



**Environmental Diplomatic Leader**  
Special Coordination Funds for Promoting Science and Technology  
Strategic Program for Fostering Environmental Leaders



**Environmental Diplomatic Leader (EDL)**  
**Education Program**  
**Annual Symposium 2010 Report**

**Program Organizer**

Master's Program in Environmental Sciences  
Doctoral Program in Sustainable Environmental Studies  
Graduate School of Life and Environmental Sciences  
University of Tsukuba



## **Environmental Diplomatic Leader (EDL) Education Program Annual Symposium**

During the second year of the EDL program, 28 students from eight countries joined us. We have accomplished both training courses and international internship; established EDL seminar, EDL debate, and EDL café. We also have met many significant leaders from various scientific fields through our “Meet the Leader” course. In order to make more progress in 2011, we would like to review and evaluate our activities of 2010, and request further suggestions through this symposium.

### **Program**

- 13:30-13:45      **Opening Remarks**  
                    **SHIOJIRI Kazuko**, *Vice President of University of Tsukuba*  
                    **TAGUCHI Yasushi**, *Director of Environment and Energy Division,  
Research and Development Bureau, Ministry of Education, Culture, Sports,  
Science and Technology (MEXT), Japan*
- 13:45-14:25      **Keynote Address**  
                    **YAMASHITA Koujun**, *Program Officer for the Special Coordination  
Funds for Promoting Science and Technology, Japan Science and  
Technology Agency (JST)*  
                    **TSUJIMURA Maki**, *EDL Program Leader, University of Tsukuba*
- 14:25-14:40      Coffee break
- Annual Report**
- 14:40-15:00      EDL Activities in 2010  
                    **ENDO Takahiro**, *EDL Associate Professor, University of Tsukuba*
- 15:00-15:10      Voice from EDL Students  
                    **SUN Xiaogang**, *EDL Assistant Professor, University of Tsukuba*
- 15:10-15:40      Reports of Internship (Internship in Tunisia, Mongolia, and Japan)  
                    **Representatives of EDL Students**
- Poster Presentation**
- 15:40-16:50      Poster presentation  
                    **All EDL Students**
- 16:50-17:10      Poster Awards and Winners Presentation  
                    **Winners of Poster Awards**
- 17:10-17:20      Comment  
                    **YAMASHITA Koujun**, *Program Officer of MEXT Special Coordination  
Funds for Promoting Science and Technology*
- 17:20-17:30      Future Perspective  
                    **WAKASUGI Naomi**, *EDL Professor, University of Tsukuba*
- 18:00-20:00      Reception Party

## Keynote Address

# **The Strategic Program for Fostering Environmental Leaders in Asia and Africa**

**YAMASHITA Koujun**

*Program Officer for the Special Coordination Funds for Promoting Science and Technology,  
Japan Science and Technology Agency (JST)*

Eco-innovation and green-innovation are keywords to tackle, solve and search for environmental problems for sustaining the human being. Special coordination funds for promoting science and technology supports the strategic program for fostering international environment leaders under the Long-Term Strategic Guidelines, “Innovation 25.” Based its policies as “fostering global environmental leaders”, “university reform” and “strengthening S&T international collaboration”, it establishes centers or systems to foster environment leaders, who will take the leadership to solve the environmental problems in developing countries of Asia and Africa.

This program has adopted 17 proposals submitted by universities in FY 2008-2010, as listed below. Financial support is 70-100 million yen/project/year and lasts for a period of 5 years. In fostering of Environmental Leaders, Japanese graduate students and international students from Asian and African countries and regions have to learn together environmental sciences, technologies and policies at graduate school, sharing common agenda and finding solutions in regions. The leadership is an important issue in this program, which would be acquired by training on field exercise, internship and so on. The outcomes could be evaluated by long-term practice in social activities.

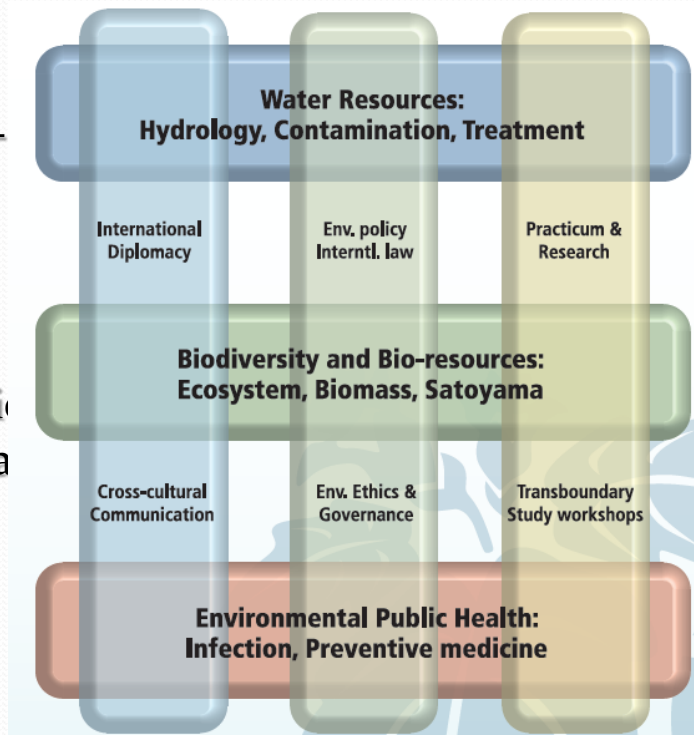
- Hiroshima University, “Global Environmental Leader Training Program for Designing a Low Carbon Society (GELs)”
- Kyoto University, “Environmental Management Leader Program (EML)”
- Nagoya University, “Nagoya University Global Environmental Leaders Program (NUGELP)”
- Waseda University, “The establishment of facilities (COE) to train international environmental leader through double (dual)-degree program”
- The University of Tokyo, “Asian Program for Incubation of Environmental Leaders (APIEL)”
- The University of Tsukuba, “Environmental Diplomatic Leader Education Program”
- Kobe College, “Woman Leaders promoting ESD based on local community”
- Gifu University, “Gifu University Rearing Program for Basin Water Environmental Leaders (BWEL)”
- Hokkaido University, “Special coordinated training program for Sustainability Leaders and Sustainability ‘Meisters’ (StraSS)”
- Yokohama National University, “Leadership Program in Sustainable Living with Environmental Risks”
- Tokyo University of Agriculture and Technology, “The Education Program for Field-Oriented Leaders in Environmental Sectors in Asia and Africa (FOLENS)”
- The University of Kitakyushu, “International Leader Training Program for Sustainable Use of Water & Resources”
- Kyushu University, “East Asia Environmental Strategist Training Program”
- Shizuoka University, “Program of the Environmental leader on the advance design brought coexistence between human society and ecosystem”
- Keio University, “International Program on Environmental Innovators for Designing the Future Society”
- Kumamoto University, “International Joint Education Program for Groundwater Environmental Leaders”
- Tohoku University, “Strategic Energy and Resource Management and Sustainable Solutions”

# What is a role of Environmental Diplomatic Leader?

Maki TSUJIMURA (Leader of EDL Education Program)

## What's EDL?

- Analytical and problem-solving skills in environmental issues germane to water resources, biodiversity/bio-resources, and public health in Asia and Africa
- Env ethnics, env governance, policy making, management, and interpretation



## What can you achieve by EDL?

- Ability to comprehend environmental issues;
- Ability to bridge natural sciences and humanities with a reliable knowledge
- Analytical and problem-solving skills applicable for real field





# Education Focusing



# A tree of EDL

**Branches:**  
Application  
Balance  
Performance



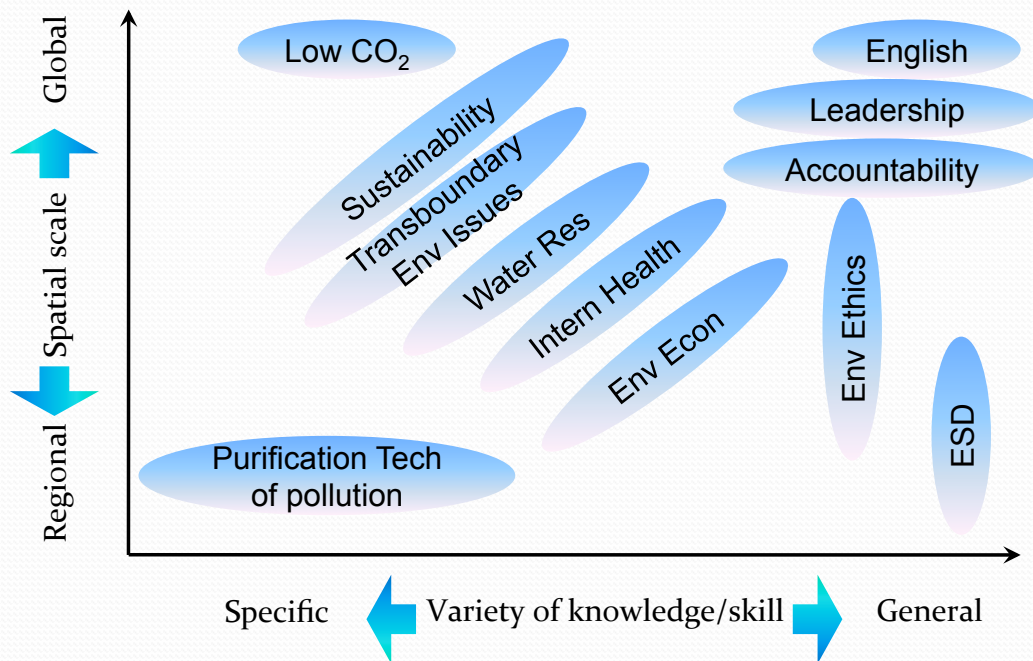
**Fruit:**  
Solutions  
Interaction  
Maintenance

**Trunk:**  
Skills  
Wisdom  
Insight

**Roots:**  
Ethics  
Respect  
Vocation / Justice

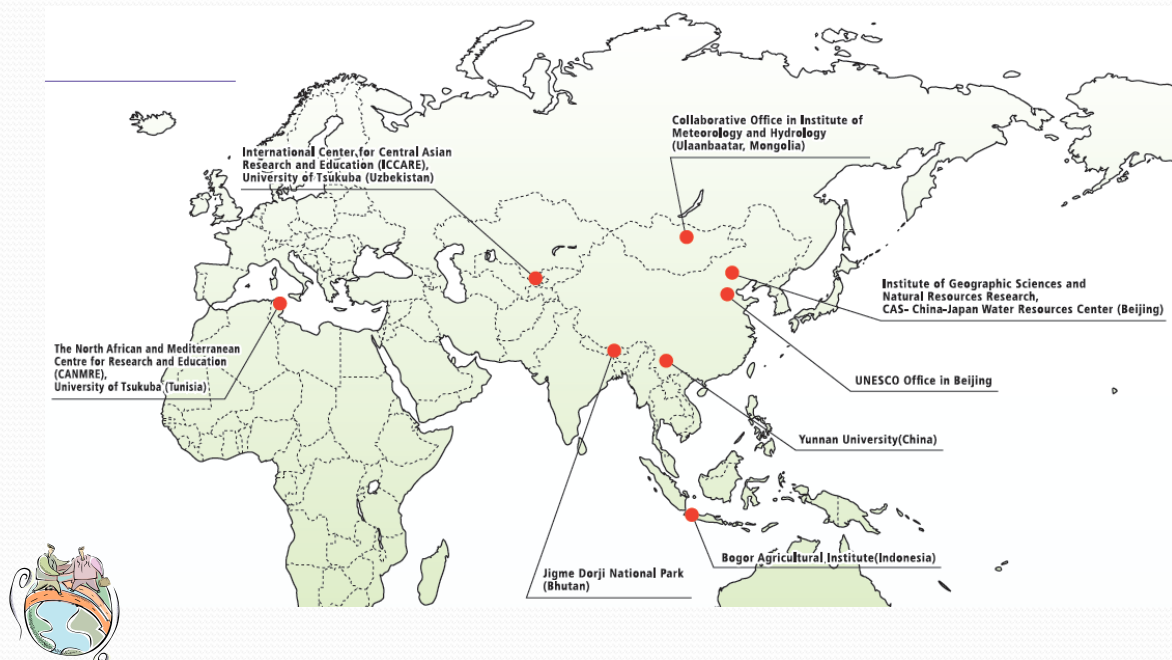
Revised from  
Gordon & Berry (2006)

# Environmental Leadership educated in Japan



## TEDLIC

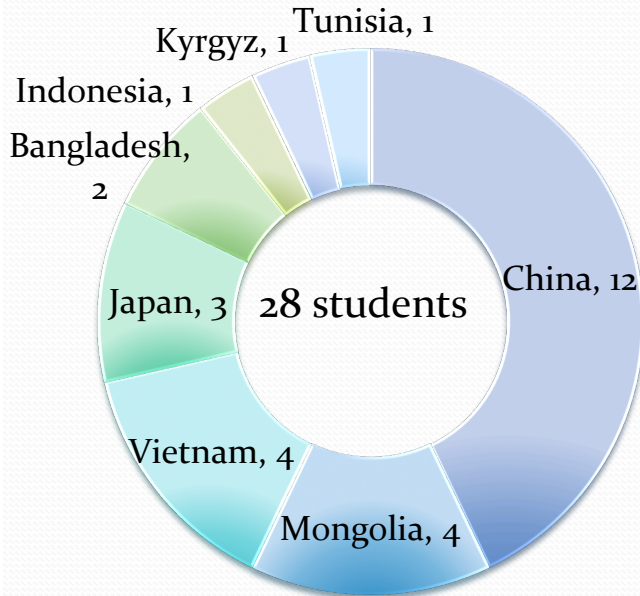
(Tsukuba Environmental Diplomatic Leadership International Consortium)



# EDL Activities in 2010

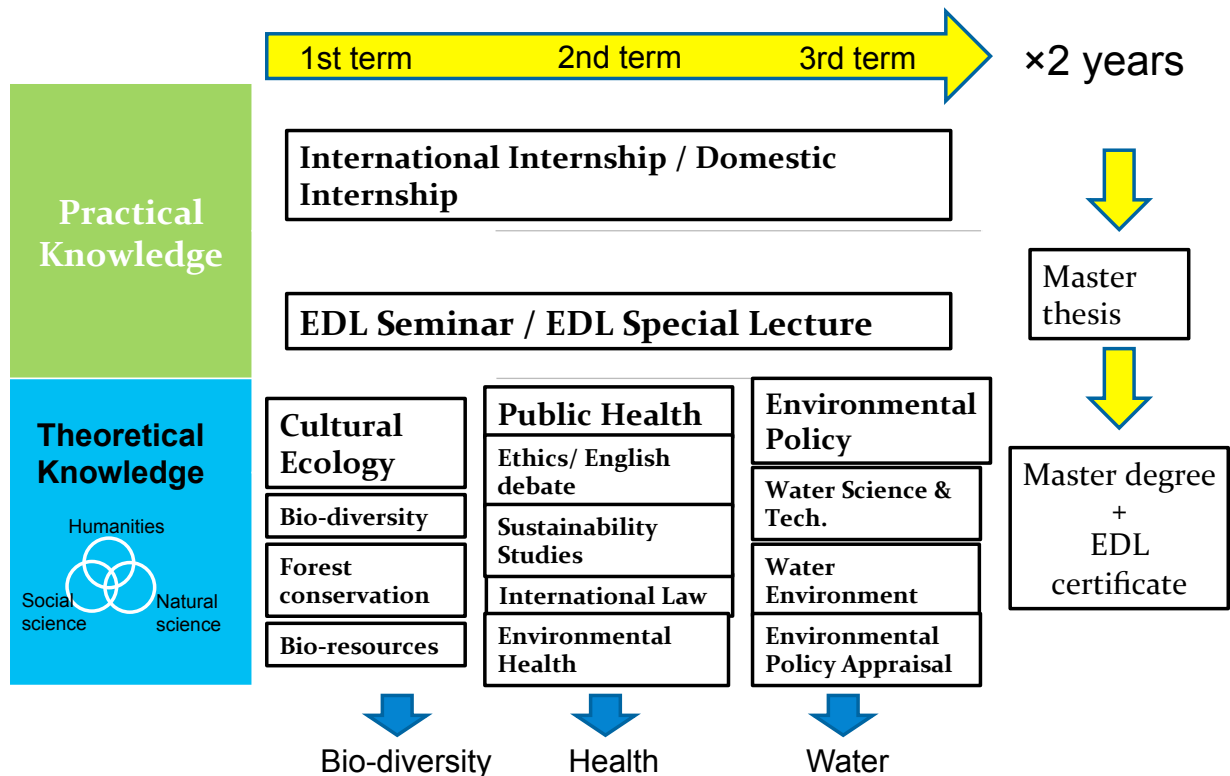
Takahiro ENDO (EDL Associate Professor)

## Students of various nationalities and research fields

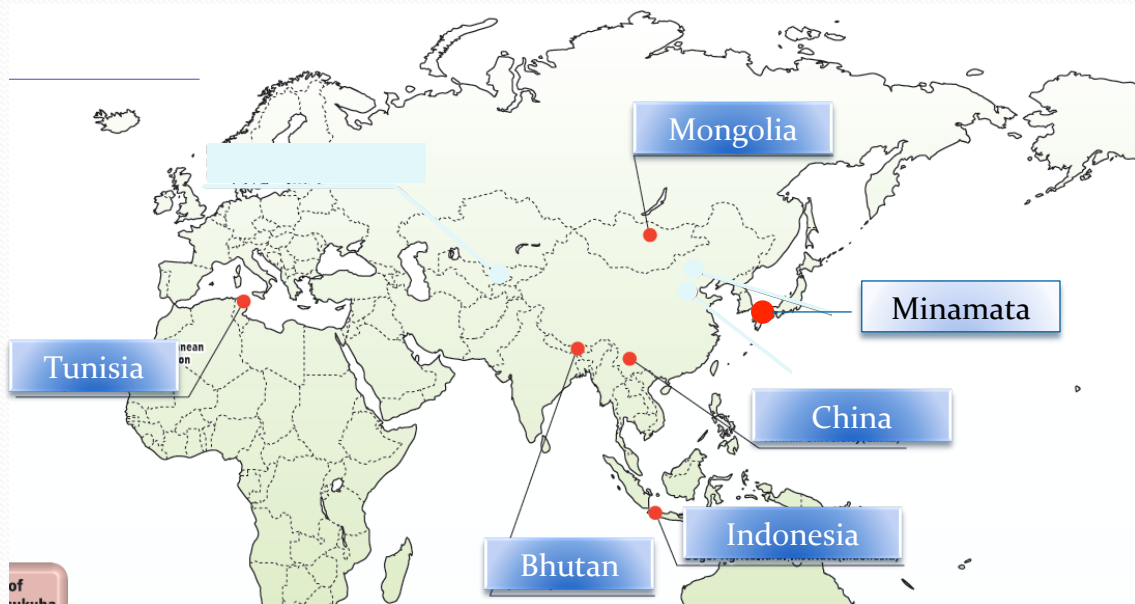


Forest management  
 Urban Planning  
 Climate change impact on agriculture  
 Micro-biology  
 Analysis of groundwater flow etc.

## A Model Study Plan in Master's Program (2 years)



## Internship program in 2010



## EDL Seminar / EDL Special Lecture I (★)

No.	Date	Lecturer	Title	
1	2010/4/21	Takahiro Endo (EDL program, University of Tsukuba)	Coping with Water Issues	
2	2010/5/7	Kazuya Endo (Ministry of Foreign Affairs)	Environmental Diplomacy of Japan	
3	2010/5/26	Naomi Wakasugi (EDL program, University of Tsukuba)	Diseases and Environment -The Role of Public Health-	
★	4	2010/6/23	Maki Tsujimura (EDL program, University of Tsukuba)	Hydrological Cycle and Environment
★	5	2010/9/17	Koki Maruyama (The Central Research Institute of Electric Power Industry)	Global Warming: Mitigation and Adaptation
★	6	2010/11/4	Makio Tamura (The Association of Membrane Separation Technology of Japan)	Membrane, Leading-edge Technology for Water Treatment
★	7	2010/11/5	Dipak Gyawali (UNU-IAS/UNESCO Visiting Professor)	Water, Cultural Diversity and Global Environmental Changes
★	8	2010/11/19	Hiroshi Satoh (Graduate School of Medicine, Tohoku University)	A wide spectrum of health effects of methyl mercury: from Minamata Disease to low-dose fetal exposure

# EDL Special Lecture II

## Project Cycle Management (PCM)

**Task: How to stop excessive uses of water resources**

- Participatory class
- Students assumes the roles of stakeholders.
- Communication skills to coordinate different opinions among students
- Planning under constraint of budget and time
- Opportunity to learn practical problems that are likely to occur in reality

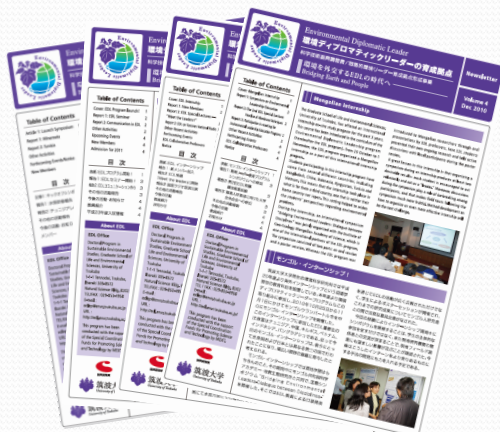


# Public Relations

## 1. Website



## 2. Newsletter (Quarterly)



## 3. E-learning system

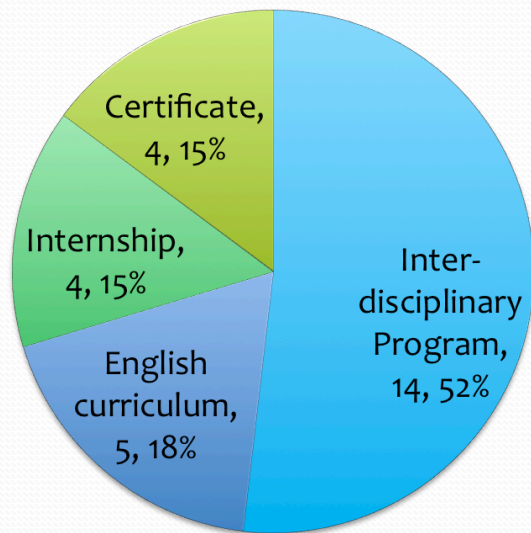




# Voice from EDL Students

SUN Xiaogang (EDL Assistant Professor)

## What attracted you the most of the EDL Program?

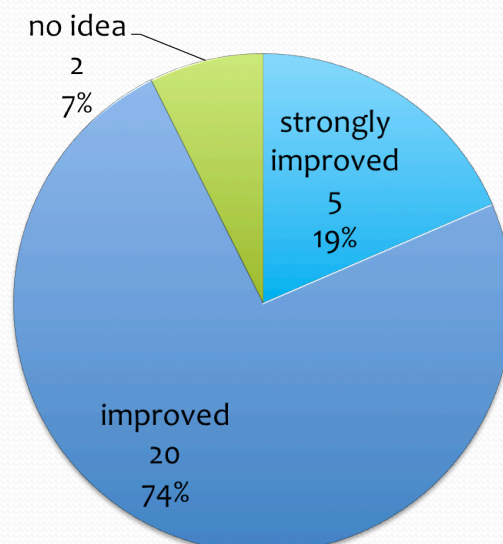


- The EDL students have an **ambition to master inter-disciplinary knowledge**.
- Our program design which consists of three major subjects and policy and culture studies realizes students' ambition.



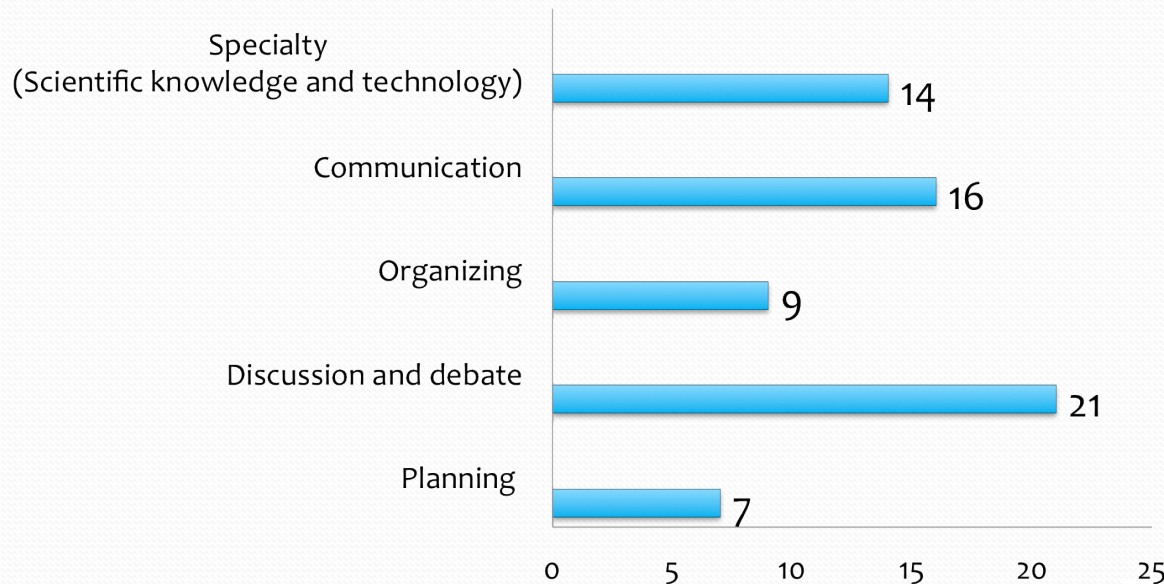
EDL Program, U Tsukuba

## Will the ability and capacity for solving environmental problems be improved after studying at the EDL program?



EDL Program, U Tsukuba

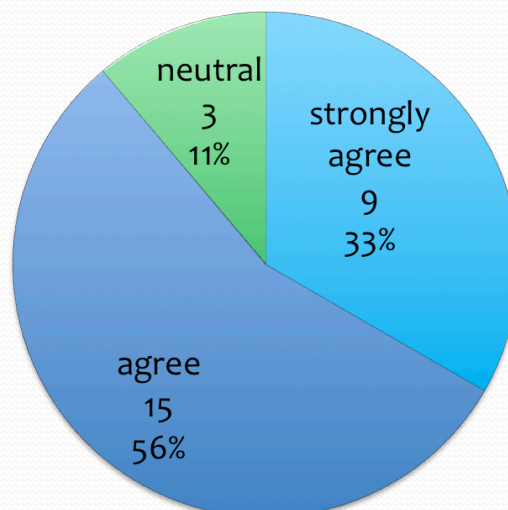
## What kind of ability will be improved? (multiple choice)



EDL Program, U Tsukuba



## The curriculum provides students with comprehensive knowledge on environmental issues.



EDL Program, U Tsukuba



## Suggestion and recommendation for further progress of the EDL in 2011

Many encouragements from EDL students:

- “I believe that my knowledge has been deepen, and my eyesight has been broadened by EDL. I really hope EDL membership can be expended. Also, I’d like to take part in every activities of the EDL.”
- “I am very glad that I joined to EDL program where I gained knowledge and a lot of positive emotions, lessons for life”
- “I think that I learned form EDL program will help me in the future. I hope that more and more people can learn from this program.”

## Suggestion and recommendation for further progress of the EDL in 2011

### *Internship:*

- Internship and training in national and international institutions can be a good opportunity for student to observe real case of environmental analysis and crucial decision making.
- More seminars and internships should be held to provide more chance to learn techniques and experiences.



## **Lists of poster presentation**

### 1. Nguyen Van Tra

Study on the Influence of Urban Growth to Agricultural Lands in the Peri-urban of Hanoi City

### 2. Nguyen Trung Thuan

Pollution Control Policy for Industrial Wastewater in Hanoi City - Vietnam

### 3. Zagdragchaa Otgonbayar

Sustainable Solution for Industrial Wastewater Handling

### 4. Nazgul Turdumatova

The Legal Status and Management of the Protected Areas in the Kyrgyz Republic

### 5. Takuya Shiraishi

Spatio-Temporal Variations of Grazing Impact in Alpine Meadow on the Qinghai Tibetan Plateau, China

### 6. Jia Chengshan

Deforestation Factors in Transmigration Village with Worse Condition in Livelihood: Case Study in Peat Swamp Land of Indonesia

### 7. Li Meihua

The Actual Status of Family Planning in Yanbian Autonomous Prefecture in China and Women's Acceptability to the Policy--From the Interviews to Women

### 8. Chekirbane Anis

Assessment of Surface Water – Groundwater Connectivity for Sustainable Water Resources Management in a Semi-Arid Coastal Plain in Cap-Bon, Northeastern of Tunisia

### 9. Natsagdorj Natsagsuren

Affect of Soil Moisture and Climate Conditions on Drought in Mongolia

### 10. Khishigsuren Nyamsambuu

The Impact of Land Use Activities on Pastureland Degradation in a Semi-arid Region in Mongolia: Case study: Bayan soum, Tuv Province

### 11. Fakir Muhammad Munawar Hossain

Strengthening Social Forestry in Bangladesh Protected Areas: Local Community Based Organization Perspectives

### 12. Gonchig Gantulga

Effect of the Extension Service for Development of Organic Comprehensive Crop-Livestock Farming in Mongolia

### 13. Yusuke Sugamoto

Development of How to Measure Net Primary Productivity by Periphyton and its Contribution at Boulder Shore

14. Wang Shuozhi  
Interactions Between Fungi and Bacteria Associated with Degradation of Persistent Organic Pollutants
15. Zhang wanjun  
Genetical Analysis of Dehalogenation Reaction and its Application
16. Zhao Yingxin  
Nitrate Removal from Groundwater Using an Intensified Electrode-biofilm Reactor(IBER)
17. Fang Hao  
Environmental Toxicological Effects of Nanoparticles on Mice
18. Yang Shengjiong  
Pollutants Removal from Wastewater through Vertical Multilevel Soil Infiltration System
19. Masatsugu Uesugi  
Photocatalyst which can Decompose Glycerol with High Efficiency
20. Hossain Md. Shahadat  
Potential Impact of Climate Change on Rice Production in the Indo-Gangetic Plains
21. Yudi Setiawan  
Characterizing Vegetation Dynamics of Agricultural Land in Java Island, Indonesia
22. Pham Tien Dat  
Mangrove Management Information System (MMIS) as a Tool for Mitigating the Effects of Forecast Climate Changes along the Coast of Northern Vietnam
23. Hoang Thanh Tung  
Policy for Risk Management in Rice Value Chain to Adapt with Climate Change in Vietnam
24. Zhu Aijun  
Optimization Approach for Municipal Waste Management in Beijing
25. Sun Shuang  
Economic Evaluation on Waste Water Treatment Approaches in Rural Area: A Case Study of Yi Long Lake, Yun Nan Province of China
26. Ni Bingbin  
Impacts of Land Use/Cover Change on Water Environment in Fuzhou City, China
27. Xiang Nan  
The Comprehensive Evaluation of Reclaimed Water Effectively Utilization Policy in Tianjin, China

## Poster No. 01

### Study on the Influence of Urban Growth to Agricultural Lands in the Peri-urban of Hanoi City

Nguyen Van Tra<sup>1</sup>, Akinobu Murakami<sup>2</sup>

*1, Graduate School of Environmental Sciences, University of Tsukuba, Ibaraki, Japan*

*2, Graduate School of System Information Engineering, University of Tsukuba, Ibaraki, Japan*

Urbanization is an essential and necessary process for development and is increasing rapidly throughout the world; especially in the developing countries. It has brought both advantages and disadvantages for human beings in term of social and economic aspect such as migration, poverty, health, education, housing, environment, etc. There are many environmental problems caused by urbanization such as air pollution, waste disposal, wastewater, urban heat island and others.

