expertise;

Methods



Results and discussions

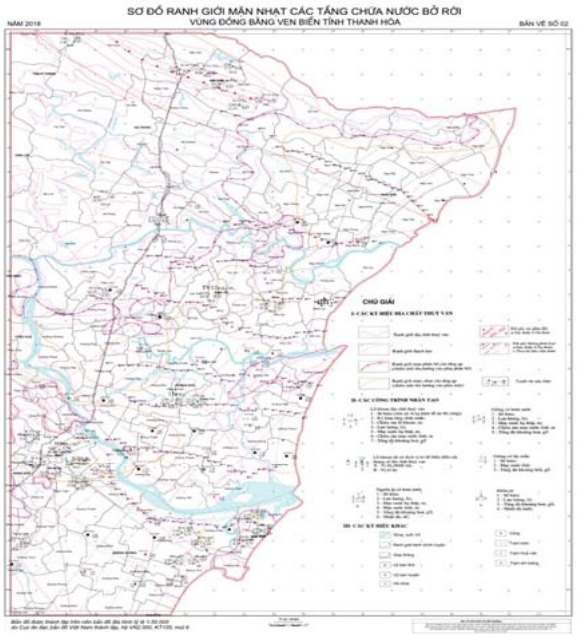
- Geophysical measurement (VES): 52 lines in Ninh Thuan, Binh Đinh, Quang Nam, Quang Tri, Ha Tinh, and Thanh Hoa plains with 1529 measurement points, length 336.380 m.
- Investigations for ground water extraction and contamination sources: 750 sheets
- 242 water samples: 223 chemical analysis, 148 stable isotopes
- Field surveys: double ring experiment 150 points, seepage 150 points
- 24 reporting sheets from experts.





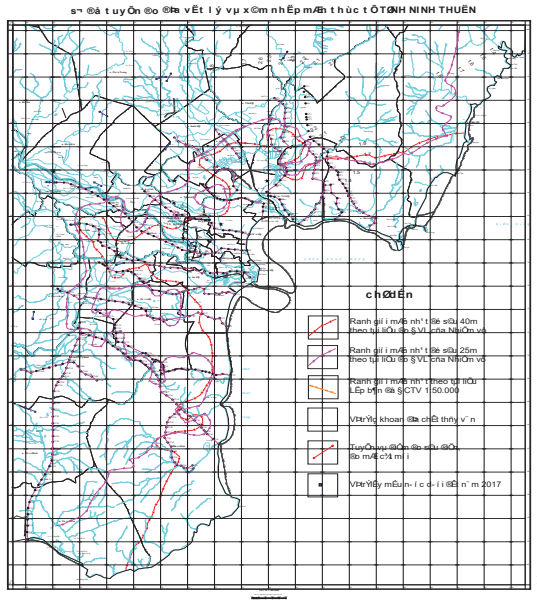
Results and discussions

Locations of geophysical measurment, water samples,



Results and discussions

Distribution of salinity in Pleistocene and Holocene aquifers in Ninh Thuan plain



Results and discussions

Distribution of salinity in Pleistocene and Holocene aquifers in Quang Tri plain

Results and discussions

Assessment method for saltwater intrusion vulnerability:

GALDIT, Lobo-Ferreira (2007) :

+ G - Groundwater Occurrence or Aquifer Type;
+ A - Aquifer Hydraulic Conductivity;
+ L - Height of Groundwater Level above Sea Level;
+ D - Distance from the Shore
+ I - Impact of existing status of Sea Water Intrusion
+ T - Thickness of Aquifer

$$GALDIT_{Index} = \frac{(W_1 \times G) + (W_2 \times A) + (W_3 \times L) + (W_4 \times D) + (W_5 \times I) + (W_6 \times T)}{\sum_{i=1}^{6} W_i}$$

Where:

W_1, W_2, …, W_6: Weighting factors based on Analytical Hierarchical Process
G, A, L, D, I, T: Points for each factor

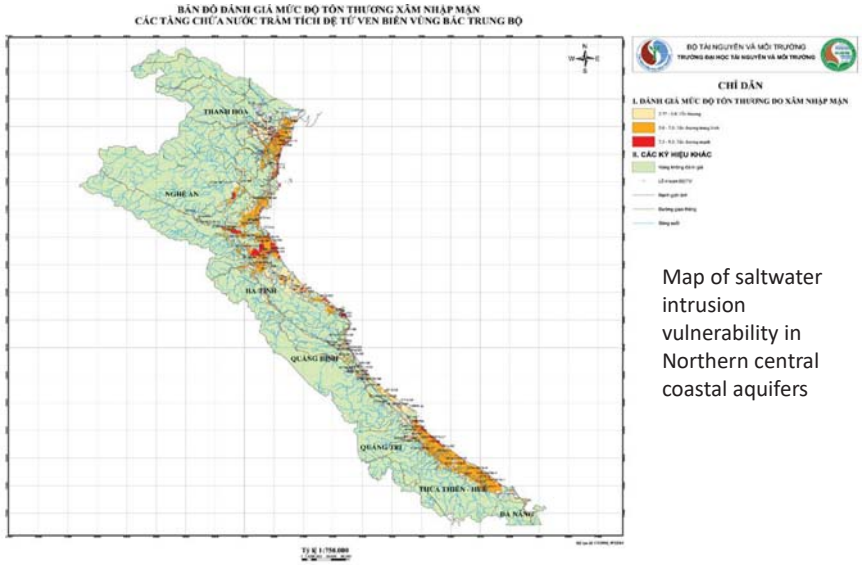
Results and discussions

Results of saltwater intrusion vulnerability

Các nhân tố ảnh hưởng	Trọng số	Đặc tính của các nhân tố	Điểm số của các nhân tố
Kiểu TCN (G)	0.419	TCN có áp	10
		TCN không áp	7.5
Hệ số thấm của TCN (A)	1.976	Cao (K>40m/ng)	10
		Trung bình (K:10-40m/ng)	7.5
		Thấp (K>5-10/ng)	5
		Rất thấp (K<5m/ng)	2.5
Mực NDĐ so với mực nước biển trung bình (L)	0.566	Rất thấp <1.0m	10
		Thấp 1.0-1.5m	7.5
		Trung bình 1.5-2.0m	5
		Cao >2.0m	2.5
Khoảng cách điểm tính đến đường bờ biển (D)	1.104	Rất nhỏ <2500 m	10
		Nhỏ 2500-5000 m	7.5
		Trung bình 5000-10000	5
		Xa > 10000m	2.5
Mức độ ảnh hưởng từ hiện trạng XNM (I)	1.618	Cao [Cl/HCO_3] >2.0	10
		Trung bình [Cl/HCO_3]:1.5-2.0	7.5
		Thấp [Cl/HCO_3]:1.0-1.5	5
		Rất thấp [Cl/HCO_3]<1.0	2.5
Chiều dày trung bình của TCN (T)	0.317	Lớn >10 m	10
		Trung bình 7.5 - 10 m	7.5

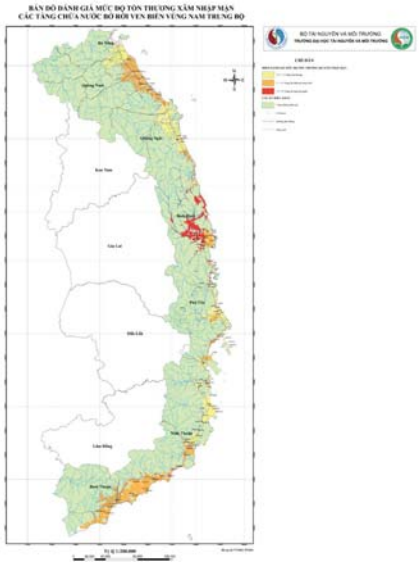
Điểm số GALDIT	Đánh giá mức độ tổn thương
2,5 - 5	Tổn thương
5 - 7,5	Tổn thương trung bình
7,5 - 8	Tổn thương mạnh

Results and discussions



Map of saltwater intrusion vulnerability in Northern central coastal aquifers

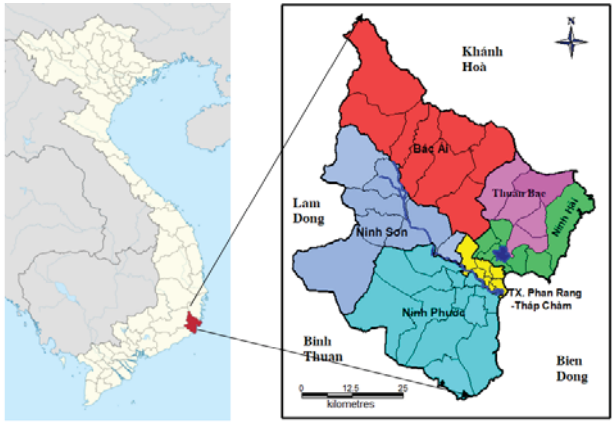
Results and discussions



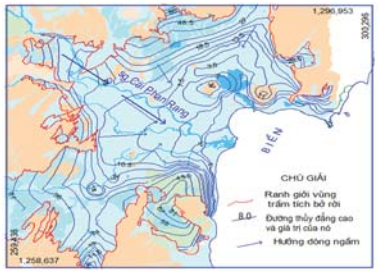
Map of saltwater intrusion vulnerability in Southern Central coastal aquifers

Results and discussions

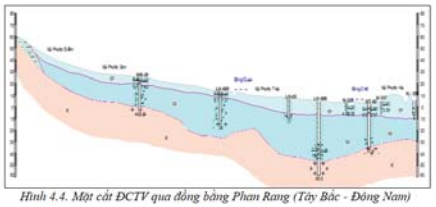
Some proposal engineering measures for mitigation of saltwater intrusion in coastal aquifers in Ninh Thuan province



Results and discussions



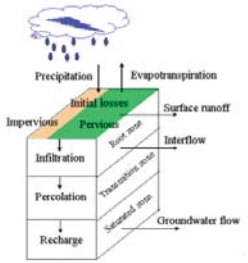
Hình 4.3. Sơ đồ thủy đẳng cao và hướng dòng ngầm lưu vực sông Cái Phan Rang



Hình 4.4. Mặt cắt ĐCTV qua đồng bằng Phan Rang (Tây Bắc - Đông Nam)

Results and discussions

Model WETSPA for groundwater recharge assessment

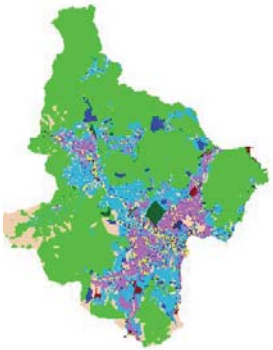


Hình 4.16 Sơ đồ tương tác giữa các hệ thống được mô phỏng trong mô hình WETSPA

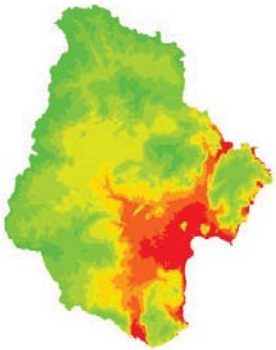
Results and discussions

Model WETSPA in Ninh Thuan

Data duration: 2011-2018



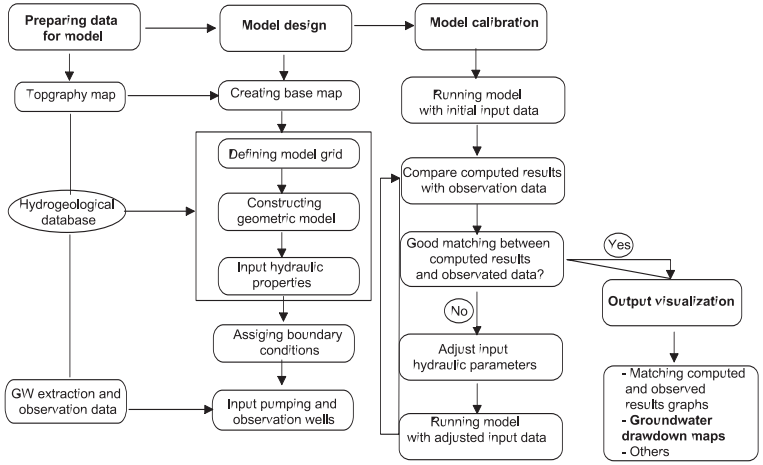
Map of land use



Groundwater recharge distribution

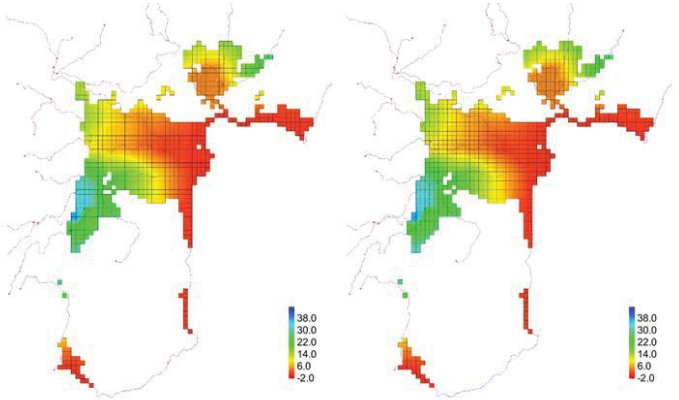
Results and discussions

Groundwater flow model



Results and discussions

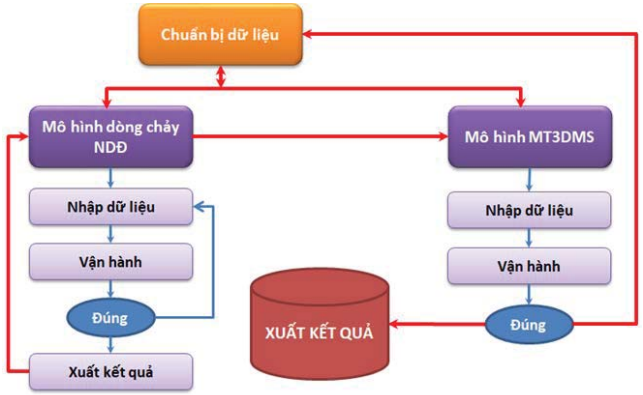
Groundwater flow model in Ninh Thuan: groundwater head predictions in Holocene aquifer in 2020 and 2050



Hình 4.34. Mực nước TCN qh năm 2020 và 2050

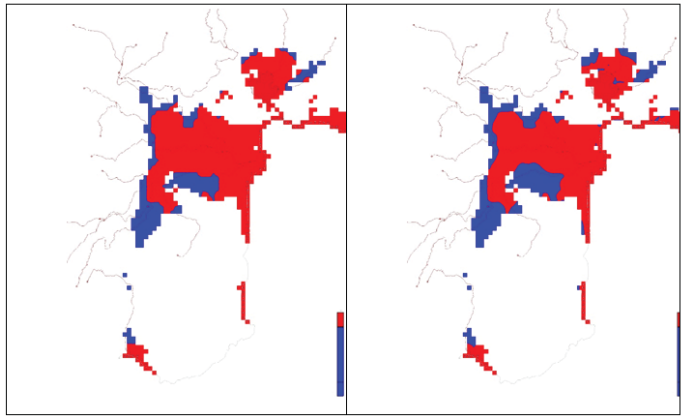
Results and discussions

Model SEAWAT for saltwater intrusion in the aquifer



Results and discussions

Model SEAWAT for saltwater intrusion in the aquifer: prediction results in Holocene aquifer in 2020 and 2050



Results and discussions

A reservoir design for groundwater recharge

Location selection:

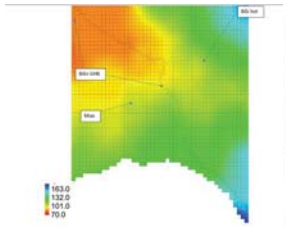
- Basin aquifers
- Unconfined aquifer
- Recharging surface water sources

Hình 4.41: Vị trí dự kiến thiết kế và xây dựng bồn thấm

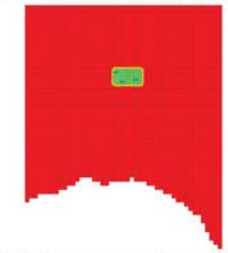
➔A selected area: An Hai, Ninh Thuan province.
Kích thước bồn thấm là 180x120m tương ứng với 21.600m^2.
Chiều sâu của bồn khoảng 5,3m

Results and discussions

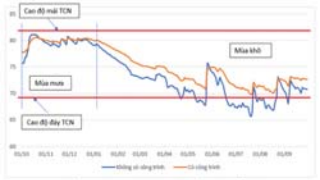
Comparisons of groundwater levels before and after reservoir construction



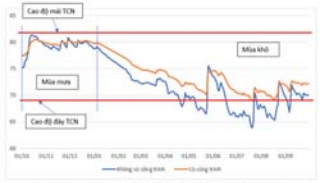
Hình 4.42: Mô phỏng điều kiện biên khu vực bồn thấm Suối Chai



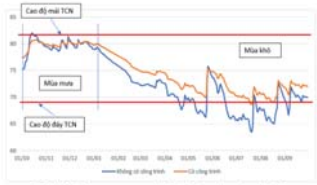
Hình 4.43. Vị trí các giếng khoan giả định trên mô hình.



Hình 4.44: Mực nước giữa 2 trường hợp của giếng G1



Hình 4.45 Tương quan mực nước giữa 2 trường hợp của giếng G2



Hình 4.46 Tương quan mực nước giữa 2 trường hợp của giếng G3

Results and discussions

A ground dam design

Selection area:
- Enough area of catchment for groundwater rising in dry season
- Aquifer thickness is thin

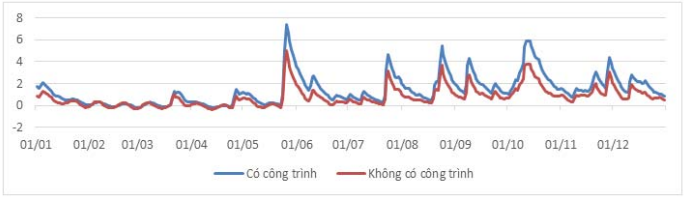
Hình 4.49: Vị trí đập ngầm được lựa chọn Vector màu trắng chỉ hướng dòng chảy NDĐ

➔Selected area: Ho Binh, Ninh Thuan province

Results and discussions

A ground dam design

Comparisons of groundwater levels before and after dam construction

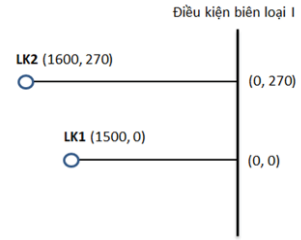


Hình 4.50 Mực nước dự báo phía trước đập ngầm trong 2 trường hợp: a) đường màu xanh thể hiện mực nước dâng lên sau khi xây dựng đập b) đường màu đỏ thể hiện mực nước trước khi xây dựng đập

Results and discussions

Optimization of pumping wells for sustainable groundwater exploitation

Adjusting the pumping rates for not being salt intrusion into wells



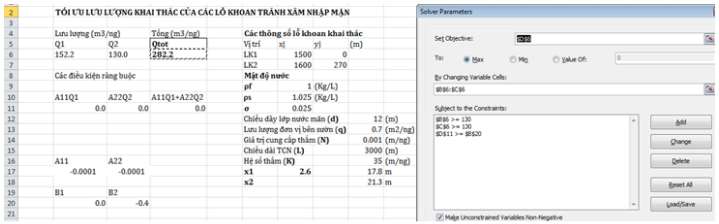
Hình 4.58 Sơ đồ hóa vị trí các lỗ khoan khai thác dự kiến TCN Holoxen vùng Ninh Thuận

Results and discussions

Optimization of pumping wells for sustainable groundwater exploitation

Results of pumping rate optimization by linear programing

Kết quả sử dụng công cụ SOLVER trong EXCEL để giải bài toán quy hoạch tuyến tính là Q1 của LK1 là 152m^3/ng; Q2 của LK2 là 130m^3/ng



Hình 4.59 Kết quả công cụ SOLVER trong EXCEL giải bài toán tối ưu lưu lượng khai thác tránh XNM

Conclusions and Recommendations

1. Current status of salinity distribution in Pleistocene and Holocene aquifers in Central coastal region
2. Assessment of saltwater intrusion vulnerability in Pleistocene and Holocene aquifers in Central coastal region
3. 03 proposal engineering measures for mitigation of salt intrusion in aquifers
4. The measures should be applied in comming years

THANKS FOR ATTENTION

Private Sector's Adaptation to Climate Change and CC Finance

TRAN Ngat Thi Thanh

Ministry of Natural Resources and Environment, Vietnam

ABSTRACT

Climate change increases risks, heightens vulnerabilities, and affects all economic sectors of countries around the world. This is especially true in developing countries, including Vietnam. The business community plays an important role in Vietnam's socio-economic development process. The presentations is about what is the impact of climate change on Vietnamese businesses and how the private sectors response to climate change. As well as climate change finance in Vietnam.

Green Banking Development in Vietnam

TRAN Thi Thanh Tu

University of Economics, Vietnam

ABSTRACT

Green banking encourages sustainable economic development and stimulates environmentally friendly activities. The objective of this paper is to assess determinants of green banking adoption in Vietnam. Based on on Kaeufer K. (2010) model of Green Bank with 5 levels, the authors use primary data from surveys collected from 128 senior managers, experts and policymakers at the beginning of the year 2020. The research results show that the level of green banking in Vietnam is 3 above of 5. That means most of Vietnamese banks have business segment or separate department focusing on green credit however that is much below the level 4 requiring that the banks have been setting up a systematic business on green banking services. The results of correlation and regression analysis indicate that the influence of macro factors on the level of green banking is the strongest, followed by the bank's financial capacity, government's supportive policies and green investment needs of business organizations. Conversely, the capacity of officials and the bank leader awareness on green banking do not significantly affect the level of green banking adoption in Vietnam. Recommendations for enhancing the green banking in Vietnam are suggested to policy makers as well as bank managers.