The main cause of land use change is the urbanization of Hanoi city. Agricultural lands, especially paddy lands in peri-urban were taken to urban region leading to the changing dramatically in land use. Agricultural land utilizations for different purpose are massive due to needs for houses, unplanned industrial zones construction and infrastructure development. The loss of agricultural lands, especially paddy lands in peri-urban of Hanoi is supposed to rapidly increase according to the rate of urbanization. Agricultural lands, natural vegetation, and other sites are converted to residential areas with enhanced transportation systems, increased housing density, and lost green space. The peri-urban areas have been gradually converted and absorbed by the city, but a large portion still remains as agricultural land and plays an important role in supplying food and other agricultural products to Hanoi.

In order to find a suitable method for Hanoi urban planning, this study focused on identifying the characteristics of process of land use conversion from agricultural land to urbanized land. The feature of Hanoi urban area will be exposed by examining the land use mixture in comparison with other several mega cities and using satellite images that cover gradual land use conversion from agricultural land to urban land. Moreover, join-counts method and GIS will be used to calculate the land use mixture. This makes it possible to more clearly understand the spatial features of urbanization in Hanoi and provides a basis for policy makers, urban planners in building an appropriate land use planning of Hanoi outskirts.

**Key words:** Hanoi, land use, agricultural lands, satellite images, GIS

# STUDY ON THE INFLUENCE OF URBAN GROWTH TO AGRICULTURAL LANDS IN THE PERI-URBAN OF HANOI CITY

Nguyen Van TRA

Graduate School of Environmental Sciences, Tsukuba University, Ibaraki, Japan

The main cause of land use change is urbanization of Hanoi city. Agricultural lands, especially paddy lands in peri-urban were taken to urban region leading to the changing dramatically in land use. Agricultural land uses for different purpose are massive due to needs for houses, unplanned industrial zones construction and infrastructure development. That leads long-term negative influences. In order to find a suitable method for Hanoi urban planning, this study focused on identifying the characteristics of process of land use conversion from agricultural land to urbanized land. The feature of Hanoi urban area will be exposed by examining the land use mixture in comparison with other several mega cities. Moreover, join-counts method and GIS will be used to calculate the land use mixture. This may help policy makers, urban planners in building an appropriate land use planning of Hanoi outskirts.

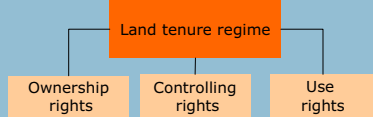


## Introduction

### Process of urban development

- Since 1980s → renovation policy (DOI MOI)
- Land law 1993 & revised 1998
  - legal basis for land allocation and lease
  - securing land use rights for land holders
- State manages land → controlling the transfer of land use rights through people committees (provincial & district levels)

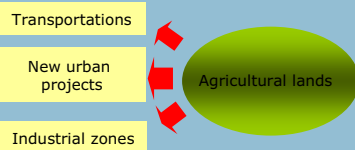
### Land management system



The overlap of land administration system & weakness of legal system → land conversion

### The development of hanoi urban

- (Colonial time) In 1936. Land area was 12km<sup>2</sup>, 300 thousands people
- 1954-1960, Hanoi > Red river's south
- 1960-1964, Hanoi > Red river's south & a part of North. Hanoi's land area: 20.000ha, 1 million people
1998. developed in both banks of Red river. Hanoi would be the center city in a bunch of new urban.
- By 2008 widened > metropolitan area of Hanoi with an area of 334,470 ha and 6,232,940 people



### Relationship to EDL Program

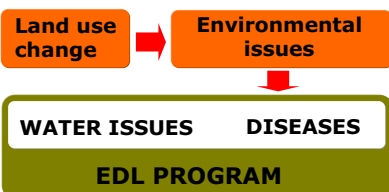


Fig.1 Area Study

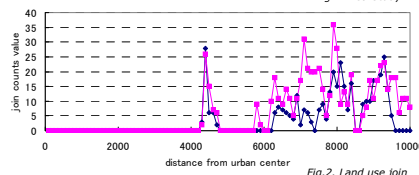


Fig.2. Land use Join counts in Hanoi

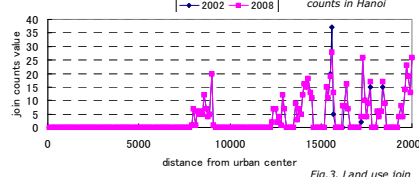


Fig.3. Land use Join counts in London

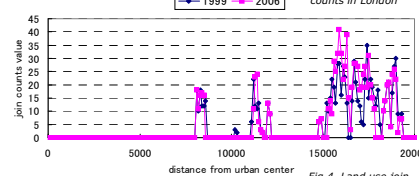


Fig.4. Land use Join counts in Manila

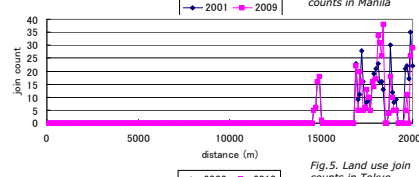


Fig.5. Land use Join counts in Tokyo

## Objectives

Agricultural lands play important ecological functions for landscaping planning and affected directly by urbanization. (Yokohari and Kato, 1995; Yokohari et al., 1994)

Identifying the changing patterns of agricultural lands

By comparing the patterns of land use b./w Hanoi and several mega cities, the feature of mixed land use will be revealed

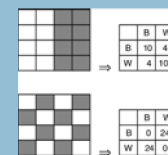
## Materials

Data	Date
Google Earth	2002
Google Earth	2008
Hanoi land use map	2003
Hanoi land use map	2008
Historical maps	
Census data	2002, 2008

### Study area:

Hanoi, the capital of Vietnam with latitude from 20° 53' to 21° 23' north, and longitude from 105° 44' to 106° 02' east. Hanoi situated in the center of the Northern Delta with a population of 3,055,300(2004), and an area of 920.97 km<sup>2</sup> (within downtown: 150km<sup>2</sup>). At this time, Hanoi has nine urban districts and five peri-urban districts.

## Methods



The graph indicates the method of calculating joins as BB joins, WW joins or BW joins in a 4x4 matrix. The join counts method uses the number of BW joins as its value since this represents the frequency of contiguity between black and white.

In this research, I analyzed join counts between urban and agricultural land use areas. Hence, the degree of land use mixture will be revealed through the value of join counts.

The first is to develop spatial database from Google Earth images in 2002 and 2008. Land use maps of Hanoi will be base maps for comparison. Land use map will be converted into cell format to identify land use types.

The second is measuring land use mixture by using the "Joint-count" method.

The final is identifying the changing patterns. Arc GIS software will be used to study these changes.

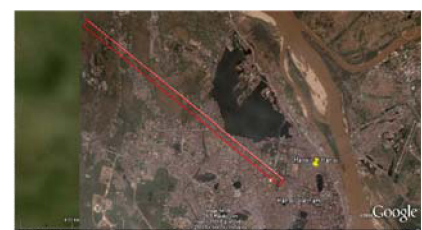


Fig.6. Belt transect in Hanoi

## Poster No. 02

### Pollution Control Policy for Industrial Wastewater in Hanoi City - Vietnam

Nguyen Trung Thuan  
*Graduate School of Life and Environmental Sciences,  
University of Tsukuba, Ibaraki, Japan*

Hanoi, the capital city of Vietnam, is located in the Northern part of Vietnam. Hanoi city became bigger since 2008 after enlarging to other areas of vicinity provinces of Vietnam. Currently Hanoi has area of 3,344.6 km<sup>2</sup> with population is about 6,537,900 persons. Hanoi is one of the leading cities of Vietnam in economic development. In general, its GDP has increased year by year that contributes to the development of the country. Beside advantages of economic development, Hanoi is facing to serious pollutions caused by economic activities in which wastewater problems are the most severe problem.

In Hanoi, there are three main pollution sources of water including domestic, hospital and industrial wastewater. With the strongly development of industry as well as economy, industrial wastewater is the most severe problem in both current and future. Everyday, there is about 40,000m<sup>3</sup> industrial wastewater discharged with high pollution load into rivers, canals of Hanoi causing serious pollution to the environment. In many industrial zones of Hanoi, a few zones have wastewater treatment plants. Besides, in the zones having wastewater treatment plant, few of them achieve the standard level of quality for wastewater. To solve the problem, Vietnam in general and Hanoi in particular issued regulations such as technical regulation on industrial wastewater, environmental fee for wastewater discharge, regulations on sanction in environmental protection, etc. However, such regulations either do not have effective enough or cause conflicts with economic development.

In order to find feasible solutions for the industrial wastewater problem in Hanoi city, it is necessary to focus on overall policy for pollution control of industrial wastewater in Hanoi. The feasible policies, regulations, incentive regimes and subsidies from government play very important roles in successful control of industrial wastewater. In other words, we need policies which are feasible for both government and producers. This is a very important point because Vietnam is a developing country which has high demand of economic development while we also need to protect environment so that the tradeoff between economy and environment is a key factor.

Working for wastewater control agency in Vietnam, I will able to apply the research on wastewater in my future work. Not only merely contains technical aspect, my research has integration approach which is received from EDL program. More importantly, EDL's skill in negotiation and integration management will be really necessary to my work at policy-making agency of Vietnam.

**Key words:** Water pollution, industrial wastewater, industrial impacts, wastewater policy, economic-environment tradeoff.

# POLLUTION CONTROL POLICY FOR INDUSTRIAL WASTEWATER IN HANOI CITY, VIETNAM

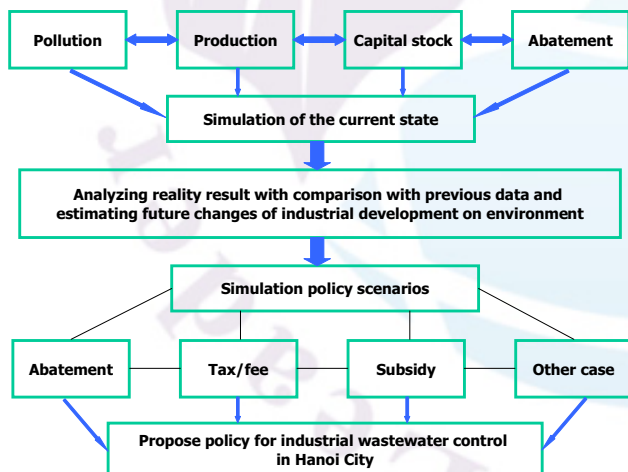
Nguyen Trung Thuan  
EDL student 2010

## Objectives of the study

- To figure out industrial wastewater situation in Hanoi City
- Estimation and distribution of wastewater discharges by major industrial sectors in Hanoi
- Analyzing current economic state and future changes considering the impact on water pollution in Hanoi City
- Maximization of industrial production expressed by output measures such as GRP, in which various wastewater treatment facilities are introduced into model to figure out the optimal numerical solution which has the highest social welfare and less environmental impacts in term of water quality objectives
- Proposing a policy for pollution control of industrial wastewater in Hanoi City

## Methodology

The methodology used for the study is based on mathematical model that defines existing environmental and socio-economic states in Hanoi City. The model will classify and categorize available data and information in each industrial zone and major industrial sector regarding wastewater discharge.



For that model, data and information on socio-economic indicators such as GRP, investments, production and flow of goods and services into the market system are needed.

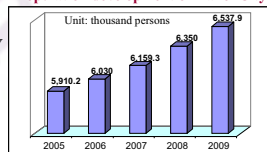
## MAP OF VIETNAM



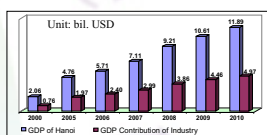
## MAP OF HANOI CITY



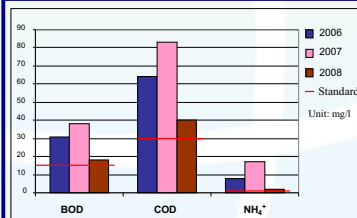
## Population development of Hanoi City



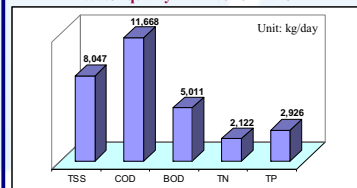
Area: 3,344.6 km<sup>2</sup>  
Population: 6,537,900 persons  
Pop. density: 1,955 persons/ km<sup>2</sup>



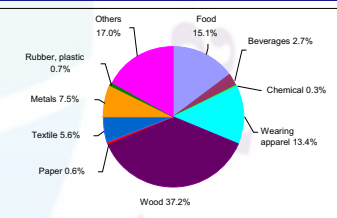
## Contribution of Industry in GDP of Hanoi



## Water quality in a river of Hanoi



## Pollutants load of industrial wastewater in Hanoi, 2009



## Major industrial productions of Hanoi, 2009

Pollutants considered in wastewater: BOD, COD, TSS, TN and TP

In Hanoi there are 23 industrial sectors; 05 treatment types in industrial sectors: no treatment, pre-treatment, chemical treatment, biological treatment and advanced treatment.

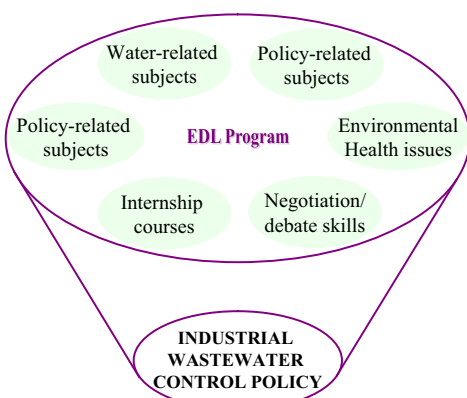
Relation of pollutants discharged from industrial activities, production and wastewater treatment:

$$PMI_p(t) = \sum_{i=1}^{23} \sum_T e^{T_{ip}} X_i^T(t)$$

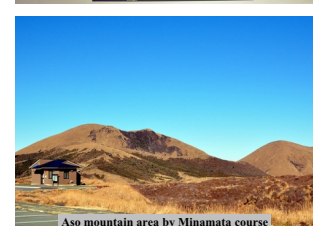
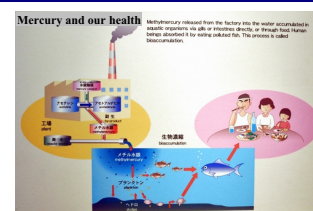
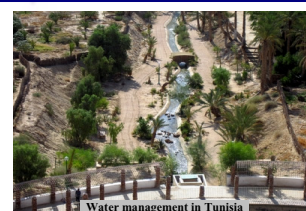
$PMI_p(t)$  : Total pollutants discharged from all industrial activities

$e^{T_{ip}}$  : An amount of pollutant  $p$  emitted by one unit of production (1 bill USD) with treatment type  $T$  for each industry  $i$

$X_i^T(t)$  : The production with treatment type  $T$



Relation between EDL program and the study on industrial wastewater control policy



During my studying, EDL program has provided a lot of relevant knowledge as well as methodologies which are very helpful to my topic. From technical aspect to policy aspect, by combination of lectures and internship courses, EDL provides a comprehensive approach for water-related problems. Based on integration of socio-economy and environment, my study has absorbed information from EDL's subjects such as Environmental Policy, Environmental Policy Appraisal. And, to achieve effectiveness of water environment, it is necessary to develop an integration method which includes not only environmental, economic issues but also social benefits such as health condition maintenance. In implementation of a strategy or policy on water environment, we must consider the whole target area which contains various factors such as community, relationship among water environment elements (surface water-groundwater for example). Not only did the lectures, EDL has internship courses providing me current states of water management and health in Tunisia or consequences of industrial wastewater pollution by Minamata case. More importantly, negotiation and integration management knowledge from EDL program will be really necessary to my future work at policy-making agency of Vietnam.

## Poster No. 03

### Sustainable Solution for Industrial Wastewater Handling

Zagdragchaa Otgonbayar  
*Graduate School of Life and Environmental Sciences,  
University of Tsukuba, Ibaraki, Japan*

The proper industrial wastewater management and its handling is one of the sustainable development issues. This research has focusing and considering on possible solutions in the case of tannery wastewater handling and searching an answer to solve the problems and how fill the occurring gaps.

In Mongolia, currently the water pollution is increasing due to majority of industrial sources, namely point-sources of chemicals from leather processing applying chromium components; irresponsible mining technologies applying extensively heavy metals and cyanide; and agricultural practices such as overgrazing by livestock. The Tuul River, strategic water resource of the capital city of Mongolia was polluted by chromium contamination. The chrome tanning method is the most widely used method in majority of the skin and hide processing factories. Chromium is unique among regulated toxic elements in the environment in that different species of chromium and releases into the air, water, and soil can be transported among the various environmental media through various intermedia transport processes. Once in the environment, chromium can be taken up by human and other ecological receptors and causes acute types of deceases. Poorly treated water charged to the natural environment is the source of chromium poisoning in surface water and living species in.

Among the most common methods for removal of chromium from industrial wastewater, the adsorption is an economical and feasible alternative method. Natural and cheaper adsorbent material for removal of chromium is studied. Akadama mud, consisting mainly of different forms of iron and aluminum oxide minerals, was used for chromium (VI) and chromium (III) adsorption from aqueous solutions. The laws and regulations including standardization on industrial wastewater and of environmental quality have being reviewed. Investigation and comparing with regulation system on industrial wastewater of the countries which has sophisticated management on the issue have being conducted.

**Key words:** Water contamination; Chromium; Adsorption; Akadama mud; Environmental Quality Standard.



## introduction

Among the numbers of possible solutions on industrial wastewater handling, if it is rationally considered by all the aspects of economic, environmental and public, it could be found sustainable solution. In Mongolia, currently the water pollution is increasing due to majority of industrial sources, namely point-sources of: chemicals from leather processing applying chromium components; irresponsible mining technologies applying extensively heavy metals such as mercury and cyanide; and agricultural practices such as overgrazing by livestock. The Tuul River, strategic water resource of the capital city of Mongolia was polluted by chromium contamination and fact has that its water became less full and 3.2 ton fishes died in 2007 and similar situation repeated in August 2010. One major influence is badly treated wastewater has flowing to the river which has high concentration of chromium, as well BOD due to industrial wastewater treatment old plant (only filtration of solid particles and sometimes post-oxidation) with outdated equipment, which collects wastewater from all tanneries located in Ulaanbaatar capital. Weightier, there is no a precise regulation system and the institution on control and monitoring of water quality. Natural and cheaper adsorbent material for removal of chromium is studied. The laws and regulations including standardization on industrial wastewater of the country have being reviewed. Investigating and comparing with regulation system on industrial wastewater of the countries which has sophisticated management on the issue have being conducted.

## results

### Experiment or Investigation of the cost-effective material as feasible adsorbent for removal of chromium from tannery wastewater

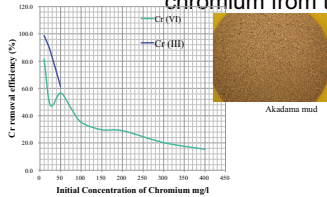


Fig. 1. Effect of initial concentration of adsorbent adsorption by Akadama mud. (initial Cr = 50 mg/L, dosage = 25 g/L, grain size range <115 mesh, contact time = 11 h).

Experimental batch study results carried out under this research say that the Akadama mud has an ability for adsorption of both of chromium (VI) and chromium (III)

It is could be used as a feasible adsorbent material for chromium removal from tannery wastewater treatment.

Studies related with the removal efficiency of adsorbent (dosage and grain size), adsorption process (cations and anions existence), adsorbate (initial concentration) and effects of conditions and factors (pH, adsorption duration) were done.

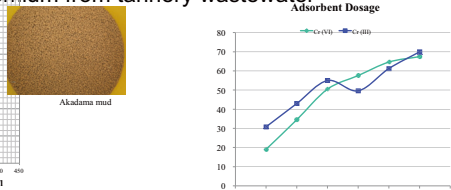


Fig. 2. Effect of adsorbent dosage on Cr(VI) and Cr(III) adsorption (initial Cr (VI) = 50 mg/L, initial Cr(III) = 50 mg/L, dosage 5-30 g/L; grain size range <80 mesh; contact time for Cr (VI) = 72 h; contact time for Cr (III) = 12 h; room temperature, without agitation)

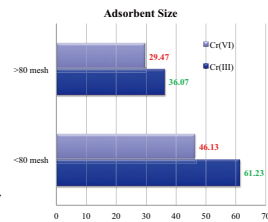


Fig. 3. Effect of adsorbent size on Cr(VI) and Cr(III) adsorption (initial Cr (VI) = 50 mg/L, initial Cr(III) = 50 mg/L, dosage = 25 g/L, grain size separated by 80 mesh, contact time = 11 h)

Chromium exhibits a wide range of possible oxidation states, where the +3 state is most stable energetically; the +3 and +6 states are most commonly observed in chromium compounds, whereas the +1, +4 and +5 states are rare.

Total Cr contents in effluents: minimum 0.005 mg/L to maximum 410.6 mg/L, and the average is 51.7 mg/L.

Almost all the hexavalent chromium in the environment arises from human activities.

Synthetic inorganic water solution of  $K_2Cr_2O_7$  for hexavalent chromium and  $NH_4Cr(SO_4)_2 \cdot 12H_2O$  for trivalent chromium were used in the experiment.

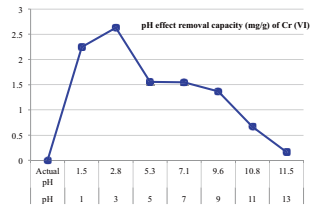
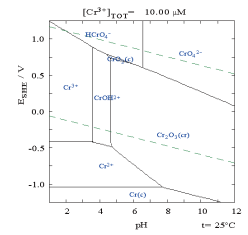


Fig. 4. Effect of pH on Cr(VI) adsorption by Akadama mud. (initial Cr = 50 mg/L, dosage = 25 g/L, contact time = 1.5 h).



The Pourbaix diagram for chromium in pure water, perchloric acid or sodium hydroxide-Puigdomenech, Ignasi (2004) KTH Royal Institute of Technology

## environmental dimension

- Standards for protecting Human Health- fixed
- Standards for protecting the Living Environment- lack
- Import the standard from international guidance, which developed based on scientific research and discussion – pleasant method
- But No such Internationally Recognized EQSs

### chromium in water specification standardized

	total chromium	0.05 mg/l
WHO guidance In drinking water for protecting human health		
Japan: National effluent standards for protecting human health	sexivalent chrome compounds	0.5 mg/l
Japan: National effluent standards for protecting the living environment	chromium	2 mg/l
Mongolia: Drinking water standard	chromium	0.05 mg/l
Mongolia: Surface Water quality standard	X	X
Mongolia: effluent standard	X	X



## What Have

Environment details are regulated by the 16 environmentally - related laws of the country including

- Law on Environmental Protection,
- Law on Water,
- Law on Protection From Toxic Chemicals and
- Law on Water and Mineral Water Use Fees

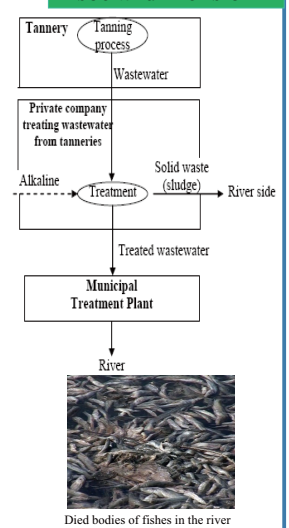
## But the Gaps Have

- Environmental legislation has included less on water quality issue
- No connection between and not accurate
- No responsibility on each tanning company
- Not enough judgment system and
- No appropriate plan for control (i.e. the water quality monitoring plan (18 specifications) for the river is excluded chromium concentration)

## What Need

- A precise and rational regulation system
- The matured institution on control and monitoring of water quality

## social dimension



## conclusions

- For the removal of chromium from tannery wastewater, the adsorption using Akadama mud is a feasible method as the mud is cheap and environmentally friendly material
- Establishment of a system that each single industry is in charge of discharging own wastewater after proper treatment fully compliance with national standards and to use feasible technology is essential
- Add some items (specifications) related to the protection of the living environment to national standards on industrial wastewater
- Make an amendment and adapt a stricter and more precise Water Pollution Control Law
- Establishment of smart institutional system on control and monitoring of water quality and quantity with well organized management

## discussions and further study

- As the both of local specified condition and international tendency on natural environment are together and holistically and count the each of environmental, economical and social dimensions, there would be sustainable solution to solve the problem in the case.
- Environmental scientists are in charge of not only conducting their own research, they have to have certain awareness on social environment and economics and have to play role of persuading through diplomatic way a decision makers and supplying scientific knowledge to support to do their rational decisions.
- Adsorbent material investigation will be continued by confirmation experiments and using real wastewater sample.
- Search and study the draft international EQS standards on chromium, which done necessary researches.





## Poster No. 04

### The Legal Status and Management of the Protected Areas in the Kyrgyz Republic

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Protected areas (PA) play important roles in maintaining environmental stability throughout the world. The sustainable development of the Kyrgyz Republic good quality of life, the health of the population and environmental safety can be achieved by maintaining well conserved natural ecosystems.

The Kyrgyz Republic is the high-mountainous country, where the altitude fluctuates from 500 to 7439 m. In spite of its small territory Kyrgyz Republic has sufficiently high amount of species diversity – about 1% of all known aspects on 0.13% of the Earth surface.

There are 4 different (in-situ conservation) types of 87 PA in the country with total area 1218.8<sup>th</sup> hectares or 6.1% of the country area. After independence, PAs has been increased about 2.5 times.

The strict nature reserve (*Zapovednik*) is one type of the PA with strict protection of ecosystem. Their main tasks are 1) the scientific research; 2) the ecosystem preservation and 3) ecological education. The system was generally successful and was considered perhaps the best system of the strict nature reserves. However after collapse of the Soviet Union, the general economic and social situations had great influence to the PA.

The objective of this study was to find the legislative systems that have supported the PAs development in the KR and examine the actual conditions behind the statistical information.

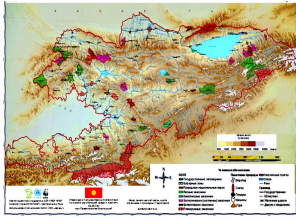
The case of the Naryn State *Zapovednik* management was analyzed. As a primary source, the closed-ended questionnaire was used for *zapovednik*'s staff. Literature survey; laws, official documents, statistics were used as secondary sources. As a tentative conclusion, because of finance, qualified staff shortages and as well as frequent staff resignation there is gap for improvement in the effective management and development of protected areas, through more in-depth and strategic planning.

**Key words:** the Kyrgyz Republic; Protected areas; Nature conservation legislation; Biodiversity; Strict nature reserve; Protected area management.

# The Legal Status and Management of the Protected Areas in the Kyrgyz Republic

Nazgul Turdumatova, Misa Masuda  
Graduate School of the Life and Environmental Sciences, University of Tsukuba

## The Kyrgyz Republic (KR) and the protected areas (PA)



- A high-mountainous country  
94.2%: higher than 1000m  
40.8%: higher than 3000m
- Before 1991, the country was a part of the Soviet Union, and became an independent country afterward.
- With only 0.13% of the world's landmass, KR has 1% of the world's known species.
- 87 PAs on the 1218.8 ha. After 1991 PAs has been increased about 2.5 times (SAEPF, 2010).
- PAs are natural complexes of land and water with special regimes of protection and use.
- PAs are environmental, eco-educational and research institutions (Law on PA, 1994).

## The previous studies and objectives of the study

Before 1991

Legal regime of *zapovedniks*, national parks and preserves in the Union of the Soviet Socialist Republic (USSR) were studied during 1970-1988. Until 1992, PAs formed a part of the USSR system, under a unified legal framework (Iashenko R. 2006).

After 1991

PA-related laws in Central Asian countries were studied (Gromov V. 2005), but historical background of legislation system have not been sufficiently described. While CBD (2010) briefly mentioned that PAs legislations have some deficiencies and contradictions with other legislations, detailed information is not provided.

Objectives

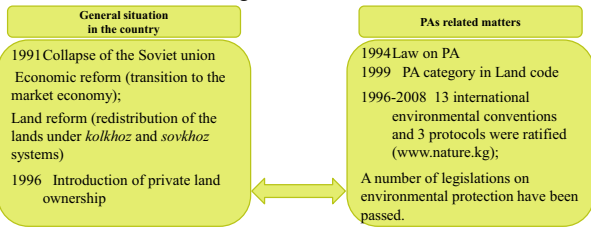
To find the legislative systems that have supported the PAs development in the KR and examine the actual conditions behind the statistical information.

## Topics and methods

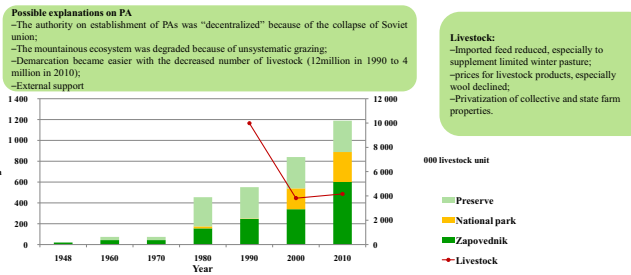
Historical development	<ul style="list-style-type: none"> <li>Soviet period</li> <li>After the independence</li> </ul>	<b>Literature survey</b> -Laws -Official documents -Statistics -Interview with staff of the Naryn State Zapovednik
Comparative study	<ul style="list-style-type: none"> <li>Kazakhstan</li> <li>Russia</li> <li>Uzbekistan</li> </ul>	
Actual management	<ul style="list-style-type: none"> <li>Management practices</li> </ul>	

Is there a disparity between the desk facts and actual conditions?

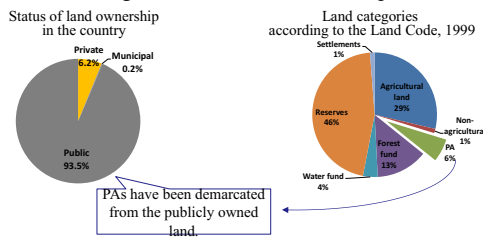
## Historical background of KR after 1991



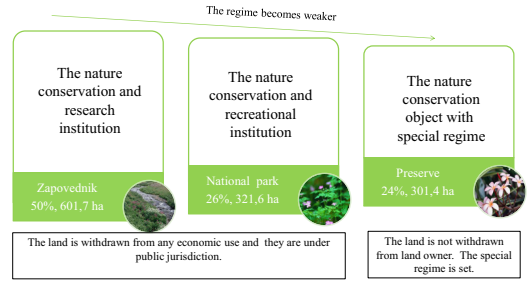
## Changes in PAs' area and number of livestock



## Background of the land ownership

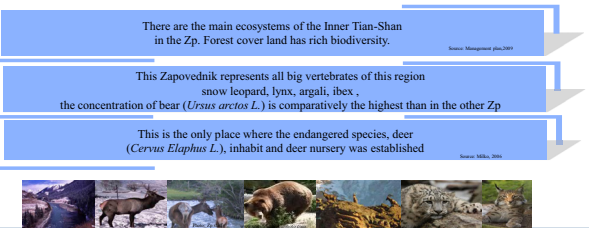


## In-situ conservation PAs

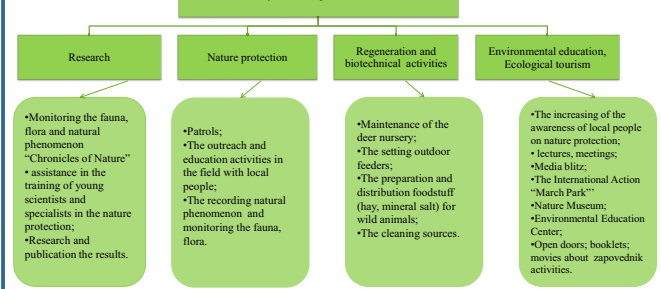


PAs are subdivided into four categories, which the IUCN uses, according to their function. Category I is Zapovedniks 10. Category II is National parks 9. Category III is Nature Monuments 18. Category IV is Protected Biotopes and Species 49. Source: Law, 1994., official documents

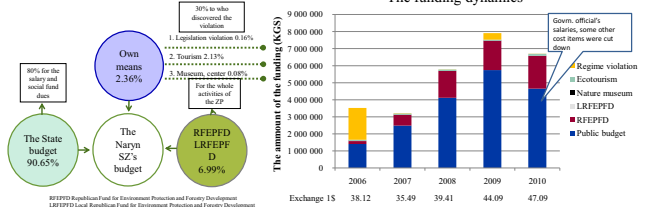
## Why this Zapovednik was chosen for case study?



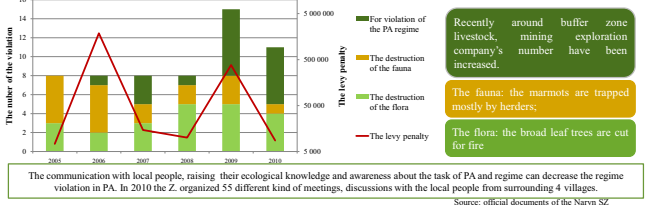
## The Naryn State Zapovednik activities



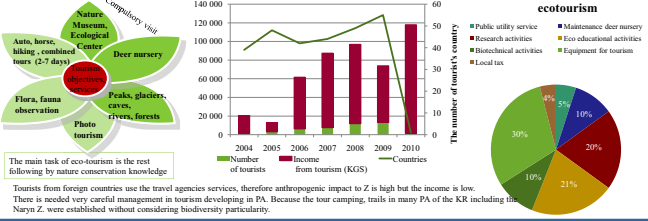
## The funding source of the Naryn SZ.



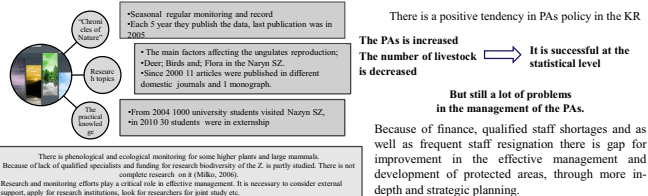
## The violation of the nature protection legislation



## The ecological tourism



## The scientific research



## Poster No. 05

### Spatio-Temporal Variations of Grazing Impact in Alpine Meadow on the Qinghai Tibetan Plateau, China

Takuya SHIRAISHI

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University of Tsukuba, Ibaraki, Japan*

Rangeland degradation by livestock over-grazing has been well known in the wide range of the Qinghai Tibetan Plateau (QTP). Although the degradation is considered to be one of the serious environmental problems, we have not yet led to manage farming system for sustainable management of the alpine meadow ecosystem on the QTP. One of the major reasons is that there is still little information on grazing impact on the ecosystem. The ecosystem includes various types of grassland and grazing system, and thus spatio-temporal variations of grazing impact in the ecosystem should be large. To propose appropriate management of the rangeland on the ecosystem, describing of degradation status and grazing impact on the ecosystem in various area and time is urgently needed. This study aims to describe grazing impact on plant biomass and species diversity of summer rangeland focusing on its yearly and altitudinal variation.

I conducted my research in an alpine slope of Qilian Mountains in the proximity of Haibei Station in the QTP. Air- and soil-temperature and soil moisture were measured along an altitudinal gradient, at 3600m, 3800m, 4000m and 4200m from 2006 to 2010. I also set four non-grazing plots (20x5m) at the four altitudes in 2006. During the growing season of 2007, 2008 and 2010, I measured plant maximum height and identified species in 50x50 cm quadrates in grazing and non-grazing plots using point-frame method (Hughes 1962). Above-ground biomass was non-destructively estimated using plant maximum height. Diversity index (Shannon-Weiner index) was calculated using frequency of each species (Krebs and Charles 1989).

Yearly change of above-ground biomass (AGB) in non-grazing plot was different among plant types and altitudes, probably due to the difference of environmental variables, such as temperature and soil moisture among years and altitudes). While total AGB and grass increased over years in every altitude (+111% and +158% compared to 2007 respectively), forbs decreased at low altitudes (-23%) and increased at high altitudes (+70%). No tendency was observed in the yearly change of diversity index. Grazing impact was markedly different among plant types and altitudes. Ave. 60% of grass in non-grazing plot was grazed in grazing plot at every altitude throughout the study period. Forbs increased at low altitudes (+122%) and decreased at high altitudes (-57%) under the influence of grazing in 2010. No tendency was found in the relationship between diversity index of grazing plots and grazing index which I defined.

**Key words:** above-ground biomass, species diversity, grazing, altitudinal gradient, Qinghai-Tibetan Plateau



# Spatio-Temporal Variation of Grazing Impact in Alpine Meadow on the Qinghai Tibetan Plateau, China



Takuya SHIRAISHI

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## Background

**Qinghai Tibetan Plateau (QTP)**  
Used as Rangeland from Prehistoric Times

In the last 60 years...

Rapid Economic Development  
Rise in Population  
Increased Demand on Meat

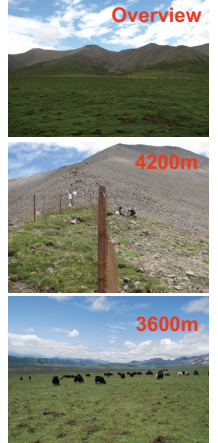
Rise in Number of Livestock  
(Du et al. 2004)



**Overgrazing**  
Grassland degradation

- Plant biomass ↓ (Hickman et al. 2002)
- Diversity ↓ (Beever et al. 2008)
- Herbage cover ↓ etc.

Example of Altitudinal variation



Different landscape in each altitude.

Both grazing impact and vegetation differ.

Problems of diverse and broad rangeland (cf. pictures on the right)

HOW TO SUSTAINABLY MANAGE RANGELAND?

	Present	Problem
Density	ca. 1 livestock ha <sup>-1</sup>	Few information especially on changing rate
Status	Spaced vegetation, degraded	Insufficient data obtained in restricted area and time
Management System	(i) Two-season rotation system • Summer-autumn rangeland • Winter-spring rangeland  (ii) Returning pasture to grassland project (退牧还草工程) Not implemented yet at our study site	Management problem in summer-autumn rangeland Used as communal lands → Less concern (Tragedy of Commons)  Impact of this project still unclear

Sustainable rangeland management cannot be achieved unless it considers the **temporal and spatial variations of grazing impact** in targeting rangeland.

## Objectives

To describe grazing impact on summer rangeland focusing on...



- ✓ yearly & altitudinal variation
- ✓ plant biomass & species diversity

Implication on **sustainable rangeland management** of alpine meadow on the Tibetan Plateau

## Methods

**Environmental factors (2006-)**

Air temp at 1m height and soil temp. and moisture at 5cm depth.

**Plant biomass and species diversity**

Period: Jul./Aug. 2007, 2008, and 2010

Area: 50x50cm, n=6 x grazing/non-grazing (see below) x 4 altitudes

Methods: Point-frame method (Hughes 1962)

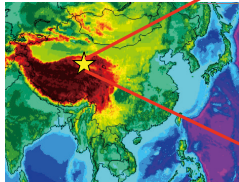
(plant maximum height, species)

- Above-ground biomass is estimated using plant maximum height
- Diversity index (Shannon Index) is calculated using frequency

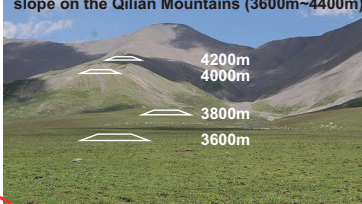


## Study Site

Haibei Station in QTP

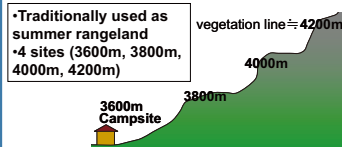
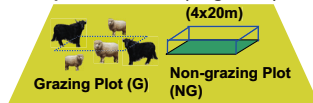


An alpine grassland along a south-facing slope on the Qilian Mountains (3600m-4400m)



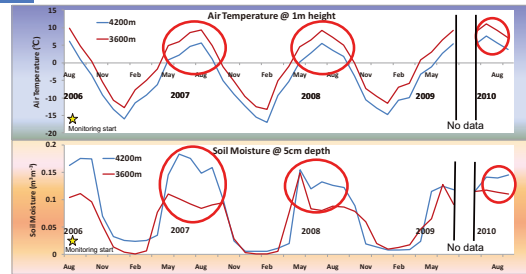
**Experimental Plot Setting**

Grazing and non-grazing plots were set up at 4 altitudes (Aug. 2006)



• Traditionally used as summer rangeland  
• 4 sites (3600m, 3800m, 4000m, 4200m)

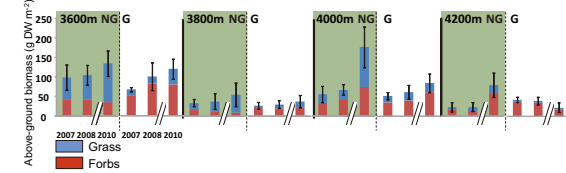
## Results Meteorological Characteristics



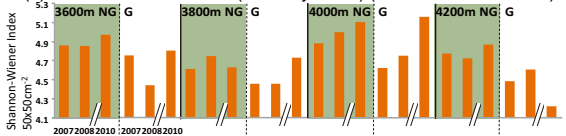
Meteorological conditions differ greatly among years and altitudes.

## Yearly Vegetation Change

(1) Above-ground biomass (AGB)



(2) Shannon-Weiner Index (Diversity Index) (Krebs & Charles 1989)



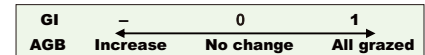
(1) Total AGB and grass increase over years in every altitude. Forbs decrease at low altitudes.

(2) No tendency was observed in the yearly change of diversity index.

## Evaluation of Grazing Impact

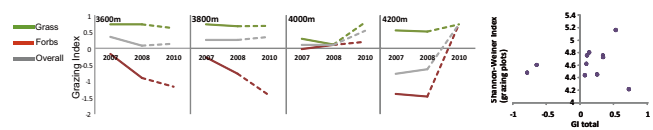
Grazing Index (GI)

$$GI = \frac{AGBin - AGBout}{AGBin} \quad (GI \leq 1)$$



(3) Temporal and Spatial Variation of Grazing Index

(4) GI vs. Diversity index



(3) 50~70% of grass in non-grazed plots is grazed at most altitudes in grazing plots. Forbs decrease in high altitudes and increase at low altitudes.

(4) No tendency was found in diversity index in grazing plots against GI.

## Conclusion & Perspective

• Meteorological variation was significantly great among years and altitudes, or temporally and spatially.

• **Grazing has different impact on AGB among plant types and altitudes.**

- Grass: always negative impact

- Forbs: positive impact at low altitudes and negative impact at high altitudes

• Spatio-temporal variation of grazing impact can be a guideline in grazing-ban policy for sustainable management.

Schedule of 2011

**March**

- Poster presentation @ 58<sup>th</sup> Annual Meeting of Ecological Society of Japan
- Submit a paper to international journal

**July-August**

- Field research (Measurement of photosynthesis rate @ QTP)

## Poster No. 06

### **Deforestation Factors in Transmigration Village with Worse Condition in Livelihood: Case Study in Peat Swamp Land of Indonesia**

Jia Chengshan

*Graduate School of Life and Environmental Sciences,  
University of Tsukuba, Ibaraki, Japan  
shengxiao516@hotmail.com*

Indonesian government has developed a “Transmigration” policy since 1905 with three objectives; poverty reduction, redistribution of population from high-populous areas to low-populous ones and development of natural resources in low populous areas.

However, transmigration policy has led to serious accelerating deforestation. Directly, as a result of transmigration, many forests were cut down for forming villages. Indirectly, soils became depleted and plants were fallen down. It was because many migrants were so poorly educated than the national average level that they were usually unfamiliar with soil types and appropriate farming techniques in transmigration villages.

Every year, Indonesia exports many timbers as a commodity, and logs tropic forest for Palm oil producing. Over time, deforested areas have been turned into industrial plantations, primarily oil palm monocultures. Wide-scaled logging activities lead to change of land use. As a result, deforestation is serious in great deal of peat swamp forest.

The aim of this study is to find out the measures of forest management for local people. In this study, data collection from government and interview with the local people will be conducted, while focusing on the previous study about transmigration policy and the development in the non-peat swamp land of Indonesia. Also field survey will be done in the selected regions to analyze the relationship between local people and the land use change in the transmigration areas. Based on the result, this study will deal with the present situation of deforestation in the transmigration areas, analyze the factors of deforestation in transmigration villages of the peat swamp land and find a suitable mechanism to deal with the conflict between local economic development and forest conservation.

**Key words:** Indonesia, Deforestation, Transmigration village, Peat swamp land



Environmental Diplomatic Leader (EDL) Education Program  
 JIA Chengshan, Student of Environmental Science, University of Tsukuba  
 Student ID: 201021335

## Background:

In order to alleviate the overpopulation pressure, some developing countries are encouraging population redistribution by the government, such as resettlement programs that are well-known in Brazil and Indonesia.

In Indonesia, this program is called “Transmigration”. Transmigration Policy has been an important aspect of Indonesian development from 1905, when Dutch colonial government moved excess population from Java to the outer islands. After independence in 1949, the Indonesian government continued the program with the following purposes; poverty reduction, alleviation of the food shortage in high-populous areas, and natural resources development for economic growth in low-populous islands.

However, transmigration policy has led to serious accelerating deforestation. Directly, as a result of transmigration, many forests were cut down for forming villages. Indirectly, soils became depleted and plants were fallen down. It was because many migrants were so poorly educated than the national average level that they were usually unfamiliar with soil types and appropriate farming techniques in transmigration villages.

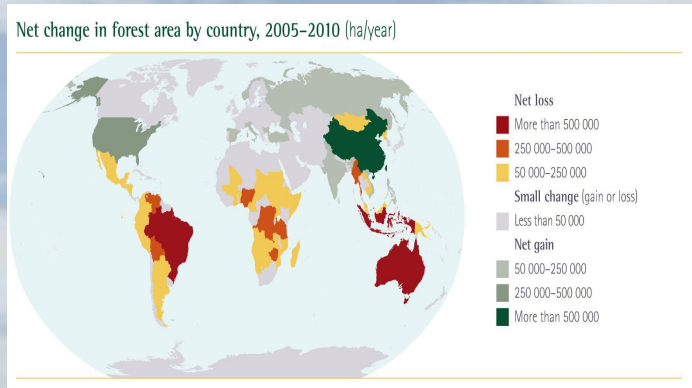


Figure1. From this figure we could see Indonesia is one of the most serious deforestation countries in the world (FAO).

## Objective:

The soil of Java Island is fertile, but not in the land where transmigration settlements took place. Moreover, pests and weeds exacerbate low productivity. The poor soil can not be harvested enough to feed on many transmigrants. Therefore, the migrants have to expand the land by deforestation for livelihood.

Furthermore, in Indonesia, there are nearly 2250 million ha peat swamp forests, of which about 7 million ha is located in Kalimantan. In Central Kalimantan, there is a Mega Rice Project with the clearing of 1 million ha of peat forest for rice farms to be developed by transmigrant farmers from Java. After the rice farms largely failed, and the cleared land has been given out in concessions for oil-palm estates. So in the transmigration villages of peat land, the condition of the soil is worse than other kind of soil and the deforestation is more serious. Every year, Indonesia exports many timbers as commodity, and logging tropic forest for palm oil producing. Over time, deforested areas have been turned into industrial plantations and primarily oil palm monocultures.

Wide-scaled logging activities lead to change of land use. As a result, deforestation is serious in great deals of peat swamp forest.

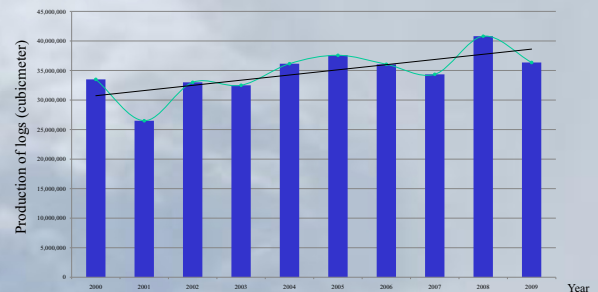


Figure2. Production of logs in Indonesia 2000-2009 (FAOSTAT).

## Hypothesis:

This study aims to find out the measures of forest management that local people used. The selected regions will be surveyed to clarify the reality between local people and the land use in the transmigration areas. Based on the result, analyze out the factors of deforestation in transmigration villages of the peat swamp land and find a suitable mechanism to deal with the conflict between local economy development and forest conservation.

## Methodology:

Based on the previous study about transmigration policy and the development in the non-peat swamp land of Indonesia, by data collection from organizations and governments, interview with the local people in the transmigration villages, this study will discuss mainly 1) the reality situation of forest land use in the transmigration area; 2) the factors leading to such actual conditions and contradictory between local people and natural resource.

## Reference:

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I know my knowledge is poor and power is limited, but what if we work together?

Let's try our best, for the beautiful earth.....

## Poster No. 07

# The Actual Status of Family Planning in Yanbian Autonomous Prefecture in China and Women's Acceptability to the Policy From the Interviews to Women

Li Meihua

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University of Tsukuba, Ibaraki, Japan  
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China is a developing country with the largest population in the world. Family planning is a basic policy of the state. Its aim is to control population growth and to enhance population quality (in terms of health and education). The policy was introduced in 1978 and initially applied in 1979. The family planning can be defined as late marriage and late birth, fewer and healthier births, viewing male and female children as the same, establishing happy, perfect and harmonious small families and seeking a modern, scientific and civilized way of life.

In 1979, a one-child policy was introduced to reduce China's burgeoning population. According to the policy as it was most commonly enforced, a couple was allowed to have one child. However, there are some exceptions. In 17 provinces, rural couples are allowed to have a second child if their first is a girl. In the wealthy southern provinces of Guangdong and Hainan, rural couples are allowed two children regardless of the sex of the first. Minority groups such as Tibetans, Miao and Mongols are generally permitted to have three children if their first two are girls. The one-child policy has been spectacularly successful in reducing population growth, particularly in the cities (reliable figures are harder to come by in the countryside).

By the mid 2000s, most couples were eligible to have two children, either because they lived in rural areas or were offspring from single-child homes. There was discussion of moving towards a two-child policy, seen by many as a sign that the Chinese were worrying more about the consequences of too few births than too many deaths.

The research aims at understanding the actual status of family planning in Yanbian Autonomous Prefecture (where lives Korean minority groups) and women's actual feeling about the policy. Due to the ongoing discussions and arguments on one-child policy is suitable for China or it is two-child policy. The interview to the women in Yanbian Prefecture will be held to understand about the policy, their awareness and ideas about the policy, and if the policy is practiced by people's own will or not.

Recently, the World Health Organization and other international agencies have called for increased attention to women's health. This research would view the family planning in China on women's eyes, and reevaluate and rethinking about the policy.

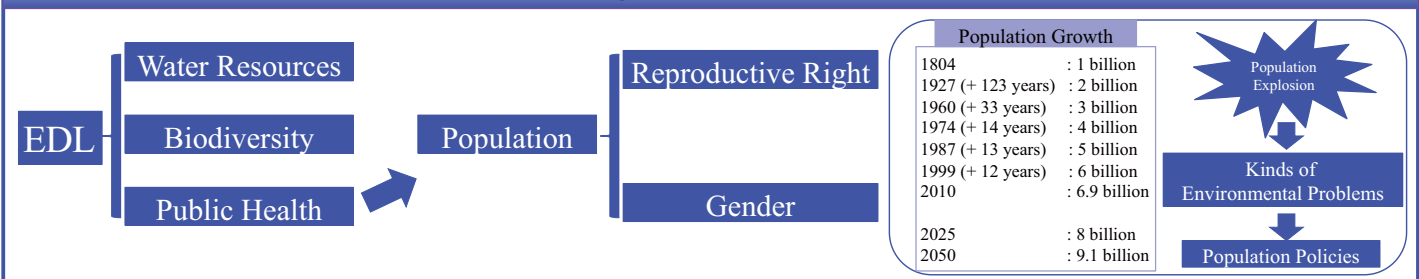
**Key words:** family planning, Korean minority group, actual status, women's acceptability



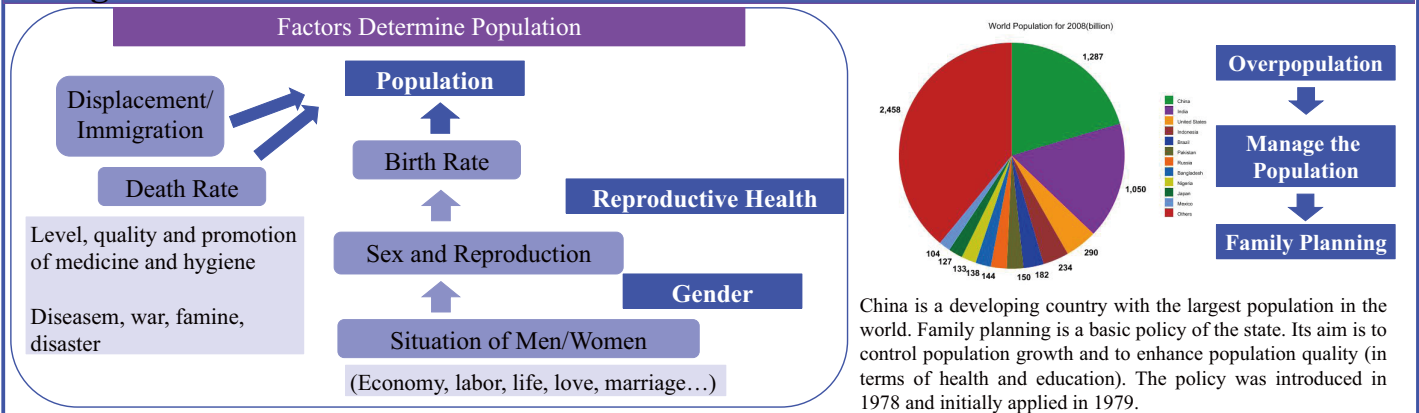
## The Actual Status of Family Planning in Yanbian Autonomous Prefecture in China and Women's Acceptability to the Policy --From the Interviews to Women

Li Meihua (Graduate School of Life and Environmental Sciences, University of Tsukuba)  
Reiji Obase (Graduate School of Systems & Information Engineering, University of Tsukuba)

### The Research in Relation to EDL Program



### Background



### Family Planning in China

**Family Planning**  
Late marriage and late birth, fewer and healthier births, viewing male and female children as the same, establishing happy, perfect and harmonious small families and seeking a modern, scientific and civilized way of life.

**One-child Policy**  
In 1979, a one-child policy was introduced to reduce China's burgeoning population. According to the policy as it was most commonly enforced, a couple was allowed to have one child. However, there are some exceptions. In 17 provinces, rural couples are allowed to have a second child if their first is a girl. In the wealthy southern provinces of Guangdong and Hainan, rural couples are allowed two children regardless of the sex of the first. Minority groups such as Tibetans, Miao and Mongols are generally permitted to have three children if their first two are girls. The one-child policy has been spectacularly successful in reducing population growth, particularly in the cities.

**Two-child Policy**  
By the mid 2000s, most couples were eligible to have two children, either because they lived in rural areas or were offspring from single-child homes. There was discussion of moving towards a two-child policy, seen by many as a sign that the Chinese were worrying more about the consequences of too few births than too many deaths.

### Introduction of Yanbian Korean Autonomous Prefecture in China

**Total area:** 42,700 square kilometers  
**Total border length:** 755.2 kilometres  
China-North Korea: 522.5 kilometres  
China-Russia: 232.7 kilometres

**Ethnicity compositions (2007)**  
2,180,383 Total population  
59.75% Han  
37.04% Korean  
2.76% Manchu  
0.31% Hui  
0.10% other nationalities,  
0.04% Mongol

**In 2007**  
Growth Rate: 1.61%  
Birth Rate: 7.93%  
Death Rate: 6.32%

### Objective

The research aims at understanding the actual status of family planning in Yanbian Autonomous Prefecture (where lives Korean minority groups) and women's actual feeling about the policy. Due to the ongoing discussions and arguments on one-child policy is suitable for China or it is two-child policy. The interview to the women in Yanbian Prefecture will be held to understand about the policy, their awareness and ideas about the policy, and if the policy is practiced by people's own will or not.

### Research Design and Methodology

- Research are: Yanbian Autonomous Prefecture in China
- Target group: around 100 couples (especially for women)
- Methodology: questionnaire interview

### Expecting Result

The field of women's health is broader than merely issues of fertility and reproductive health, because there is growing recognition that social as well as biological factors strongly influence health outcomes in women. In addition, the third goal of the Millennium Development Goals is to promote gender equality and empower women. Recently, the World Health Organization and other international agencies have called for increased attention to women's health. This research would view the family planning in China on women's eyes, and reevaluate and rethinking about the policy.



## Assessment of Surface Water – Groundwater Connectivity for Sustainable Water Resources Management in a Semi-Arid Coastal Plain in Cap-Bon, Northeastern of Tunisia

Chekirbane Anis and Maki Tsujimura  
*Graduate School of Life and Environmental Sciences,  
University of Tsukuba, Ibaraki, Japan*

### Introduction

The eastern coastal plain of Cap-Bon peninsula is located in the northeastern of Tunisia. It is characterized by a semi-arid climate with an average annual precipitation of 420 mm. Increase in water demand and quantitative and qualitative degradation of groundwater suggests enhancing the aquifer recharge and understanding the interaction between surface water and groundwater. However, such kind of knowledge is still limited especially in arid and semi-arid regions such as Cap-Bon zone in Tunisia, where the most previous studies mention that the main aquifer recharge is primarily occurring in the carved glaciais rivers having a very porous lithology. Furthermore, most plain streams are subject of point contamination especially by the abundant discharges of non treated waste water.