Enhancing the Role of Local Development Funds to Support Climate Change Adaptation in Bac Ninh Province

NGUYEN Phuong Bac

Ministry of Natural Resources and Environment, Vietnam

ABSTRACT

Bac Ninh is a province located in the Red River Delta, characterized by its small and narrow area, high population density, and lack of mineral resources. Specifically, the province ranks at third place after Ho Chi Minh city and Hanoi for the population's density. After 23 years of development, from an agricultural province, Bac Ninh has embraced the modernization direction for industrialization. Bac Ninh's economy is growing significantly, staying in the group of leading provinces and cities nationwide, and becoming a significant growth pole of the Capital Region and the Northern Vietnam key economic region. To achieve the above results, Bac Ninh has made good use of its natural advantages, developed and implemented many bold policies and breakthrough mechanisms, utilized its comparative advantage and competitiveness, etc., to promote economic growth towards sustainable development. Besides, Bac Ninh is also particularly interested in preventing climate change's negative impacts on economic development and attracting investment and business development.

Climate-smart Agriculture Opportunities for Mitigating Greenhouse Gas Emission from Paddy Rice in Quang Nam Province – Vietnam

DAO Thi Thu Hang[1], BUI Thi Phuong Loan[2], DINH Quang Hieu[2]

[1]Vietnam Japan University, Vietnam

[2]Institute for Agriculrual Environment, Vietnam

ABSTRACT

Widespread adoption of climate-smart agriculture (CSA) has the potential to reduce agricultural greenhouse gas (GHG) emission by managing irrigation and fertilizer and decreasing nitrous oxide (N2O) and methane (CH4) emissions. This study quantified the impact of CSA and conventional (CF) management practices on GHG fluxes for rice paddy fields in Dai Loc district, Quang Nam province in the winter-spring seasons of 2018 and 2019. GHGs was collected by closed chamber method at eight rice growth stages in two seasons so the total samples for two models (CSA and CF) were 640. The reductions corresponding with a conversion from CSA to CF practices are estimated to be have a mean reduction potential of 1788 kg CO2e ha-1 yr-1 and 837 kg CO2e ha-1 yr-1 in 2018 and 2019, respectively. The application of alternative wetting drying was considered as the main factor leading to the effective GHG emission mitigation of CSA model compared to CF model applying the continuous flooding.

Climate-smart Agriculture opportunities for mitigating greenhouse gas emission from paddy rice in Quang Nam Province – Vietnam

Presenter: MSc. Dao Thi Thu Hang
Vietnam Japan University, Vietnam National University, Hanoi, Vietnam
Institute for Agricultural Environment, Vietnam

Content

1. **Introduction**
2. **Methodology**
3. **Results**
4. **Conclusion**

Introduction

- **Rice** is the most important food crop and accounts for **>50% total food production** in Vietnam
- ¾ agricultural land is rice cultivation area but almost traditional farming with continuous flood, tillage, improper in using fertilizer → **major source of GHG emission**.
- BUR3 in 2018

+ Agriculture: 27.92% total GHGs emission in which **rice cultivation account for 49.35%**

Introduction

- Despite being a major emitter, agriculture is also considered to have a high potential for emissions reduction like **rice production activities**.

TARGETs:

- **Measurement and evaluation of GHG emissions in Climate-smart agriculture (CSA)** to assess the impact of adopting sustainable rice farming techniques to GHG emissions and propose sustainable farming solutions that both ensure productivity and reduce GHG emissions towards sustainable farming in low-emission green agriculture.

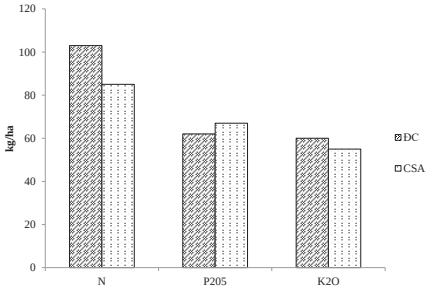
(Irrigated Agriculture Improvement in Vietnam (VIAIP) project funded by the International Development Association (IDA) of WB)

Methodology

1. Material

The study conducted in 2 fields: Climate-smart Agriculture (CSA) and conventional farming (CF) in Dai Loc district, Quang Nam province.

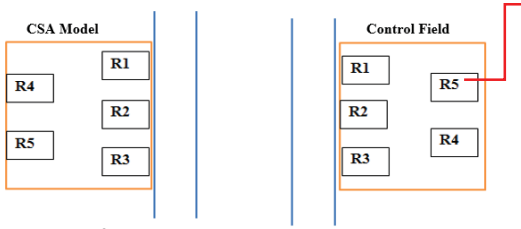
Items	CSA	CF
Coordinate	108,0751ºĐ; 15,8533ºB	108,0735ºĐ; 15,8574ºB
Soil type	Fluvial	Fluvial
Area	6800 m^2	6850 m^2
Cultivar	HT1	HT1
Amount of variety	70 kg/ha	90 kg/ha
Fertilizer management	Properly based on leaf colour chart for fertilizer nitrogen management	Based on farmer traditionally experiences
Water management	Alternative Wetting and Drying	Flood continuous



The amount of fertilizer in both models

Methodology

2. GHG sampling method



Closed Chamber

Total of samples: 4 samples (t0, t10, t20, t30) x 5 spots x 8 stages/season x 2 seasons x 2 observation site (CSA+control) = 640 samples

Transplanting stage, Top tillering, Stem elongation, Panicle initiation, Flowering stage, Milk stage, Dough stage

Methodology

2. GHG analysis method

- Gas samples are stored and analyzed for CH4 and N2O on GCMS machines at the laboratory of the Institute of Agricultural Environment.
- Greenhouse gas (CH4, N2O) flows were determined using static flow technique and gas chromatographic analysis of gas samples. Gas samples were analyzed by gas chromatography (Bruker 450-GC 2011).
- The amount of GHG emissions is calculated by the difference of the concentrations of CH4 and N2O at 4 times measuring 0, 10, 20 and 30 minutes, then calculating the emissions per hour, day, crop and year for unit area m2 or hectare.

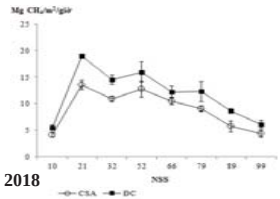
3. Calculating GHG emission

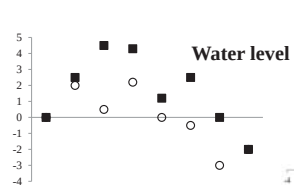
- Based on IPCC 2007. Total GHGs emission:

GHGs = CH_4 (CO_2 equiv.) + N_2O (CO_2 equiv.) = CH_4*25 + N_2O*298

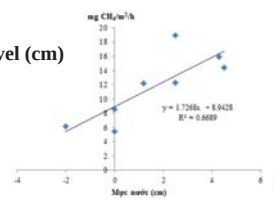
Results

1. CH4 emission

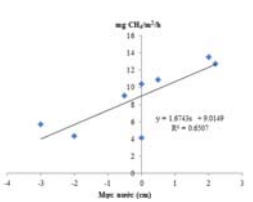




Water level and CH4 in CF

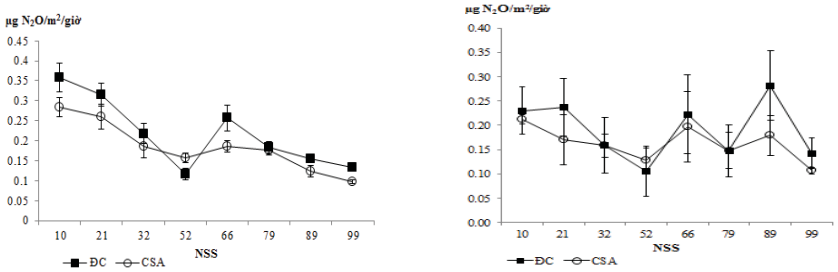


Water level and CH4 in CSA



Results

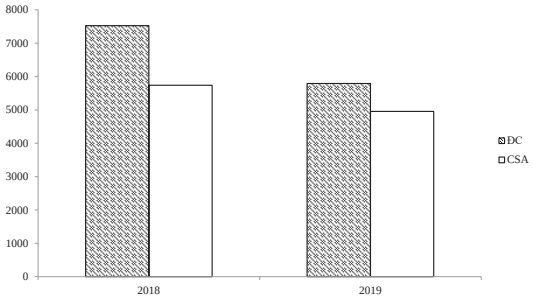
2. N2O emission



2018 **2019**

Results

3. Evaluation of Global warming potential



- CSA emissions are 23.8% lower in the winter-spring crop of 2018 and 14.5% in the winter-spring crop of 2019 compared to CF.
- CH4 accounts for 97% of total emissions in terms of CO2e, so the reduction of CH4 in CSA models due to the application of **AWD techniques** is the main cause of the reduction in GWP.

Results

4. Rice Production

Year	CSA/ CF	Total CH_4 emission (kg CH_4 ha/crop)	Total N_2O emission (kg N_2O ha/crop)	Total CO_2 emission (kg CO_2e/ ha/crop)	Yield (kg/ha)	Total emission kg CO_2e/kg paddy
2018	CF	294,61[a]	0,54[a]	7525,20[a]	6540,4[a]	1,15[a]
	CSA	223,99[b]	0,46[b]	5736,94[b]	6746,6[b]	0,85[b]
	LSD0.05	3,05	0,03	84,74	141,01	0,03
	CV (%)	0,70	3,4	0,7	1,2	1,5
2019	CF	226,2[a]	0,46[a]	5791,5[a]	6500[a]	0,89[a]
	CSA	193,5[b]	0,39[b]	4954,5[b]	6990[b]	0,71[b]
	LSD0.05	21,72	0,03	536,63	320	0,05
	CV (%)	5,9	4,1	5,7	2,8	3,8

Note: [a], [b]: Significant differences between formulas ($p<0.05$)

Conclusion

- CSA farming model has total emissions reduced by **14.5% - 23.8%** compared to traditional farming. Total GHG emissions from CSA fluctuate **4954.5 - 5736.9 kg CO2e/ha/crop**; CF from 5791.5 - 7525.2 kg CO2e/ha/crop. The application of **alternative wetting and drying (AWD)** irrigation techniques has significantly reduced CH4 emissions, which is the main source of emissions in paddy rice.
- The proper reduction of seeds, fertilizer and irrigation water in CSA model increases yield by **3.2% - 7.5%** higher than that in the conventional model. Emissions calculated per unit of product ranged from **0.71 - 0.85 kg CO2e/kg paddy** in the CSA model and 0.89 - 1.15 kg CO2e/kg of paddy in the CF model.

Thank you for your listening!







Examining the Effects of Climate Variability on Potato Yield: An Evidence from Bangladesh

JANNAT Arifa[1], ISHIKAWA-ISHIWATA Yuki[2], FURUYA Jun[3]

[1] University of Tsukuba, Japan

[2] Ibaraki University, Japan

[3] Japan International Research Center for Agricultural Sciences, Japan

ABSTRACT

The current research tried to highlight the effects of climatic factors variability on potato yield which is considered as the second largest produces after rice in Bangladesh. Bangladesh is the most climate change vulnerable country in the world where cereal production is adversely influenced by erratic rainfall, the extreme temperature during summer, increased water salinity, droughts, floods, river erosion, and tropical storms. This climate catastrophe leads to falls in major crop yields of up to 30% of total production, creating a very high risk of hunger. Although potatoes are not traditionally high on the menu for an approximate 160 million Bangladeshi people, but a surge in rice and wheat prices has prompted the government to popularize the potato as substitute to rice. The production of potato in different regions of Bangladesh are impacted by several climatic factors. To explore those climatic factor's effects, the current research was taken into consideration using district-level time-series data (1986-2013) based on the major seven climate zones of Bangladesh. This research, firstly, attempted to show the overall changes of climatic variables at the regional level and secondly, tried to predict the probable scenario for potato yield up to 2030. To generate the outlook of the variation of potato yield due to the changing scenario of climatic factors regression models were applied. The results indicated that on an average increase of temperatures 0.86˚c lower the yields of potato in most regions between 2.36 to 2.40%, but solar radiation had a positive effect on yield in some regions. The determinations of the study will generate an overview on the production constraints of potato due to weather patterns that can help the policymakers to formulate micro or macro level policy for the expansion of potato area with the pace of climate change.

Examining the effects of climate variability on Potato yield: An evidence from Bangladesh

Arifa Jannat[1], Yuki Ishikawa-Ishiwata[2], and Jun Furuya[3]

1 Faculty of Life and Environmental Sciences, University of Tsukuba
2 Global and Local Environment Co-creation Institute, Ibaraki University
3 Japan International Research Center for Agricultural Science

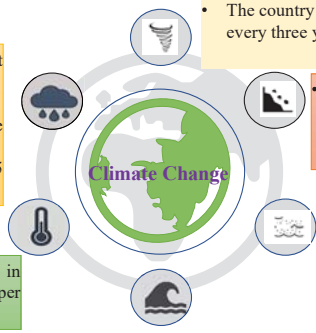
Climatic Variability in Bangladesh

Cyclones and Storm Surges

- UNDP has ranked Bangladesh first of all countries in the world in terms of vulnerability to tropical cyclones.
- The country is hit by a severe cyclone on average every three years.

Rainfall and Floods / Flash Floods

- Precipitation rate during monsoon is about 80%
- Flooding season: July-August
- Inundated area: About 25% in an average year
- (During severe floods, occurring every 4-5 years, over 60% of the country is covered.)



- Riverbank **erosion** results in the loss of thousands of hectares of agricultural lands16 and affects the population for decades.

Extreme Temperature and Drought

- The average daily temperature in Bangladesh has increased by 0.103° C per decade over the past four decades.

Salinity intrusion

- Loss of harvests but also of productive agricultural land.
- Out of 2.85 million hectares of coastal and offshore areas, about 1.2 million hectares of arable land are already affected by varying degrees of soil salinity.

Sea level rise

- The IPCC projected increases of 14 cm by 2030, 32 cm by 2050, and 88 cm by 2100 (compared to 2000).
- By 2050, about 27 million will be at risk due to the effects of sea level rise.

Over 72,480 families have been marooned by floodwaters in Kurigram district, relief and rehabilitation office sources said. [Zakir Hossain Chowdhury/Al Jazeera]

A man showing his field during drought [The Daily Star, 2016]

A woman in the Khulna district surveys crops destroyed by Cyclone Bulbul, which hit Bangladesh last month. [Zakir Hossain Chowdhury/Al Jazeera]

A depressed picture of crop loss due to cyclone *Amphan* [The Financial Express, 2020]

Focus of the study

- Self sufficiency in cereal production
- Imbalance dietary intake
- Nutritional deficiency

✓ Climate adaptation measures for cereal

× Insignificant research on non-cereal

Highlights…

- ☑ Potato, largest non-cereal food crop (alternative of rice)
- ☑ High yield and great nutritive value .
- ☑ Best adaptability capacity to temperate climates
- ☑ All year round crop
- ☑ Need less technology
- ☑ Price responsive

Study theme and Methods

Theme : 1

To overview the climatic factors at different climate prone area.

Theme: 2

To examine the impact of climate factors on potato yield in Bangladesh

Analytical Techniques

- Descriptive statistics
- Ordinary least square method
- Durbin-Watson test
- ADF test

Study Period: Historical data from 1986 to 2013

Data Sources: Bureau of Statistics (BBS), Food and Agricultural Organization (FAO), World Databank (World Bank), Data Distribution Centre (DDC) of IPCC, Representative Concentration Pathway (RCPs): IIASA

Analytical Tools: STATA, Microsoft Excel

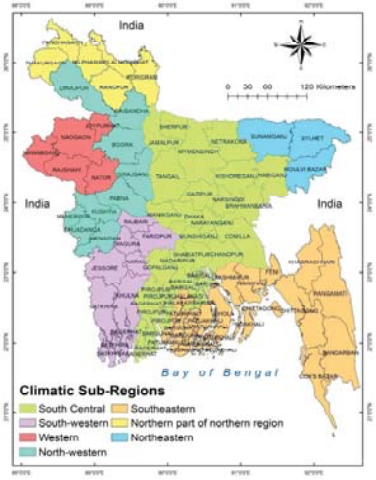


Fig: Map of Bangladesh showing seven climatic zones

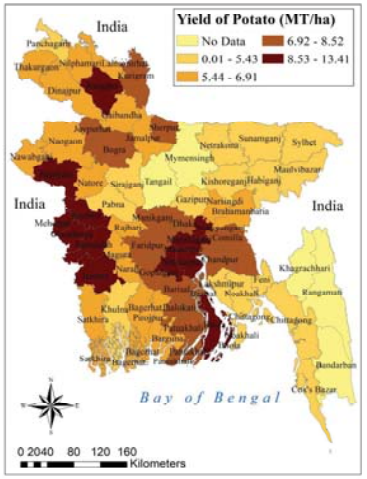
Potato crop calendar for Bangladesh

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Production Activities	↔	↔	↔								↔	↔

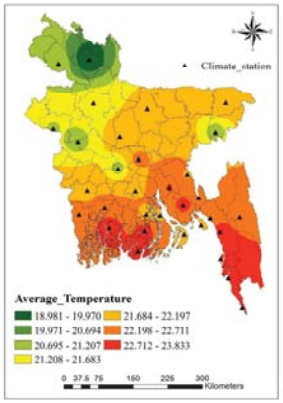
Source: Adopted from GIEWS, FAO 2008 and modified by Author

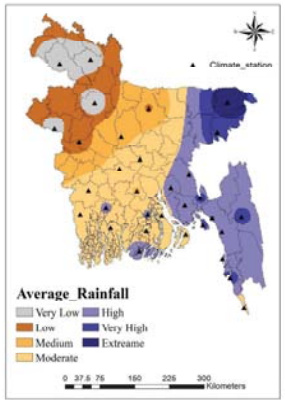
- Planting
- Tuberization
- Growing
- Harvesting

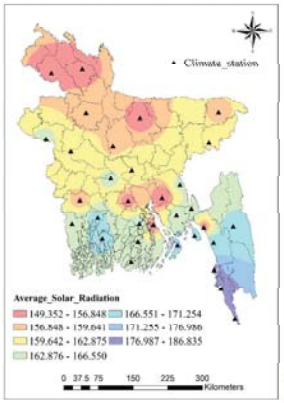
Overview of Potato yield (2012-2013)



Map of average temperature, rainfall and solar radiation (1986-2013)







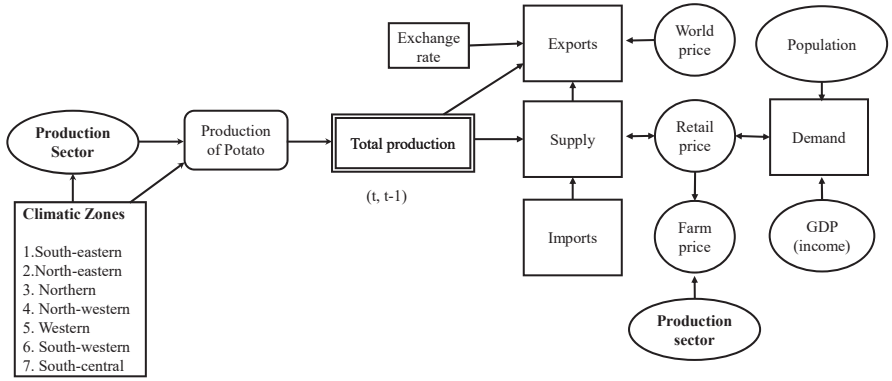


Figure: Flowchart showing supply and demand of the potato econometric model for Bangladesh

Parameters of Potato yield model

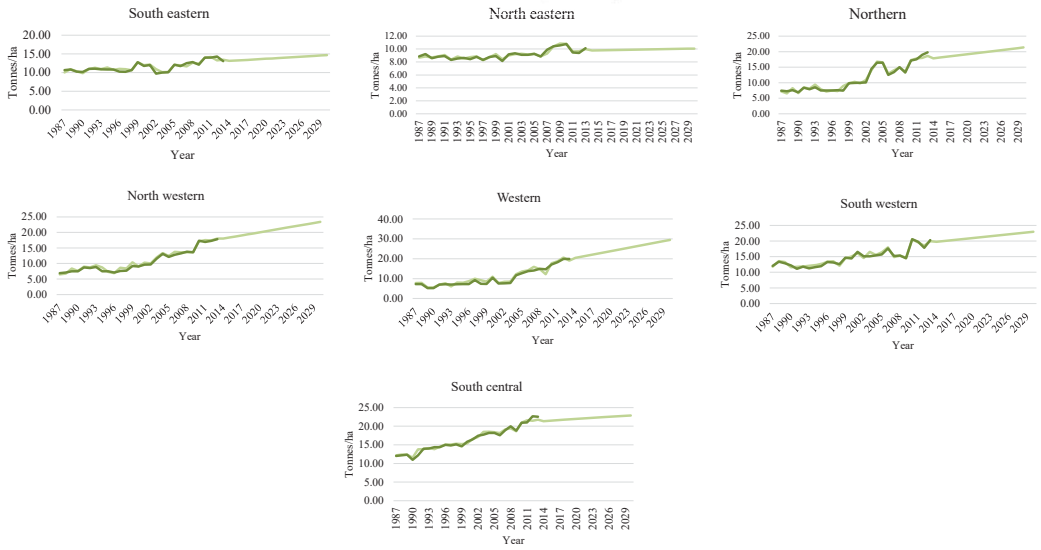
$Y_{iPotato} = f(Temp_i, SLR_i)$…….. (1.1)

Where, Y_{potato} is the potato yield of , i = 1, 2,3, 4, 5, 6 and 7 (seven climate sub-regions). Temp and SLR are denoted monthly temperature and solar radiation in the year of 1986-2013.