### Problematic

Independent management of groundwater and surface water was usually performed in Cap-Bon area. Therefore, pumping from aquifer near a river can dramatically change along with the amount of stream runoff. In contrast, if the river water is salty or contaminated, increased recharge can have a negative effect on the groundwater quality. Understanding the extent of groundwater-surface water connectivity is crucial for the sustainable management of the overall water resource.

### Methodology

The study area is Al Ayn watershed, a small coastal plain, including one of the most vulnerable parts of the aquifer due to its sandy lithology and the presence of several point contaminations. Our objectives are to explain the point contamination processes of groundwater in Al Ayn plain, to assess stream – aquifer connectivity and to propose a management approach that can integrate surface water – groundwater interaction into the actual management plan in Ca-Bon area. For this reason, two field surveys were conducted in the study area during them water temperature, stream flow rate, pH, electrical conductivity and water table depth were measured. Laboratory analysis of taken water samples included major ions and stable isotopes.

### Main results and conclusions

The observed water table variations, stable isotopic content and hydrochemical data show that stream water of wadi Al Ayn seems to have a notable contribution on groundwater recharge. The stream – aquifer connectivity was mapped. In fact, in its upstream portion, Al Ayn river is playing the role of gaining / losing stream. In its middle part, recharging function is ensured by a bank storage process. However in its downstream portion, losing function seems to be dominant.

Regarding the connectivity degree between stream and aquifer, we proposed an adoptive management zone approach:

- Gaining stream: no active management relating aquifer pollution by river water infiltration is required
- Losing stream / bank storage: preventive measures (law delineating the sensitive area and penalizing the polluter) and curative measures (law and restriction enhancing remediation processes) are required

**Key words:** interaction, surface water, groundwater, contamination, Al Ayn, Cap-Bon

Anis Chekirbane and Maki Tsujimura  
EDL Education Program, University of Tsukuba

## Introduction

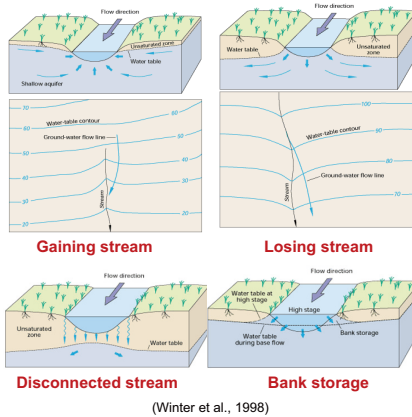
Groundwater in arid and semi-arid areas is the most important renewable water resource



Some water wells were abandoned  
Increasing demand, contaminants load, dissatisfaction of water users  
Understanding the interaction SW – GW = urgent to quantify exchanges of water and contaminant fluxes between different water bodies

Sustainable water resources management

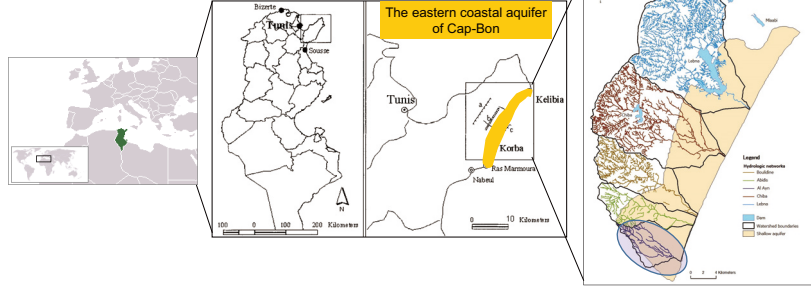
## Principles of stream – GW interaction



## Objectives

- 1-To explain the point contamination processes of groundwater in Al Ayn plain induced by the interaction surface water – groundwater
- 2-To propose a management approach that can integrate SW – GW interaction into the actual management plans in Cap-Bon area

## Study area



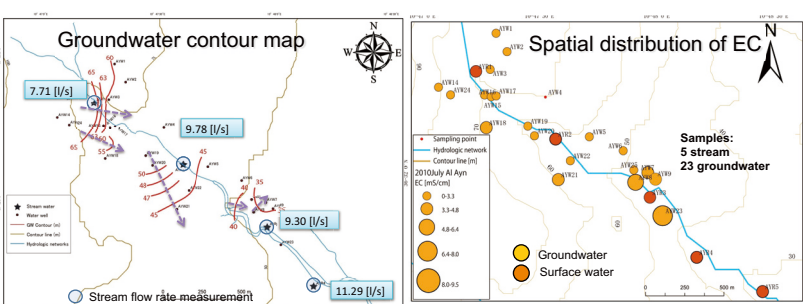
- Small coastal flood plain located in the south eastern part of CapBon
- Since 2004, a salinization of groundwater was registered in the vicinity of Al Ayn stream
- Some water wells were abandoned
- Previous studies suspected some point and diffuse contamination (Harbaoui, 2005; Chekirbane, 2008)
- Induced contamination of GW by its interaction with SW should be clarified

## Methodology

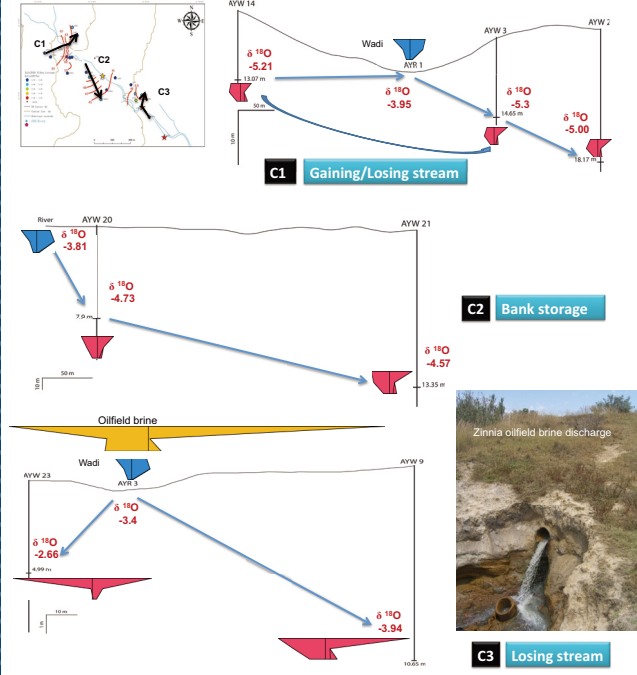
- 2 field surveys: 32 samples of stream water and groundwater
- Field measurements: pH, T, EC, water table depth, stream flow rate
- Laboratory analysis: Stable isotopes by Mass Spectrometer, Ions by IC, Cations by ICP

## Assessment of stream aquifer connectivity in Al Ayn watershed

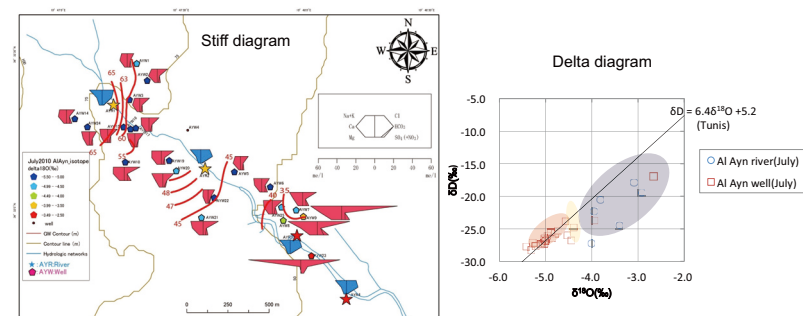
### Hydrodynamic approach



### Categorisation of stream – aquifer connectivity



### Geochemical and isotopic approach



## Summary and conclusion

<b>Al Ayn plain:</b> - water table variations - stream flow analysis - stable isotopes content - chemical characteristics	Upstream region: gaining / losing stream
	Middle region: losing stream – bank storage
	Downstream region: losing stream

Adoptive management zone approach seems to be an effective method that can be applied to integrate SW – GW interaction into water resources management plan in Cap-Bon

Al Ayn watershed can constitute a pilot area for adaptive management approach that can be expanded in all Cap-Bon area in the future

## Need for an adaptive management approach

- Water resources management plan in Cap-Bon doesn't include any consideration of stream – aquifer connectivity
- Integrating SW – GW interaction for sustainable use of water resources in Cap-Bon is possible through adaptive management approach
- Adaptive Management is an approach that involves learning from management actions, and using that learning to improve the next stage of management (Holling, 1978). It is "learning to manage by managing to learn" (Bormann et al., 1993)
- Adoptive management zone approach: according to degree of stream – aquifer connectivity, it is possible to set specific measures
  - Gaining stream: no active management relating aquifer pollution by river water infiltration is required
  - Losing stream / bank storage: preventive measures (law delineating the sensitive area and penalizing the polluter) and curative measures (law and restriction enhancing remediation processes)

## Affect of Soil Moisture and Climate Conditions on Drought in Mongolia

Natsagdorj Natsagsuren  
*Graduate School of Life and Environmental Sciences,  
University of Tsukuba, Ibaraki, Japan*

### Introduction

The land cover with insufficient and unstable soil moisture is predominant in the north-eastern Eurasia. Especially, arid and semi-arid region covers Mongolia with annual precipitation ranging from a few mm/y to 300 mm/y. Therefore, a development of integrated approaches to evaluate the soil moisture is principal for better understanding the natural potential under the climate change. The remotely sensed data are quite useful to investigate the soil moisture change in spatial and temporal, and they should be compensated by the ground truth information.

The previous studies in hydrology and climatology suggests that not only the climate condition but also the soil moisture condition might have an influence on a drought in Mongolia, however a clear evidence showing a relationship between the soil moisture and the drought has not been reported yet. For this purpose, the data analysis on the soil moisture for the long time period is necessary using the observed soil moisture and the remote sensing information considering the vegetation and the atmosphere conditions.

### Objective

The objective of the master thesis is to predict the temporal and spatial distribution of soil moisture content by correlation analysis using the observed data and remote sensing data, and to make clear the important factors affecting on the future drought condition, focusing on an area of Khustai National Park, northern Mongolia.

### Methods

Firstly, a correlation analysis of the observed soil moisture data in Khustai National Park is performed to make clear a relationship between the soil moisture and some parameters of precipitation, temperature, humidity in the atmosphere, and to predict the soil moisture in the future. Secondly, a calibration of the remote sensing data on the soil moisture is performed using the observed data at the meteorological stations in Mongolia. Thirdly, the parameters affecting on the drought are evaluated using the SVAT Model (Soil Vegetation Atmosphere Transfer) coupling the observed data and remote sensing data. The results of the present study would contribute much to a construction of the drought prediction system to guard the agriculture and the nomadic activities from the drought in Mongolia.

**Key words:** Soil moisture content, meteorology, hydrology, model, drought

## Affect of soil moisture and climate conditions on drought in Hustai national park

Supervisor: Dr. Prof Maki Tsujimura  
Presenter: Natsagdorj Natsagsuren

### Research Plan

The land cover with insufficient and unstable soil moisture is predominant in the north-eastern Eurasia. Especially, arid and semi-arid region covers Mongolia with annual precipitation ranging from a few mm/y to 300 mm/y. Therefore, a development of integrated approaches to evaluate the soil moisture is principal for better understanding the natural potential under the climate change. The remotely sensed data are quite useful to investigate the soil moisture change in spatial and temporal, and they should be compensated by the ground truth information.

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### Methodology

Soil Moisture

#### SVAT model

Surface characteristics such as soil moisture, vegetation, and temperature to any models seeking to simulate hydrologic and climatologically processes.

#### Modis satellite Remote Sensing using Satellites

Powerful tool for periodic collection of Study area information on soil moisture

#### Meteorological condition

rainfall, temperature, wind and other condition

#### Definition of Drought

There are actually many different ways that drought can be defined.

Surface characteristics such as soil moisture, vegetation, and temperature and the interactions between them are of critical importance to any models seeking to simulate hydrologic and climatological processes.

**Agricultural**-refers to a situation where the amount of moisture in the soil no longer meets the needs of a particular crop.

Water content in vegetation affects the sensitivity of the optic remote sensing for soil moisture.

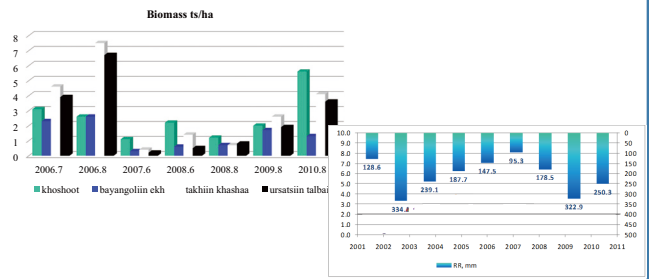
**Hydrological**-occurs when surface and subsurface water supplies are below normal.

### Objective

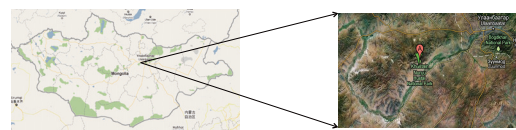
The objective of the master thesis is to predict the temporal and spatial distribution of soil moisture content by correlation analysis using the observed data and remote sensing data, and to make clear the important factors affecting on the future drought condition, focusing on an area of Khustai National Park, northern Mongolia.

### Ongoing research

1. Climate data analyses
2. Study model of SVAT
3. Reading research papers



### Study area



Source: Home page Hustai national park

Source: Google earth

**Khustain Nuruu National Park (Birch Mountains)**, located in Tuv province (Aimag), is a national park of Mongolia. The Tuul river runs through the park.

It was declared reserve status (category III) for over 50,000 hectares of the Khustain Nuruu area.

#### Long term monitoring

- Climate
- Plants and vegetation
- Density and location of the wild animals
- Growth, fertility rate and behaviors of the takhi
- Water balance

IHM selected four point on this area. Observation monitoring has began since 2001.



Source: home page Hustai national park

## Poster No. 10

### **The Impact of Land Use Activities on Pastureland Degradation in a Semi-arid Region in Mongolia: Case study: Bayan soum, Tuv Province**

Khishigsuren Nyamsambuu

*Graduate School of Life and Environmental Sciences,*

*University of Tsukuba, Ibaraki, Japan*

*khishigee\_ns@yahoo.com*

This research is concerned about the impacts of land use activities on pastureland degradation in a semi-arid region of Mongolia. The objectives of this research are to evaluate the performance of the vegetation index for estimating vegetation cover of grassland, and to analyze the reasons why pastureland has been degraded in the study area. The hypothetical conclusion is that carrying capacity of pastureland has been exceeded due to excessive livestock grazing and other land use activities.

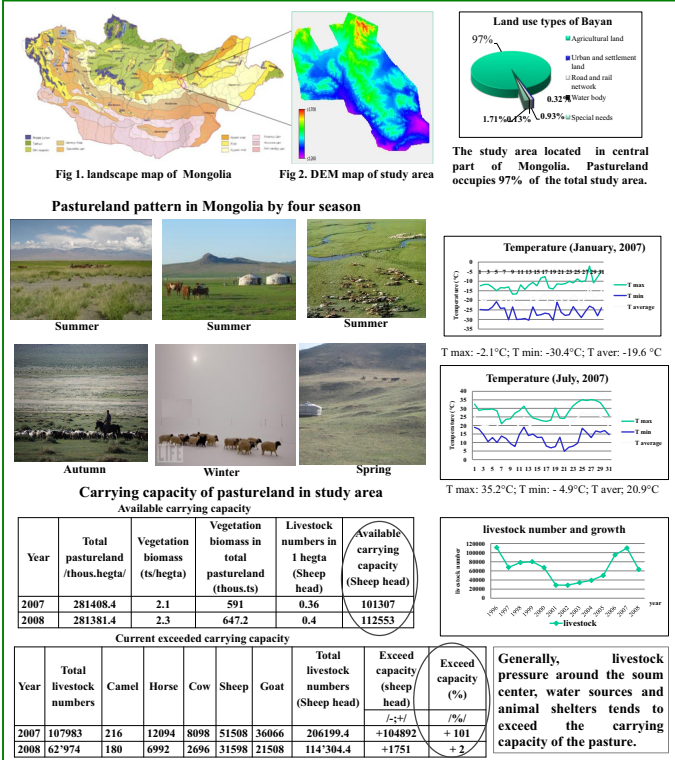
The study experiment was conducted on grasslands of Bayan soum, which was located in a semi-arid steppe in Mongolia. The pastureland occupies high percentage of the study area, whose economy strongly depends on livestock production. Therefore, land is mainly used for grazing, as it constitutes around half of the total population's livelihood income. Consequently in recent years, productivity of pastureland in this region has been decreasing because of the demands for feeding has exceeded carrying capacity of land productivity.

In the study area, some grassland managements are necessary for sustaining the grassland with proper land use planning. In order to make a profit pastureland use planning to develop effectiveness of pastureland use, the identification of the impact of pastureland degradation is important to avoid negative land use activities.

**Key words:** semi-arid, exceeded carrying capacity, vegetation cover, land use planning



### 1. Background of study area



### 2. Objectives

1. To determine the relationships between vegetation biomass from ground survey measurement and vegetation index from satellite imagery
2. To assess land use activities impact on pastureland vegetation biomass change
3. To formulate pastureland use recommendations

### 3. Methodology

1. To determine the relationships between vegetation biomass from ground measurements and vegetation index from satellite image

1.1 Classify green grass on 1 square m color photos of each measurement points *The characteristic of spatial distribution of vegetation biomass using semivariogram analysis*

1.2 Classify vegetation index on satellite image by ALOS AVNIR-2 *The characteristic of spatial distribution of vegetation biomass using semivariogram analysis*

2. To determine the relationships between vegetation biomass (g/m<sup>2</sup>) and vegetation cover (%)

2.1 Measure vegetation biomass (g/m<sup>2</sup>) on 1 square m points of the ground survey area

2.2 Classify green grass cover (%) on 1 square m vegetation photos of the ground survey area

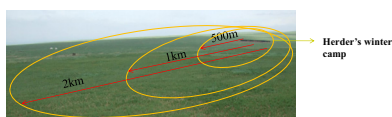
3. Multi temporal analysis of aboveground biomass using ASTER satellite image

3.1 Temporal changes in pastureland vegetation

4. To assess main land use activities impact on pastureland vegetation biomass change.

4.1 Vegetation biomass change at different distances from

1. Wells, springs
2. Herder's winter camp
3. The mining industry

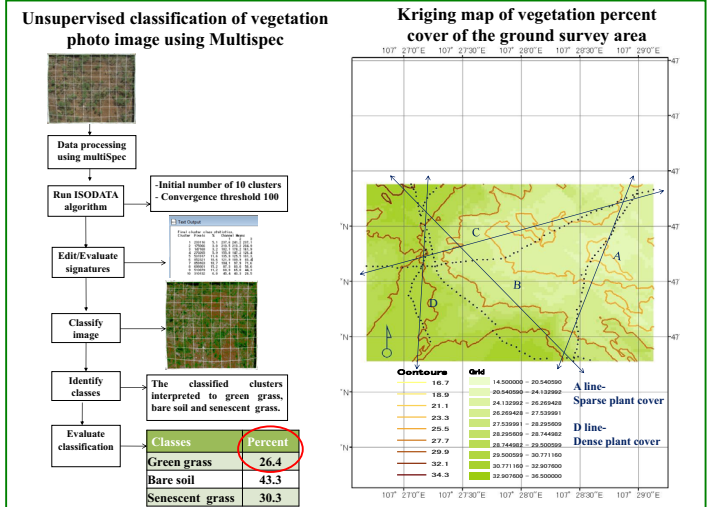


5. Good-practice pastureland use planning

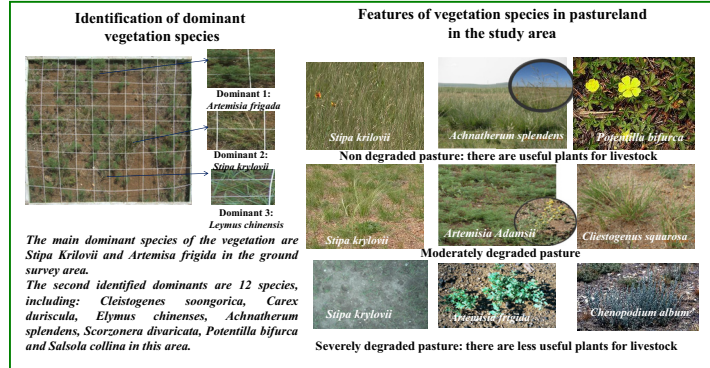
5.1 Avoid negative land use activities

1. To increase number of wells if vegetation cover degraded around wells
2. To create the farming system if vegetation cover degraded around herder's winter camp

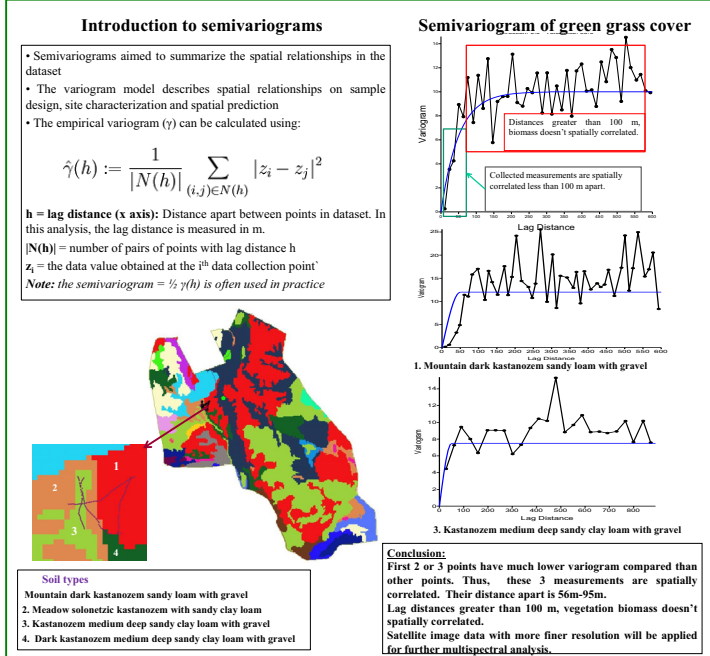
### 4.1 Current results: Analysis 1



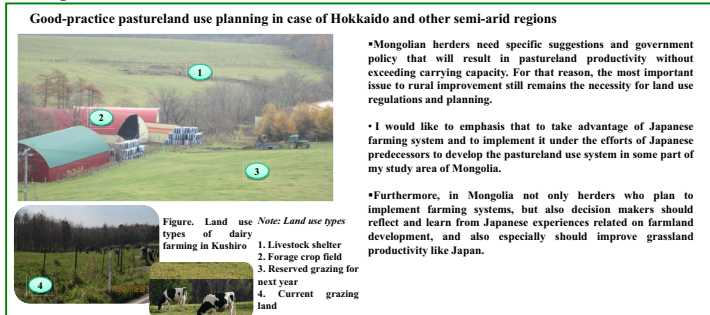
### 4.2 Analysis 2



### 4.3. Analysis 3



### 5. Expected result



## Poster No. 11

### Strengthening Social Forestry in Bangladesh Protected Areas: Local Community Based Organization Perspectives

Fakir Muhammad Munawar Hossain, Misa Masuda  
*Graduate School of Life & Environmental Sciences,  
University of Tsukuba, Ibaraki, Japan*  
rokanhstu06@yahoo.com

Bangladesh Government has conducted experimental forestry program since 1979, which pays attention to local people's participation. After subsequent completion of several community forestry projects, Govt. realized the strength of multi-party involvement in forest management and steady loss of forest resources from the forest reserves. The concept of decentralized forest management system namely by 'Upazilla Environment and Forest Development Committee,' and 'Co-management Council' was created based on those findings.

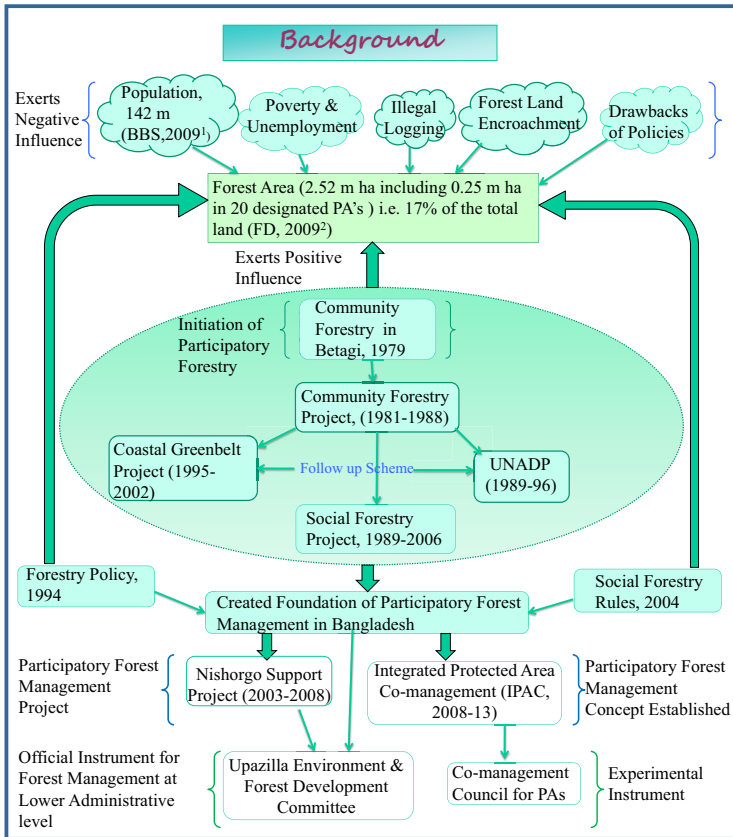
Government introduced social forestry program in the degraded reserved forests, not in the protected areas (PA) on a ground that plantations developed in the PAs cannot be harvested. Consequently, a large area of denuded hills inside the PAs is treeless and, due to lack of legal supports, local community based organizations cannot proceed for participatory plantations. But it is necessary to know whether participatory forestry can be introduced effectively in the PAs for biodiversity conservation, water management as well as public health or not.

The overall objective of the study is to evaluate the functionality of 'Upazilla Environment and Forest Development Committee' and 'Co-management Council' in biodiversity conservation and forest management inside the PAs. This will be done by review of policy supports and evaluation of Community Based Organizations performance. Through this research, guiding principles will also be set to integrate social forestry and co-management for PA management whereby win-win situation for biodiversity conservation and improved livelihood of local people can be ensured.

**Key words:** protected area, bangladesh, social forestry

## Strengthening Social Forestry in Bangladesh Protected Areas: Local Community Based Organization Perspectives

Fakir Muhammad Munawar Hossain<sup>a</sup>, Prof. Misa Masuda<sup>b</sup> <sup>a</sup>Master's Program (First Year) School of Life & Environmental Sciences University of Tsukuba <sup>b</sup> Professor School of Life & Environmental Sciences University of Tsukuba



### Methodology

Primary and secondary information will be collected and analyzed

**A) Primary Sources:**

- i) Focus Group Discussion:
- ii) Key informant Interviews:
- iii) Participation in Regular CBO meetings:
- iv) Open-ended discussions with the external agencies and relevant personalities:

Using semi-structured questionnaire

**B) Secondary Sources:**

Literature review from concerned policy papers, FD documents, NSP reports, journals, books, web portals etc

### Expected Output

After completion of the proposed research, Government can be formulated effective policy measures to conserve its Protected Areas of Forest from the denudation and encroachment by the local people and Rohingya refugees

### Rationale

Legally, there should not be any human intervention/habitat in reserved/protected forests

But in reality, hundreds of poor neighboring communities are living within the forests and largely depend on it for their daily livelihood

Government introduced social forestry program in the degraded reserved forests, not in the Protected Areas on a ground that plantations developed in the PAs cannot be harvested. Consequently a large area of denuded hills inside the PAs is tree less and due to lack of legal supports local CBOs cannot be proceed for participatory plantations. At this juncture, the study would pave a research ground whether participatory forestry can be introduced effectively in the PAs for biodiversity conservation as well as people's well being or not.

### Conclusion

Protected Areas (PA) of forest of Bangladesh are now in threatened to extinct by the pressure of over population and Rohingya refugees. It is high time to take necessary measures to save PAs forest from extinction at any cost. If we can suggest a policy sustainable to conserve forest, then it may save forest and consecutively maintain our sound environment and stand against Global Climate Change

### Objectives

**Overall objective** → To evaluate the functionality of 'Upazilla Environment and Forest Development Committee' and 'Co-management council' in biodiversity conservation and forest management as a whole

**Specific objectives**

- Review policy supports
- Evaluating CBOs Performance
- Setting guiding principles to integrate social forestry & co-management for PA management
- Compile & analysis of empirical evidences

### Annexure

PA means Protected Area  
CBO means Community Based Organization  
FD means Forest Department, The People's Republic of Bangladesh  
NSP means Nishorgo Support Project  
Upazilla means Sub-district, The smallest administrative unit  
UNANDP means Upazilla Nursery Aforestation & Nursery Development Project

### References

1. BBS, 2009. Bangladesh Bureau of Statistics. Statistical Pocket Book of Bangladesh
2. FD, 2009. Web portal of Bangladesh. Forest Department at [www.bforest.gov.bd](http://www.bforest.gov.bd)
3. Nishorgo Support Project (NSP, 2004). Site level Field Appraisal for Protected Area Co-management: Teknaf Game Reserve. Forest Department, Dhaka

### Study Area

Area: 11,615 ha  
Habitat: Unique habitat of majestic Asian Elephants and many other flora and fauna (NSP, 2004<sup>3</sup>)  
Topography: Irregular denuded hills, deep valleys, slopes and often steep  
Forest Type: Tropical evergreen or semi-evergreen forest  
Population: About 113 villages with a population of 150,000 are largely dependent on this protected areas; further influx of Rohingya refugees

Study Area: Teknaf Game Reserve



## Poster No. 12

# Effect of the Extension Service for Development of Organic Comprehensive Crop-Livestock Farming in Mongolia

Gonchig Gantulga  
*Graduate School of Life and Environmental Sciences,  
University of Tsukuba, Ibaraki, Japan*

The aim of The Food and Agriculture Policy of Government of Mongolia is to create favorable economic and business conditions, to increase capacity and productivity of the production, to ensure sustainable development of livestock and crop production, to produce safe and ecologically clean food products with improvement of their availability and quality. By 2008 about 38 percent of labor force in Mongolia worked in the agricultural sector. Even though it seems like much, 30 percent of this force works in animal husbandry and only 8 percent works in agrarian field.