Zone	Intercept	Trend	Climate Variable	AdjR² DW
South-eastern	28.28134*** (5.03)	0.0966588*** (5.74)	-0.4499127DecT** (-2.12) -0.0553394JanSLR*** (-3.42)	0.82 2.01
North-eastern	6.437672*** (5.02)	0.0192224** (2.22)	0.2132203FebT*** (4.03) -0.0145707DecSLR (-3.02)	0.86 1.98
Northern	9.765469*** (3.41)	0.1880925*** (4.90)	-0.3415832JanT** (-2.31) 0.0194072NovSLR* (1.76)	0.97 1.69
North-western	22.73688*** (4.08)	0.3341331*** (7.54)	-0.5511593JanT** (-2.12) -0.0464835DecSLR** (-2.26)	0.89 2.08
Western	29.46091*** (6.41)	0.5662215** (2.84)	-1.14662DecT*** (-6.22) -0.0344241JanSLR* (-1.81)	0.97 1.87
South-western	6.666521* (1.95)	0.2018934*** (4.85)	-0.4635218JanT** (-2.56) 0.0823956JanSLR*** (5.86)	0.95 2.45
South-central	4.429411* (1.82)	4.480285*** (5.86)	-0.4586981JanT** (-2.54) 0.032975FebSLR** (2.01)	0.89 1.83

***,** **and** * indicates the level of significance at 1, 5 and 10%.
Values in ( ) indicates **t–values**. AdjR² is adjusted **R–square** and **DW** is Durbin–Watson values.
T and SLR indicate temperature and solar radiation, respectively.

Probable scenario of potato yield



Conclusion

- Potato, considered as second staple food, can replace the place of cereal item as major non cereal which covers 3.13% area after rice.
- It provides as much as 6% of the daily per capita calories and protein consumed in rural areas and a much higher percentage of total food intakes.
- This is also the off season for rice, the major staple for which potatoes are a partial substitute in many households.
- Besides, potato is grown in many different environments, but it is best adapted to temperate climates.
- This research can help the policy makers can formulate appropriate policy considering the future adverse climatic effects and encourage the farmers to expand potato growing area for sustainable food and nutritional security.

Thank You

Study on Short-Lived Climate Pollutants in Hanoi

DO Duy Tung[1], KITA Kazuyuki[2]

[1]Vietnam Japan University, Vietnam

[2]Ibaraki University, Japan

ABSTRACT

One of the most significances of Short-Lived Climate Pollutants (SLCPs) is warming effect to near term climate system at local and regional scale. They also disturb Asian monsoon and rainfall patterns in impacted regions through cloud conformation and reflection mechanism. Beside climate effects, SLCPs also cause human health problems and diseases related to respiratory and vascular organisms. Specifically, black carbon (BC) aerosols can cause lung cancer or heart diseases, tropospheric ozone can be dangerous to children and old people. In terms of food production, tropospheric ozone can damage plants by reducing their ability of CO2 absorption.

In my research, simultaneous observation of BC, tropospheric ozone (TO3) and particulate matter 2.5 (PM2.5), which are significant climate forcers, was carried out at Hanoi to clarify the concentrations and variations of Short-lived Climate Pollutants (SLCP) in Hanoi and Northern Vietnam. The research applied HYSPLIT trajectory model to distinguish contribution source regions of SLCPs to Hanoi. The results showed monthly average of BC, daytime TO3 and PM2.5 as 1-3μg/m3, 21-55ppbv, 18-65μg/m3, accordingly. Both BC and PM2.5 were remarkably increased during rush hours or night-time in diurnal variation. In contrast, TO3 was often high at noon and depleted to zero at night. These diurnal variations can be attributed to their local/regional emissions and production of them near Hanoi. The climax episodes of BC and PM2.5 were observed in wintertime, especially in January with periods lasting from 1 day to 1 week. These high rises were mostly associated with winter monsoon trajectories from South China Sea, which actually transported emissions from North East region of Northern Vietnam. These results firstly show a large contribution of Northern Vietnam sources of SLCP to their concentrations.

Given the significant climate forcing of BC, this study strongly suggests that mitigation measures to reduce BC in Vietnam can considerably improve both regional climate change and air quality in the Northern Vietnam region.

INTERNATIONAL SEMINAR FOR CLIMATE CHANGE ADAPTATION PROGRAM

Sharing Interlocal Adaptation Lessons:
Climate change adaptation and development
in East and Southeast Asia

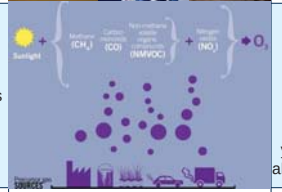
Study on **Short-lived Climate Pollutants** in Hanoi

Nov 17, 2020

Do Duy Tung – Vietnam Japan University

Hanoi

SLCPs and their significance

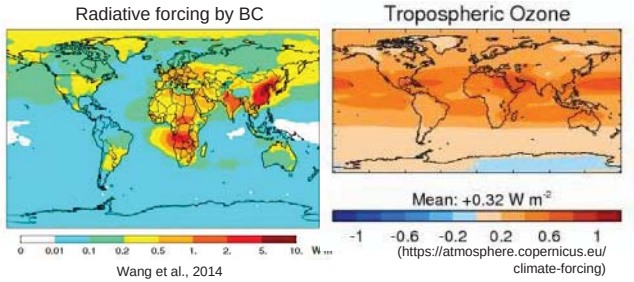
RF Agents	RF (W/m^2)	Lifetime in the atmosphere	Main Sources	Environmental effects
BC	+0.60 (best estimation)	4-12 days		**Health:** carrier of toxic chemicals to the human body as PM2.5
TO_3	+0.35	Hours - Weeks		**Health**: Cardio(heart)-Respiratory (lung etc.) diseases **Agriculture:** reduction of crop yield by damaging ability to absorb CO_2
CH_4	+0.48	12 years	Agriculture as a key factor contributing 40% globally	Increase of TO_3
HFCs	+0.32	Up to 29 years	Refrigerator, air-conditioning, foam agents, solvents	Reduction of stratospheric O_3
CO_2	+1.66	200 years	Fossil fuel and industrial processes	Acidification of ocean

IPCC 2007; UNEP and WMO 2011; CCAC

- Short-lived Climate Pollutants (**SLCPs**) are air pollutants, which have significant **warming effects** and **short lifetime** in atmosphere.
- Black carbon aerosol (**BC**) from incomplete combustion and Tropospheric ozone (**TO_3**) produced photochemically from other pollutants are target in this study.
- **$PM_{2.5}$** concentration data are also used as the **proxy of BC** data.

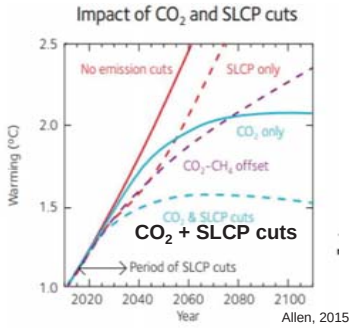
Climate effect of SLCPs

- **Co-benefits** of SLCPs' cut will avoid negative trade-offs since climate change, air pollution and sustainable development are inter-linked (IPCC, 2018).



Wang et al., 2014

Radiative forcing by BC and TO_3 increases is larger in East-Southeast-South Asia.

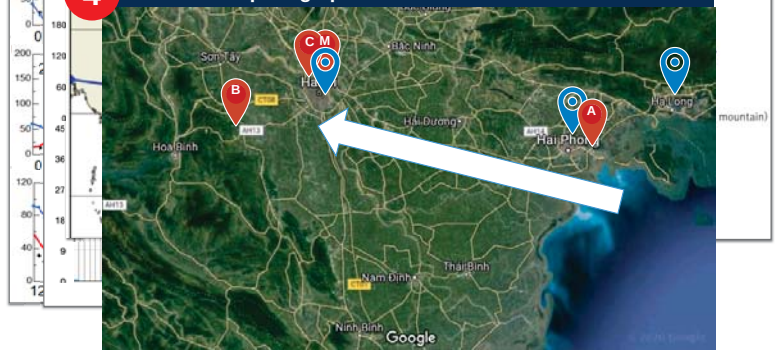


Allen, 2015

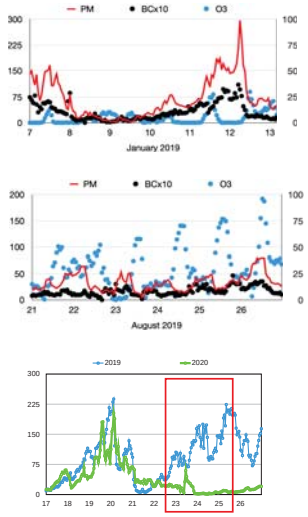
SLCP cut is essential for achieving +1.5C target.

Signatures indicating local/regional/remote contribution sources

1. Diurnal variation of SLCP concentration
2. Dependence on local meteorological condition
3. Trajectoy Areas near by Hanoi in different variations of SLCPs
4. Comparing upwind/downwind station data



SLCP variation observed in Hanoi



A. Winter monsoon season

- Episodic large increases of PM2 often observed. The episodes continued fo
- During the episodes, O gatively correlated with PM2.5

B. Spring and Summe

- PM2.5, BC and O_3 PM2.5 and BC incr daytime.

C. Variation during ever

- PM2.5 was reduced du

Observation strongly suggested that BC and TO3 increases are attributed to local/regional sources in Northern Vietnam.

Mitigation measure for SLCP

This study indicates:

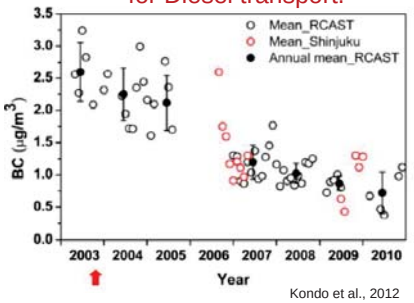
✓BC in Ha Noi was high enough to increase atmospheric heating rate.

✓Significant part of BC in Ha Noi was emitted from local/regional sources in Northern Vietnam.

⇩

Mitigation measures to reduce BC in Vietnam can considerably improve both regional climate change and air quality in the Northern Vietnam.

70-80% of BC was reduced in Tokyo by Stringent Regulations especially for Diesel transport.



Kondo et al., 2012

Conclusion

SLCPs in Hanoi are impacted significantly by **local/regional sources** rather than remote sources

The high rises of BC in winter were mostly associated with **trajectories from North East** region of Northern Vietnam

Mitigation measures to reduce BC in Vietnam can considerably improve both regional climate change and air quality in the Northern Vietnam

Cam on!

Climate Change Adaptation in Myanmar: Case Study in Wet Te Ku Group of Villages

Mai Ei Ngwe Zin

Vietnam Japan University, Vietnam

ABSTRACT

The average daily temperature over the country (Myanmar) has increased by 0.25°C and the maximum daily temperature has risen at a rate of 0.4°C during 1981-2010. Adaptive capacity and delivering adaptation actions reflect the adaptation response and it depends mainly on climate change awareness, policy, and education. Wet Te Ku group of villages, located in the Lewe Township, Dekkhina District, Nay Pyi Taw, Myanmar, characterized by low income and migrant workers. A livelihood survey was conducted from 19th – 23rd February 2020. Thirty farmers, including female-headed households, were selected randomly within the three villages for the interview. Agriculture is the major livelihood for the local people and rice contributes as the major crop. Harvest losses in 2019/2020 rice-growing season due to the earlier leaving of monsoon rain and low productivity by changing rice growing practice due to high expenditure, especially in female-headed households were noticed. These conditions lead some of the youths and men to migrate to nearby cities and abroad to find jobs, result in increasing the number of female-headed households. From the case study, limited knowledge in nature conservation, low level of climate change awareness, weak policy, limited research, financial and technical support are adaptation constraints and lead to vulnerable livelihood.

Southeast Asia Research-based Network on Climate Change Adaptation Science (SARNCCAR)

Climate Change Adaptation in Myanmar: Case Study in Wet Te Ku Group of Villages

17th, Nov, 2020

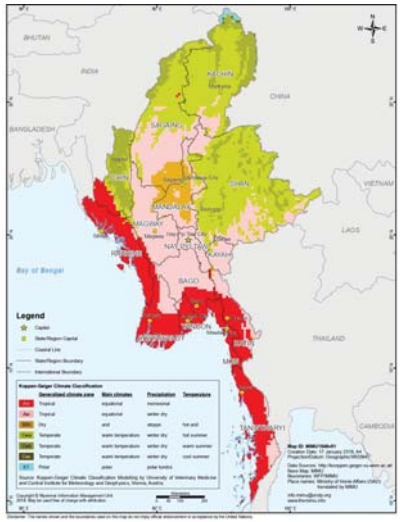
Present by Ms. Mai Ei Ngwe Zin
MCCD; Vietnam-Japan University

Contents

I. Introduction to Myanmar
II. Case Study in Wet Te Ku Group of Villages
III. Discussion: Gap between Myanmar Climate Change Policy and Ground Conditions
IV. References

I. Introduction

- Situated in Southeast Asia region
- Bordered with China on the north and northeast, Laos and Thailand on the east and southeast.
- Bay of Bengal arrange in the south of the country and the west by Bangladesh and India.



Map ID: MIMU1548v01 Creation Date: 17 January 2018, A4 Projection/Datum: Geographic/WGS84 Data Sources: http://koeppen-geiger.vu-wien.ac.at/ Base Map: MIMU

- Influenced by the **seven Koppen climates**, three distinct seasons: the monsoon season or wet, cold season, and the dry or hot season.
- Climate Change: Average daily temperature over the country has increased by **0.25°C** and the maximum daily temperature has risen with a rate of **0.4°C** during 1981-2010.
- The temperature in Myanmar is projected to rise by **0.7-1.1°C** during 2011-2040.

II. Case Study in Wet Te Ku Group of Villages

- ✓ Comprising with three sub-villages (Thit Taw Village, Wet Te Ku Village, and Naung Pin Thar Village), located in the Lewe Township, Dekkhina District, Nay Pyi Taw, Myanmar.
- ✓ 804 households and the total population is 3,240 . Agriculture is the major livelihood for the local people and rice contributes as the major crop.
- ✓ Characterized by low income and migrant workers.

II. Case Study in Wet Te Ku Group of Villages

- A livelihood survey was conducted from 19th – 23rd February 2020.
- Thirty farmers, including female-headed households, were selected randomly.

Discussion

(1) Types of livelihood

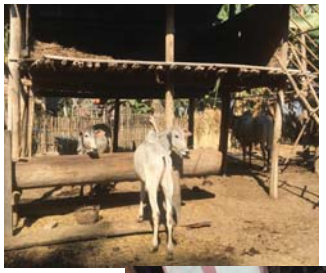
(2) Income contribution from their livelihood

(3) Experiences of climate change impact in their farms

(4) Alternative livelihood

(5) Support from local government

(6) Farmers'awareness in Climate Change.



II. Case Study in Wet Te Ku Group of Villages

- Monsoon paddy is the major cultivar and black gram, groundnut and sesame are cultivated after harvesting the paddy.
- Unavailable Irrigation system, ineffective support from government.
- Almost all of the interviewees encountered **harvest losses** for the 2019/2020 rice growing season due to the **earlier leaving of monsoon rain** and some farmers still could not harvest till February of this year, 2020.
- Frequency of shifting in raining patterns has become frequent during the previous five years but 2019/2020 season was the worst (According to farmer's experience).
- Low productivity by changing rice growing practice due to high expenditure, especially in female-headed households.
- Unwilling to follow Agro-ecological practices instructed by farmers schools.
- Only 6% of interviewee have alternative livelihood- gardening bamboo, dragon fruits, fish ponds. Others: migrant to nearby cities and abroad.

III. Discussion: Gap between Myanmar Climate Change Policy and Ground Conditions

- Adaptive capacity and delivering adaptation actions reflect the adaptation response and it depends mainly on climate change awareness, policy, and education (Roger B. Street, 2007).

Myanmar National Environmental Policy (2018-2030)

Vision
A clean environment, with healthy and functioning ecosystems, that ensures inclusive development and wellbeing for all people in Myanmar.

Mission
To establish national environment policy principles for guiding environmental protection and sustainable development and for mainstreaming environmental considerations into all policies, laws, regulations, plans, strategies, programmes and projects in Myanmar

National Environmental Policy Principles
1. Clean environment and healthy, functioning ecosystems
2. Sustainable economic and social development
3. Mainstreaming environmental protection and management

Sustainable Development Goals

National Strategic Framework

- National Environmental Master Plan/s
- States and Regions Environmental Master Plans
- Thematic Area Master Plan/s
- Sector-based Environmental Master Plan/s

Myanmar Climate Change Policy (2018-2030)

Vision
Myanmar's vision is to be a climate-resilient, lowcarbon society that is sustainable, prosperous and inclusive, for the wellbeing of present and future generations.

Guiding Principles:
1. Sustainable Development 2. Precaution, 3. Prevention 4. Environmental Integrity 5. Shared responsibility and cooperation 6. Inclusiveness 7. Good governance, 8. Climate justice and equity 9. Gender equality and women's empowerment

Policy Recommendations:
1. Food and water security 2. Healthy ecosystems 3. Low-carbon and resilient growth
4. Resilient urban and rural settlements 5. Human wellbeing 6. Knowledge, awareness and research

Measures for implementation
1. Laws, regulations, strategies, action plans and policies 2. Institutions 3. Finance, budgets and investment 4. Capacity-building 5. Research and technology 6. Partnerships 7. Transparency and accountability 8. Monitoring, evaluation, reporting and learning

III. Discussion: Gap between Myanmar Climate Change Policy and Ground Conditions

- Ground Condition: Limited knowledge in nature conservation, low level of climate change awareness, weak policy, limited research, financial and technical support (Wet Tel Ku Group of Villages).
- Considerable gap.
- Need to strengthen people knowledge, climate change awareness, research, and policy.

IV. References

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THANK YOU

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Is Vietnam a Real Transition Country in Terms of Forest Cover? A Case Study in Nghe An Province

DO Thi Nhinh[1], THORKIL Casse[2], KOTERA Akihiko[1]

[1]Vietnam Japan University, Vietnam

[2]Roskilde University

ABSTRACT

1. Background

As one of the first countries participating in REDD(+) programs, Vietnam has been claimed to experience a remarkable transition from net forest loss to afforestation in the last twenty years with an example of Nghe An province (Khuc et al., 2020). Using satellite image analysis, however, Hansen et al., 2013 concluded that Vietnam classifies as a top nation for gross tree cover loss in the beginning of the 21st century. Later, Khuc et al., 2018 singled out Nghe An as a province exhibiting the most deforestation between 2000-2010.

2. Methodologies

• Technical component: GIS was used to analyze the satellite images at all scales.

• Social-economic component: RCT was deployed for comparison between the two selected communes in Nghe An. Data was collected from 118 households by questionnaire interviewing and in-depth interviews with forest and local authorities.

3. Findings of the project

• The imagery analysis showed that during 2000-2018, Vietnam lost 1,105,000 hectares of primary forest and 32,474,966 hectares of tree canopy cover. 5 provinces exhibiting the most deforestation include Binh Phuoc, Dak Nong, Quang Ninh, and Bac Giang. In Nghe An, Thanh Chuong presented the highest deforestation rate while Con Cuong remains the greatest forest cover.

• In Nghe An, deforestation took place in Thanh Chuong mainly due to the construction of Ban Ve hydropower plant while deforestation is an issue in Con Cuong due to lack of livelihood choices. Fieldwork observations and interviewing with local people has demonstrated that the increase of forest cover in Nghe An originates from mono-crop forests (acacia), not natural forest. From the viewpoint of Climate Change, the conversion process constitutes a two-fold problem of higher emission and lower carbon sequestration in plantations compared to primary forests.

Is Vietnam a real transition country in terms of forest cover? A case study in Nghe An province

Do Thi Nhinh
Vietnam Japan University

Hanoi, 10 November 2020

Outline

- What is the situation of forest cover change in Vietnam?
- How to check the fluctuations of the forests and the drivers?
- What are the findings and its implications?

1. Forest cover change in Vietnam: Controversial

- Vietnam has been claimed to experience a remarkable transition from net forest loss to afforestation in the last two decades with an example of Nghe An province (Khuc et al., 2020).
- Using satellite image analysis, however, Hansen et al., 2013 concluded that Vietnam classifies as a top nation for gross tree cover loss in the beginning of the 21st century (p.851). Later, Khuc et al., 2018 singled out Nghe An as a province exhibiting the most deforestation between 2000-2010 among all Vietnamese provinces (p.133).

2. Methodologies

- Technical component: To check the fluctuations of the forests, GIS was used to analyze the satellite images at both national and provincial scales, here in Nghe An province between 2000 and 2018.
- Social-economic component: To work out drivers of forest depletion, RCT (Randomized Controlled Trial) was deployed for comparison between the two selected communes in the two districts of Nghe An province. Data was collected from 118 households by questionnaire interviewing. In-depth interviews with forest and local authorities were also carried out.

3. Findings of the project and its implication

- The imagery analysis showed that during 2000-2018, Vietnam lost 1,105,000 hectares of primary forest and 32,474,966 hectares of tree canopy cover.
- 5 provinces exhibiting the most deforestation include Binh Phuoc, Dak Nong, Quang Ninh, and Bac Giang.
- In Nghe An, Thanh Chuong presented the highest deforestation rate while Con Cuong remains the greatest forest cover.
  - Deforestation took place in Thanh Chuong mainly due to the construction of Ban Ve hydropower plant
  - Forest degradation is an issue in Con Cuong due to lack of livelihood choices.