We can almost say Animal husbandry is an old traditional custom of Mongolian life. The main foundation of Mongolia's economy, pasturing livestock husbandry still plays an important role in our economy, employment and export revenues. Mongolia is one of the leading countries of livestock per capita. By January 1st 2009 the number of livestock in Mongolia has reached 42.2 million heads. In this case we should think about Mongolian population of 2.7 million people. During the traditional farming system the use of pasture land was very effective and beneficial, but before decades desertification has increased dramatically due to different influences, such as social, economic, climate, farming system etc

A half century has passed since Mongolia has owned arable land in 1959. The first expedition observed an area of 1.7 million hectares which could be used for planting. Until 1989 Mongolia used 76%, 1.3 million hectares, of the eligible land. During the first 3 decades the use of Agricultural land was very effective, but after 1990s it has decreased dramatically due to different influences, such as social, economic, climate, cropping system etc. One of the most important factor is soil erosion.

Mongolia is a country with an extremely harsh climate. In connection with the climate characteristic, preventing the agriculture and livestock sector from any risks, including production decline, is becoming crucial. We feel it is really needful now to process and formulate strategies, wise managements and tactics on both, crop planting and animal husbandry, because private farm owners and herdsman are lack of information, experience and financial ability.

Since July 2006 to May 2009 JICA has been implementing the project 'Support for the Development of Comprehensive Crop-Livestock Management Model Project' to promote integrated agriculture and livestock through making model entities in eight village and three prefecture and Technical Extension Manual etc. During that Model farm Project implementation, some problems were found, for example; deficit of budget for the activities of the extension center, especially on the village (soum) level; different level of skills of the extension managers who gives the technological advices; technology and information is not transferred smoothly among the Extension Center in UB, prefecture and village. Besides it is profitable to prevent soil erosion and enhance its fertility. Contemporary highly developed countries use the organic farm technology which reduces soil erosion so it is important to enter such technologies to Mongolia and use in the agricultural sector.

### Current study

- Organic farming development in the word (to get idea)
- Arid/semi arid conditions
- Social capacity to accept organic farming
- Information/ education among policy-makers and farmers about shifting to organic farming
- Traditional people and knowledge (how can traditional knowledge be incorporated into organic farming)

**Key words:** Organic farming, extension, sustainable agriculture (water, soil, biodiversity), public health, pure food

Gonchig Gantulga

## INTRODUCTION

The aim of The Food and Agriculture Policy of Government of Mongolia is to create favorable economic and business conditions, to increase capacity and productivity of the production, to ensure sustainable development of livestock and crop production, to produce safe and ecologically clean food products with improvement of their availability and quality.

Mongolia is a country with an extremely harsh climate. In connection with the climate characteristic, preventing the agriculture and livestock sector from any risks, including production decline, is becoming crucial.

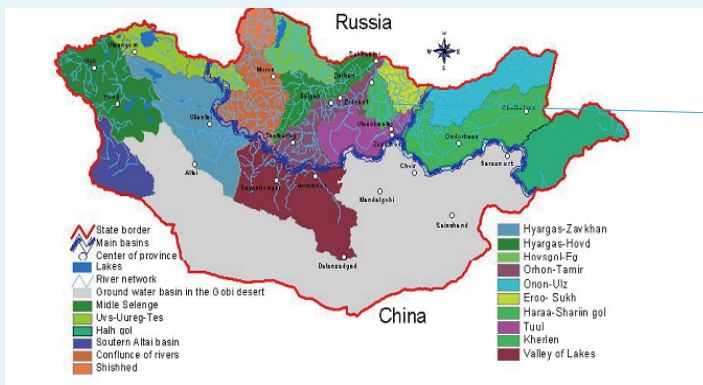
We feel it is really needful now to process and formulate strategies, wise managements and tactics on both, crop planting and animal husbandry, because private farm owners and herdsmen are lack of information, experience and financial ability.

Besides it is profitable to prevent soil erosion and enhance its fertility. Contemporary highly developed countries use the organic farm technology which reduces soil erosion so it is important to enter such technologies to Mongolia and use in the agricultural sector.

### Key words:

Organic farming, extension, sustainable agriculture (water, soil, biodiversity), public health, pure food

### Study area:



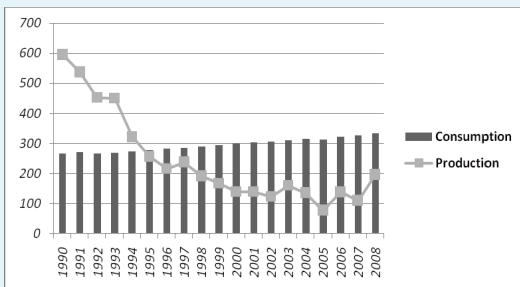
Kharaa catchment (14,553 km<sup>2</sup>)  
 Grassland – 60%  
 Forest – 26 %  
 Cropland – 11%

### Climate

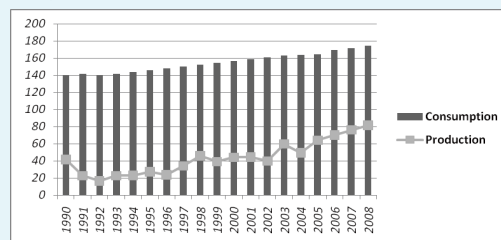
- Long and cold winter
- Dry and hot summer
- Low precipitation
- High temperature fluctuation
- An average of 260 sunny days per year

## FOOD DEMAND AND SUPPLY OF MONGOLIA

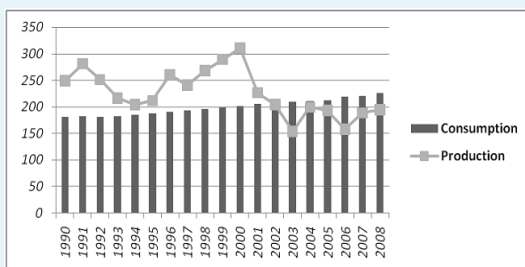
### Wheat balance



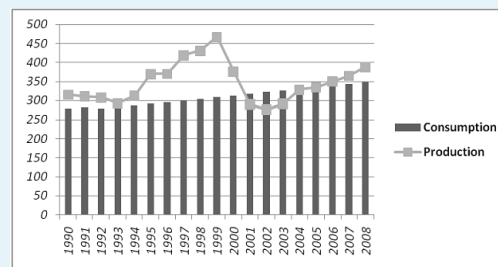
### Vegetable balance



### Meat balance



### Milk balance



## STUDY PLAN

- Organic farming development in the word (to get idea)
- Arid/semi arid conditions
- Social capacity to accept organic farming
- Information/ education among policy-makers and farmers about shifting to organic farming
- Traditional people and knowledge (how can traditional knowledge be incorporated into organic farming)

## Poster No. 13

### Development of How to Measure Net Primary Productivity by Periphyton and its Contribution at Boulder Shore

Yusuke Sugamoto  
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University of Tsukuba*  
Sugamoto.yusuke@gmail.com

This research focuses on the development of how to measure Net Primary Productivity (NPP) at intertidal boulder shore. Although boulder shores are good habitats for benthic organisms and seem to have high productivity due to its huge variety, the measurement has not been established. Therefore, it is important to elucidate the NPP as the basis of organisms at intertidal boulder shore in terms of coastal ecosystem.

Research field is Ebisu Island in Shimoda city, Shizuoka prefecture. The characteristic of this research is to distinguish two cases which are the case of high tide and low tide. Isotope tracer method will be used to measure NPP in both cases. Especially, special attention is paid to NPP produced by periphyton which lives and attaches around stones as primary producers at intertidal boulder shore. First, some stones with periphyton are collected in the field, and then those will be incubated for a few hours by using chamber method. Also, other environmental factors which are related to controlling NPP such as water temperature, sky irradiance, nutrients of seawater and so forth will be measured. After incubation is finished, periphyton will be removed from stones and analyzed by using elemental and mass analyzer to estimate periphyton's carbon contents as its NPP.

There are large coastal areas in Japan compared to other foreign countries, so elucidation of NPP at intertidal boulder shore is essential to consider coastal ecosystem in terms of coastal biodiversity. NPP produced by periphyton, phytoplankton and other producers is on the basis of all the organisms living in intertidal coastal areas. Without considering how much NPP is produced at a certain area, it is difficult to indicate, evaluate and improve the biodiversity exactly at coastal areas. Also, it will be more important for the future that such a basic study is linked with applied study about biodiversity.

**Key words:** NPP, intertidal boulder shore, periphyton,  $^{13}\text{C}$  isotope,

### Introduction

#### Background and contents of my research topic

Although the importance of intertidal coastal ecosystem is recognized generally, it is still unclear about how much net primary productivity (NPP) is produced and the circulation of organic matters at coastal



Intertidal areas where are habitats of phytoplankton, seaweed and benthic organisms, especially at boulder shore. In addition, according to the data from Ministry of Land, Infrastructure, Transport and Tourism, coastal areas in Japan per country are much larger than other foreign countries. Also, the elucidation of NPP there leads to protection, conservation and improvement of coastal ecosystem. Therefore, I believe that my study as essential information of coastal ecosystem will be the basis of marine ecosystem.

The reason why I chose intertidal boulder shore as the one of the remarkable field is because it seems to have high productivity. However, the measurement of NPP has not been established so far due to technical problems which



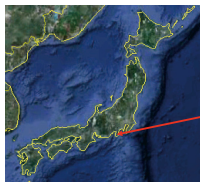
mean difficulties because of various environmental conditions such as emersion time, tide level, sky irradiance and so forth. Therefore, establishment of how to measure NPP at boulder shore and elucidation of its contribution to coastal ecosystem are core of my research, so particularly I would like to focus on NPP by periphyton which might be primary producers at intertidal boulder shore.

### Materials and Methods

#### Experimental method

The characteristic of my research topic is to focus on various conditions at intertidal boulder shore. Two cases which are high tide and low tide are assumed to measure NPP by using a stable  $^{13}\text{C}$  isotope methodology in addition to environmental conditions.

#### Field



Shimoda city

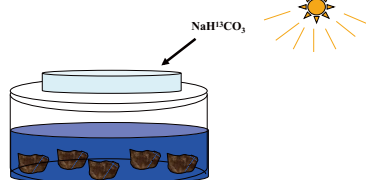
(Google Earth)

Intertidal boulder shore in Ebisu island, Shimoda city, Shizuoka Pref, Japan.

#### Measurement of environmental condition

- Water temperature
- Air temperature
- Humidity
- Sky irradiance
- Nutrients of sea water

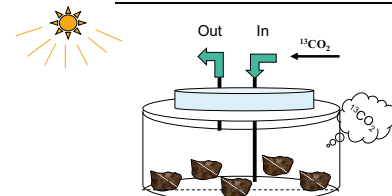
#### In the case of high tide



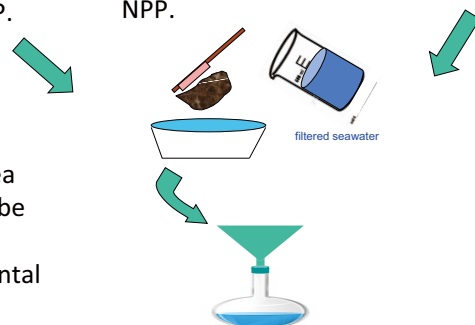
In assumption of the case of high tide, periphyton which attaches around stones will be incubated with filtered sea water after collecting stones from the field. Then,  $\text{NaH}^{13}\text{CO}_3$  is put into the incubator as a tracer to measure NPP.

After incubation, periphyton will be removed from stones with filtered sea water, then its suspended liquid will be filtrated. Finally, periphyton's carbon contents will be measured by elemental and mass analyzer as its NPP.

#### In the case of low tide



In assumption of the case of low tide, periphyton which attaches around stones will be incubated with  $^{13}\text{CO}_2$  gas after collecting stones from the field to measure NPP.



### Relation between my research and EDL program

As a part of basic information about marine ecosystem, elucidation of NPP at intertidal boulder shore is strongly relating to biodiversity at intertidal coastal areas. All the organisms at intertidal coastal areas are on the basis of NPP produced by producers. Therefore, when we think about the importance of biodiversity at coastal areas, not only to focus on the variety of organisms but also to consider how much NPP is produced at a certain area. Without such a study, it is impossible to indicate and improve biodiversity at intertidal coastal areas, and it will be more important that such a basic study is linked with applied study about biodiversity for the future.

## Poster No. 14

### Interactions Between Fungi and Bacteria Associated with Degradation of Persistent Organic Pollutants

Wang Shuozhi, Nobuhiko Nomura, Toshiaki Nakajima, Hiroo Uchiyama  
*Graduate School of Life and Environmental Sciences, University of Tsukuba*

Nowadays, the contamination of land and water environment is reported by many agencies and countries. Such environmental pollution concerns a large number of high-molecular-weight (HMW) pollutants via many routes, including the burning of fossil fuels, leaking out of crude oil, the manufacture of gas and the incineration of waste. The presence of HMW pollutants in soil and water poses significant risk to human health and biodiversity. Hence, the environmental remediation has attracted great notice in the world.

As a bioremediation technique, the fungal ability to degrade xenobiotics had achieved success due to their predominance and multiplex pathways. Diverse ligninolytic fungi had been confirmed as an effective strategy to remove pollutants from environment by bioremediation. On the other hand, bacterial degradation studies have shown that it is much more difficult to remove HMW pollutants since which are thermodynamically stable, hydrophobic and being always absorbed to solid particles. Therefore, we are searching for a new biodegradation strategy which could use the cooperation between fungi and bacteria. This study investigated the interactions between fungi and bacteria which are associated with degradation of polycyclic aromatic hydrocarbons (PAHs). Seven soil fungi were screened for their ability to metabolize phenanthrene, fluoranthene and pyrene when used as sole source of carbon and energy. Meanwhile, five soil bacteria were also screened for which could degrade PAHs as co-workers with those of fungi. High performance liquid chromatography (HPLC) analyses showed the maximal pyrene degradation rate(60%, 28d) was obtained when fungi and bacteria were co-cultured at soil condition, as compared to a degradation rate of 28% for fungi group and 47% for bacteria group respectively. Meanwhile, we conducted a metabolites analysis of cells exposed to pyrene using one strain of fungi combining with one strain of bacteria. Gas chromatography-mass spectrometry(GC-MS) was used to analyze composition of PAH-metabolites to which identify the mechanism of synergistic function between fungi and bacteria. At present, the data analysis is under processing.

In the future, this study are expected to establish a new strategy for environmental remediation which has high performance in PAHs removing.

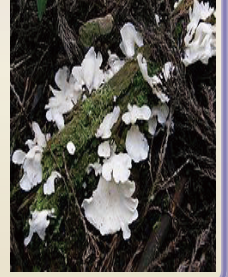
**Key words:** bioremediation; fungi; bacteria; polycyclic aromatic hydrocarbons (PAHs); co-culture



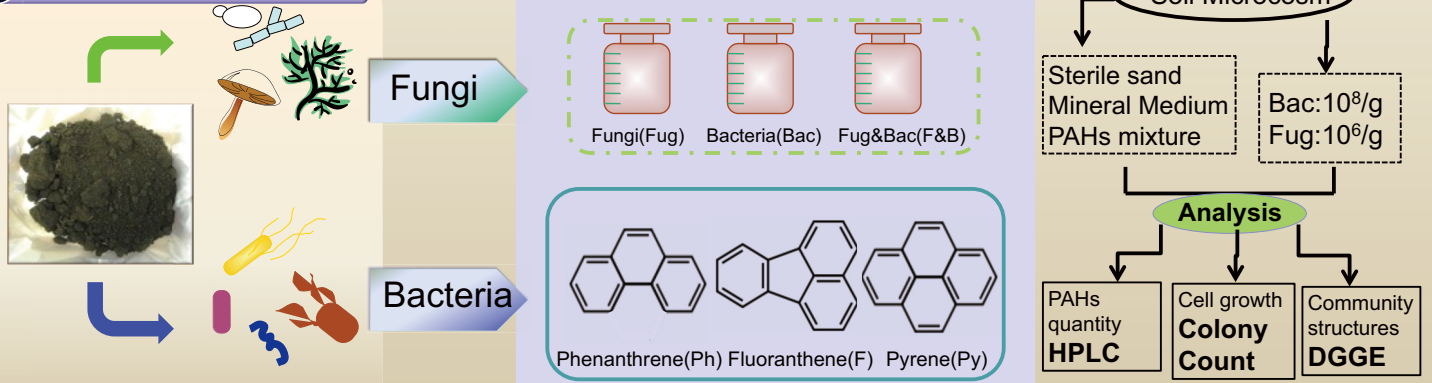
## 1 Introduction

The presence of high-molecular-weight (HMW) pollutants in soil and water poses significant risk to human health and biodiversity. Hence, the environmental remediation has attracted great notice in the world. As a bioremediation technique, the fungal ability to degrade xenobiotics had been confirmed as an effective strategy to remove pollutants from polluted area. On the other hand, bacterial degradation studies have shown that it was much more difficult to remove HMW pollutants since which are thermodynamically stable, hydrophobic and being always absorbed to solid particles. Therefore, a new biodegradation strategy seems indispensable for which could use the cooperation between fungi and bacteria.

**The objective of this study** was to investigate the interactions between fungi and bacteria which are associated with degradation of polycyclic aromatic hydrocarbons (PAHs). Furthermore, the application of co-culture biodegradation into environmental remediation are being expected.



## 2 Materials & methods



## 3 Results

Fig. 1. PAHs concentrations after culture with single inoculation vs. Time (2weeks & 4weeks)

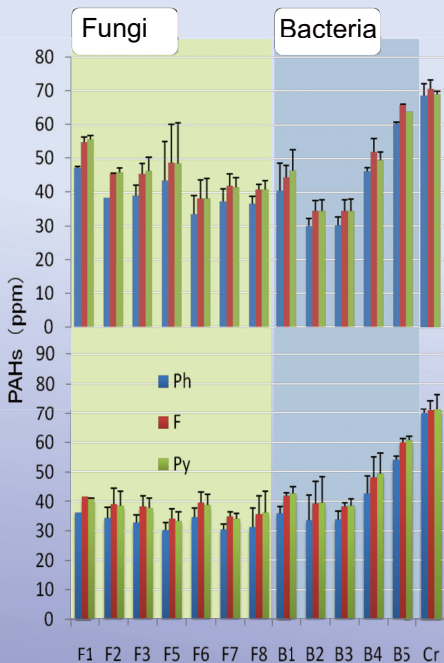


Fig. 2. Pyrene concentrations during 4 week treatment with group inoculation

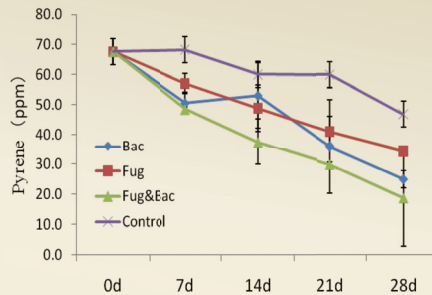


Fig. 3. Cell numbers during 4 week treatment

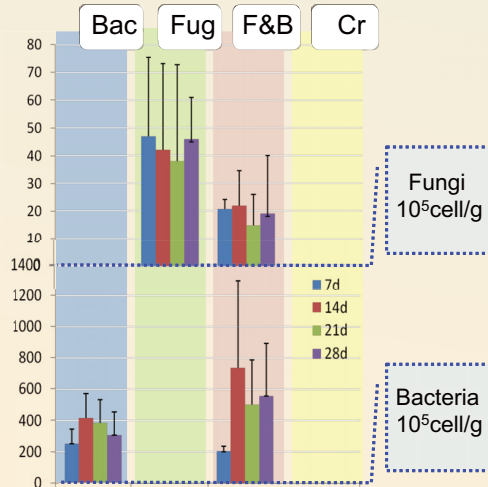


Fig. 4. DGGE analysis of monitoring in time of community structure (Bac&Fug)

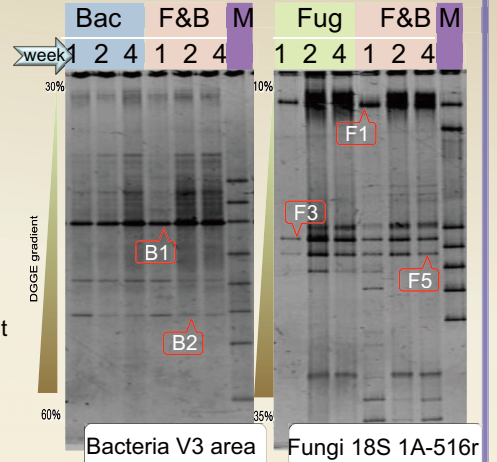
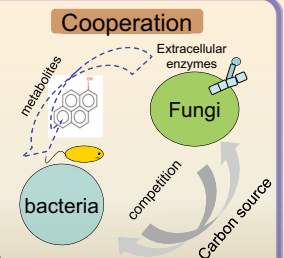


Table 1. Sequence similarities of strains marked in Fig.4

Fungi	Result of BIAST	Length	Identity(%)
F1	<i>Debaryomyces vanriijae</i>	308	99
F3	<i>Fusarium</i> sp.	541	99
F5	<i>Penicillium</i> sp.	329	96
Bacteria			
B1	<i>Pseudomonas nitroreducens</i>	700	95
B2	<i>Labrys</i> sp.	338	94

## 4 Conclusions

In this study, seven soil fungi and five bacteria were screened respectively for which can metabolize phenanthrene, fluoranthene and pyrene using as sole source of carbon and energy. The cooperation between fungi and bacteria were examined combined with soil culture degradation. High performance liquid chromatography (HPLC) analyses showed the maximal pyrene degradation rate (60%, 28d) was obtained when fungi and bacteria were co-cultured, as compared to a degradation rate of 28% for fungi group and 47% for bacteria group respectively. Meanwhile, concentrations of bacteria were increased after co-culture with fungi. The temporal changes of bacterial and fungal communities structures were observed in all three reactors. It was concluded that combining interactions of F1, F3, F5 and B1, B2 were possible. Since we conducted a metabolites analysis using one strain of fungi combining with one strain of bacteria. At present, the data analysis is under processing. In the future, we are looking forward to establish a new strategy for environmental remediation which has high performance in PAHs removing.



## Genetical Analysis of Dehalogenation Reaction and its Application

Zhang wanjun, Hiroo Uchiyama  
Graduate School of Life and Environmental Sciences,  
University of Tsukuba

Many environmental pollution chemicals have molecular chlorine and residual in the environment because it is difficult to be degraded. Environmental bioremediation technologies, owe to eco- friendly, cost-effective and natural technology, is widely used to remove pollution around the world. Over the last few decades, many bacterial cultures, both mixed and pure, have been described which are capable of dehalogenation. In same time, the potential for dehalogenation in microorganisms is also evident in samples from soil and marine and freshwater sediments not exposed to haloorganic compounds. Although numerous reports and reviews on microbial dehalogenation activities are available, this process is not, as yet, completely understood. Therefore gene-scale information becomes critical in pursuing such research directions.

In our laboratory, the bacterium that can degrade chloral hydrate has been found, and it was identified as *Pseudomonas* and was named as LF54. The degradation product was determined by gas chromatograph. The Chloral hydrate was transformed into 2,2,2-Trichloroethanol, 2,2-Dichloroethanol, step by step.

In general, the biodegradation process is a biocatalysis process by enzymes which translated by DNA on either genome or plasmid. As we know, many of biodegradation genes were on plasmid. so I extracted the plasmid from LF54 at first. I also used two bacterial that carry plasmid as control. *E.coli* has a plasmid whose length is 4kbp. and *the P.putida PpY101*, the length of pSUP104 is 9,5kbp. The plasmid of LF54 can't be extracted. So we think that the LF 54 doesn't have the general plasmid and the degradation gene is probably on the genomic DNA.

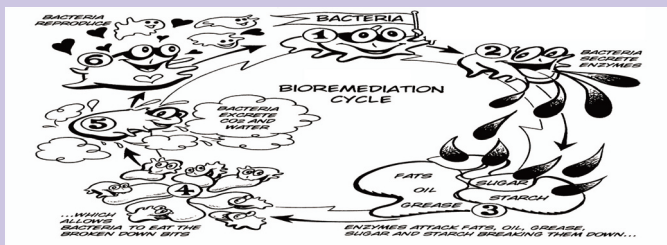
In this study, we used Transposon method to find out the dehalogenation gene with the transposome inserted and inactivated the gene. About 3800 mutants had been picked up to make the insertion mutant groups. To find out the insertional inactivation strain, colorimetric methods were used. If the gene which reductive aldehyde group into alcohol group is inactivated, CH can't be degraded and red compound can form. If the gene which control the dehalogenation is inactivated, Cl can't appear and yellow compound can't form. If the insertional inactivation mutant is found, the dehalogenation gene can be sequenced from genomic DNA directly.

With analyzing the factors of gene expression, gene expression can be increased and bioremediation will become rapid. With designing specific primers, the distribution of the dehalogenation gene can be evaluated in the environment. We hope our study can contribute to the development of environmental bioremediation technologies from genetically.

**Key words:** Dehalogenation, Bioremediation, Genetical analysis, Transposon, Insertional inactivation mutant

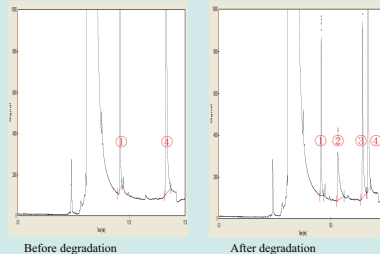
## Introduction

Many environmental pollution chemicals have molecular chlorine and residual in the environment because it is difficult to be degraded. Environmental bioremediation technologies, owe to eco-friendly, cost-effective and natural technology, is widely used to remove pollution around the world. In this study, we focus on the dehalogenation reaction and clarifying the genetic characteristics, and we hope that the study can contribute to the development of environmental bioremediation technologies.



## The previous work

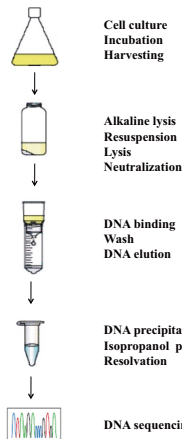
Chloral is one of chlorinated hydrocarbons. It reacts with water to form chloral hydrate (CH). CH is the agricultural chemicals and medicine intermediate it also uses as medicine sedative. Furthermore, as the by-product of water purification with chlorine, and CH frequently encountered as environmental contaminants. In our laboratory, the bacterium that can degrade CH has been found and it was identified as *Pseudomonas* and we named it LF54. The degradation product was determined by gas chromatograph.



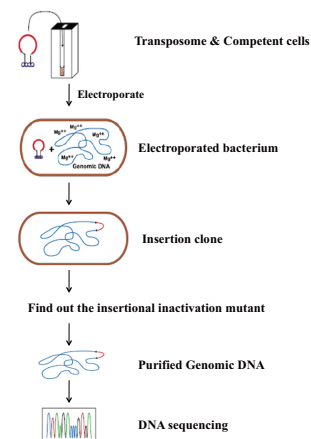
## Method

### STEP A: Obtain dehalogenation gene

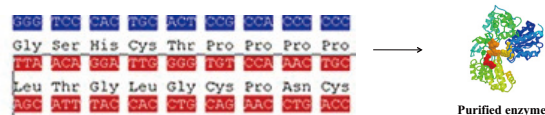
#### 1. Plasmid Extraction



#### 2. Transposon



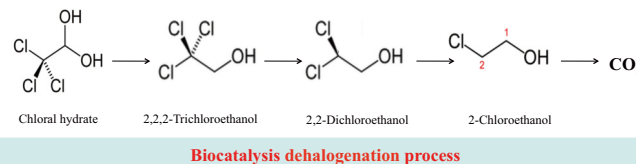
### STEP B: Obtain dehalogenation Enzyme



### STEP C: Application

- Analyzing gene expression, to find out the factors of gene expression.
- Designing specific primers, to evaluate the distribution of the dehalogenation gene in the environment.

## Proposed mechanisms



## Result

### STEP A -2: Transposon

#### ① Kanamycin resistance of LF54

Table1 clones	Kanamycin				
	0ug/L	25ug/L	50ug/L	75ug/L	100ug/L
dilution ratio					
1.00E-04	>1000	0	0	0	0
1.00E-05	195	0	0	0	0
1.00E-06	26	0	0	0	0

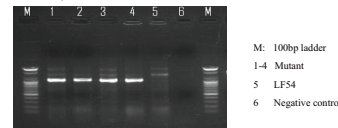
The concentration of kanamycin is increased step by step, and LF54 can't grow even in the lower kanamycin concentration.

#### ② Electroporation

Table2: Host	Sample		Efficiency (CFU/ug DNA)
	H <sub>2</sub> O		
LF54	pSUP104(9.5K)		1.92x10 <sup>6</sup>
	Transposome		7.61x10 <sup>5</sup>

The electroporation is successful, because the efficiency of the transposome is almost the same as the plasmid.