3. Findings of the project and its implication (cont.)

- Fieldwork observations and interviewing with local people has demonstrated that the increase of forest cover in Nghe An originates from mono-crop forests (acacia), not natural forest.
- From the viewpoint of Climate Change, the conversion process constitutes a two-fold problem of higher emission and lower carbon sequestration in plantations compared to primary forests.

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Development of Bio-aerosol Sampler Onboard UAV (Drone)

SUZUKI Yuhei, KITA Kazuyuki

Ibaraki University, Japan

ABSTRACT

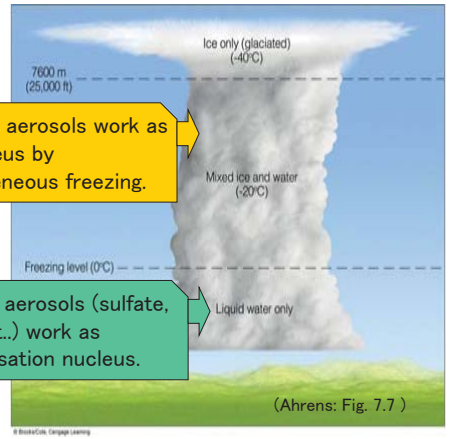
Primary organic particles released by living organism, including pollens, spores, virus and so on are called as Bio-aerosol. Bio-aerosol may play an important role in the formation of cloud nuclei and ice nuclei at higher air temperature than other aerosols. Thus, Bio-aerosols have been widely noticed because they can play an important role in climate. We want to estimate the emission flux by altitude distribution of aerosols concentration and dispersion model. And to measure the temperature at which bio-aerosols released from forest to the atmosphere become ice nucleus. For this purpose, our group is trying to measure the amounts of bio-aerosols released from forest to the atmosphere. We sampled bio-aerosols at the top of forest (20 m) and from helicopters (500 m) and found significant gap between them. To fill this gap, we are planning to sample bio-aerosols by using a UAV. As a first step, we are now designing bioaerosol sampler onboard UAV. The sampler needs to have following functions: monitoring sample air flow rate and altitude (atmospheric pressure) and controlling the shutter to avoid contamination of bio-aerosols at outside of target altitude range. To sample enough amount of bioaerosols, we designed inlet size (radius) and the impactor, which is a device to collect larger aerosols by utilizing inertial force. Next, we test of each component of the sampler, pressure sensor, flow meter, sampling target and shutter. Finally, we will assemble and test of total performance. We will present the significance of bioaerosols, concept of bioaerosol sampler design for UAV, and present status of its development.

S3-6.
Development of Bio-aerosol sampler onboard UAV (Drone)

Nov. 17, 2020
SUZUKI Yuhei, KITA Kazuyuki
Ibaraki University

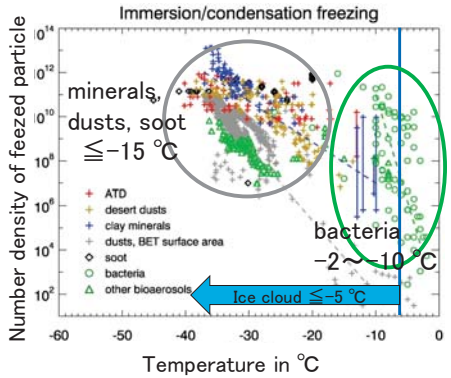
1. Introduction – Clouds and aerosol

- Clouds play significant role in weather and climate processes to affect:
  - Albedo (reflection of solar
  - Precipitation
- Aerosols work as nucle… the formation of cloud particles from water vapor.



1. Introduction
– Bioaerosols may fill the gap in cloud formation.

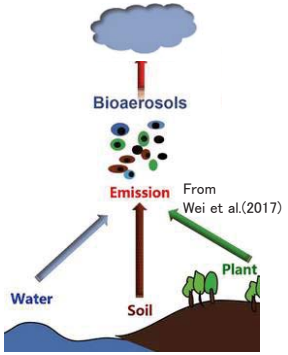
- Known ice nuclei (mineral dusts, soot …) can produce ice cloud particles only below temperatures of −15°C.
- Recently, it was found that some of **bioaerosols**, such as bacteria, spore and pollen, can produce ice particles at above −15°C.



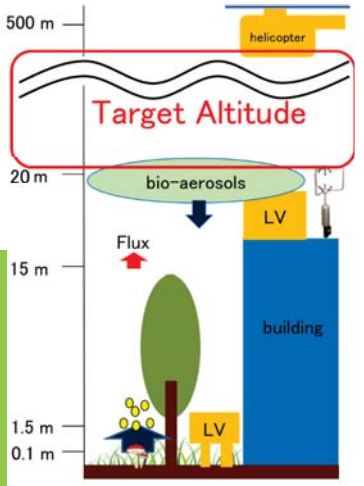
(Fröhlich-Nowoisky et al., 2015)

1. Introduction – Point at issue

- Sources of bioaerosols are plants (forests), soil and (ocean) water.
- Our group is trying to measure amount of bioaerosols released from forest.



We sampled bio-aerosols at the top of forest (20 m) and from helicopters (500 m) and found significant gap between them.



Emission Scenario
From Minami et al. (2020)

2. Objective of this study

- To estimate the emission flux from altitude distribution of bioaerosols concentration, we need to sample bioaerosols just above the forest trees.
- Sampling of bioaerosols on-board a UAV (drone) is a useful method for measuring bioaerosol profile above forest.

Developing a light-weight aerosol sampler designed for UAV.

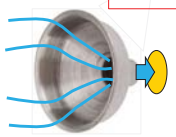
3. Design of UAV aerosol sampler

1. How to sample bioaerosols.

Air pump + filter

Too heavy and use much power

Air collector+ impactor

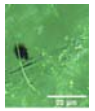


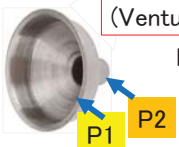
Using UAV motion, aerosol can be collected without power.

2. How to monitor air sampling rate

Mass flow meter

Larger aerosols may be lost:
D_{IN}=3.5mm
D_{out}=2mm





Pressure change (Venturi effect)

DP=P2-P1 indicates flow rate.

P1 P2

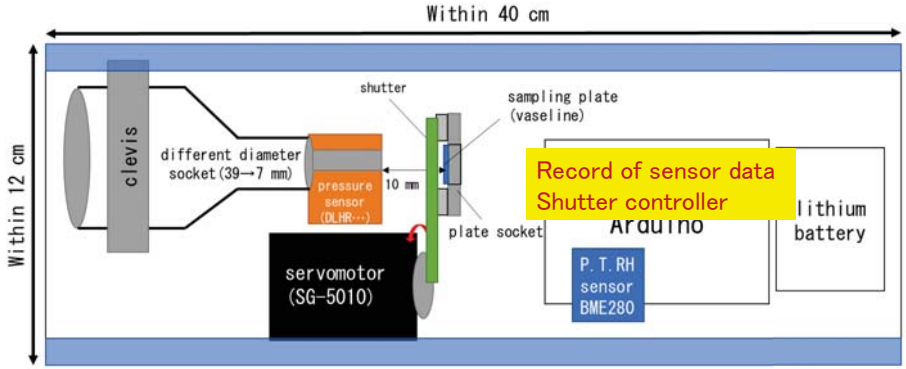
DP can be measured without loss.

3. How to monitor sampling altitude

Using a compact P,T,RH sensor, UAV altitude can be determined. Atmospheric condition can be also monitored.

3. Schematic design of the sampler

Conceptual design of bioaerosol sampler onboard UAV



Height··· within 75 mm, Weight··· within 500 g

2. Study plan – Development program

- Design

  Inlet size to get enough sampling air flow

  Impactor
- Test of each component of the sampler

  Pressure(+ temperature and RH) sensor

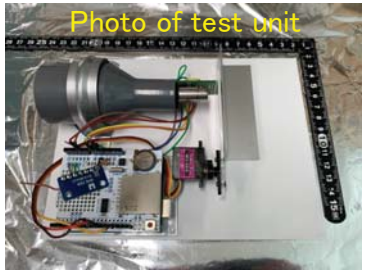
  Flow meter

  Sampling target

  Shutter
- Assembling and Test of total performance

4. Future plan

- We are assembling a experimental model unit now.
- The model unit will be onboard a vehicle.
- Check the total performance and improvement
- Trial sampling in Forest (next year)



Thank you for kind attention!!

Effects of Vegetation on The Urban Thermal Environment: A Case Study in Hanoi

TRAN Huyen Chi[1], KUSAKA Hiroyuki[2], PHAN Van Tan[1]

[1]Vietnam Japan University, Vietnam

[2]University of Tsukuba, Japan

ABSTRACT

Hanoi, like other cities in the world, has been facing a temperature rise due to urbanization and climate change, which may cause many problems related to human health and well-being. With its cooling effect provided through shading and transpiration, vegetation can be a good solution to regulate the thermal environment in cities like Hanoi. The present study aims to investigate the relationship between vegetation cover and air temperature (Ta), relative humidity (RH), and temperature-humidity index (THI). Ta and RH data in 14 sites and 20 sites among 23 urban sites with different green fractions in Hanoi were collected in January and June 2020 respectively to represent the winter and summer of 2020 in Hanoi, and the THI in these two months was estimated based on Ta and RH. It was shown that the urban heat island (UHI) effect was present in Hanoi in both January and June, but its magnitude was larger in June (2.1 °C) than in January (1.2 °C), and at night than by day. The green fraction was found to be positively correlated to Ta and THI, and negatively correlated to RH in June, but not correlated to those in January. On average, in June, the Ta in the areas with 15 - 42.5% vegetation was 0.9 - 1.7 °C lower than those with below 5% vegetation, and the THI in the areas with 9.1 - 42.5% vegetation was 0.5 - 0.9 lower than those with below 5% vegetation. Also, the green fraction was more significantly correlated to Ta, RH, and THI by day than at night. These results suggest that vegetation is an effective solution to higher temperatures as it can reduce the Ta and provide better thermal comfort in summer, especially during daytime, but does not make the surrounding area much colder in winter. However, as the cooling effect of vegetation is not significant at nighttime, there should be other solutions to the nighttime UHI.

Effects of Vegetation on the Urban Thermal Environment: A Case Study in Hanoi

Tran Huyen Chi
Vietnam Japan University

1. INTRODUCTION

- Cities have been facing a temperature rise due to **urbanization** (which leads to the ***urban heat island (UHI)*** effect) and **climate change**.
- Higher temperatures have adverse impacts on human health and well-being.
- Vegetation can be a good solution to this problem with its cooling effect provided through ***shading*** and ***transpiration***, as well as other benefits (beautiful landscape, air pollution reduction, carbon storage, etc.)

1. INTRODUCTION

Objectives

Investigate the relationship between vegetation cover and air temperature (T_a), relative humidity (RH), and temperature-humidity index (THI)

Study area

- Hanoi – the capital and the second largest city in Vietnam with 3,359 km^2 and 7.52 million people (as of 2018, according to GSO, 2020)
- Tropical climate with four distinct seasons
- Urbanized significantly during 1990-2010

2. METHODS

- Calculate mean monthly, daytime and nighttime T_a, RH, and THI in 14 urban sites in January and 20 urban sites in June 2020 (23 sites in total) using hourly T_a and RH data collected from PAM Air
- Compare the T_a means in urban sites to that on the outskirts (Ba Vi and Son Tay) collected from Meteorological Administration to find UHI
- Estimate the green fractions in 23 urban sites on an area with a distance of ~150 m from the sensors using aerial images collected from the United States Geological Survey (USGS) and Google Earth.
- Estimate the correlations of green fraction with T_a, RH, and THI

3. RESULTS

3.1 Seasonal and day-night variations of the UHI in Hanoi
3.2 Correlations of the green fraction with T_a, RH, and THI in January and June 2020

3.1 Seasonal and day-night variations of UHI

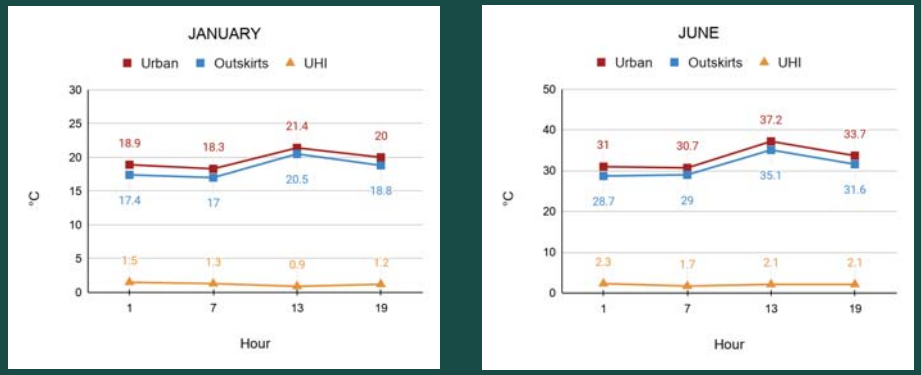


Figure 3.1 Air temperature and UHI between urban sites and outskirts in January (left) and June (right) 2020 at 1:00, 7:00, 13:00, and 19:00. "Outskirts" is the average of Son Tay and Ba Vi. "UHI" is equal to "Urban" minus "Outskirts"

3.2 Correlations of the green fraction with T_a, RH, and THI

- Correlations of the green fraction with T_a, RH, and THI were weak in terms of monthly mean, and both by day and night in January (very low r and $p > 0.05$).
- The green fraction was negatively correlated with T_a and THI ($r = -0.72$, $p = 0.0004$; $r = -0.59$, $p = 0.006$), and positively correlated with RH ($r = 0.52$, $p = 0.018$) in June.
- During daytime in June, the green fraction had a significant correlation with air temperature, humidity and THI ($r = -0.64$, $p = 0.0024$; $r = 0.57$, $p = 0.0091$; $r = -0.54$, $p = 0.014$). However, at nighttime, the correlations did not show a statistical significance ($p > 0.05$).

Lower T_a and higher THI in June found in areas with higher green fractions

Figure 3.2 Two streets in Hoan Kiem District

Hang Quat
T_a **33.8 °C**
THI **30**

Ly Thuong Kiet
T_a **32.3 °C**
THI **29.3**

Table 3.1 Air temperature, relative humidity, and THI classified by green fraction in June 2020

Green fraction (%)	Monthly			Daytime			Nighttime		
	T_a (°C)	RH (%)	THI	T_a (°C)	RH (%)	THI	T_a (°C)	RH (%)	THI
2.4 - 4.8	33.9	64.9	30.2	35.7	59.1	30.9	31.9	71.2	29.2
9.1 - 9.7	33.1	65.2	29.5	34.5	60.4	30.2	31.6	70.3	28.8
15 - 18.1	33.0	66.4	29.6	34.6	60.8	30.2	31.2	72.4	28.7
22.4 - 24.9	32.9	68.0	29.6	34.6	61.8	30.4	31.0	74.6	28.7
42.5	32.2	69.2	29.2	33.7	63.9	29.9	30.6	74.9	28.3

- Monthly T_a in the areas with 15 - 42.5% vegetation was **0.9 - 1.7 °C** lower than those with below 5% vegetation.
- Monthly THI in the areas with 9.1 - 42.5% vegetation was **0.5 - 0.9** lower than those with below 5% vegetation.
- During daytime, T_a and THI in the areas with 9.1 - 42.5% vegetation was respectively **1.1 - 2 °C** and **0.5 - 1** lower than those with below 5% vegetation; while at nighttime, the differences were only **0.3 - 1.3 °C** and **0.4 - 0.9**, respectively.

4. CONCLUSIONS

Key findings

- The UHI in Hanoi varies with the season and between day and night. Its magnitude is larger in summer than winter, and at night than by day.
- Vegetation has effects on T_a, RH, and THI in summer, but does not in winter.
- In summer, the green fraction is negatively correlated with T_a and THI, and positively correlated with RH.
- The cooling effect of vegetation is more significant during daytime than at nighttime.

4. CONCLUSIONS

Lesson learned

- Vegetation is an effective solution to higher temperatures as it can reduce the T_a and provide better thermal comfort in summer, especially during daytime, but does not make the surrounding area much colder in winter.
- As the cooling effect of vegetation is not significant at nighttime, there should be other solutions to the nighttime UHI in Hanoi.
- The vegetation cover in Hanoi is relatively small, so it is necessary to increase the vegetation cover.

4. CONCLUSIONS

Limitations

- The UHI magnitudes may not be the exact UHI magnitudes since urban and outskirts data were collected from two distinct organizations, but they can still show the difference trend between seasons, and day and night.
- The green area used just reflects the relative correlations as it is difficult to find the influence radius of air on temperature and humidity sensors.
- The research did not consider the effects of other factors on T_a and RH in the study sites, so the pure effects of vegetation on these variables have not been figured out.

THANK YOU!

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Climate Security in Vietnam from Policy's Perspective

BUI Thi Hoa, Mai Trong Nhuan

Vietnam Japan University, Vietnam

ABSTRACT

Climate change was recognized by UN in 2006 as a comprehensive threaten to the humanity – an issue of security. It might lead to the collapse of some countries which are vulnerable to climate change, including Vietnam. This paper tried to clarify the concept of climate security and how climate-related policies in Vietnam should be prioritized to response to climate change in the future. In the scope of this study, climate security was viewed under four main pillars: food security, water security, energy security and human security. Current situation of policy system in Vietnam on climate security also was analyzed.

Students' Perception on Climate Change Mitigation

VU Kim Duyen[1], ITO Tetsuji[2]

[1]Vietnam Japan University, Vietnam

[2]Ibaraki University, Japan

ABSTRACT

By the mixing method, the study "Students' perception on climate change mitigation- case study in Ibaraki and Hanoi" has shown a number of characteristics in students' perception on climate change mitigation.

In general, there is not much difference between Vietnamese and Japanese students in terms of access to climate change information. Therefore, most students in both study sites have basic knowledge and understanding of climate change as well as its causes and consequences. However, Japanese students were more concerned with disasters and some of them believe that tsunamis and earthquakes are one of the fears that go beyond climate change.

Meanwhile, Vietnamese students expressed concerns on the increase in temperature as well as the unusual developments of extreme weather events because these directly affect their family's life and livelihood.

More specifically, while Vietnamese students feel that the responsibility of climate change mitigation is being implemented unfairly and equally in their home country, most Japanese students realize that this is being implemented in a very fair way and social responsibility is equally divided among all individuals and organizations.

Students' perception on climate change mitigation

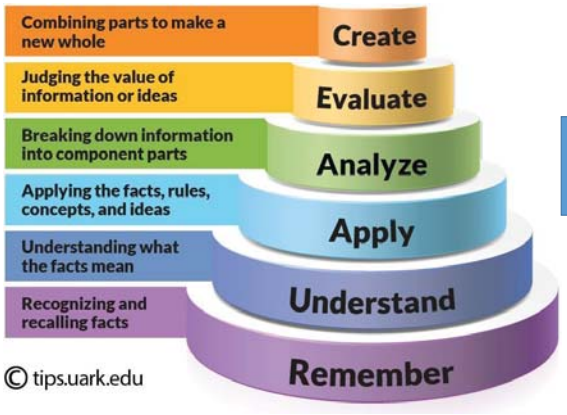
Vu Kim Duyen
Program: MCCD
University: Vietnam Japan University

Contents

Logical framework
Main results
Conclusions

1. Logiccal Framework

Bloom's taxonomy



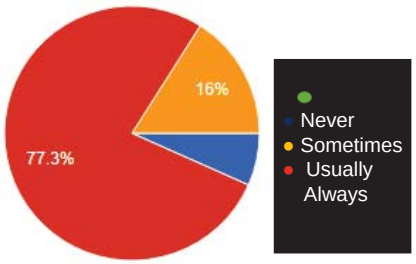
Survey and interview

Students in Ibaraki and Hanoi

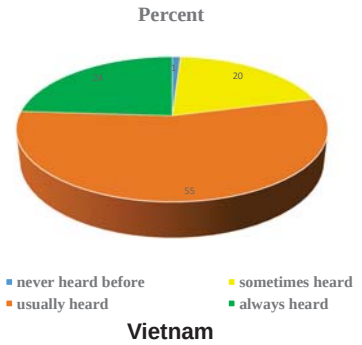
Source: https://tips.uark.edu/using-blooms-taxonomy/

2. Main results

Have you ever known about global warming?

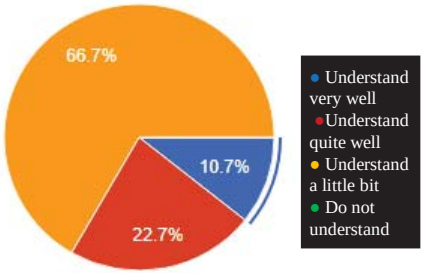


Japan

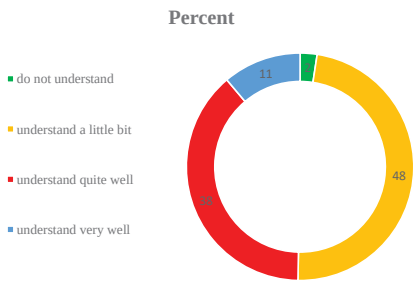


Vietnam

Understanding level about global warming

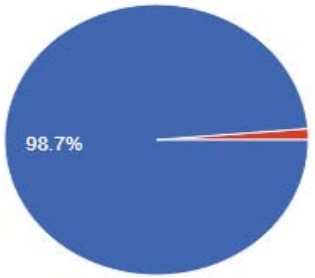


Japan



Vietnam

Are you believe global warming happening?