#### ③ Assay the transformation



The length of transposome fragment is about 1200bp. The mutants can be amplified, and the LF54 doesn't have this fragment. It indicated transposon is successful.

#### ④ Mutant selection (Colorimetric method).

##### a. Chloral hydrate (Residues)

Sample	1	2	3	4	5	6	7	8	9	10	11	12
MiliQ	0.001	0.005	0.000	0.000	0.000	0.001	0.009	0.001	0.008	0.010	0.009	0.006
Phosphate buffer	0.001	0.060	0.001	0.001	0.001	0.007	0.010	0.014	0.002	0.020	0.004	0.000
Color reagents	0.054	0.002	0.005	0.005	0.005	0.003	0.002	0.004	0.004	0.011	0.002	0.006
Total	0.000	0.001	0.005	0.008	0.003	0.007	0.023	0.024	0.003	0.001	0.020	0.000
98°C 15min.	0.007	0.001	0.005	0.002	0.004	0.001	0.004	0.008	0.002	0.004	0.001	0.005
Formed red compound and measured by 480nm.	0.004	0.001	0.001	0.005	0.003	0.002	0.001	0.009	0.003	0.003	0.004	0.001
	0.005	0.004	0.003	0.004	0.010	0.006	0.003	0.001	0.000	0.013	0.003	0.002
	0.003	0.001	0.000	0.001	0.000	0.003	0.012	0.005	0.004	0.000	0.008	0.178

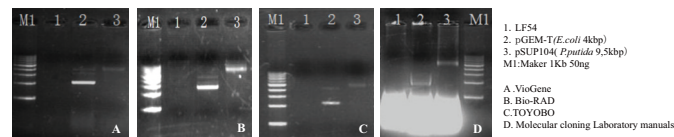
##### b. Chloridion (Production)

Sample	1	2	3	4	5	6	7	8	9	10	11	12
Fe(NH4)(SO4)2	0.076	0.095	0.109	0.108	0.113	0.117	0.085	0.077	0.089	0.082	0.078	0.083
Hg(SCN)2	0.074	0.035	0.091	0.091	0.102	0.093	0.073	0.075	0.094	0.074	0.093	0.098
Total	0.038	0.109	0.104	0.109	0.120	0.127	0.123	0.113	0.102	0.088	0.094	0.087
Room temperature 15min	0.076	0.102	0.097	0.102	0.087	0.103	0.096	0.083	0.097	0.089	0.075	0.094
Formed yellow compound and measured by 460nm.	0.063	0.086	0.097	0.086	0.087	0.092	0.089	0.077	0.091	0.079	0.086	0.093
	0.070	0.100	0.114	0.088	0.091	0.089	0.093	0.094	0.076	0.081	0.076	0.082
	0.107	0.106	0.061	0.100	0.108	0.106	0.095	0.090	0.055	0.074	0.095	0.083
	0.084	0.082	0.100	0.082	0.093	0.108	0.076	0.088	0.082	0.000	0.063	0.007

About 3800 mutants had been picked up to make the insertion mutant groups. To find out the insertional inactivation mutant, colorimetric methods were used. If the gene which reduce aldehyde group into alcohol group is inactivated, CH can't be degraded and red compound can form. If the gene which control the dehalogenation is inactivated, Cl<sup>-</sup> can't appear and yellow compound can't form. In these two tables, H10 is the Blank and negative control (Culture medium only), and H12 is the positive control (Culture medium + CH). Pink indicated the residues of CH between max/5 and max/2. Pale yellow is the production of Cl<sup>-</sup> between max/5 and max/2.

## Result

### STEP A -1: Plasmid Extraction



Four Plasmid Extraction methods were used. The plasmid of *E.coli* and *Pspitida* can be extracted, and the plasmid of LF54 can't be extracted. So we think that the LF54 doesn't have the general plasmid and the degradation gene is probably on the genomic DNA.

## Outlook

Over the last few decades, many bacterial cultures, both mixed and pure, have been described which are capable of dehalogenation. In same time, the potential for dehalogenation in microorganisms is also evident in samples from soil and marine and freshwater sediments not exposed to haloorganic compounds. Although numerous reports and reviews on microbial dehalogenation activities are available, this process is not, as yet, completely understood. Therefore gene-scale information becomes critical in pursuing such research directions. In this study, we used Transposon method to find out the dehalogenation gene with the transposome inserted and inactivated the gene. If the insertional inactivation mutant is found, the dehalogenation gene can be sequenced from genomic DNA directly. With analyzing the factors of gene expression, gene expression can be increased and bioremediation will become rapid. With designing specific primers, the distribution of the dehalogenation gene can be evaluated in the environment. We hope our study can contribute to the development of environmental bioremediation technologies from genetically.

## Poster No. 16

### Nitrate Removal from Groundwater Using an Intensified Electrode-biofilm Reactor(IBER)

Yingxin ZHAO, Zhengya ZHANG  
*Graduate School of Life and Environmental Sciences,  
University of Tsukuba, Ibaraki, Japan  
zyxin111@126.com*

Groundwater has become more and more important because it is widely used as drinking water in most countries of the world. But groundwater is seriously polluted by nitrate through agricultural, industrial and domestic wastes, which bring healthy problems to people.

Traditional physico-chemical approaches generally require further treatment or disposal. Biological technologies are promising attributing to harmless end-product. Heterotrophic denitrification has disadvantages of secondary pollution from excessive organic carbon, while autotrophic denitrification has relatively low efficiency. In this study, an intensified biofilm reactor using cooperation of heterotrophic and autotrophic denitrification was developed for treatment of nitrate contaminated groundwater ( $50 \text{ NO}_3^- \text{-N mg L}^{-1}$ ). Denitrification bacteria were inoculated by anaerobic sludge from a waste water treatment plant. The reactor was operated continuously for eighteen months with synthetic water to maximize treatment efficiency under different hydraulic retention time (HRT) levels (24, 20, 16, 12 and 8 hours), carbon to nitrogen ratios(C/N: 3.00, 2.50, 2.00, 1.50, 1.25, 1.00, 0.75, and 0.5) and electric currents(I: 10, 20, 40, 60, 80, 100mA). Nitrate removal efficiency, nitrite accumulation,  $\text{NH}_3\text{-N}$ , COD(cr) and pH in the treated water were investigated in the experiments.

Nitrate removal efficiency was higher than 97% at the ranges of C/N (3–0.75), HRT(24–8 hours), and I (10–40 mA). The optimum parameters were C/N=0.75, HRT=8h, and I=40mA, and there was no nitrite accumulation until the C/N was decreased to 0.75.  $\text{NH}_3\text{-N}$  and residual organic carbon (methanol) were not detected at the best condition. It is concluded that the cooperation of heterotrophic and autotrophic denitrification in the IBER is a promising configuration for enhanced treatment of nitrate-contaminated water.

**Key words:** Nitrate, Groundwater, Denitrification, Intensified electrode-biofilm reactor





# Nitrate Removal from Groundwater Using an Intensified Electrode-biofilm Reactor

Graduate School of Life and Environmental Sciences

University of Tsukuba

Exhibitor: Yingxin Zhao

Supervisor: Zhengya Zhang



Special Coordination Fund for Promoting Science and Technology



Nitrate in groundwater is increasingly an important problem, which prohibited the direct use of the groundwater resources for human consumption in some parts of the world including **India, Japan, China, USA, Saudi Arabia, UK and several parts of Europe.**

Exceed nitrate in drinking water can cause

**gastric cancer & blue baby syndrome**

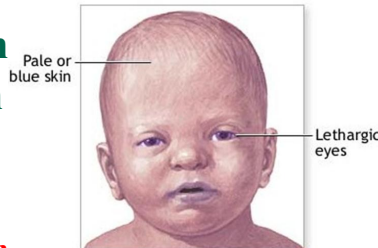


Photo source : [www.wix.com/chikdancer/nitratecamanddani](http://www.wix.com/chikdancer/nitratecamanddani)

The maximum contaminating levels of nitrate in groundwater proposed by the World Health Organization(WHO) is **10 mg/L.**

**Physical**

- ❖ Ion exchange
- ❖ Reverse osmosis
- ❖ Electrodialysis

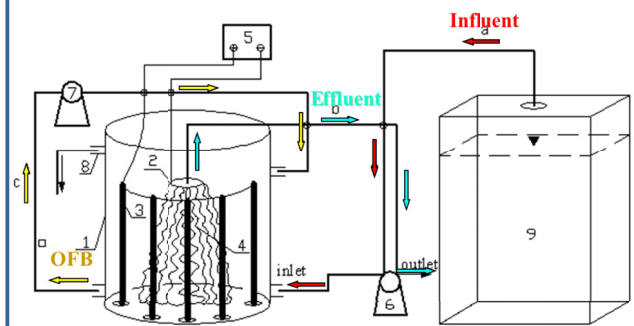
**Chemical**

- ❖ Active metal reduction
- ❖ Catalytic denitrification

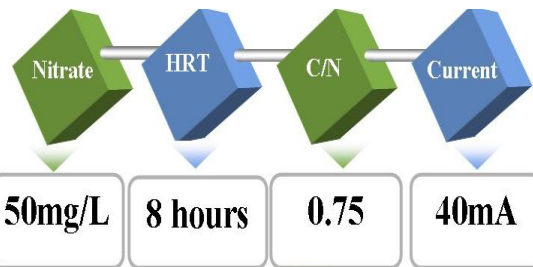
*Secondary treatment*

## Biological Denitrification

- Clean end-product
- Economical
- No secondary pollution
- High efficiency



- 1 biofilm reactor; 2 cathode(stainless steel wire); 3 anode(carbon rods);  
4 carrier(fiber thread);5 power supply; 6 peristaltic pump;  
7 circulating pump; 8 overflow pipe; 9 influent tank  
※ OFB: the treated water out of biofilm



removal efficiency

Nitrate: 98%

COD: > 97%

**The reactor has a good prospect of application in nitrate removal from groundwater.**



## Poster No. 17

# Environmental Toxicological Effects of Nanoparticles on Mice

Hao Fang

Graduate School of Life and Environmental Sciences,  
University of Tsukuba

### Introduction

Nanomaterials are engineered structures with at least one dimension of 100 nanometers or less. The unusual physicochemical properties of nanomaterials have made them being used in diagnosis, drug delivery, cosmetics, sensors, food, electronics, optics, magnetic, catalysis and many other fields. With the rapid growth of nanotechnology, nanomaterials could enter into the environment in different pathways and subsequently enter into human body via manufacture and use of nanomaterials as well as food chains. Great concern has been focused on the biological safety worldwide. Environmental groups, government regulatory agencies, and even the commercial sector itself all have recommended caution in promoting the widespread use of nanomaterials before addressing potential ill effects. Hence, it is necessary for the evaluation of health risk for nanomaterials.

### Methods & Results

We studied the effects on the antioxidant system of mice after oral exposure to nano-sized ZnO. The results revealed that both of two kinds of nano-sized ZnO had oxidative damage on the kidney, spleen and heart in mice. Nano-sized ZnO could induce the oxidative stress in these tissues and stimulate the generation of reactive oxygen species. In the meanwhile, we evaluated the genotoxicity of mice sperm after exposure to different sized Ag nanoparticles *in vitro*, using the comet assay to determine the DNA damage of sperm cells. The results suggested that both 10 nm and 30 nm Ag nanoparticles had DNA damage effects on mice sperm while the damage of Ag ions was higher. Additionally, CD-1CR mice was acutely exposed to multi-walled carbon nanotubes combined with 4-nonylphenol (MWCNTs-NP) by intraperitoneal injection and *in vivo* oxidative effects and genotoxic responses to stress were evaluated. The results showed that MWCNTs-NP induced higher oxidative stress in mice than pure MWCNTs and 4-NP did, leading to more oxidative damage. Comet assay data indicated that MWCNTs-NP have greater genotoxic effects than other groups.

### Discussion

One of the three core fields in EDL Program is public health/epidemiology/medical policy. I am greatly attracted by the knowledge and practice in this course, from which I could gain originality and problem solving skills. In addition, it makes me rethink about the relationship between new technology and human health and apply them in the methodology of my research. After the verification, I will gain more deep understanding of public health and medical policies.

**Key words:** nanomaterials; mice; comet assay; oxidative stress; DNA damage

○ Hao Fang

Graduate School of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Ibaraki, Japan

## Background

Nanomaterials are engineered structures with at least one dimension of 100 nanometers or less.

### Nanoparticles' properties

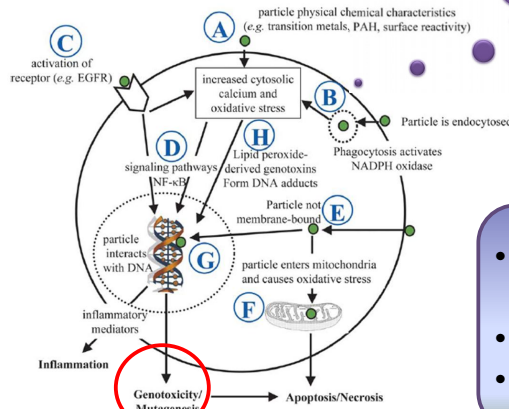
- Small size
- High surface area
- High surface reactivity

#### Routes

- waste of nano drug carrier
- nanomaterials for environment treatment
- factory and lab waste of nanomaterials
- daily use: cosmetics, opacifier, etc.

Human body

### Hypothetical cellular interactions of nanoparticles



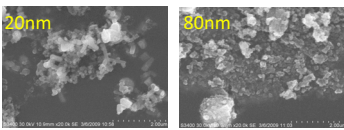
Gunter Oberdorster et al. 2007

Thinking about the environmental toxicological effects?

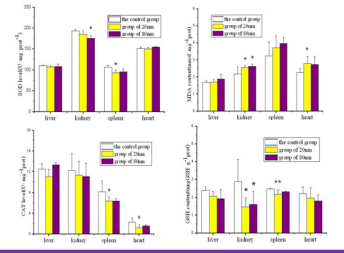
- Influence on antioxidant system
- Genotoxicity
- Fraction of tissues

## Effects on antioxidant system

### Characterization of nanoparticles



### Results

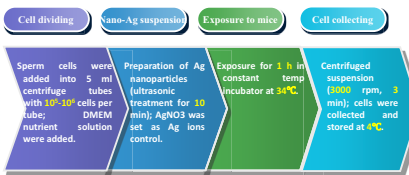


### Animals and treatment

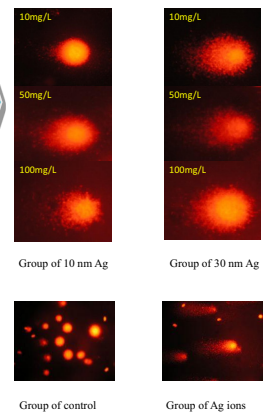
30 CD-1CR mice, male and female in equal, (20 ± 2) g for weight  
 domesticate for 1 week  
 control 20 nm 80 nm  
 exposure with nano-ZnO  
 a single oral gavage at the dose of 5 g/kg weight  
 after 14 days  
 mice were sacrificed; liver, kidney, spleen, heart were used for detection  
 SOD (superoxide dismutase), MDA (malondialdehyde), CAT (catalase), GSH (glutathione) in mice organs were detected

## Genotoxicity

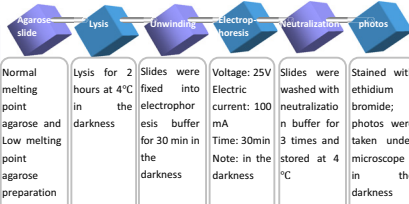
### Exposure with Ag nanoparticles



### Results



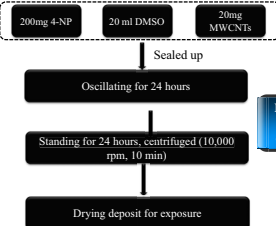
### Comet assay



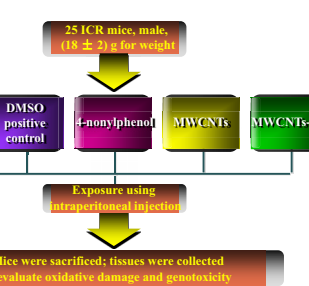
## Joint toxicity with EEDs

Carbon nanotubes have attracted increasing attention due to their widespread applications. In order to evaluate the joint toxicity of multi-walled carbon nanotubes (MWCNTs) and environmental endocrine disruptors (EEDs), the acute toxicity and genotoxicity of nonylphenol, pure MWCNTs and MWCNTs combined with 4-nonylphenol (MWCNTs-NP) on mice was investigated compared with normal saline.

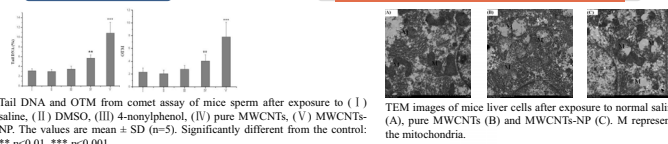
### Preparation of MWCNTs-NP



### Exposure to animals



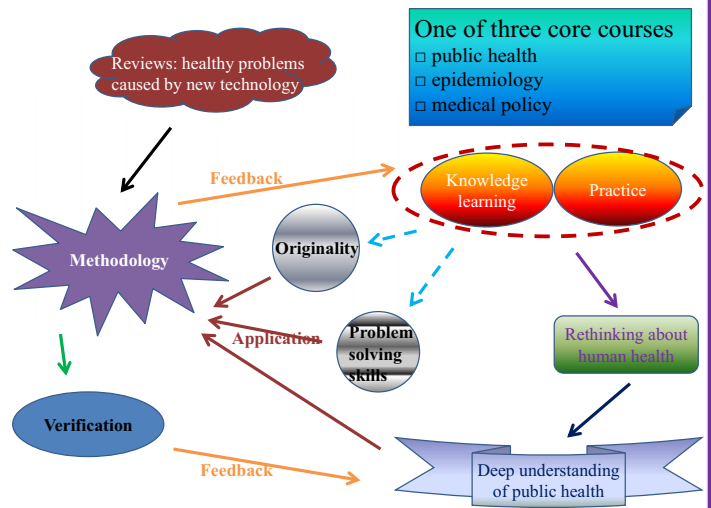
### Results



## EDL and nanotoxicology

### Nanotoxicology

### EDL Program



One of three core courses  
 public health  
 epidemiology  
 medical policy

## Poster No. 18

### Pollutants Removal from Wastewater through Vertical Multilevel Soil Infiltration System

Shengjiong Yang  
*Graduate School of Life and Environmental Sciences,  
University of Tsukuba*

Water environment might be polluted when wastewater discharged into water environment without any treatment. In recent decades, wastewater treatment by traditional, such as electrochemistry, active sludge, MBR (membrane bioreactor), oxidation pond, etc., were excogitated for wastewater treatment by researchers. Furthermore, traditional on-site systems, such as septic tank, wetland system etc. were also performed in wastewater treatment, these treatment techniques achieved effective pollutants removal ability in domestic wastewater treatment, but still defects, such as high capital investment and operation costs, complicated operation etc., which restrict the practicability in rural areas of developing nations.

Soil had potential ability on wastewater treatment; this ability was discovered and utilized rapidly. Soil treatment was proven to be a suitable technology for wastewater treatment and exhibited effective pollutants removing capacity. This kind of treatment system was sprang up in Japan, Europe and America, whose advantages were generally accepted and consistent with the current situation of developing nations, such as low constructing cost, effective removal, simple operation and no surplus sludge.

Zeolite, sawdust, active carbon and scrap iron were packed to intensify the remove efficiency of nitrogen. Quartz sand and soil were mixed in proportion of to avoid clogging phenomenon and to enhance the treat efficiency together. The soil containing high ferrous element and scrap iron was packed in system to remove TP (total phosphorus). The modified system named VMSI (vertical multilayer soil infiltration) system

This study revealed the pollutants removal capacity of VMSI system:

A. COD (chemical oxygen demand) from the wastewater was adsorbed at first by mixed materials and degenerated by organism in VMSI system. It was effective in removing COD with average removal percentage of 92.25.

B. The  $\text{NH}_4^+\text{-N}$  (ammonia nitrogen) removal 98.16% of average efficiency of  $\text{NH}_4^+\text{-N}$  was achieved in performance-period.

C. The removal efficiency of TN (total nitrogen) was directly associated with the nitrate removal. Anaerobic, deoxidized area and efficient external carbon source were main factor in TN removal; the average efficiency of TN achieved 56%.

D. TP removal was excellent in VMSI system, it could be removed effectively, and high removal efficiency may last for a comparatively long-period.

I will continue my research to seek the most suitable wastewater treatment techniques. I believe that it will give the huge support to me for my research life even to be an environmental leader.

**Key words:** Soil, VMSI, Modified, low cost, effective.





# Pollutants Removal from Wastewater through Vertical Multilevel Soil Infiltration System

Graduate School of Life and Environmental Sciences  
University of Tsukuba



Special Coordination Fund for Promoting Science and Technology

Exhibitor: Shengjiong Yang

Advisor: Zhenya Zhang

1. With the large-scale urbanization and industrialization in last century, huge quantities of wastewater were produced by human production and domestic activities. The annual discharge amount of wastewater in China exceeded 57.2 billion tonnes in 2008, which inevitably resulted in the further worsening of water quality of the top seven rivers in China, including Yangtze River, Yellow River and Huai River, etc., and there were only 55.0% of these rivers with water quality up to the Environmental Quality Standards (levels I–III) for Surface Water.

Water environment might be polluted when wastewater discharged into water environment without any treatment. In recent decades, wastewater treatment by traditional, such as electrochemistry, active sludge, MBR, oxidation pond, etc., were excavated for wastewater treatment by researchers. Furthermore, traditional on-site systems, such as septic tank, wetland system etc. were also performed in wastewater treatment, these treatment techniques achieved effective pollutants removal ability in domestic wastewater treatment, but still defects, such as high capital investment and operation costs, complicated operation etc. Which restrict the practicability in rural areas of developing nations.

2. Soil had potential ability on wastewater treatment; this ability was discovered and utilized rapidly. Soil treatment was proven to be a suitable technology for wastewater treatment and exhibited effective pollutants removing capacity. This kind of treatment system was sprang up in Japan, Europe and America, whose advantages were generally accepted and consistent with the current situation of developing nations, such as low constructing cost, effective removal, simple operation and no surplus sludge.



zeolite

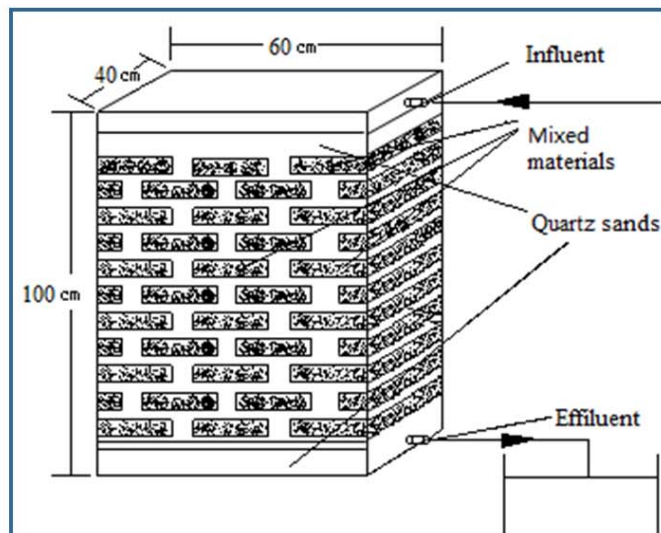
sawdust

3. Zeolite, sawdust, active carbon and scrap iron were packed to intensify the remove efficiency of nitrogen. Quartz sand and soil were mixed in proportion of to avoid clogging phenomenon and to enhance the treat efficiency together. The soil containing high ferrous element and scrap iron was packed in system to remove TP. This system was named as Vertical Multilevel Soil Infiltration system (VMSI) and exhibited excellent removal efficiency in domestic wastewater treatment.



Scrap iron

Active carbon



The device abridges general view of VMSI system

4. This study revealed the pollutants removal capacity of VMSI system:

- A. COD from the wastewater was adsorbed at first by mixed materials and degenerated by organism in VMSI system. It was effective in removing COD with average removal percentage of 92.25.
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- D. TP removal was excellent in VMSI system, it could be removed effectively, and high removal efficiency may last for a comparatively long-period.

I will continue my research to seek the most suitable wastewater treatment techniques. I believe that it will give the huge support to me for my research life even to be an environmental leader.

Research Plan for next:

- A. Optimization in filtering layer and modification of combined stuffing
- B. Research on microorganism species
- C. Research on external organic carbon sources for denitrification processes

## Poster No. 19

### Photocatalyst which can Decompose Glycerol with High Efficiency

Masatsugu Uesugi  
*Graduate School of Life and Environmental Sciences,  
University of Tsukuba*

In these days, the global warming is one of the serious problems in the world. The global warming is caused by the increase of the greenhouse gas such as CO<sub>2</sub>. To deal with this problem to use the biodiesel as a fuel is one of the useful coping methods. It is because biodiesel is a carbon-neutral. But, to make the biodiesel, we get glycerol as a by-product. The formation is about 10 percent of the source. In general, glycerol is useful. So, it is used for some goods like a cosmetic. In spite of it this glycerol which we can get it as a by-product cannot use for an efficient use due to the low purity. This glycerol gets mixed with catalyst and a fatty acid. Using the enzymatic method or supercritical method, we can get a high purity glycerol as a by-product. But, to think about the supply, demand and cost, this glycerol has no ways to use. So, the disposal way is a problem to be solved.

Photocatalyst such as TiO<sub>2</sub> or WO<sub>3</sub> can decompose an organic matter into H<sub>2</sub>O and CO<sub>2</sub>. So, to use a photocatalyst, we can decompose a glycerol into H<sub>2</sub>O and CO<sub>2</sub>. But, photocatalyst also has a disadvantage which is lower efficiency. In these days, to deal with the disadvantage of photocatalyst, to dope with some an inorganic substance like a Pt is studied a lot because of the high efficiency. In this study, to make a good material and to find an optimum condition which can decompose glycerol with high efficiency will be established as a main purpose. The result will be analyzed by the Chemical Oxygen Demand (COD), X-Ray Diffraction (XRD) and Transmission Electron Microscope (TEM).

Moreover, as we know Environmental Diplomatic Leader (EDL) opens a lot of course, through the lectures I feel the importance of the feasibility. So, using the knowledge and skill about the environment which we got those through the lectures, I want to develop the argument to the feasibility. This will be established as a sub-purpose.

**Key words:** Photocatalyst, waste-water treatment, TiO<sub>2</sub>, WO<sub>3</sub>



# Photocatalyst which can decompose glycerol with high efficiency

Name : Masatsugu Uesugi Supervisor : Zhang Zhaneya

## 1 Abstract

In these days, the global warming is one of the serious problems in the world. The global warming is caused by the increase of the greenhouse gas such as CO<sub>2</sub>. To deal with this problem to use the biodiesel as a fuel is one of the useful coping methods. It is because biodiesel is a carbon-neutral. But, to make the biodiesel, we get glycerol as a by-product. The formation is about 10 percent of the source. In general, glycerol is useful. So, it is used for some goods like a cosmetic. In spite of it this glycerol which we can get it as a by-product cannot use for an efficient use due to the low purity. This glycerol gets mixed with catalyst and a fatty acid. Using the enzymatic method or supercritical method, we can get a high purity glycerol as a by-product. But, to think about the supply, demand and cost, this glycerol has no ways to use. So, the disposal way is a problem to be solved.

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## 2 The relationship between my research and EDL program

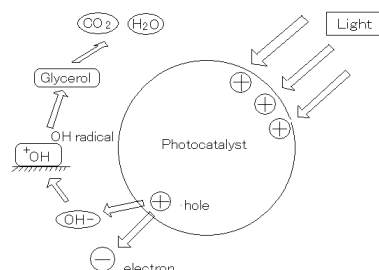
EDL program has three core areas of focus:

- (1) water resources, water treatment, and water environmental policy;
- (2) biodiversity and bio-resources
- (3) public health, epidemiology, and medical policy

And, EDL program opens a lot of course which are related to these core areas. I took those classes and strongly feel the relationship between these core areas. So, I establish my research as "Photocatalyst which can decompose glycerol with high efficiency." The decomposition of glycerol is directly related to the spread of bio-resources and improvement of water quality. Moreover, this research will be related to the public health because of the decrease of bad water quality. And, I also feel the important of the feasibility. So, I want to develop my argument to not only the development of new material but the feasibility.

## 3 What is a photocatalyst

### 3.1 Mecanism of photocatalyst



### 3.2 Advantage

- a. Degradability of organic
- b. Nontoxic
- c. Hydrophilic
- d. No effect on the environment
- e. Low cost

### 3.3 Disadvantage

- a. Low efficiency

## 4 Material and method

### 4.1 Material

- Pt doped with WO<sub>3</sub>

### 4.2 Method

- COD : Chemical Oxygen Demand
- XRD : X – Ray Diffraction
- TEM : Transmission Electron Microscope

## 5 Future plane

First, using the photocatalyst of Pt doped with WO<sub>3</sub>, I want to find the optimize condition to change the pH, the distance between the source and the light, the concentration of WO<sub>3</sub>, the concentration of glycerol and the range of light wave.

Next, to change the material of which is doped with WO<sub>3</sub> and find a good photocatalyst which can show the good decompose efficiency as time permits. It is because, the efficiency of the photocatalyst depend on this doped material.

Lastly, I want to think about how this photocatalyst can be adapted to the real society.

## 6 References

- [1] Photocatalytic Materials inc.  
<http://www.photocatalyst.co.jp/index.html>
- [2] Yasuhiro Hosoki, Yasu Kurota "Development and application of visible-light-driven photocatalyst Cu ion/WO<sub>3</sub>," CiNii, Material stage 10(4), 37-39, 2010-07

## Poster No. 20

### Potential Impact of Climate Change on Rice Production in the Indo-Gangetic Plains

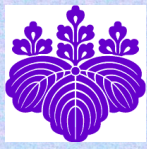
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Paralleling the Southern Himalayan Province, the Indo-Gangetic Plains (IGP) is very important for the food security of South Asia. IGP region is also highly susceptible to climate induced geo-physical events like floods and droughts. Paddy is the most important agricultural crop in IGP. IPCC has already reported that, due to future climate change the crop yield could decrease up to 30% in the region by the mid-21 century. *Aman* (wet) season rice, which mostly depend on monsoon rain and *Boro* (dry) season rice which vulnerable to temper cultivated across all parts of IGP. To understand the future impact of climatic variability's on this two main rice seasons CERES-Rice model will be used.

The CERES-Rice model is variety-specific and is able to predict more accurately rice yield and rice-plant response to various environmental conditions. Data for previous yearly production of seasonal rice collected from Bangladesh Agricultural Research Council (BARC) and then trend will be analyzed. Long term observed data set for precipitation, temperature, humidity, sunshine hour and wind speed for 32 stations was obtained from Bangladesh Meteorological Department (BMD) data set available for 1954-2002. Data set are then analyzed to observe the trend of rainfall and temperature in Bangladesh. From the analysis of past climate data and yield trend, relationship between climatic events such as minimum temperature, maximum temperature, solar radiation and rainfall with seasonal rice yield can be determined. Then climate change scenarios will be assessed and future climatic changes can be found out from model data analysis which is consistent with the IPCC Fourth Assessment Report (AR4). At now all 20 GCMs are considered to get the projected data on temperature, precipitation and other changes. At least two projection years 2030, 2050 will be compared to one base year. After projecting possible changes in climatic condition until 2030 and 2075, I try to find out how this change would impact rice production in the region.

The results which will be obtained from this research can be useful in climate change adaptation particularly in agriculture sector and food security of this region.

**Key words:** Climate Change, Rice Production, Indo-Gangetic Plain (IGP), Food security, Climate adaptation



University of Tsukuba

# Potential Impact of Climate Change on Rice Production in the Indo-Gangetic Plains

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## Introduction

Paralleling the Southern Himalayan Province, the Indo-Gangetic Plains (IGP) is very important for the food security of South Asia. IGP region is also highly susceptible to climate induced geo-physical events like floods and droughts. Paddy is the most important agricultural crop in IGP. IPCC has already reported that, due to future climate change the crop yield could decrease up to 30% in the region by the mid-21 century.

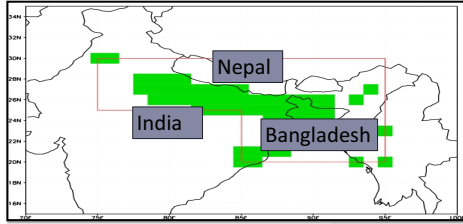
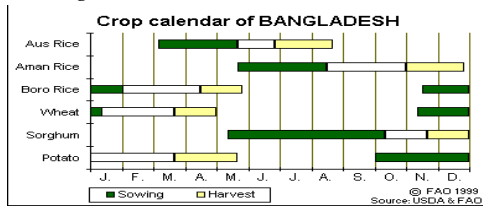


Figure 1: The study region, showing the model grid with simulation cells shaded

## Objectives and Methodology

*Aman* (wet) season rice, which mostly depend on monsoon rain and *Boro* (dry) season rice which vulnerable to temper across all parts of IGP. To understand the future impact of climatic variability's on this two main rice seasons CERES-Rice model will be used. From the analysis of past climate data and yield trend, relationship between climatic events with seasonal rice yield can be determined. Then climate change scenarios will be assessed and future climatic changes can be find out from model data analysis which is consistent with the IPCC Fourth Assessment Report (AR4). At least two projection years 2030, 2050 will be compared to one base year. After projecting possible changes in climatic condition until 2030 and 2075, try to find out how this change would impact rice production in the region.



## GCMs

For this study, it is considered to use climate change predictions produced for the 4th Assessment Report of IPCC. At now all 20 GCMs are considered to get the projected data on temperature, precipitation and other changes. Then validation analysis also planned to be performed on the region 18.80 to 28.80 N latitudes and 86.30 to 93.80 E longitudes for 4 seasons, winter (December, January and February-denoted by DJF), pre-monsoon (March, April and May-denoted by MAM), monsoon (June, July and August-denoted by JJA) and post-monsoon (September, October and November-denoted by SON). Projections will be done using A1-BIM scenario.

## CERES-Rice Model

The CERES-Rice model was developed under the International Benchmark Sites for Agro technology Transfer (IBSNAT) project and has been successfully applied to a number of crop yield studies. The CERES-Rice model is variety-specific and is able to predict more accurately rice yield and rice-plant response to various environmental conditions.

### Weather data

- Daily maximum air temperature
- Daily minimum air temperature
- Daily precipitation
- Daily solar radiation

### Agromonic

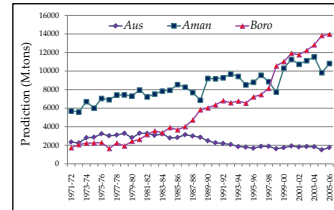
- Transplanting date
- Row spacing
- Number of plants per hill
- Number of plants per square meter
- Age of seedling
- Fertilizer application dates, amounts

### Pedological-hydrological data

- Soil texture
- Number of layers in soil profile
- Drainage
- Soil layer depth
- pH of the soil in water for each layer
- Root quantity for each layer

## Observed Data

Data for previous yearly production of seasonal rice collected from Bangladesh Agricultural Research Council (BARC) and then trend were analyzed. Long term observed data set for precipitation, temperature, humidity, sunshine hour and wind speed for 32 stations was obtained from Bangladesh Meteorological Department (BMD) data set available for 1954-2002. Data set was then analyzed to observe the trend of rainfall and temperature in Bangladesh.



*Aman* has not significant change over the 1971-2006 period, but yield is low (3 t/ha). *Boro* shows a rapid change contributing more in production than *Aman* due to introduction of modern irrigation technology (yield is 4.5 t/ha).

Figure 2: Trend of changes in production of seasonal rice during 1971 – 2006 period

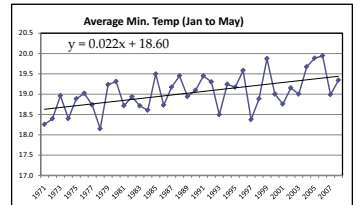
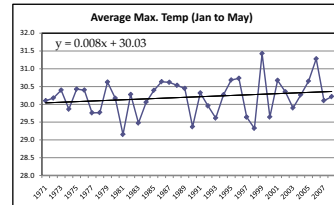


Figure 3 & 4: Trend of changes in average maximum and minimum temperature during January to May over Bangladesh

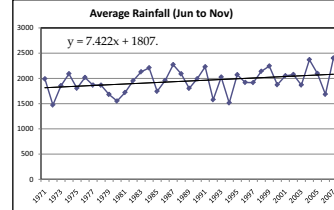
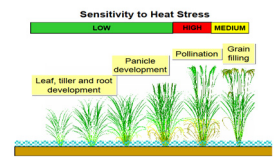


Figure 4: Trend of changes in average rainfall during June to November over Bangladesh

As *Boro* is mostly irrigated, the crop yield of *Boro* could be impacted by increase of max. and min. temperature. Trend of max. and min. temperature over 1971-2006 period shows a rapid increase which could have relation to *Boro* yield and need further study. *Aman* is mostly rainfed and trend of rainfall during 1971 – 2006 period shows a significant increase and need further study.

## Results

It is reported by many studies that higher temperatures and extreme rainfall events causes reduction of yields. I am in my initial stage of my research and hope to find out interesting results during my masters course.



## Conclusions

The results which will be obtained from this research can be useful in climate change adaptation particularly in agriculture sector and food security of this regions. It is already clear that Bangladesh is going to face higher temperature and rainfall during all the seasons. Due to unappreciable rainfall at the start of the planting season in winter would severely affect most of the rainfed crops like *Aman* season rice because of moisture stress. Also if higher temperature in the winters is happened that will also lead increased yield loss of *Boro* season. After managing historical data of Indian part of IGP, I can give a clear picture that could help policy makers to take adaptation strategies for farmers who producing rice in IGP region.

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## Characterizing Vegetation Dynamics of Agricultural Land in Java Island, Indonesia

Yudi SETIAWAN<sup>1</sup> and Kunihiko YOSHINO<sup>2</sup>

<sup>1</sup>*Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan*

<sup>2</sup>*Graduate School of System and Information Engineering, University of Tsukuba, Japan*

### Introduction

Water is the key natural resource, and a dynamic water supply thus is a critical challenge if agriculture is to be sustainable. Considering seasonal vegetation dynamics in multi-year series data leads to a broader view of agricultural lands. In tropical regions, for example Java Island, a paddy field might undergo a sequence of covers through the year, such as: 1) paddy-bareland-secondary crops-bareland, 2) paddy-bareland-inundated-paddy-bareland-secondary crops, and 3) paddy-bareland-secondary crops-bareland-inundated-paddy, where the sequence is repeated year after year following the seasons.

### Method

Characterization of vegetation dynamics has often been made by using vegetation index values, either the normalized difference vegetation index (NDVI) or enhanced vegetation index (EVI). The temporal dynamics of those index values are useful for distinguishing land surface conditions by differentiating among vegetation types and their distributions. We characterized the temporal vegetation dynamics of long-term agricultural lands by using multi temporal MODIS product (MOD13Q1) 16-day composite data from 2001 to 2007.

### Result and Discussion

The temporal pattern analysis was able to provide information of the planting, heading and harvesting dates of the lands; and also identified the change in dynamic agricultural system, such as cropping system changed from triple cropping system to double cropping system, also delaying of seedling stage while the rain season start changed, and others phenomena; however, such outstanding capability of the method in this research was limited due to mixtures of land covers in MODIS of which spatial dimension are 250m by 250m.

The results explained that the seasons, it was the most of important factor which affected the change of dynamics agricultural system. The long dry season or extreme dry season by global climate changed caused many agricultural lands become bareland/un-planting as well the planting time was postponed. In some areas, even if the irrigation infrastructure exists locally in these areas, if irrigated water is limited, double or triple cropping may not possible in a given year. However, there are many aspects that impact the agricultural system, such as social capital, farmer welfare, irrigated water, and the price of rice. The next stage of research, we will perform a field survey with more attention to the kind of social-economic aspects of those changes.

### Conclusion

Understanding of vegetation dynamics of agricultural land in Java Island provides information about the time of water need for the cropping. Then, since the cropping calendar of agriculture land is different for each area, this detail information is useful for improving the effectiveness of irrigation water in agricultural lands.

**Key words:** Vegetation dynamics, agricultural land, enhanced vegetation index (EVI), MODIS, Java Island



# CHARACTERIZING VEGETATION DYNAMICS OF AGRICULTURAL LAND IN JAVA ISLAND, INDONESIA

Yudi SETIAWAN<sup>\*)</sup>, Kunihiko YOSHINO<sup>\*\*)</sup>

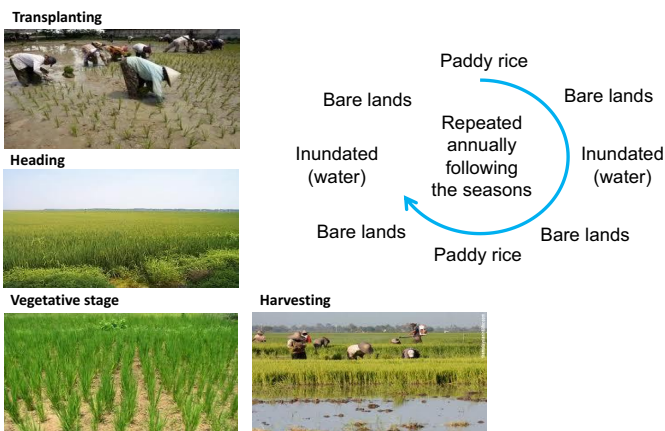
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## Introduction

Water is the key natural resource, and a dynamic water supply thus is a critical challenge if agriculture is to be sustainable. As populations grow and urban water demands increase, competition for water has intensified. Concerning an agricultural land of the tropical regions, some trajectories of agricultural land are repeated annually following the seasons, such as: paddy - bareland - secondary crops - bareland, paddy - bareland - inundated - paddy - bareland - secondary crops, and paddy - bareland - secondary crops - bareland - inundated - paddy, they are eventually describing temporal patterns that are characteristic of that agricultural land, which reflected in temporal variations or fluctuation of the vegetation attributes, either the Vegetation Index (VI) or Leaf Area Index (LAI).

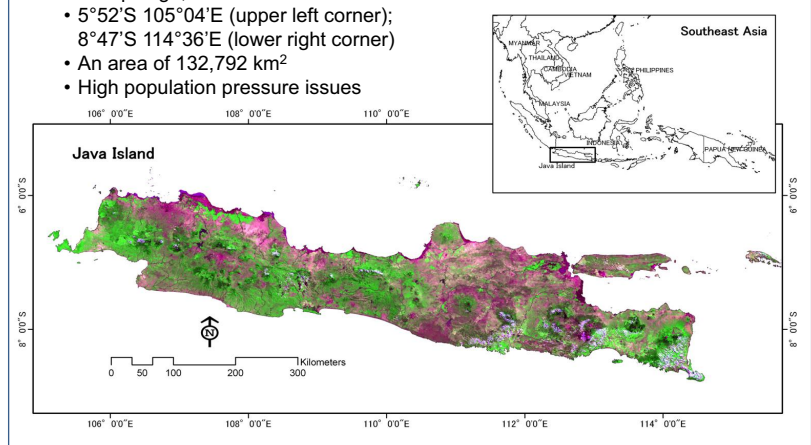
**Objective** To observe the dynamic system of agriculture based on temporal pattern change in tropical region



## Study area

- The southern rim of the Indonesian archipelago,
- 5°52'S 105°04'E (upper left corner); 8°47'S 114°36'E (lower right corner)
- An area of 132,792 km<sup>2</sup>
- High population pressure issues

Figure 1. The study area



## Methodology

- The MODIS EVI datasets acquired from January 2001 to December 2007 (captured 161 time series with interval time 16 days).
- The data were obtained at no cost from Land Processes Distributed Active Archive Center (LP DAAC), U.S. Geological Survey ([https://lpdaac.usgs.gov/lpdaac/get\\_data/data\\_pool](https://lpdaac.usgs.gov/lpdaac/get_data/data_pool)).

$$EVI = G \frac{\rho_{nir}^* - \rho_{red}^*}{\rho_{nir}^* + C_1 \rho_{red}^* - C_2 \rho_{blue}^* + L} (1 + L)$$

where,  $\rho_{nir}^*$  and  $\rho_{red}^*$  are the remote sensing reflectances in the NIR and red, respectively,  $L$  is a soil adjustment factor. The  $C_1$ ,  $C_2$ , and  $L$ , are empirically determined as 6.0, 7.5, and 1.0, respectively.  $G$  is a gain factor set to 2.5 (Huete et al. 1997).

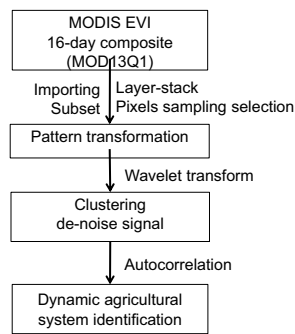


Figure 2. Flow chart of data analysis

## Results

e.g. The changed of heading time

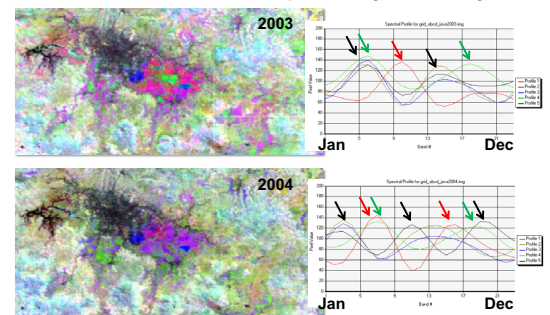


Figure 3. The change of heading time of several type of paddy field in 2003-2004

## Discussions and Conclusions

The results explained that the seasons, it was the most of important factor which affected the change of dynamics agricultural system. The long dry season or the extreme dry season by global climate changed caused many agricultural lands become bareland/un-planting as well the planting time was postponed. In some areas, even if the irrigation infrastructure exists locally in these areas, if irrigated water is limited, double or triple cropping may not possible in a given year. However, there are many aspects that impact the agricultural system, such as social capital, farmer welfare, irrigated water, and the price of rice. The next stage of research, we will perform a field survey with more attention to the kind of social-economic aspects of those changes.

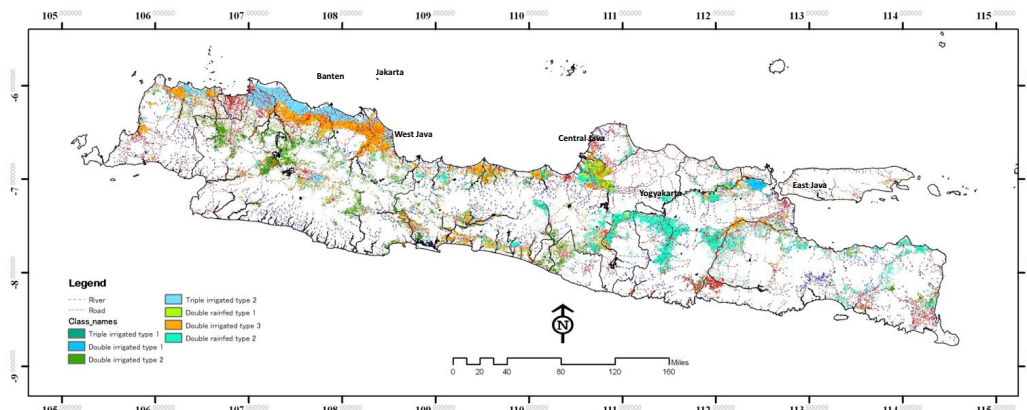


Figure 4. Agricultural system in Java Island identified by temporal pattern analysis



## Poster No. 22

# **Mangrove Management Information System (MMIS) as a Tool for Mitigating the Effects of Forecast Climate Changes along the Coast of Northern Vietnam**

Pham Tien Dat

*Graduate School of Life and Environmental Sciences,  
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The vast majority of population in Vietnam lives in the lowland and near the coastal areas, which are vulnerable by rising sea level and tropical cyclones. Mangrove forests play a vital role for protect dyke systems and prevent shoreline erosion as well as defend the impact of storms and flood risk; however, these forests are under severe threat due to the rapid growth of population and migration into the coast. In order to monitor mangrove change, satellite based mapping is used. Moreover, Geographic Information Systems (GIS) and Remote Sensing application could be applied for analyzing how the mangroves interact with population centers, infrastructure and other land uses in order to locate areas that are in the most critical need for intervention and then using Mangrove Management Information System (MMIS) to model the sea level rise, flood hazard, vulnerability and risk mapping in order to predict the effects of climate change. Based on that, it could be progressed for mitigation and adaptation to climate change through improved management of mangroves along the coast and proposed long terms strategies to protect and enrich the livelihood and the security of people living in the lowland in the coastal zones in Vietnam.

**Key words:** *Climate change, GIS, mangrove change, Remote Sensing, risk mapping.*



# MANGROVE MANAGEMENT INFORMATION SYSTEM AS A TOOL FOR MITIGATING THE EFFECTS OF FORECAST CLIMATE CHANGE ALONG THE COAST OF VIETNAM



MSC. Student PHAM TIEN DAT, supervisor: Prof. K. YOSHINO - Institute of Engineering and Sciences Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan

## INTRODUCTION

Much of Vietnam, over 75% is mountainous areas; however, approximately 80% of the population live near the coast. These areas are threatened by rising sea levels associated with climate change, and frequently visited by tropical storms.

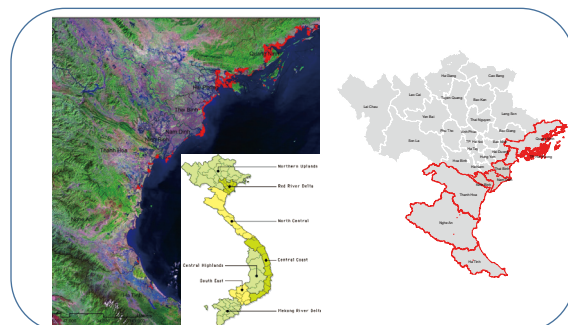
Mangroves provides protection from both of these events. They play an important role to protect dyke systems. Moreover, they are found in the inter-tidal zones where they prevent shoreline erosion and act as the first line of defence against the impact of storms and associated risk of flooding. Nevertheless, over the years they have been destroyed or degraded due to high population growth and migration into coastal areas.

Like other countries in Southern Asian, the mangrove area in Vietnam has decrease markedly. Between the years 1980 and 2005, the area of mangroves declined from 270,000 hectare to 157,000 (FAO, 2007). Therefore, the identification and monitoring mangrove forests is vital and important in order to support coastal zones management and planning programs. A combination between satellite based mapping and Geographic Information System (GIS) is used to analyze how the mangroves changes and then to locate areas that are in most critical need for intervention.

## STUDY SITES AND OBJECTIVES

### Specific objectives:

- Analyzing mangroves changes using GIS and Remote Sensing techniques;
- Understanding mangrove changes due to expansion of aquaculture, paddy cultivation and urbanization;
- Modeling rising sea level, flood hazard, vulnerability and risk mapping to predict effect of climate change;
- Propose long term strategies to protect and improve the livelihood of households living in the coast.



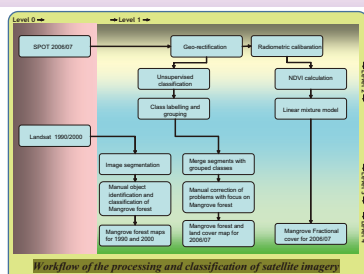
## DATA AND MATERIALS

Satellite sensor	Date of acquisition	Spatial resolution	Spectral resolution
ALOS	2008/09	2.5 m	Panchromatic, Pan-sharpen
ALOS	2008/09	10 m	Multi-spectral (4 bands)
SPOT	2006/07	20 m	Multi-spectral (4 bands)
Landsat ETM+	2000/01	30 m	Multi-spectral (6 bands)
Landsat TM	1989/91/92/93	30 m	Multi-spectral (6 bands)



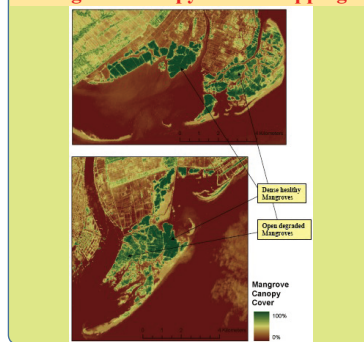
Feature	Source/type
Mangrove maps	Satellite imagery/raster
Land cover (e.g. aquaculture and croplands)	Satellite imagery/raster
Infrastructure (roads, railway etc.)	Topographic maps*/vector
Population (towns, settlements)	Topographic maps*/vector
Land elevation	ASTER GDEM
Flood hazard maps	Satellite images/raster

## METHODOLOGIES



Workflow of the processing and classification of satellite imagery

### Mangrove Canopy Cover Mapping



### Flood Hazard Mapping

Definition: Hazards refers to a dangerous phenomenon that may cause loss of life, or economic damage (Ben Wisner et al, 2009)

Rank	Flood depth (cm)	Class
1	0-50	Very low hazard
2	50-150	Low hazard
3	151-300	Moderate hazard
4	301-450	High hazard
5	More than 450	Very high hazard

### Vulnerability Mapping

Vulnerability: is influenced by the capacity to anticipate, cope with, resist and recover from the impact of a hazard

Feature	Input	Rank	Nominal	Weight
P	Settlement density	1 to 5	From low to high	0.25
I	Road density	1 to 5	From low to high	0.5
L	Distance to Heritage	1 to 5	From close to far	0.25

$$\text{Vulnerability} = ((P * w_i) * (L * w_{ii})) / (I * w_{iii}) \quad (\sum w = 1)$$

### Risk Mapping

Definition: Risk is the combination of "Hazard" and "Vulnerability"; more specifically and probable level of loss to be expected from a predictable magnitude of hazards (UNISDR Terminology and 'At Risk' by Ben Wisner et al.)

$$R = H \times V$$

R: risk mapping  
H: hazard mapping  
V: Vulnerability mapping

		Vulnerability score				
		1	2	3	4	5
Hazard score	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25
Low risk						
Medium risk						
High risk						
Very risk						

## EXPECTED RESULTLS

A variety of maps provide an overview of the pattern and potential hazard activity along a stretch of coastline.

Map 1: Coastal defence

Map 3: Coastal assets and coastal population (Vulnerability map)

Map 2: Potential coastal hazard

Map 4: Coastal risks and planning guidance

This research is related to coastal biodiversity and biological application for mangrove forests conservation and management.



## Poster No. 23

# Policy for Risk Management in Rice Value Chain to Adapt with Climate Change in Vietnam

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Rice is the most important crop in Vietnam; rice production is livelihood source of well over 50% Vietnamese population. It contributes about 1.5 billion USD of export turnover annually. It has an immense role in ensure food security and partly contributes to world food security as result of its position in the world rice export market. However, presently, rice production in Vietnam has to face increasingly difficulties due to climate change, especially in the Mekong river delta and the red river delta, where dominating more than 70% of total rice quantity. In addition to annual flood, abrupt climate variation causes extraordinary loss for rice production. Therefore, promoting risk management capacity to mitigate loss caused by climate change in rice production is extremely necessary.

To date, government has clearly recognized that climate change adversely affects to rice production, yet it does not have specific policies for risk management in rice production. Risk management makes it possible to implement all process of management such as planning, organizing, leading and assessing. The ultimate objective of risk management is to mitigate loss that may occur for rice cultivating community that has motivations to use all social resource to cope with climate change. So community-based risk management responding to climate change is also an effective solution to lessen loss in rice production. It also aims to secure livelihood and income for farmers and related stakeholders.

To achieve these objectives, literature review, questionnaire and expert meeting will be conducted to collect information about what is considered as risk in rice value chain, how present farmers, stakeholders and government respond to risk and what kind of policy measures should be implemented. The research will also use a simulation model to evaluate what the most dominant factors among those affecting rice production such as CO<sub>2</sub> concentration, temperature fluctuation, land use change, water resource management etc. Both negative and positive elements in rice production and market will be revised to find out a holistic policy for risk management.

In conclusion, climate change is a global issue, which affects many aspects of environment. The sooner measures conducted effectively, the less loss human life have to pay. Solving climate change problem requires a holistic and systematic approach, it also require for begin with specific solutions for specific cases. Thus risk management in rice value chain may be a typical example for a solution to a specific issue in the context of climate change. It regards many issues from current production and market, respond of farmers to policy makers then addressing the most appropriate solution to mitigate loss and improve livelihood for farmer and involved stakeholders.

**Key words:** Risk management, Value chain, Climate change, Institutions, simulation modeling

Student name: Hoang Thanh Tung  
Student Number: 201025047

## Objective and methodology

## Map of Vietnam by the regions

### General objectives

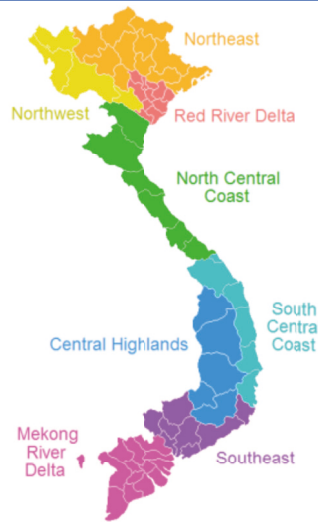
- 1) Defining risks in rice value chain
- 2) Identify appropriate policies and protocols for rice production in regions
- 3) Improving the capacity of rice cultivation community to adapt with climate change

### Methodology

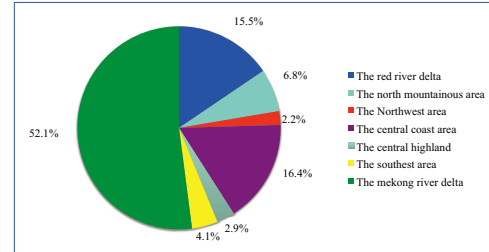
- 1) Use value chain approach in analyzing climate elements to all processes of rice from production to final consumption
- 2) Use simulation to identify level of climate factors impacting rice cultivation
- 3) Establish policy framework for risk management, analyze present policies and future perspective

### Research place

Research thesis will be focused on the two main rice cultivation regions: the red river delta and the mekong river delta

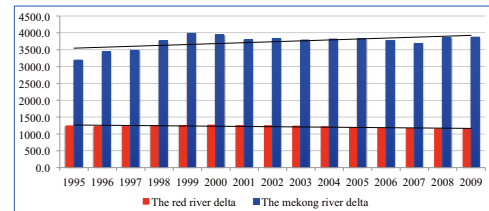


## Structure of rice production area by main regions



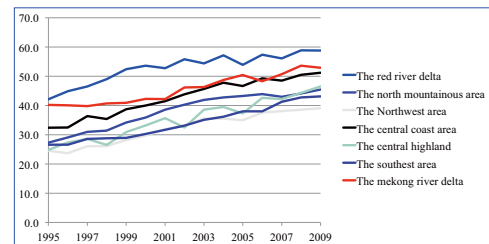
## Change of production area in the two main rice production region

Unit: 1000 ha



## Change in rice yield in differential regions

Unit: 100 kg/ha



## Planning contents

- 1) Current state of rice value chain, risk and food security in Vietnam
- 2) Policy measure for risk management and gap should be filled to adapt with climate change
- 3) Establish simulation model factors affect to rice production
- 4) Identify key factors affecting rice value chain
- 5) Recommend holistic policy for risk management in rice production in Vietnam

## Data requirement

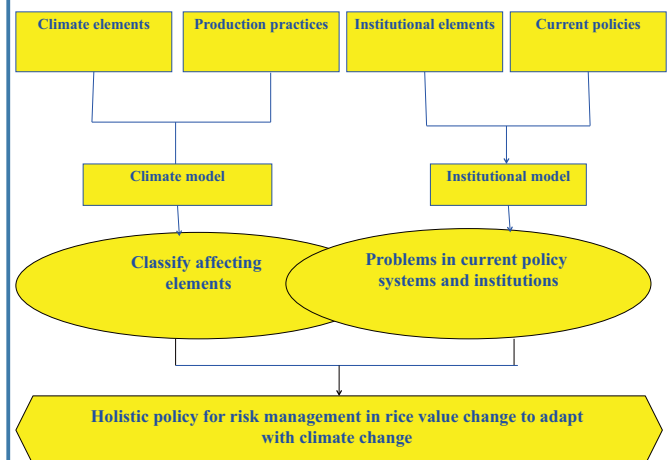
### Climate model and production practices

- CO<sub>2</sub> concentration
- Temperature
- Precipitation
- Fertilizer, pesticide and herbicide use
- Harvesting practice and market

### Institutional model

- National strategy
- Current policy of local government
- Current responds of producers and involvement stakeholders
- Community based risk management

## Simulation model for risk management in rice production



## Expected results

- Have policy framework for risk management
- Improve practical skills of farmers by providing persuasive information
- Improving rice production and trade practice of farmers
- A holistic strategy for risk management



## Optimization Approach for Municipal Waste Management in Beijing

Aijun ZHU

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Due to the rapidly increase amount of waste and change in composition of MSW (municipal solid waste), the strategies for waste management should be adjusted. This poster first presents the current condition of waste management system in Beijing of China, and then propose 4 options to analyze a relatively optimization approach for waste management not only cost factors but also the impacts on environment and human health are taken into account in this approach.