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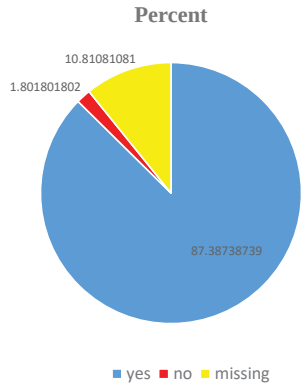
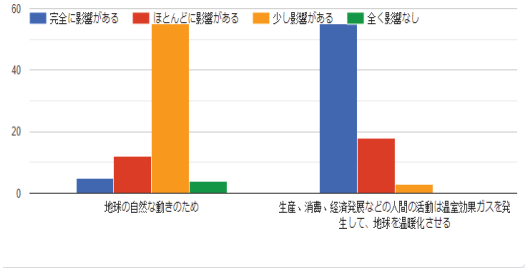
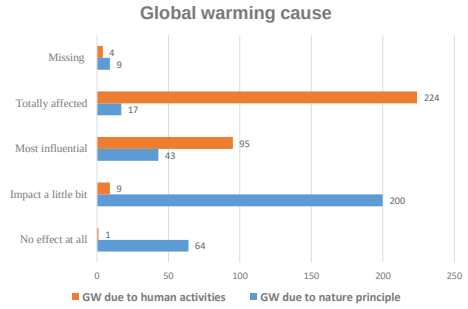


Vietnam

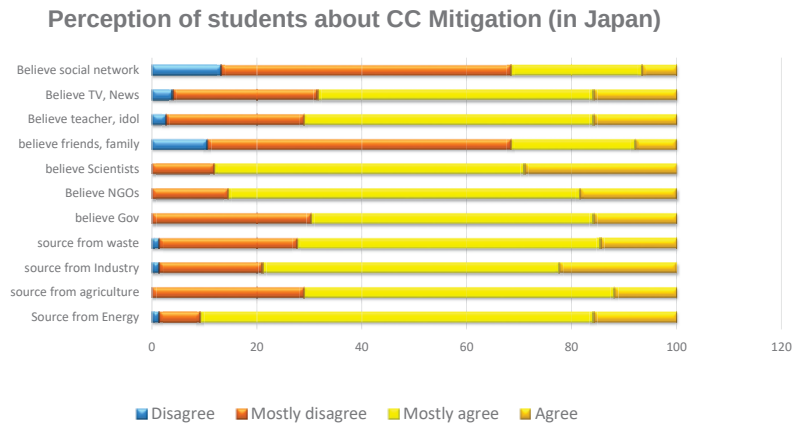
What are the cause of global warming?



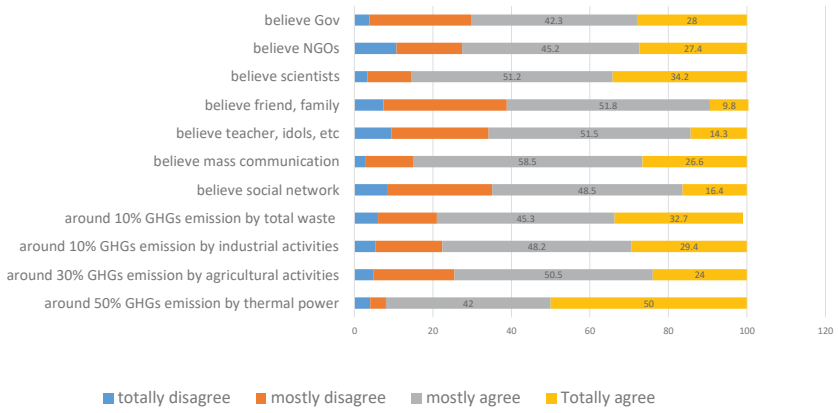
Japan



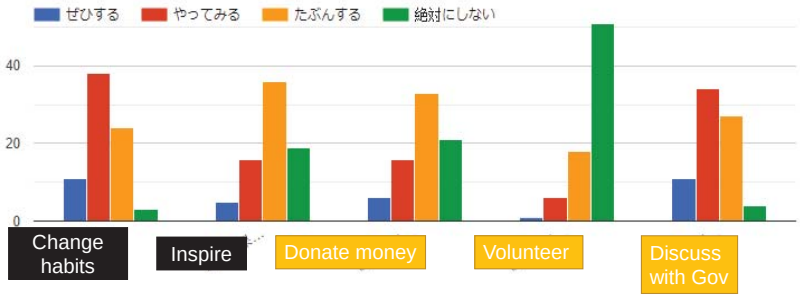
Vietnam



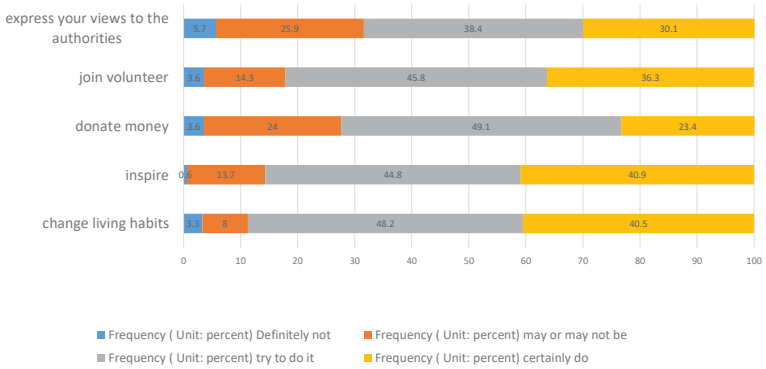
Perception of students about CC Mitigation (in Vietnam)



Willingness to do (Japan)



Willingness to change behaviors (in Vietnam)



From perception to action?

38 Vietnamese students donated money to project “Planting tree” and 2 people want to become volunteer

Only one Japanese student who is my friend, donated for this project

➔ It means that Japanese students are very concerned about climate change and willing to contribute. But, they need to find a reliable and professional place to accompany them

Name	Intentive money
Phuong MIE	100,000
Trọng Hoang	500,000
P.K.Dien	200,000
D.K.Ngoc	300,000
Ms.Ha	550,000
Lien	500,000
Thang	100,000

Name	Intentive money
.....	
Thuy (Lang ta)	3,995,000
Duong Ha (Thailan teacher)	100,000
Mrs. Hien	200,000

3. Conclusions

- ❖ Most students have a basic understanding of climate change
- ❖ Students are well aware of the causes of climate change and the sources of emissions that increase greenhouse gases
- ❖ There is a big gap between students' perceptions and actions

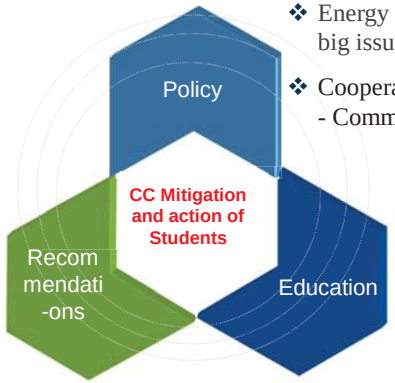
➔More specific policies and action strategies are needed to engage students

➔Solidarity - coordination between domestic and international students

➔Students expect empowerment and impetus from government and community

4. Recommendations

- ❖ Supply of decarbonized energy.
- ❖ Improvements in energy efficiency
- ❖ Minimization of demand for energy
- ❖ Increase sequestration by forests.
- ❖ RE should be consisder
- ❖ Develop transportation in big city and synchronized planning new cities
- ❖ Increase forests



- ❖ **Focus on many private sectors.**
- ❖ Energy is the most important –and big issues
- ❖ Cooperate Gov- Scientist- Business - Communities

- ❖ Students choose eco-life not sure by CC or Environment, maybe it's by economic or law.
- ❖ Saving energy
- ❖ Develop ressearch and inovation

Not now, when?

Why not students – young generation?

Source: baoquangngai.vn

A Perspective of Heatwave in Vietnam for Decades (1980-2018)

VU Thuan Yen[1], PHAN Van Tan[1], KUSAKA Hiroyuki[2]

[1]Vietnam University, Vietnam

[2]Tsukuba University, Japan

ABSTRACT

One of the most important issues for increasing the local resilience against compound disasters in the context of climate change is that adaptation philosophy should be changed from the reactive to the proactive measure. As among compound disasters, the author picks up, as an example, the inundation of coastal regions undergoing combination of water level rise with land subsidence. The current paper explores the way how to make the inter-local adaptation successful at the low-lying areas from comparative study both in Vietnam and Japan, and emphasizes that monitoring system and predictive methodology of relative sea-level rise (SLR) considering land subsidence (LS) are essential as the proactive measure.

Heatwave-related studies in Vietnam have limitations for understanding deeply about heatwave due to the fixed threshold. They limit heat extreme events to hot days and hot spells, while the understanding of characteristics of the heatwave is crucial for projection in the context of climate change. Therefore, this study would define heatwave and calculate heatwave characteristics based on references to the crucial studies in the world, together with available data of Vietnam. This study would define heatwave according to the relative threshold (percentile calculated), simultaneously, the reference to the absolute threshold (35°C) given by the Vietnam Meteorological and Hydrological Administration (VNMHA). Along with that, some heatwave characteristics are other indicators to calculate. From the new approach of calculation, there is a new perspective of Heatwave across Vietnam would analyzed based on observation available data which cover all seven sub-regions. The series of data is daily maximum temperature data in the summertime from April 1 to September 30 for the period 1980 - 2018 (39 years) from 109 meteorological stations in seven sub-regions. Qualitatively, there are two characteristic groups with different trends. Group 1, showing an uptrend (HWN, HWF, Hdays, HWDx, HWS, HWSx), while group 2 shows a trend of not increasing much (HWMag, HWAmp, HWDmean). The study concludes the overall increase tendency in number, frequency, and severity of heatwave occurred across Vietnam territory over decades (1980-2018). In terms of trend, firstly, most characteristics of stations have increased over time, especially in the climatic sub-region R3 (Red River Delta). One possible reason for this increasing trend is rapid urbanization. The other reason is related to the synoptic mechanism.

Southeast Asia Research-based Network on Climate Change Adaptation Science

A perspective of Heatwave in Vietnam for decades (1980-2018)

Presenter: Vu Thuan Yen
Date: Nov 17, 2020

Main Contents

1. Introduction
2. Data and Method
3. Results and Discussion
5. Conclusion

1. Introduction

- **Heatwave** is one of the most **extreme event** inluents disastrously worldwide.
  It affect negatively on natural, industrial and human's health.
  Russia 2010 : 500 wildfire;1 mil ha burned areas, crop failure 25% yearly, deficit 15USD bil
  Australia 2009: 173 deaths, 3500 destroyed tree, 3000 suffered flying fox .
  England Aug 2003, 38.5°C, 2193 heat-related deaths in 10 days.

- In context of climate change, heatwave is **predicted to increase** both in frequency and intensity due to global warming; warning negative impact on nature and human system.

- **Vietnam** is one of the most **vulnerable country** to Climate Change. (IPCC AR5)
  In 2019, North Central Region, Apr 18-26, record heat at station Tuong Duong (Nghe An Province): 42.4 °C, Huong Khe (Ha Tinh Province) 43.4°C.

Research Gap:
Regarding to heat extreme event, study in Vietnam mostly use hot spell (use fixed threshold 35°C), while evaluating trends and variability of heatwave is not mentioned. This thesis focus on "**observed change and variability of heatwave across Vietnam**" - crucial scientific importance and necessity for further adaptive measurement in the context of Climate Change.

1. Introduction

1.2. Research objectives

Understand solidly the **spatial** and **temporal variations** and **changes of heatwave characteristics** over Vietnam under the context of global warming.

1.3. Research questions

1. How are spatial and temporal variations of heatwave across Vietnam ?
2. What are heatwave characteristics could be calculated ?
3. What are trends of change of heatwave charateristics in Vietnam?

1.4. Research hypothesis

1. Heatwave in Vietnam for decades have the increase trend, similar to global trend.
2. Heatwave characteristics have increase trend for decades regardless regions.

1. Introduction

1.5. Scope of Research

39 years (**1980-2018**)

7 climatic sub-regions of Vietnam
(Nguyen Duc Ngu & Nguyen Trong Hieu,2004)

R1- Northwest,
R2- Northeast,
R3- Red River Delta,
R4- North Central,
R5- South Central,
R6- Central Highland,
R7- Mekong River Delta

109 meteorological stations

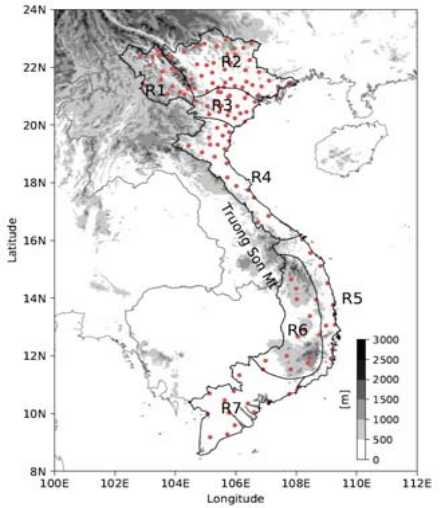


Figure 2.1. 7 sub-regions of Vietnam

2. Data and Method

Data

Daily maximum temperature
in summertime **(1980 -2018)**
Observed data **109** meteorological stations

7 sub-regions:
R1- Northwest (10 stations),
R2- Northeast (31 stations),
R3- Red River Delta (15 stations),
R4- North Central (26 stations),
R5- South Central (9 stations),
R6- Central Highland (14 stations), and
R7-Mekong River Delta (4 stations)

ID	Region	Station Name	ID	Region	Station Name	ID	Region	Station Name	ID	Region	Station Name
1	1	TUANGIAO	29	2	YENBAI	57	4	HOIXUAN	83	5	DANANG
2	1	TAMDUONG	30	2	THAINGUYEN	58	4	YENDINH	84	5	TRAMY
3	1	MUONGTE	31	2	DINHLAP	59	4	BAITHUONG	85	5	QUANGNGAI
4	1	SINHO	32	2	MONGCAI	60	4	THANHHOA	86	5	BATO
5	1	LAICHAU	33	2	HUULUNG	61	4	SAMSON	87	5	QUYNHON
6	1	DIENBIEN	34	2	TAMDAO	62	4	NHUXUAN	88	5	TUYHOA
7	1	SONLA	35	2	PHUHO	63	4	QUYCHAU	89	5	NHATRANG
8	1	BACYEN	36	2	QUANGHA	64	4	TINHGIA	90	5	PHANRANG
9	1	YENCHAU	37	2	LUCNGAN	65	4	QUYHOP	91	5	PHANTHIET
10	1	MOCCHAU	38	2	HIEPHOA	66	4	TAYHIEU	92	6	DAKTO
11	2	BAOLAC	39	2	SONDONG	67	4	TUONGDUONG	93	6	KONTUM
12	2	TRUNGKHANH	40	2	TIENYEN	68	4	QUYNHLUU	94	6	PLEIKU
13	2	HAGIANG	41	2	BAICHAY	69	4	CONCUONG	95	6	ANKHE
14	2	HOANGSUPHI	42	3	VINHYEN	70	4	DOLUONG	96	6	AYUNPA
15	2	BACME	43	3	VIETTRI	71	4	VINH	97	6	BUONHO
16	2	CAOBANG	44	3	BAVI	72	4	HUONGSON	98	6	MDRAK
17	2	NGUYENBINH	45	3	SONTAY	73	4	HATINH	99	6	BMTHUOT
18	2	BACQUANG	46	3	CHILINH	74	4	HUONGKHE	100	6	DAKNONG
19	2	CHORA	47	3	HANOI	75	4	KYANH	101	6	DALAT
20	2	NGANSON	48	3	HAIDUONG	76	4	TUYENHOA	102	6	PHUOCLONG
21	2	SAPA	49	3	HOABINH	77	4	BADON	103	6	LIENKHUONG
22	2	THATKHE	50	3	PHULIEN	78	4	DONGHOI	104	6	DONGPHU
23	2	LUCYEN	51	3	HUNGYEN	79	4	DONGHA	105	6	BAOLOC
24	2	HAMYEN	52	3	THAIBINH	80	4	HUE	106	7	VUNGTAU
25	2	THANUYEN	53	3	NAMDINH	81	4	ALUOI	107	7	CANTHO
26	2	MUCANGCHAI	54	3	NHOQUAN	82	4	NAMDONG	108	7	RACHGIA
27	2	LANGSON	55	3	NINHBINH				109	7	CAMAU
28	2	TUYENQUANG	56	3	VANLY						

Region 1 (R1)	Northwest	Region 3 (R3)	Red River Delta	Region 5 (R5)	South Central		Mekong River Delta
Region 2 (R2)	Northeast	Region 4 (R4)	North Central	Region 6 (R6)	Central Highland	Region 7 (R7)	

Table 2.1. Name, ID of 109 stations

Baseline: **1981-2010** for calculate threshold.

2. Data and Method

Method Step 1: *Define heatwave*

Determine threshold of heatwave

Heatwave event is a period of **at least 3 conservative day**, have daily maximum temperature (Tx) is greater than the threshold.

For each stations, there are 183 threshold for 183 calendar days (**Apr 1- Sep 30**), for baseline (1981-2010).

Threshold q90 determined by : **90th-percentile** with **centered 31-days window.**

For example, *for calculating* ***q90 of May 16,***

(1) *collect* ***series data*** *from* ***May 1*** *(15 days before May 16) to* ***May 31*** *(15 days after May 16) for* ***30-year baseline (1981-2010),*** *totally we have* ***930 values*** *(31 days x 30 year) of* ***Tx.***

(2) *determine* ***90th percentile*** *of this 930-value data, we have a threshold for* ***May 16***

➢ *For* ***each station****, we have* ***183 values of threshold*** *corresponding to 183 calendar days (Apr 1 – Sep 30)*

2. Data and Method

Method Step 2: *Calculate HW characteristics*

1.**HWN**: number of HW events (spell);
2.**HWF**: total number of HW days;
3.**HWMag**: average temperature of all HW days;
4.**HWAmp**: average highest Tx of all HW;
5.**HWDmean** = average length of a HW event;
6.**HWDx**: length of longest HW period;
7.**Hday**: number of all days with Tx ≥ q90;
8.**HWS**: heatwave mean severity: sum of difference between Tx of all HW events and threshold;
9.**HWSx**: heatwave maximum severity: sum of diferrence between Tx of HW event having highest Tx and threshold.

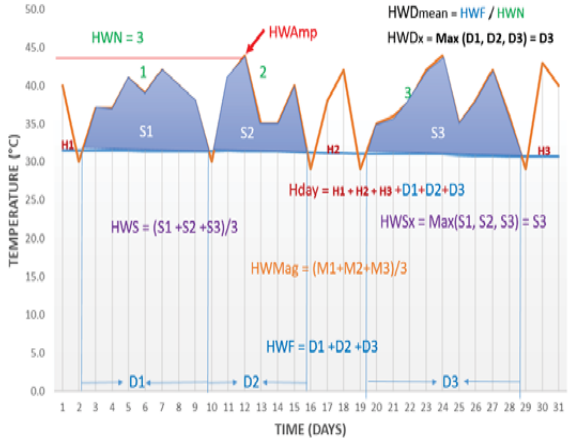


Figure 2.2. Heatwave characteristics demonstration

2. Data and Method

Method

Step 3: ***Analyze variability of heatwave***

- Thresholds are analyzed through time (inter-annual variation).
- Thresholds are analyzed between regions.
- Relationship between heatwave characteristics with ENSO could be detected.

2. Data and Method

Method **Step 4:** ***Analyze the trends of HW characteristics*** with non-parametric's **Mann Kendal test** and **Sen's slope** method.

- The changing trend of HW characteristics is evaluated based on the calculation of the original coefficient of linear regression line; while the **Sen's slope coefficient**.

  Positive slope : **increase** trend

  Negative slope: **decrease** trend
- The **larger absolute value** of slope, the **stronger the trend** of increase(decrease).
- The **significance** and **reliability** of the slope is determined by **Mann-Kendall test** which is applied to calculate the trend of data series (arranged in chronoligcal order).
- In this thesis, trend values are indicated with **5% significance level**, meaning the probality of error is 5%.

3. Results and Discussion

Results:

3.1. Daily threshold for defining heatwave

3.2. Spatial and Temporal variation of heatwave across Vietnam

3.3. Trend of changes of heatwave characteristics

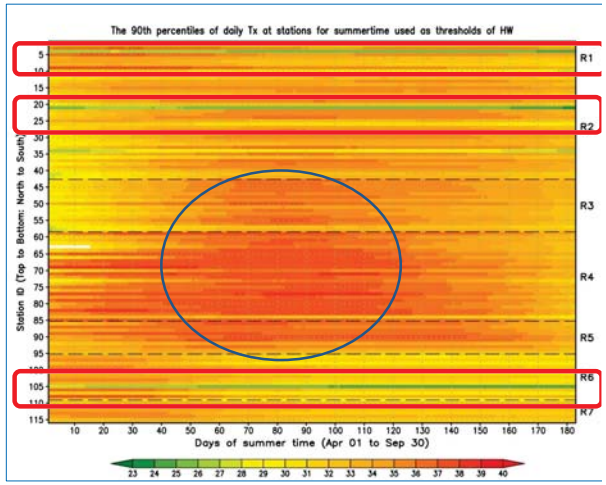
3. Results and Discussion

3.1. Daily threshold for define heatwave

183 calendar days
(Apr 1- Sep 30)
(1981-2010)

> maily threshold 29°C
high threshold up to 39°C
(stations in North Central (R4) in June-July)

> Station Sinho, Sapa, Dalat have low threshold < 25°C.
(humid subtropical climate)



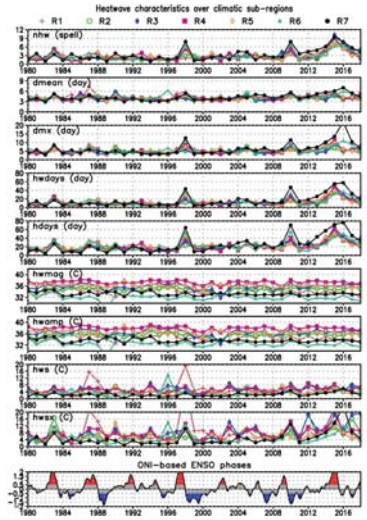
3. Results and Discussion

3.2. Spatial and temporal variations of heatwave across Vietnam

HWMag & HWAmp: all region remain the same. Amongst regions, R4 is highest, R6 is lowest.

Relationship with ENSO phases

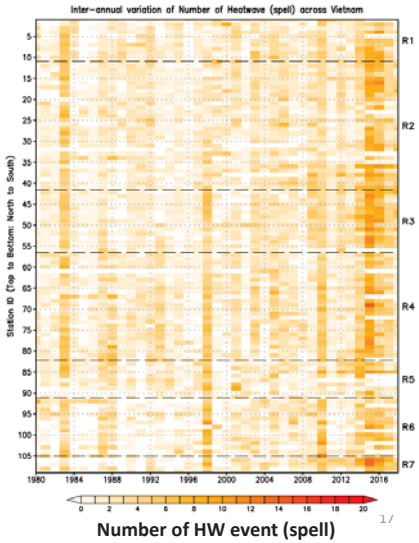
Characteristics (HWN, HWF, HWDmean, HWDmax Hdays,HWS, HWSx) correlation with El Nino years.



3. Results and Discussion

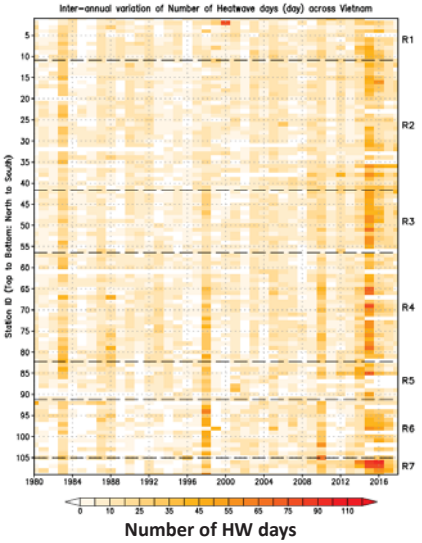
3.2. Spatial and temporal variations of heatwave across Vietnam

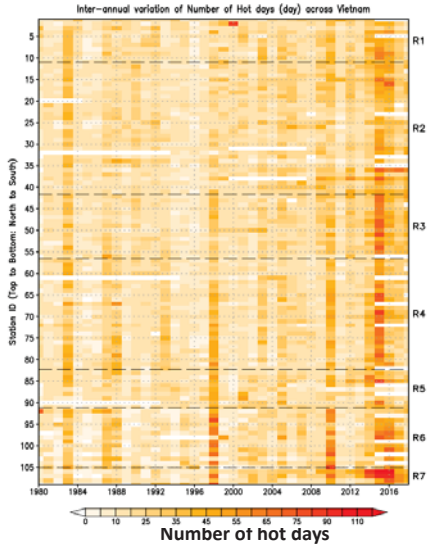
Overal, recent year from 2015 to 2018, number of heatwave increase.



3. Results and Discussion

3.2. Spatial and temporal variations of heatwave across Vietnam





3. Results and Discussion

3.3. Trend of changes of heatwave characteristics

HWN: all positive slope > increase

Qualitatively, there are 2 characteristics groups with different trends.

- Group 1: HWN, HWF ,HWDx, Hdays,, HWS, HWSx increase trend (positive slope) significant in R3 (Red River Delta) & north of R4 (North Central)
- Group 2: HWMag & HWAmp (light color) not show the increase trend clearly.

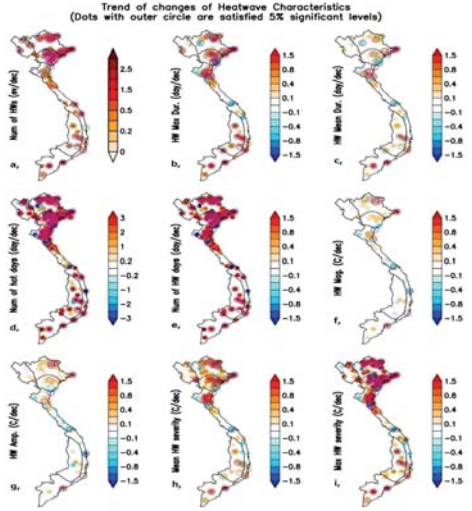


Figure 3.6. Trend of changes of HW characteristics

4. Conclusion

- Heatwave characteristics **overally have increase tendency** in frequency and severity across Vietnam (1980-2018)
- In stations with low elevator, especially in **big cities**, common threshold is **above 35°C.** The reason may because of Urban Heat Island (UHI) effect and Foehn wind effect.
- El Nino years have HWN, HWF, Hdays have the highest value due to rise of sea temperature of El-Nino year. Otherwise, HWMag, HWS of La Nina years are higher than both El Nino and Neutral years.
- Most characteristics have increase trend, especially **Red River Delta** (R3) and **north of North Central** (R4)
- The **future study** from this study may related to **heat stress** for better **evaluate impact** of HW on human health, helping early heat warning system for better **adaptation solutions** in context of **Climate change**.

Thank you for your attention.

Innovative Approach in Developing a Disaster Preparedness Plan for Primary Schools in Da Nang City in The Context of Climate Change

NGUYEN Thi Hong Duong

Vietnam Japan University, Vietnam

ABSTRACT

In the context of climate change (CC), the frequency and intensity of natural disasters are increasing can seriously affect Vietnam's education system and threaten the achievement of goal 4 - The Quality of Education in the Sustainable Development Goals. Although natural disasters occur every year, schools still have the embarrassment of handling before, during, and after a disaster. This study assessed the disaster resilience of 96 public primary schools (PS) in Da Nang city by School Disaster Resilience Assessment (SDRA) tool, results showed that the disaster resilience of PS reached an average (3.33 points). The disaster resilience level of PS is highest in the coastal area, followed by mountainous and low plains. After 7 years from 2012, the disaster resilience level of PS in Da Nang has grown in scores. However, PS in Da Nang City still faces some problems in preparing for disaster prevention, response, and recovery. A specific plan for disaster preparedness to improve natural disaster resilience and at the same time effectively implement natural disaster response has been developed, including 7 steps. This process is based on an innovative approach, as demonstrated by the bottom-up approach, assessing disaster resilience level of PS by SDRA tool, key interviews with stakeholders to promote the solutions, and focus group discussion to evaluate and choose suitable solutions for schools. Three PS represented the regions were selected to pilot developing solutions for a disaster preparedness plan, and focus group discussion was then held at the school to evaluate these solutions. This route is compatible with the conditions of PS in Da Nang City. Applying this approach to school disaster preparedness plans saves time, resources, and schools can develop their own plans. This will play an important role in improving schools' ability to respond to the natural increase in the context of CC.

Southeast Asia Research-based Network on Climate Change Adaptation Science (SARNCCAR)

Innovative approach in developing a disaster preparedness plan for primary schools in Da Nang city in the context of Climate Change

Presenter: NGUYEN THI HONG DUONG
Date: 17th Nov, 2020

Contents

1 Introduction
2 Disaster resilience level of schools
3 Innovative approach in developing a disaster preparedness plan
4 Conclusion and recommendation

1.1. Introduction

Background of research

Climate change → Disasters → Education section

No.	Contents	Unit	Damage from floods	Damage from storms
1	Number of floods/storms	number of floods/storms	46	26
2	Number of floods/storms which causes damage	number of floods/storms	12	15
3	Dead	people	82	113
4	Injured	people	39	192
5	People lost	people	-	17
6	Room damaged	room	454	3657
7	Total damage	Billion VND	2637.3	6769.2

Table 1. Damage due to floods and storms in Da Nang city from 1998 to 2013 (Source: Da Nang SCCC, 2013)

Figure 1. Typhoon caused wall collapsed in Phan Dang Luu PS in 2018 (Source: Vietnam News Agency)

1.1. Introduction

The process of developing a disaster preparedness plan in Da Nang

National Action Plan - Response to Climate Change (CC) | **National Action Plan - Disaster Risk Reduction (DRR)**

Top-down approach

MoET's Action Plan
CC | DRR

Provincial People Committee
Socio-economic development plan with CC-DRR

DoET
Anual plan

School
Anual plan

Schools had difficulty implementing the plan;
Disaster recovery takes time;
Affecting learning

1.1. Introduction

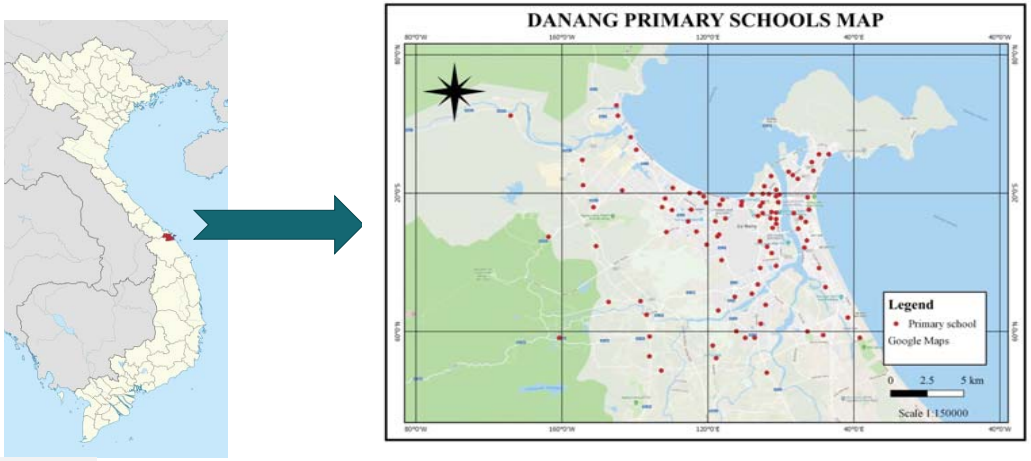


Figure 2: Location of PS in Da Nang city

Survey

Using the **School disaster risk resilience (**SDRA) method to assess schools' disaster resilience in Da Nang

1. Physical conditions	2. Human resources	3. Institutional issues	4. External relationships	5. Natural conditions
1.1 School building	2.1Teachers and Staff	3.1 Planning	4.1 Collaboration	5.1 Severity of natural disasters
1.2 Facilities and equipment	2.2 Students	3.2 Management	4.2 Relationship of school and community	5.2 Frequency of natural disasters
1.3 Hygienic and environmental conditions	2.3 Parents/ guardians	3.3 Budget	4.3 Mobilizing fund	5.3 Surrounding environment

Table 1:List of indicators

2. Disaster resilience level of schools

2.1. Overal level

The **disaster resilience level** of PS in Da Nang city is at **medium** (**3.33 points**).

The **Dimension 2: Human resources** play the most important factors deciding the disaster resilience level in Da Nang City

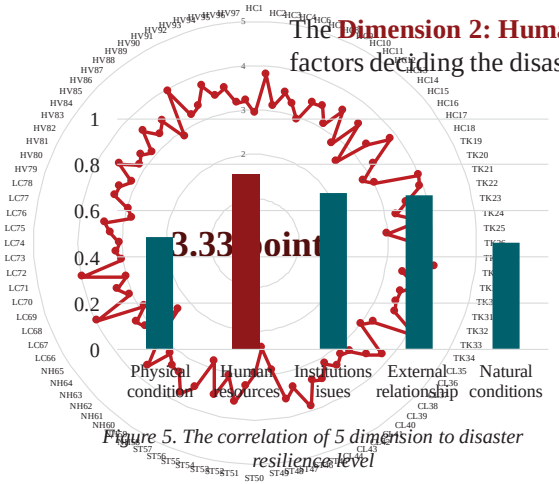


Figure 5. The correlation of 5 dimension to disaster resilience level

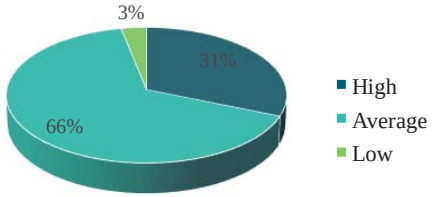


Figure 4. Percentage disaster resilience level of school

Figure 3. Disaster resilience level of 96 primary schools in Da Nang city

2.2. Disparities in disaster resilience between schools have the highest and lowest scores

- Highest score: **Nguyen Binh Khiem** PS (TK34) 4.19 points.
- Lowest score: **Tieu La** PS (ST49) with 2.37 points

➡ The school's disaster resilience level depends on the school's Disaster Prevention Awareness.

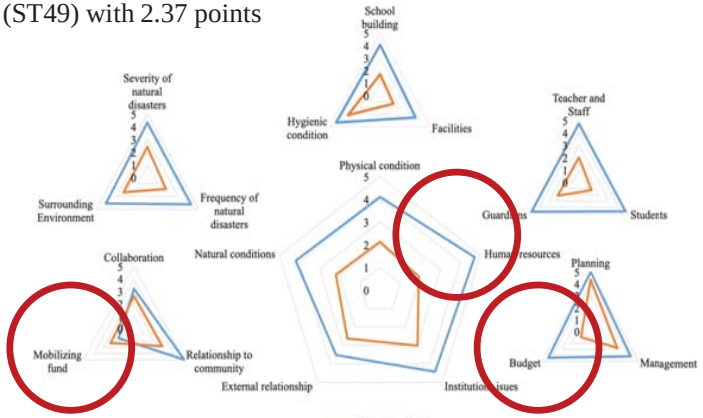


Figure 6. The average of the parameters

2.3. The change of disaster resilience of primary schools from 2012 to 2019

Table 2. Score of indicators between 2012-2019

Parameter	2012	2019	Change (%)
School building	3.36	3.55	5.65
Facilities	3.44	2.89	-15.99
Sanitation condition	4.3	3.95	-8.14
Teacher and Staff	3.87	3.86	-0.26
Students	3.44	3.86	12.21
Parents	4.3	3.41	-20.70
Planning	3.88	4.08	5.15
Management	3.1	3.42	10.32
Budget	2.36	2.57	8.90
Collaboration	3.2	3.27	2.19
Relationship to community	3.92	3.99	1.79
Mobilizing fund	1.77	1.92	8.47
Severity of natural disasters	2.44	2.53	3.69
Frequency of natural disasters	2.29	2.26	-1.31
Surrounding Environment	3.41	3.51	2.93

2.3. The change of disaster resilience of primary schools from 2012 to 2019

The cause of the score decrease:

1. Failure to promptly **replace devices** immediately after a disaster;
2. 31% schools do not have a **system to collect, reuse, and recycle** waste;
3. Not emphasizing the importance of **disaster training** for teachers and staff;
4. The **role of parents** in disaster recovery is not appreciated;
5. The **frequency of disasters** becomes **more erratic** and **more unpredictable**.

Improvement:

1. **Safe construction regulations** issued by the Government.
2. **Linking theory and action** through **disaster reduction education** activities for students;
3. **Integrate disaster risk-related** content into subjects, school plans, regulations, and curriculum;
4. **Disaster warning system**;
5. **Disaster-related working groups**;

Part 2: Planning

3. Innovative approach in developing a disaster preparedness plan

1. Disaster resilience assessment

Assessing school disaster resilience by the SDRA method: (1) Physical conditions, (2) Human resources, (3) Institutional issues, (4) External relationships, and (5) Natural conditions.

2. Developing solutions

Developing solutions for factors that have low score and a strong correlation to the school's disaster resilience

3. Discussing with stakeholders

Conducting group discussions to evaluate the feasibility, effectiveness, implementation time, priority, funding sources, and implementers of the solutions.

4. Disaster preparedness plan

5. Reevaluating the plan

Before the new school year, assessing results of the implementation of the plan and results proposed

6. Updating the plan

Consulting with stakeholders to update innovative solutions.

Figure 7. Developing disaster preparedness plan process

Developing the disaster preparedness plan in an innovative approach

4. Conclusion

1. The **disaster resilience level** of primary schools in Da Nang city is at **average (3.33 points)**. The **Dimension 2: Human resources** play the most important factors deciding the disaster resilience level in Da Nang City;
   - The disaster resilience level of PS is **highest in the coastal area**, followed by mountainous and low plains;
   - The disaster resilience level of PS in Da Nang in **2019** is **higher than 2012**;
2. **7 steps** to develop a disaster preparedness plan: (1) Disaster resilience assessment; (2) Developing solutions; (3) Discussing with stakeholders; (4) Disaster preparedness plan; (5) Assessing the disaster resilience level again; (6) Reevaluating the plan; (7) Updating the plan.

Developing the disaster preparedness plan in an innovative approach

4. Conclusion

- **Bottom-up approach and using SDRA method** makes it easier for schools to create their own disaster preparedness plan.
- The use of **focus group discussions** has **enhanced the role** of not only **stakeholders** but alsso **students, parents, and surrounding communities**
- The **reevaluating**, improvements, and finalization of the plan make it more **updated, suitable, effective, and feasible**.
- **Contribution**: help the stakeholders build an **effective disaster preparedness plan** for schools and **minimize the impact** of **disaster**, better **adapt to climate change**. Ensuring the teaching and learning activities of the school, towards the **Goal 4: Sustainable Quality Education**.

Indicators for Comprehensive School Safety in Response to Climate Change for Lower Secondary Schools in Coastal Areas, Vietnam

DUONG Huong Giang

Vietnam Japan University, Vietnam

ABSTRACT

Climate change is great threat to humanity and children are one of the groups most vulnerable to the effects of this. The losses associated with degradation of health, education and protection caused by climate change are high. According to official reports, in recent years, climate-change-induced natural disasters caused detrimental effects to the education sector. The study proposes indicators for comprehensive school safety in response to climate change for lower secondary schools in coastal areas, Vietnam by using the Comprehensive School Safety Framework (CSSF) with three pillars of school safety including Safe Learning Facilities, School Disaster Management Risk Reduction and Resilience Education (Wardell, 2017), desk researching on educational damage data, policy and programs of reducing disasters risk in education and analysis of data from in-depth interviews. Based on 5 dimensions namely physical condition, human resource, natural condition, institutional issue and external relationship, the study provides information for selecting appropriate indicators for lower secondary schools in coastal areas to build up disaster preparedness plan and enhance school disaster resilience that are aligned with Vietnam's law and policy on natural disasters, climate change and education innovation; and the need of schools in the study sites. From the result, a set of minimum standards for comprehensive school safety will be proposed and studied further.

Whether Climate Change is Really Affecting on Land Use Land Change in Xuan Thuy National Park?

NGUYEN Thi Thuy Dung, VU Thi Hai Ha, NGUYEN Van Duong*, THAMMAVOGSA Piya, KOTERA Akihiko

Vietnam Japan University, Vietnam *Corresponding author

ABSTRACT

The 21 century has experienced tremendous changes in both positive and negative directions; in which climate change is a non-debatable topic all over the world. The impact of climate change can be seen here and there, from the remoted Poles to the populous cities in America. However, in some serene regions, where the existence of heat island effect cannot be seen or sea level rise seems to be a peculiar topic, the non-appearance of climate change is really easy to be proven or not? This research will look into the practical experience of local peoples and experts in the buffer zone of Xuan Thuy National Park (XTNP), Nam Dinh Province, Vietnam and verify the impact of climate change to the land use and land cover changes in Giao An and Giao Thien Commune – the two communes located in the buffer zone of XTNP - in the year of 2000, 2009 and 2019 using the different methodologies including interview, image processing, field survey and observation.

HANDS-ON TRAINING

WHETHER CLIMATE CHANGE IS REALLY AFFECTING ON LAND USE LAND CHANGE IN XUAN THUY NATIONAL PARK?

Group A

1. Nguyen Van Duong
2. Nguyen Thi Thuy Dung
3. Vu Thi Hai Ha
4. Thammavongsa Piya

Supervisor

Dr. Kotera Akihiko

Hanoi, November -2020

Group members and tasks allocation

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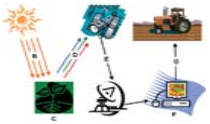
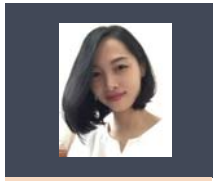
- First author



Maps making

People behind our innovation



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Nguyen Van Duong
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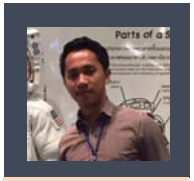


Thammavongsa Piya
- Author

Data analysis

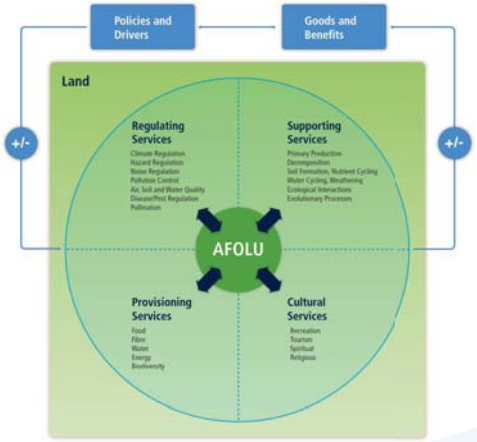
Interview + Policymaker

Weather station installation

1.1 Theoretical background

Land use & Land cover change

- Food security
- Sustainable development
- Climate change adaptation and mitigation

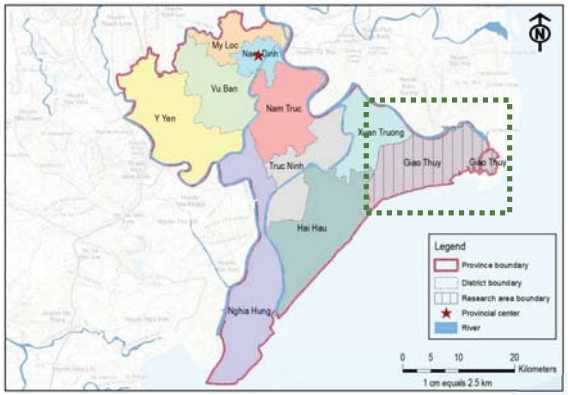


(Source: IPCC, WGIII-AR5)

*AFOLU: Agriculture, Forestry and Other Land Use

1.2 Natural background

- **Xuan Thuy National Park**
  - Area: 71 km²
  - First Ramsar site in Vietnam
  - Representative for coastal ecosystem in the North of VN
  - Biodiversity and livelihood in for people living in buffer zone
  - Reduce impact of disaster and provide services to people and animals



2.1 Objectives

OB1 Find evidence of climate change

OB2 Identify the changes of land use

OB3 Identify the causes of land use changes

OB4 Proposing solutions on land use in the context of climate change

2.2 Scope

(I) Giao Thien & Giao An Commune

- Area: 2,315 ha
- Population (People):

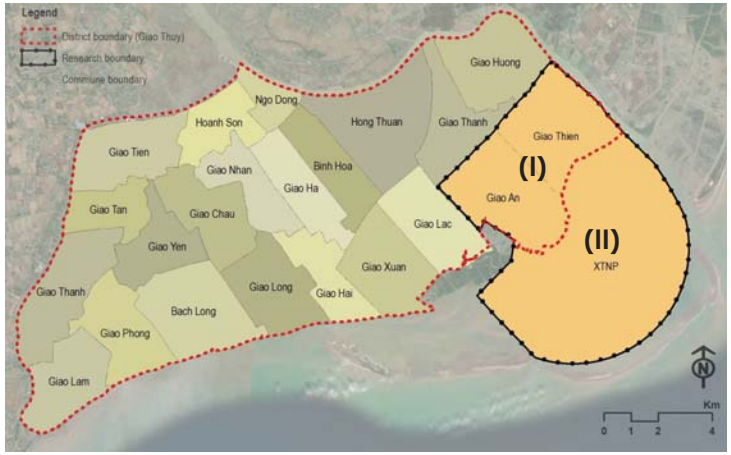
  Giao Thien: ~12,400

  Giao An: ~ 11.000

(II) A part of XTNP

- Area: 3,969 ha

→ **Total area:** 6,284 ha



3.1 Data collection

Primary data

(P1) Interview (primary data): Local people, Expert in XTNP, Expert in Van Ly station, Government authority

(P2) Flycam data (Phantom DJ4)

3.1 Data collection

Secondary data

(S1) Weather data (from VanLy station) : Temperature, Precipitation, Wind direction, Humidity, Radiation, Soil moisture and Pressure.

(S2) Government data

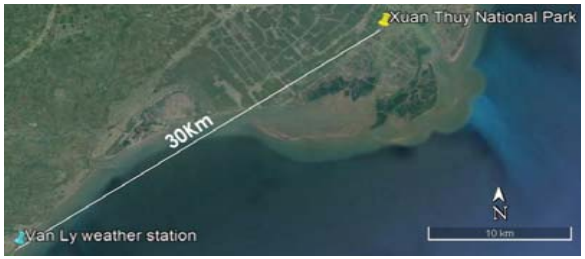
- Socio-economic report
- Disaster prevention report
- Current land use map (Cadastral maps)
- Project map of the coastal road

(S3) Remote sensing data

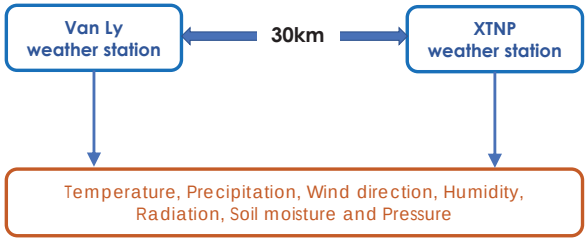
(S4) GIS data

3.2 Methodology

Weather station



General Meteorological Standards (WMO, 1988)
*"Each global station should…located in a remote area where no significant changes in land-use…for the coming decades within a reasonable distance (**30–50 km**) in all directions from the station."*



Clause 2, Article 5 - Circular 03/2018/ MONRE
*"**Each national park will have at least one meteorological station**; Depending on the size of the national park, it is possible to arrange more meteorological stations, but ensure the distance between stations from 25km to 30km."*

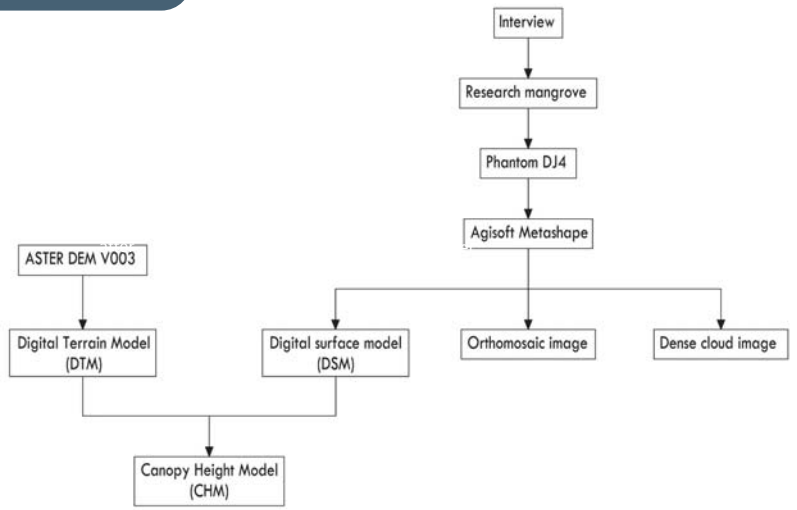
3.2 Methodology

Flycam

Interview

Image processing

Map overlay



3.2 Methodology

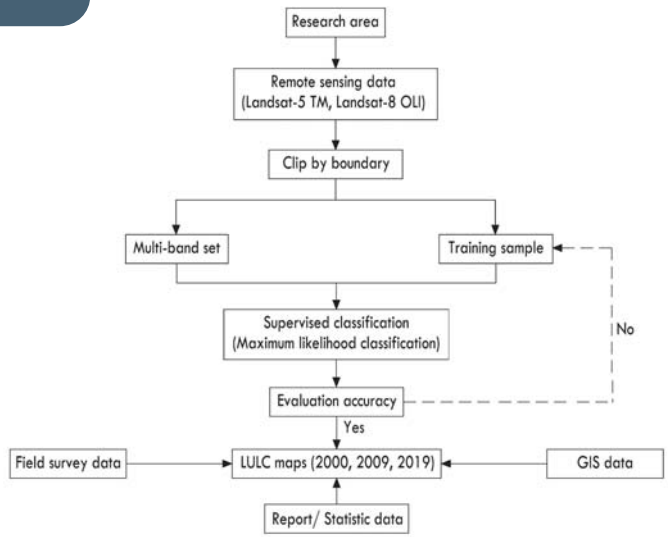
Land use land cover

Image processing

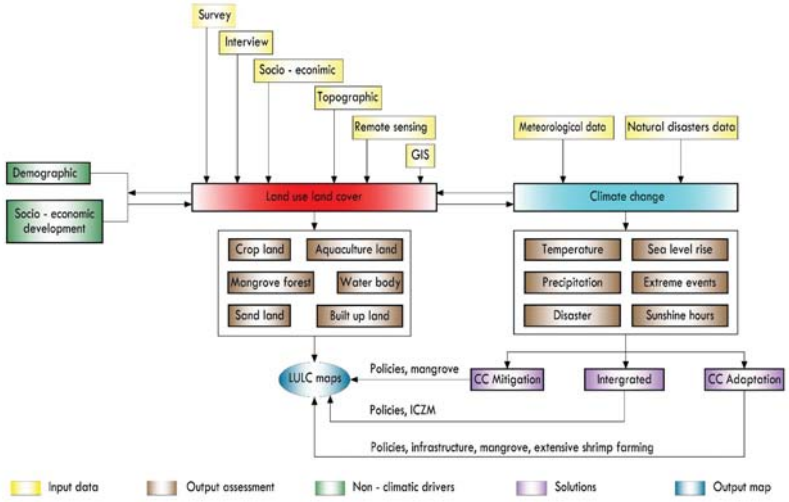
Map overlay

Field survey

Observation



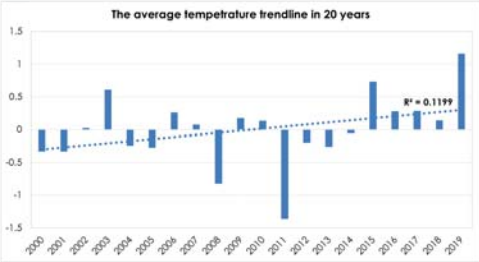
4 Research Framework

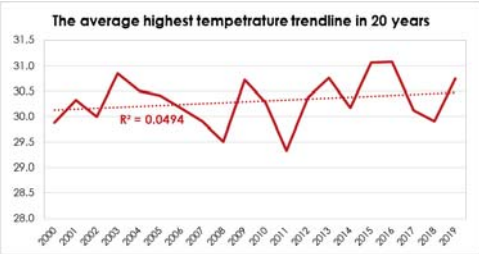


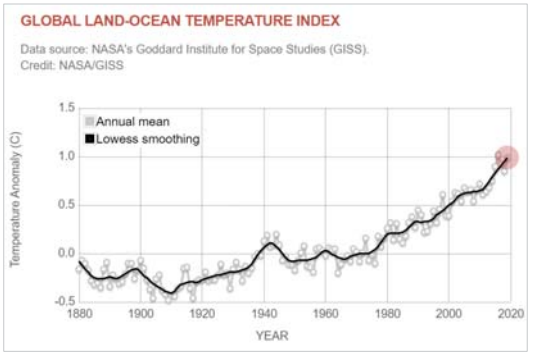
5.1 Results of weather data analysis

Data from Van Ly Weather station

→ (OB1) Find evidence of climate change







Temperature trend in XTNP over 20 years

5.1 Results of weather station installation

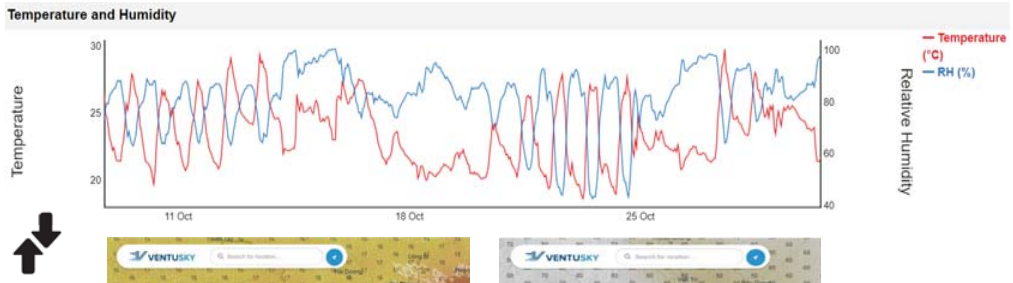
XTNP Weather station installation

→ (OB1) Find evidence of climate change

5.1 Results of weather data analysis

Data from XTNP Weather station

→ (OB1) Find evidence of climate change



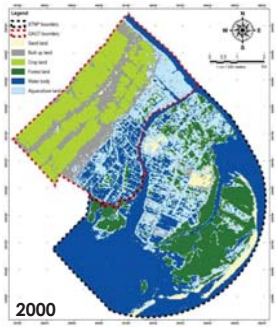
Temperature in Ventusky

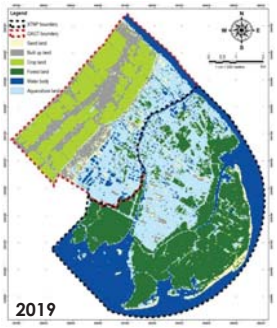
Humidity in Ventusky

5.1 Results of Land use change

Data from Remote sensing

→ (OB2) Identify the changes of land use





5.1 Results of Land use change

Data from The coastal road project

→ (OB3) Identify the causes of land use changes

The coastal road of Giao Thien commune

→ **Land use change by human activities: The coastal road**

- The total length: 66km (through Giao Thuy, Hai Hau and Nghia Hung).
- Total investment: 2,655 billion VND
- Duration: 45 months

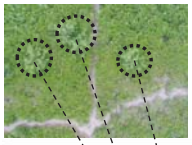
→ **Land lossed estimation in Giao Thien commune:**

- Crop land: ▼14Ha
- Built up land: ▼0,5Ha

5.1 Results of Flycam survey

Mangrove forest

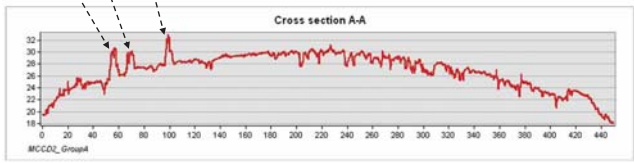
→ (OB3) Identify the causes of land use changes

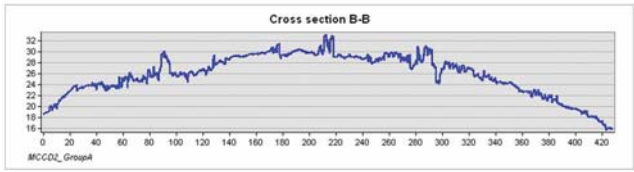


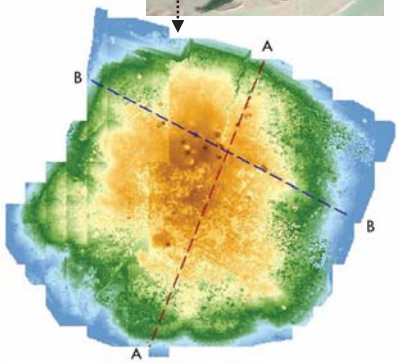
Characteristics: Mangrove forests recovered from storms

→ Preliminary simulate cross-section of mangrove forests

→ mangrove height, mangrove health







5.1 Results from Interview & 2nd data

→ (OB3) Identify the causes of land use changes

NEGATIVE IMPACT TO AGRICULTURAL PRODUCTION

Extreme weather | Diseases and pollution

CHANGES IN LIVELIHOOD

Work in other sectors | Change types of crops

CHANGES IN LAND USE

Reduce rice-farming area | Grow other types of crops

(plant varieties change)

Name: Sophora japonica
Characteristics: easy to grow, high productivity
Annual income: (1.5 mil – 2mil/tree) VND 150,000/kg x 10-15kg/tree

(farming change)

Extensive farming (for Shrimp and Clam)

- Save cultivating area
- Utilize natural condition (food, living area)
- Reduce pollution impact to environment
- Low cost, fewer labor

5.2 Solutions

→ (OB4) Proposing solutions on land use in the context of climate change

No	List of measures	Type of solutions	Effect	Stakeholders			
				Goverment	Scientist	Farmer	Organization
1	Change in plant variety	(A)	Low	●	●	●	●
2	Change in crop land	(A)	Int.	●	●	●	●
3	Change in agricultural management (fertilizers, pesticides, etc)	(A)	Int.	●	●	●	●
4	Change in agricultural infrastructure (irrigation system)	(A)	Hight	●	●		
5	Extensive shrimp farming or aquaculture combined with mangrove forests	(A)	Hight	●		●	
6	Expand mangrove planting	(A,M)	Hight	●		●	●
7	New mangrove varieties	(A)	Hight	●		●	
8	Insurance for agriculture, aquaculture, etc	(A)	Int.			●	●
9	Monitoring-warning-forecasting system for hydro-meteorology, SLR, and saline intrusion	(A)	Int.	●	●		●
10	Develop ecotourism in association with mangrove forests protection and restoration	(A, I)	Hight	●			●
11	Upgrading infrastructure for coastal protection	(A, I)	Hight	●	●		
12	Land use change (change in land function)	(A, M, I)	Hight	●			

(A)=Adaptation **(M)=Mitigation** **(I)=Intergrated**

6.2 Conclusion

- **Van Ly station**: in 20 years (2000-2019) most of the observed meteorological data such as temperature, precipitation, etc have witnessed an increasing trend; the cause may be due to the effects of climate change.
- **Automatic weather station**: Most of the meteorological measurement indicators have very close results with actual measurements. Therefore, the measured data from the automatic station can be trusted and used as input for future research.
- **Mangrove:** In general, mangroves have changes, the trend is mainly increased. The reason is mainly due to accretion.
- **Interview**: Most households have little change in land use over the past decades, however, some households change their crops and farming methods due to the adverse effects of weather. Therefore, it can be said that cc has partly affected people's livelihoods.
- **LULC**: The change in land use is mainly due to *human factors*. The impact of CC to LULC is not too clear *in the short term*. However, when the frequency and intensity of extreme weather events will cause harmful effect to daily activity, livelihood and health of the people and surrounding ecosystem.

Awareness of Local People on Cost-benefit of Mangrove Forest Conservation in Climate Change Adaptation in Xuan Thuy National Park, Nam Dinh Province

BUI Thi Lan[1], LE Thi Ngoc Diep[1], NGUYEN Duc Tam[1], NGUYEN Thanh Hai[1], OKEH Bernard[1], ISHIKAWA-ISHIWATA Yuki[2], HOANG Thi Thu Duyen[1]

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[2] Ibaraki University, Japan

ABSTRACT

Mangrove ecosystem in Xuan Thuy national park plays a vital part in climate change mitigation and adaptation. Evidently, conserving mangrove forest is crucial to the local community in the context of intensive climate-induced hazards. Apart from orientation and direction of managerial authority, participation and support of local people greatly facilitate conservation process. This research explores local people's awareness about costs and benefits of mangrove conservation as a determinant for their willingness and contribution to mangrove conservation. Social survey was taken in Giao Thien commune - in the buffer zone of Xuan Thuy national park, investigating respondents' awareness about climate change, benefits from mangrove conservation for tackling climate change, cost incurred from conservation, and their willingness to contribute to mangrove conservation. The relationship between awareness about costs-benefits and involvement of the stakeholders is taken into account. Survey results reveal that local people are well aware of the benefits provided by mangrove for livelihood improvement and disaster risk reduction at 92% and 90% respectively, and 98% of them are willing to support and contribute to mangrove conservation. Accordingly, voluntarily participating in forest patrol team and donating to conservation fund (up to 500,000VND/year) are the two most popular options. The research also suggests integrated measures and management recommendations to harmonize mangrove conservation with sustainable livelihood in the context of climate change.

Key words: Mangrove ecosystem, costs and benefits, mangrove conservation, climate change

Southeast Asia Research-based Network on Climate Change Adaptation Science (SARNCCAR) seminar

AWARENESS OF LOCAL PEOPLE ON COST-BENEFIT OF MANGROVE FOREST CONSERVATION IN CLIMATE CHANGE ADAPTATION IN XUAN THUY NATIONAL PARK, NAM DINH PROVINCE

Vietnam National University, Hanoi
Vietnam - Japan University
Master program in Climate Change & Development

Bui Thi Lan | Le Thi Ngoc Diep | Pham Thanh Hai
Nguyen Duc Tam | Okeh Bernard | Hoang Thi Thu Duyen

Quang Nam, 17th Nov 2020

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- Research question & hypothesis
- Research objectives

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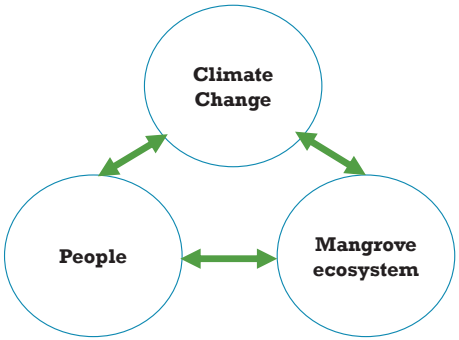
- Local people's awareness
- Willingness toward mangrove conservation
- Recommendations

4. Conclusion
- Conclusion & Recommendation

1. INTRODUCTION
1.1. BACKGROUND



Local community and mangrove ecosystem in XTNP under CC impacts

1. INTRODUCTION
1.2. RESEARCH QUESTION & HYPOTHESIS

Research questions:

- How local people are aware of the cost & benefit of mangrove forest conservation in XTNP?
- What is the relationship between people's awareness & mangrove conservation?

Research hypotheses:

- Local people recognize and are utilizing benefits of mangrove forest, they are well aware of mangrove values.
- People's awareness determines their willingness toward mangrove conservation

1. INTRODUCTION
1.3. RESEARCH OBJECTIVES

General objective

- ✓Evaluate awareness of local people on cost-benefits of the mangrove forest in climate change adaptation & willingness toward mangrove conservation

Specific objectives

- ✓Identify CC impacts on mangrove ecosystem & local community
- ✓Evaluate values of mangrove forest in CC mitigation & adaptation
- ✓Evaluate people's awareness about cost & benefits of mangrove conservation
- ✓Propose solutions and recommendations for decision makers on conservation & management related issues

2. METHODOLOGY
2.1. STUDY SITE DESCRIPTIONS

Giao Thien commune – Giao Thuy district, Nam Dinh province

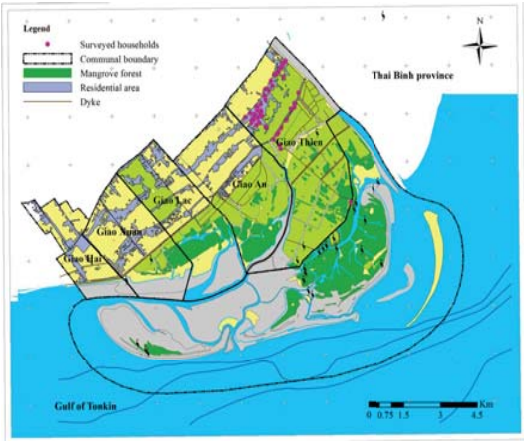
❑ **Socio-economic feature**

Population: 12,422 people (3,376 households), >75% are Christian;

Main livelihood: agricultural & aquacultural production

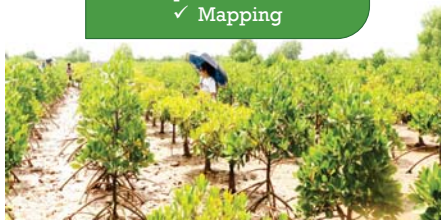
❑ **Physical feature**

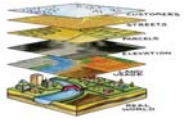
Coastal commune, highest biodiversity, sensitive to CC



2. METHODOLOGY
2.2. METHODS

- ✓ Site visit & observation
- ✓ Social survey
- ✓ Narrative review
- ✓ Statistical/ Data analysis
- ✓ Expert consultation
- ✓ Mapping





2. METHODOLOGY
2.3. FRAMEWORK

Conceptualization
- Survey design
- Criteria to evaluate people's awareness
- Expert consultation

Data collection
- Social survey
- Site visit
- Narrative review
- Remote sensing data

Data processing
- Statistical analysis tools
- Mapping tool

Data analysis

Conclusion & Recommendation

- CC & its impacts
- Benefits of mangrove conservation
- Costs of mangrove conservation
- Willingness toward conservation

3. RESULTS & DISCUSSION
3.1. CC IMPACTS ON MANGROVE & LOCAL PEOPLE

Impacts on mangrove

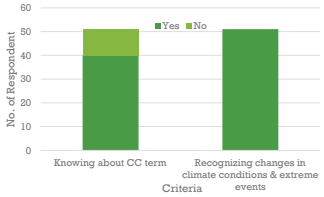
- Reduction of mangrove area
- Death & damage of mangrove trees
- Health & growth of mangrove trees
- Loss of ecosystem biodiversity

Impacts on local people

- Health
- Household assets & infrastructure
- Economic activities

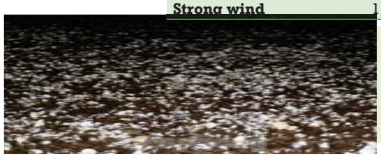
3. RESULTS & DISCUSSION
3.2. LOCAL PEOPLE'S AWARENESS

CC & CC impacts



Information receiving sources:
- ✓ Local communication channels (speaker, notice...)
- ✓ Mass media (TV, radio...)
- ✓ Shared by a friends
- ✓ Training courses
- ✓ Research team

Existing extreme event	Total number of answered people	Frequency of existing extreme events					Increasing trend
		Mean	Standard deviation	Median	Min	Max	
Prolonged heat	49	1.09	0.35	1	1	3	90%
Typhoon	43	1.77	0.82	2	0.5	4	51%
Prolonged coldness	31	1.06	0.25	1	1	2	61%
Heavy rainfall	26	1.38	0.80	1	1	4	88%
Sea-level rise	25	1.00	0.00	1	1	1	96%
Saline intrusion	24	1.12	0.45	1	1	3	79%
Flood	21	1.10	0.30	1	1	2	52%
Drought	14	1.11	0.40	1	1	2.5	50%
Erosion	13	1.23	0.44	1	1	2	69%
Strong wind	1	1.00	NA	1	1	1	100%

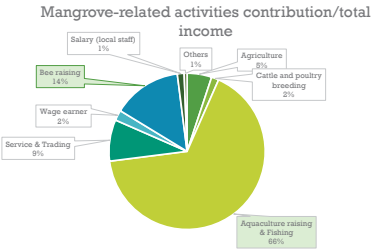


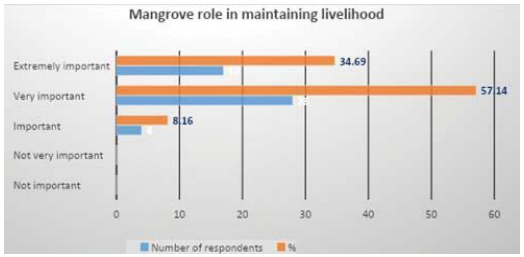
Clamp died of prolonged heat in 2018
Soure: tienphong.vn

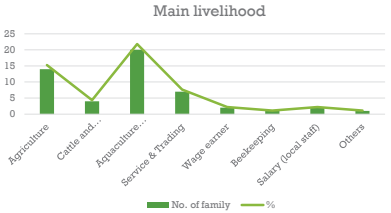
CC exerts signigicant & negative impacts on:
- Agriculture production (40/51)
- Aquaculture and fishing (15/51)
- Health (51/51)

3. RESULTS & DISCUSSION
3.2. LOCAL PEOPLE'S AWARENESS

Mangrove conservation's benefits in adapting to CC
Livelihood improvement



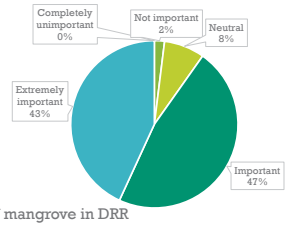




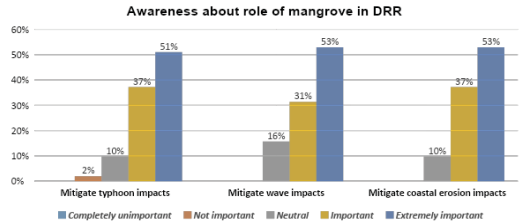
Mangrove conservation benefits to livelihood:
- ✓ Increase number of tourists and related services;
- ✓ Increase aquaculture productivity;
- ✓ Increase flowers for bee production;
- ✓ Create habitats for natural aquaculture products;
- ✓ Create favorable conditions for aquaculture raisi

3. RESULTS & DISCUSSION
3.2. LOCAL PEOPLE'S AWARENESS

Mangrove conservation's benefits in adapting to CC
DRR



Role of mangrove in DRR



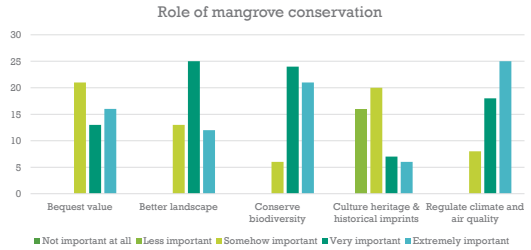
Mangrove forest as green dyke...

3. RESULTS & DISCUSSION
3.2. LOCAL PEOPLE'S AWARENESS

Mangrove conservation's benefits in adapting to CC
Other benefits

Other benefits from mangrove conservation

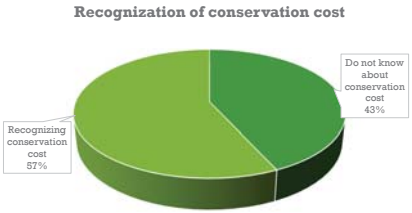
Bequest value
Better landscape
Conserve biodiversity
Culture heritage & historical imprints
Regulate climate and air quality

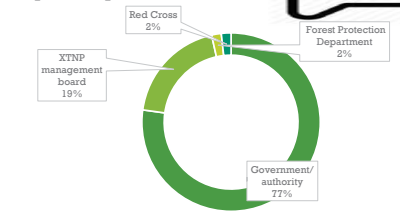


3. RESULTS & DISCUSSION
3.2. LOCAL PEOPLE'S AWARENESS

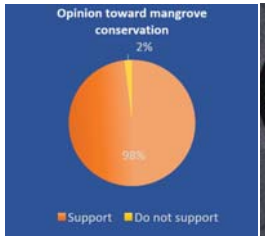
Mangrove conservation cost

Cost incurred from mangrove conservation
- Innitial planting cost
- Protection cost
- Management cost
- Re-planting cost



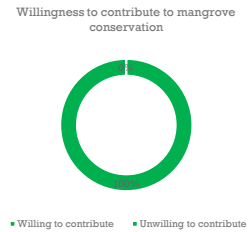


3. RESULTS & DISCUSSION
3.3. WILLINGNESS TOWARD MANGROVE CONSERVATION

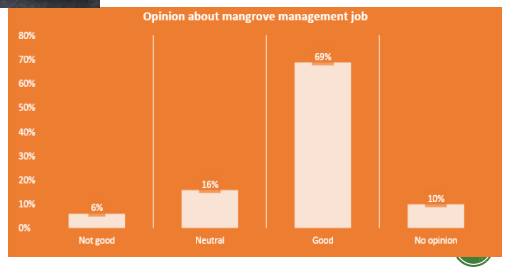


100% support!!!

- Planting more mangrove in flood plain
- Communicating with local people
- Organizing training course,
- Financial punishment policy



- participating in patrolling duty
- contributing to mangrove conservation fund
- communicating to family members and friends
- planting mangrove trees



3. RESULTS & DISCUSSION
3.4. RECOMMENDATIONS

Recommendations for better mangrove conservation and management


Institution & Policy


Application of Science-Technology


Budget & Finance


Capacity enhancement


International partnership

4. CONCLUSION & RECOMMENDATION

- Local people recognize climate change expression & its impacts and are well aware of roles of mangrove in mitigating and adapting to climate change;
- Local people support mangrove conservation & show their willingness to contribute to mangrove conservation;
- People's awareness determine their willingness to contribute to mangrove conservation.

Photo source: XTNP

4. CONCLUSION & RECOMMENDATION

- Specialized research on awareness & willingness of individuals & organizations relying on aquaculture activities is encouraged.
- Deeper exploration of indigenous knowledge & recommendation on how to harmonize economic activities & mangrove conservation is necessary.

Photo source: XTNP

Awareness plays crucial roles in response to CC

Climate Change and Disaster Management for Sustainable Livelihood in Xuan Thuy National Park

NGUYEN Thi Hoa[1], NGUYEN Ha My[1], DUONG Huong Giang[1], NAW Khu Khu Sann[1], PHAN Thi Lan Anh[1], ITO Tetsuji[2], NGUYEN Van Quang[1]

[1]Vietnam Japan University, Vietnam

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ABSTRACT

Xuan Thuy National Park (XTNP), one of coastal areas of Vietnam, is severely affected by climate change and natural disasters. In XTNP, many different livelihood activities have been practiced, mainly depend on agriculture and aquaculture. The study focused on the effects of climate change and natural disasters on the people's current livelihood activities of the area. The results show that both livelihood and natural resources in XTNP have been greatly impacted by climate change and natural disasters. For nature, the quality and quantity of mangrove forests, bird migration, and aquatic species have been decreased. For livelihood, productivity has been reduced, while production costs, environmental pollution, and disease have been increased. According to the survey results, people's perceptions of climate change and natural disasters are influenced by many factors such as gender, education, and information sources about climate change. Besides, local governments have taken many measures to propaganda solutions aimed at raising public awareness about climate change. In fact, local residents have taken several measures to reduce the impact of natural disasters on their livelihoods: against the house, move to a safe place, early harvest, change breeds/species, and so on. Some recommendations were proposed by the research team such as enhancing awareness of local residents; cooperating with other governmental bodies, organizations, institutions. Moreover, the research team also suggests a strategy for improving disaster management and sustainable development of livelihood in XTNP.

SOUTHEAST ASIA RESEARCH-BASED NETWORK
ON CLIMATE CHANGE ADAPTATION SCIENCE (SARNCCAR)

CLIMATE CHANGE AND DISASTER MANAGEMENT FOR SUSTAINABLE LIVELIHOOD IN XUAN THUY NATIONAL PARK

Members: Nguyen Thi Hoa
Nguyen Ha My
Duong Huong Giang
Naw Khu Khu Sann
Phan Thi Lan Anh
Prof. ITO Tetsuji
Dr. Nguyen Van Quang
Master's program on Climate change and Development
Vietnam Japan University

Hoi An, November 2020

Main Content

1	Introduction
2	Impacts of climate changes/natural disasters/ extreme events on XTNP
3	Awareness
4	Adaptation measures
5	Mitigation measures
6	Recommendation

Introduction

➢Xuan Thuy National Park is in an economically dynamic area which has become the drivers of economic growth because of aquaculture, fisheries and services.

➢ In XTNP, so many difference livelihood activities have practiced, mainly depend on agriculture and aquaculture.

➢XTNP plays an important role in combatting climate change but itself had been under the vulnerability of climate.

Impacts of climate changes/natural disasters/extreme events on XTNP

Effect of climate change /natural disasters/extreme events on mangrove ecosystems

Figure 1: Casuarina forest is dislodged by waves

Casuarina trees die because two reason:
(1) subsidence (about 1cm/year) and sea-level rise and
(2) the decline in sand dunes

Figure 2: Mangroves are directly affected by waves

Impacts of climate changes/natural disasters/extreme events on XTNP

Effects of climate change /natural disasters/extreme events on people's livelihoods

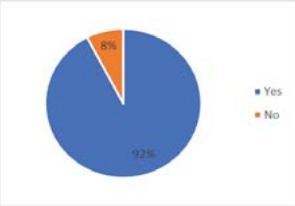


Figure 3: Percentage of households directly affected and not affected

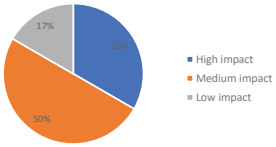


Figure 4: The level affects people's livelihoods

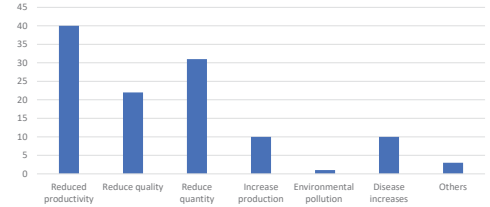


Figure 5: The types of impacts of CC/natural disasters/extreme events on people's livelihoods

Figure 6: Paddy field after heavy rain

Awareness

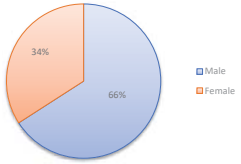


Figure 7: The percentage of male and female respondents answering that they know about "climate change"

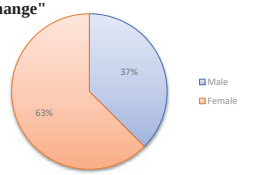


Figure 8: The percentage of male and female respondents answering that they do not know about "climate change"

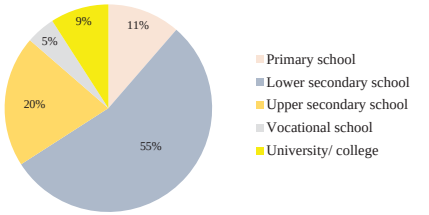


Figure 9: The percentage of respondents answering that they know about "climate change" classified by levels of education

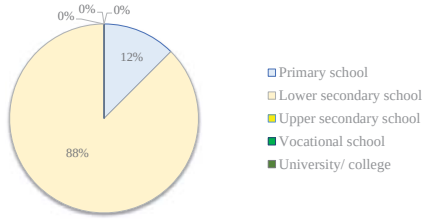


Figure 10: The percentage of respondents answering that they do not know about "climate change" classified by levels of education

Awareness

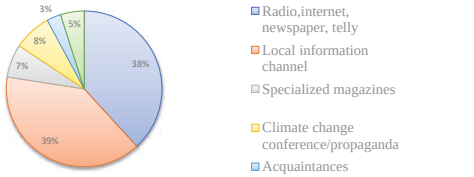


Figure 11: Information channels providing knowledge about CC

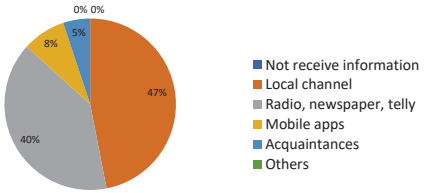


Figure 12: Weather forecast channels

	Answer	%
No	1. No	25
	2. Yes, but not regularly	37.5
	3. Regularly	37.5
	Total	100

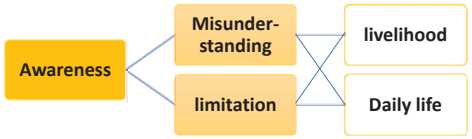
Table 1: Assessment of Awareness raising campaigns on CC of the local government by respondents who do not know about CC

	Answer	%
Yes	1. No	11.4
	2. Yes, but not regularly	61.4
	3. Regularly	27.3
	Total	100

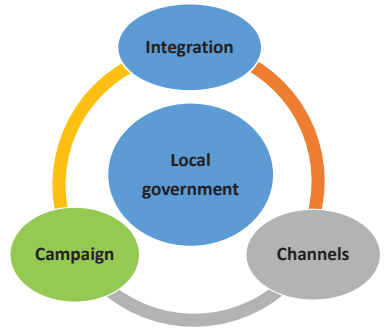
Table 2: Assessment of Awareness raising campaigns on CC of the local government by respondents who know about CC

Awareness

Observation



Awareness of the local people about climate change in particular and environment in general is still at low level, especially when it comes to women and people with low level of education.



Adaptation measures

Local authority

Based on main policy in the development plan of Nam Dinh province

- **Hardware:** systems of natural disaster prevention, irrigation systems, etc.
- **Software:** hazard maps, evacuation instructions, etc.
- **Humanware:**

- Early warnings and preventive measures through the mass media.
- Regularly campaigns to raise awareness.
- Training courses: crop structure transition, S&T application, etc.
- Plan for diversify livelihoods

Figure 13: Training program about production activities in response to climate change in Giao Thien Commune

Adaptation measures

Households

Figure 14: Warnings from local authority

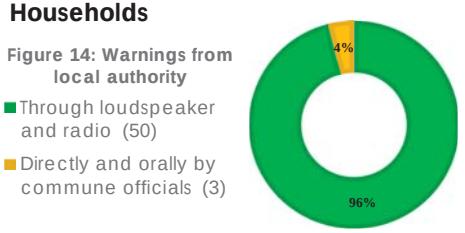


Figure 16: Preventive measures proposed by local authority

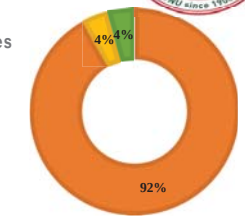
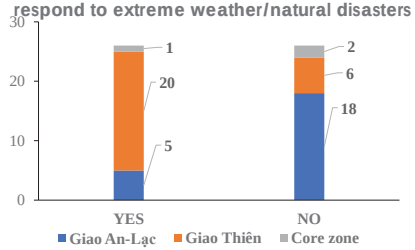


Figure 15: Number of households trained how to respond to extreme weather/natural disasters



⇒ **Problems**:

- Limited and unsynchronized information
- Training program: not properly integrated

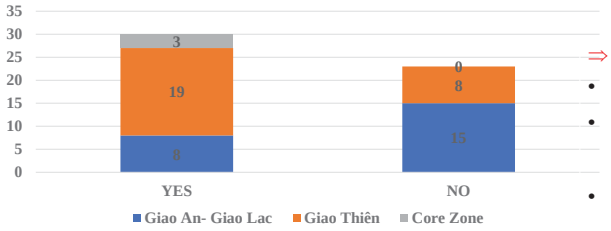
Table 3: Adaptation measures in response to CC and natural disasters

Unit: %

Adaptation measures	Giao An-Giao Lac	Giao Thien	Core zone
Structural Measures			
1. Against the house	75	88.5	66.7
2.Making the attic, heightening the floor, the yard	8.3	3.8	33.3
3. Home improvement	4.2	3.8	0
Non - Structural Measures			
1. Move to a safe place	29	65.4	33.3
2. Buying new boats	0	7.7	0
3. Prepare food, drink	100	100	100
4. Prepare finances	100	96	100
5. Change breeds/species	12.5	30.7	0
6. Change of career	0	0	0
Adaptation measures during the production process			
1. Early harvest	16.6	30.7	0
2. Using water pumps	29.3	11.5	0
3. Learn about the experiences of other localities	25	30.7	66.6

Adaptation measures

Figure 17: Demand for State support



Households

⇒ Problems:

- Lack of financial support.
- Most people do not have disaster prevention plans in production
- Experience of farmers is not yet systemized

BOARD OF XTNP MANAGEMENT

Ecosystem preservation activities:

- **Wise use program** - climate change adaptation policy in livelihood development

Households

⇒ Problems:

Not easy to change careers: most of households own one career (~34%) or two careers (51%), only 13% of households has over 3 careers

Mitigation measures

Local authority

- Organize activities such as plant trees for the environment protection.
- Encourage and provide technical assistance to develop the friendly-environment model
- Recommend farmers to reduce 20-30% of chemical fertilizers than their current practice.

Board of XTNP Management: Limit the impact of people on forests: Livelihood activities, waste/burning issues, design of a buffer zone separating the forest from the livelihoods.

Households: 100%: no specific knowledge about climate/ GHGs mitigation and awareness that their livelihood activities cause emissions. The most common activity: waste collection (and separation).

⇒ Problems:

- Lack of capital support for production to increase income and emission reduction at the same time.
- Lack of application of new forms of energy, increasing use of renewable energy

Recommendation

Targets: Livelihood improvement along with disaster preparedness

Raising awareness of the local people in climate change

- Effective methods in providing knowledge and raising awareness for the local people about climate change and its impacts on the livelihoods of the community.
- The content of the training courses: easy to understand and close to daily production activities.

Institutional issue

- Financial and technical supports from GOs and NGOs.
- Integrating policy to support the livelihood with mangrove conservation and CC mitigation
- Enhance the role of local experts
- Collect and synthesize farmer's experience to be official guide for all other farmers.
- Create new jobs/livelihood resources
- Develop new forms of energy

Co-Operation and Partnership

- Cooperation with governmental bodies, organizations, institutions in other sectors are necessary
- Projects should integrate economic development in disaster preparedness, shelters, facilities and equipment of community consolidation.

THANK YOU FOR YOUR ATTENTION!