Scenario 0 consists of 89.6% of landfill, 5.8% of composting and 4.6% of incineration. Scenario 1 is to incinerate all waste. Scenario 2 includes 15% with RDF (Refuse-derived fuel) which is a fuel produced by shredding and dehydrating (MSW) with a waste converter technology. 85% of incineration. Scenario 3 is with 23% material recycling and 77% incineration. Due to lack of data to calculate, here I can just present part of my study, which just compared cost and diversion rate. The result shows that S1 is both low cost and high diversion rate from landfill. Although S4 showed the highest diversion rate from landfill, it also costs most. When we consider an integrated optimization approach and multi-scenario decision, using LCA (Life Cycle Assessment) technique to analyze more factors on the impacts on environmental and human health is effective.

This research is expected to help policy-makers to introduce policy more efficiency. Other factors analysis and policy proposal will be my next study subject.

**Key words:** MSW waste management, LCA, RDF, incineration, landfill



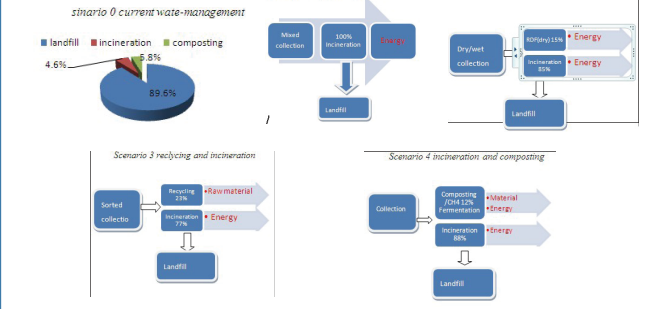
## ABSTRACT

Due to the rapidly increase amount of waste and changes in composition of MSW (municipal solid waste), the strategies for waste management should be adjusted. This poster first presents the current condition of waste management system in Beijing of China, and then propose 4 options to analyze a relatively optimization approach for waste management not only cost factors but also the impact on environment and human health are taken into account in this approach.

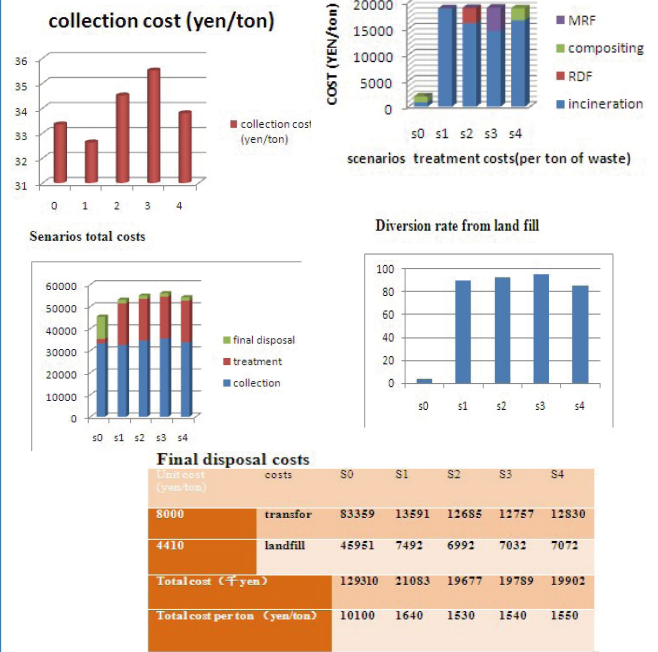
## INTRODUCTION

The generation of municipal solid waste in Beijing has been increasing rapidly for several years the amount of MSW generation in Beijing in 2006 was 5.382 million tons (involving a population of 15.81 million) which increased by 15.5% compared to 2005(NBSC,2007). It is recognized that effective MSW management in Beijing is very necessary to solve problems can caused by the substantial generation of waste(Pei,2003). Comparing with the current system this report try to find out a optimization approach, which considered integrated factors from environmental and socio-economic problems.

## Scenario modeling



## LCA analysis result



## CONCLUSION

This is my temporary master thesis study. In this study the data is from 2006 Beijing statistics yearbook and price calculate is from Japan. Comparing the scenario S0 to S4 we can see S1 is both low cost and high diversion rate from landfill. Although S4 showed the highest diversion rate from landfill, It also costs most. When we consider an integrated optimization approach and multi-scenario decision, using LCA (Life Cycle Assessment) to analyze more factors on the impact on environment and human health is effective. This research is expected to help policy-makers to introduce policy more efficiency. Other factors analysis and policy proposal will be my next study subject.

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B.D Xi J.Su, GH.Huang, X.S Qin Y.H Jiang..
- Survey of composition and generation rate of household wastes in Beijing, China  
Xiao-yan Qu a, Zhen-shan Li a,b,\*, Xin-yuan Xie a, Yu-mei Sui b, Lei Yang b, You Chen b  
a The Key laboratory for Environmental and Urban Sciences, Shenzhen Graduate School, Peking University, Shenzhen 518055
- Introduction to waste management week 9  
Integrated waste management systems: scenario modeling Helmut Yabar

## ANALYSIS

### 1.WSM generation

#### Basic information of Beijing

Division s : 16 districts 2 counties  
289 towns and villages  
Population : 22,000,000 (2009).  
Area municipality : 16,801km2  
Density : 1,309.4/km2  
GDP : US\$173.7 billion (nominal)  
US\$283.92 billion (PPP)  
Per capita: USD10,070 (nominal)  
US\$17,063 (PPP)

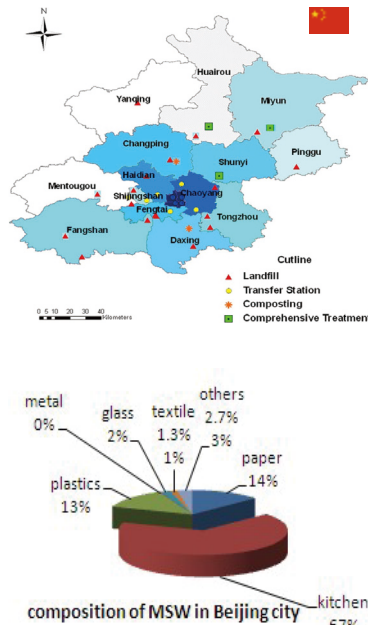


Fig.2

### 2. Current MSW transportation and disposal system

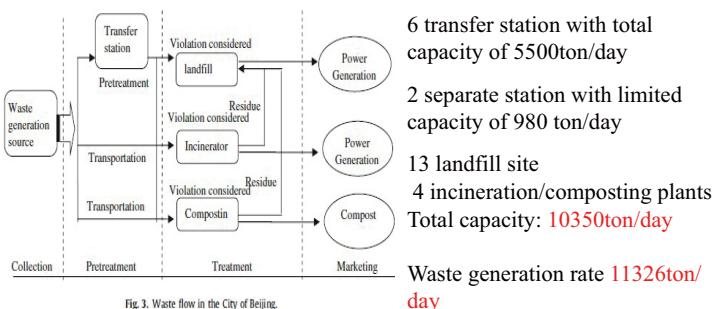


Fig. 3. Waste flow in the City of Beijing.

### 3.Scenario modeling and analysis

In order to find the optimization approach for municipal waste management in Beijing. Considering the current condition I assume 4 scenarios and compare the impact and cost on environmental and socio-economic.

## Poster No. 25

### **Economic Evaluation on Waste Water Treatment Approaches in Rural Area: A Case Study of Yi Long Lake, Yun Nan Province of China**

Sun Shuang

*Graduate School of Life and Environmental Sciences,*

*University of Tsukuba, Ibaraki, Japan*

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This research focuses on comprehensive evaluation on the influence of environmental technologies and policies on local development with reference to economic and social aspects by means of computer modeling and simulations. Since the environmental technologies and policies can generate significant social, economic and natural impacts, these impacts will not be easily changed once these technologies and policies are implemented. Therefore, a comprehensive evaluation both on social aspect and environmental aspect should be made beforehand, which could provide a stable and credible reference for the policy makers.

The level of eutrophication in Yilong Lake, Shi Ping County, Yun Nan Province, China has been high, due to the over use of chemical fertilizer in the field lands and also waste water discharged from households. In order to mitigate high eutrophication caused by these non-point pollutions, local government built Chenghe Artificial Wetland in 2005. The main purpose of Chenghe Artificial Wetland is to treat the water of Chenghe River by using absorption and immobilization function of vegetations which planted is Chenghe Artificial Wetland. Those functions can reduce the eutrophic pollutants such as nitrogen and phosphors within the water body which originate from the sectors discussed above. However, the vegetations harvested from Chenghe Artificial Wetland are not properly treated. Most parts of vegetations are incinerated, and rests of the vegetations are taken as fertilizers through composting process. The local government is taking biomass utilization plan into considerations to treat the harvested vegetations properly.

Three scenarios regarding the different features will be analyzed in this research: the traditional sewage treatment construction plan, artificial wetland treatment facilities and integrated model of artificial wetland and biomass plants. The first step of the research will be literature survey. Then, general information collection will be conducted. The information will includes pollution situation, artificial wetland construction situation, and current biomass utilization information and so on. A correspond modeling and simulation will be carried out after the data collection. In modeling step, a mathematical model will be made regarding the current situation, and then future economic and environmental prediction will be done by means of computer programming. Finally a proposal will be issued based on the simulation results.

**Key words:** Constructed Wetland, water eutrophication, non-point pollution, comprehensive simulation, biomass utilization

# Economic Evaluation on Waste Water Treatment Approaches in Rural Area A Case study of Yi Long Lake, Yun Nan Province of China

Sun Shuang  
Graduate School of Environmental Science, Tsukuba University

## Introduction

Water environmental issue has been a popular topic all over the world since it relate to human lives, biodiversity, ecological conservation and other vital environmental issues. Sewage discharge, non-point pollution and followed water body eutrophication phenomenon has always been focused by the scientists. The trend of water body eutrophication is retarded after decades of technology improvement and environmental conservation. However, there is still no efficient method available for treating non-point pollution caused by chemical fertilizer utilization in the farmland.

This research focuses on comprehensive evaluation on the influence of environmental technologies and polices on local development with reference to economic and social aspects by means of computer modeling and simulations.

My research target is to evaluate and simulate social impacts and environmental impacts of different comparison of waste water treatment approaches and conduct a comparison between integrated system of artificial wetland with biomass facilities and traditional sewage treatment facilities.

## Study Area Information

The target field of my research is Chenghe Artificial Wetland which located besides the main branch river of Yilong Lake, Shiping County, Honghe Prefecture, and Yun Nan Province of China. As a polluted lake, the pollution sectors of Yilong Lake are total phosphors, ammonia-nitrogen, transparency, chemical oxygen demand, biological oxygen demand, and chromaticity. Annual temperature of Yilong Lake is around 18.0°C, the height of bottom of lake is 1,407.11 meters, and its volume is 44,000,000 square kilo meters. The main branch rivers include Chenghe River, Cheng Nanhe River, and Cheng Beihe River. Except Chenghe River, all the other rivers are seasonal rivers.

Intent to mitigate the level of eutrophication situation of Yilong Lake, local government built Chenghe Artificial Wetland in 2005. The main purpose of Chenghe Artificial Wetland is to treat the water of Chenghe River by using absorption function and immobilization function of vegetations which planted in Chenghe Artificial Wetland. Those functions could reduce the eutrophic pollutants such as nitrogen and phosphors within the water body. The main pollution sectors are non-point pollution from the farm land and local house hold. The effects of this artificial wetland are satisfied through years observation, however, the vegetations harvested from Chenghe Artificial Wetland annually are not properly treated. Most of them were incinerated, and rests of the vegetations were taken as fertilizers through composting process. The local government is taking biomass utilization plans into considerations to treat harvested vegetations properly.

## Scenario Design

### Scenario One

- Traditional Treatment facility Study

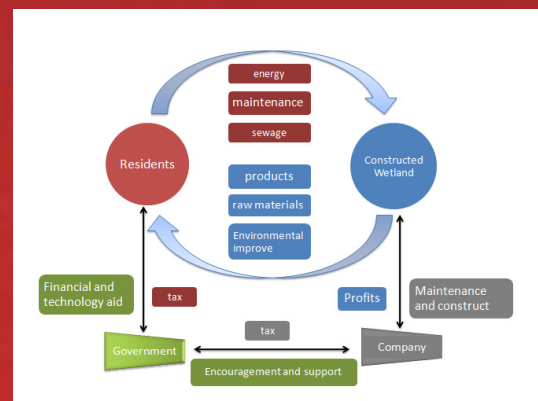
### Scenario Two

- Artificial Wetland Treatment without biomass energy utilization

### Scenario Three

- Artificial Wetland Treatment with biomass energy utilization

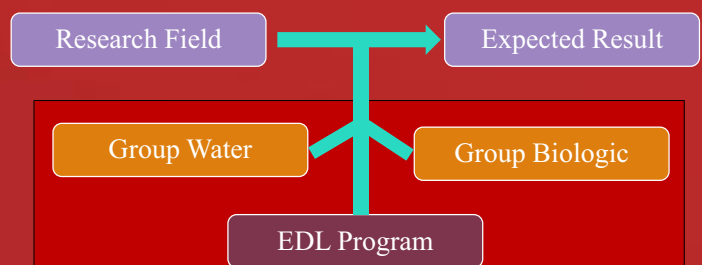
## Economic Flow



## Expected Result of Research

In the case study, both advantages and disadvantages of Constructed Wetland Water Treatment Approach will be reviewed and discussed from both environment aspects and social aspects. It might be helpful for the future study of rural area water treatment, and also could be a new option for the water treatment construction which located in the lower density of population.

## Relationship with EDL Program



## Poster No. 26

# Impacts of Land Use/Cover Change on Water Environment in Fuzhou City, China

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*Graduate school of Life and Environment Sciences,  
University of Tsukuba*

Land-use and land-cover change (LUCC), is a general term for the human modification of Earth's terrestrial surface. Though humans have been modifying land to obtain food and other essentials for thousands of years, current rates, extents and intensities of LUCC are far greater than ever in history, driving unprecedented changes in ecosystems and environmental processes at local, regional and global scales. One significant effect of these changes is the water environment degradation. Water environment is very important for forming and maintaining abundant water resource. Sufficient water resource/supply is very essential and important for the development of the society as if the vital blood circulation keeping the life of the city.

China has experienced rapid population growth and continuous expansion in the past decades, resulting in considerable and sustained demand for land resources. Fuzhou City, as one provincial capital city of China, had gone through this period. And its rapid urbanization has imposed significant pressure on the land-use structure, terrestrial and aquatic ecosystems, in this area. One of the critical consequences is the hydrological system degradation which seriously influences the sustainable development of this city. In the latest decades, the government is carrying out a policy called "1997-2010 land-use plans". Referring to some surveys, this policy has dramatically changed the land-cover in this area. Hence, a research which focuses on analyzing the relationship between land use/cover change and water environment degradation is very important.

In this research, remote sensing and GIS are used as a tool to analyse land use/cover change, and to make LUCC maps. Water quantity and quality analysis are based on hydrology data, which is published in the government sites and national monitoring sites. The hypothesis is about relationship between water issues and LUCC, and the objective is to give the countermeasures of supposed water issues and finally make watershed management plans/policies.

This research not just contains technology and soft analyses, but also needed a comprehensive thinking about the society, economy and environment of the target city. And such kind of comprehensive thinking way is one of the essential skills for an environmental leader.

**Key words:** land use/cover change, watershed management, hydrology, remote sensing, GIS

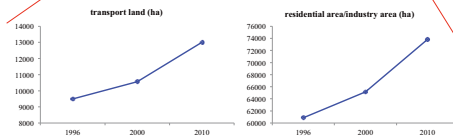


## Introduction

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118°08'---120°31' E and 25°16'---26°39' N  
Subtropics marine monsoon climate zone  
Mean annual precipitation 900~2100 mm  
Mean annual temperature:16°C~20°C  
Area: 12152.56 km<sup>2</sup> (urban area 1043km<sup>2</sup>)  
Population: 6.83 million (urban population 2.71 million)

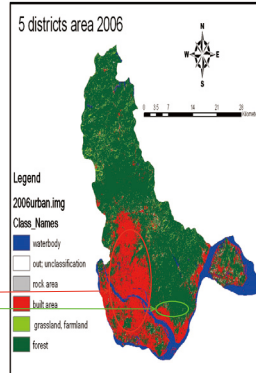
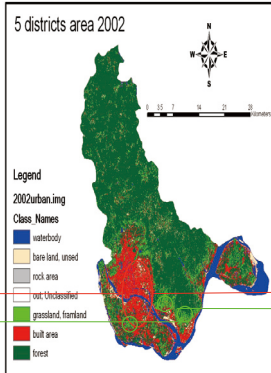
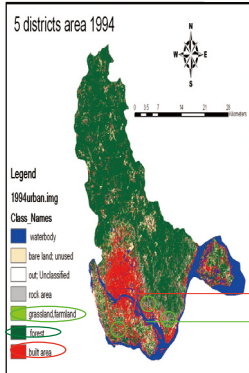
### Study area



The increasing area of construction land is concentrated on urban area (5 districts area).

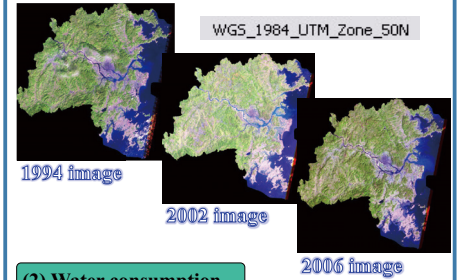
Due to urbanization and industrialization, intensively land use/cover change occurred.

### Land use/cover change



## Research data source

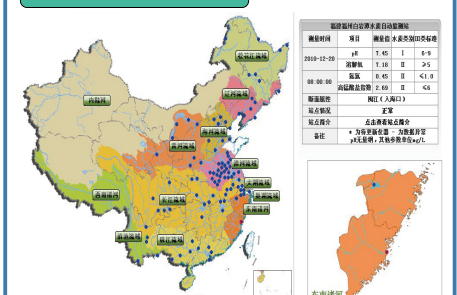
### (1) Satellite image



### (2) Water consumption

Year	Total water consumption (0.1 billion m <sup>3</sup> )		Agriculture		Industry		Domestic		Others	
	amount	ratio	amount	ratio	amount	ratio	amount	ratio	amount	ratio
1998	23.28	12.99	5.97	6.30	37.06%	3.99	17.11%	0.00	0.00%	
1999	25.22	12.72	51.44%	7.70	31.53%	4.29	17.01%	0.31	1.23%	
2000	21.61	11.12	51.44%	6.19	21.64%	3.94	18.23%	0.36	1.67%	
2001	23.36	12.79	51.75%	6.52	27.05%	3.96	16.95%	0.29	1.25%	
2002	25.45	12.68	49.81%	8.25	31.42%	4.15	16.31%	0.37	1.45%	
2003	29.66	11.89	40.09%	13.27	4.74%	4.12	13.89%	0.38	1.28%	
2004	30.20	12.04	39.87%	12.16	4.26%	4.16	13.77%	1.84	6.09%	
2005	31.35	12.20	39.90%	12.86	4.02%	4.48	14.33%	1.81	5.77%	
2006	31.57	11.70	37.06%	13.62	4.14%	4.56	14.44%	1.69	5.35%	
2007	32.83	11.77	35.85%	14.82	4.45%	4.47	13.62%	1.67	5.09%	
2008	33.21	11.64	35.05%	15.24	4.57%	4.68	14.09%	1.65	4.97%	
2009	33.92	11.90	35.08%	15.67	46.20%	4.70	13.26%	1.65	4.85%	

### (3) Water quality data



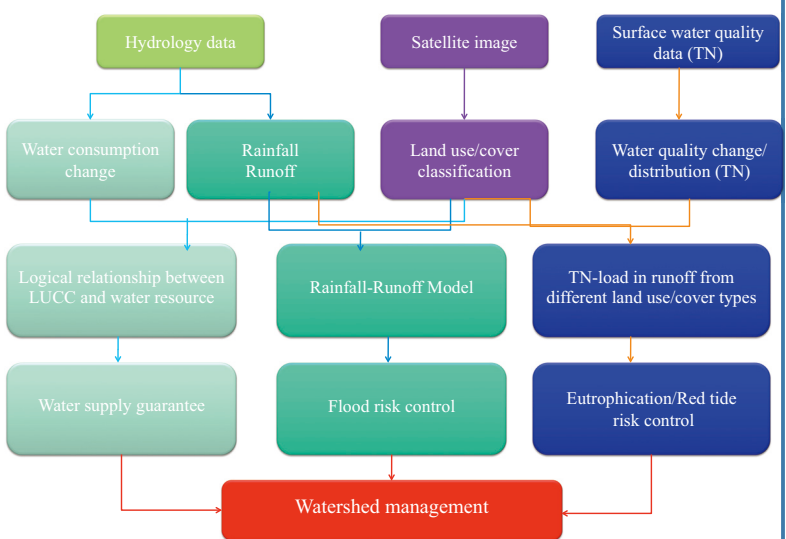
## Hypothesis and objective

- Under the dramatically development, such as, economic progress, population growth, urbanization and industrialization in this city, some unreasonable land use plans had been carried out, and water shortage has become a barrier of sustainable develop.
  - Increase of impermeable area, stream way change and so on, had increase the flood and water logging risk of this city.
  - The increase of nutrient loads such as nitrogen to the river due to land use/cover changes in surrounding areas has been the main factor of eutrophication/red tide in this area.
- The objective is to give the countermeasures of above mentioned problems and make watershed management plans/policies.

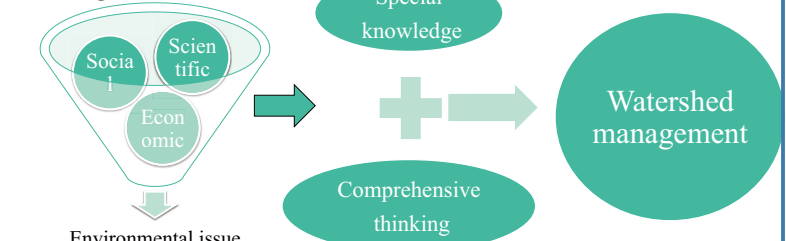
## Expected result

- Land use classification map will show us the land use change trend between 1994-2006.
- Combine the LUCC map and water consumption data, to find out the logical relationship, and then make a improved water supply plan.
- Flood risk level map, risk control management.
- TN-load map, eutrophication/red tide control management.
- Using the above analysis results to make a watershed management.

## Research Framework



## Learning from EDL





## Poster No. 27

# The Comprehensive Evaluation of Reclaimed Water Effectively Utilization Policy in Tianjin, China

Nan XIANG

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Water resources are one of the most important things-for human existence and social development. Also, with economic development and population increase in developing countries, water scarcity and pollution problems are becoming more and more prominent recently. Tianjin, one of four biggest municipalities in China, is located in northern China, near Beijing, the capital of China. Water shortage is a serious problem in Tianjin. The per capita water resources in Tianjin is 159.8 m<sup>3</sup> in 2008, it is only 1/13 of China average, and only 1/52 of world average. And a large part of its water supply relies on water transferred from Hebei Province. Furthermore, waste water reuse rate is really low, only 1.65% of reclaimed water is used in Tianjin. While the waste water disposal rate is 72.40%, a large amount of treated wastewater has not been used. With the rapidly regional development, water scarcity is intensifying and water pollution is deteriorating. Thus, it is important to research on wastewater utilization and recycles in order to solve water shortage and water pollution problems. This paper is concerned about a comprehensive reclaimed water utilization evaluation model with consideration of environment, societal and economic issues. This research also intends to utilize LINGO language to accomplish the simulation to give policy proposals to relief water shortage pressure, save energy, and perfect environment, and finally accomplish sustainable development in the study area.

**Key words:** Reclaimed water, water pollution, water resources recycle, modeling, Tianjin

# 中国天津市における再生水有効利用政策の総合評価

## The Comprehensive Evaluation of Reclaimed Water Effectively Utilization Policy in Tianjin, China

### Research Background:

Water resources is one of the most important thing for human existence and social development. Also, with development of economic and population in developing countries, water scarcity and pollution problems are becoming more and more prominent recently. Tianjin, one of four biggest municipalities in China, is located in northern China, near Beijing, capital of China . Water shortage is a serious problem in Tianjin. The per capita water resources in Tianjin is  $159.8 \text{ m}^3$  in 2008, it is only  $1/13$  of China average, and only  $1/52$  of world average. And a large part of its water supply relies on water transferred from Hebei Province. Furthermore, waste water reuse rate is really low, only  $1.65\%$  of reclaimed water is used in Tianjin. While the waste water disposal rate is  $72.40\%$ , a large amount of treated waste water has not been used. With the rapidly regional development, water scarcity is intensifying and water pollution is deteriorating. Thus, it is important to research on waste water utilization and recycles in order to solve water shortage and water pollution problems.

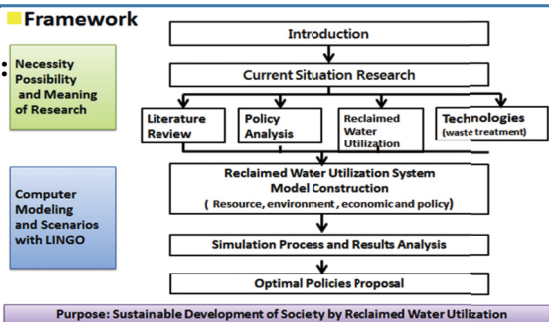


### Research Purpose:

This paper aims to give policy proposals to relief water shortage pressure, save energy, and perfect environment, and finally accomplish sustainable development in the study area—Tianjin, China.



### Research Framework:



### Research methods:

This paper constructed a **comprehensive reclaimed water utilization evaluation model** with consideration of **environment, societal and economic** issues. This research also utilized LINGO language to accomplish the simulation scenarios.

Nan XIANG

相楠

EDL member

Graduate School of Life and Environmental Sciences, University of Tsukuba

筑波大学生命環境科学博士后期1年生

### Model Frame:

#### Objective Function: Max GDP

#### 1. Water Cycle Model

$$WS(t) = \sum_j \sum_m WSP_j^m(t) + \sum_j \sum_m WSR_j^m(t) + \sum_j WSP_j^p(t)$$

WS(t): water supply in time t;  
WSPj(t): water supply from pipeline;  
WSRj(t): water supply from reclaimed water.

$$WS(t) \geq WD(t)$$

$$WD(t) = \sum_j \sum_m Ew_j^m X_j^m(t) + \sum_j \square Ew_j^p z_j(t)$$

WD(t): Water demand in time t;  
 $Ew_j^m$  : Coefficient of water demand of industry m in region j;  
 $X_j^m(t)$ : production of industry m in the area of region j;

#### 2. Water Pollutant Flow Balance Model

$$TP_p^m(t) = \sum_j \sum_m Ep_{-}^{pm} \cdot X_j^m(t) + \sum_j Ep^{ij} \cdot z_j(t)$$

$TP_p^m(t)$ : The total net load of water pollutant p at time t

$Ep_{-}^{pm}$ : Coefficient of water pollution p of industry m;

$P=1(COD), P=2(T-N), p=3(T-P)$

#### 3. Social and Economic Model

$$GDP(t) = \gamma X(t)$$

$$X(t) \geq A \cdot X(t) + C(t) + I(t) + B^{SP} \cdot I^{SP} + e(t)$$

X(t): Total product of industry in the study area(en);

A: Input-output coefficient matrix (ex.);

C(t): Total consumption at time t(en);

I(t): Total investment at time t(en);

$B^{SP}$ : Column vector of m-th coefficient that induced production by construction of sewage plant(ex);

$I^{SP}$ : Total investment for construction of sewage plant(en);

e(t): Column vector of net export(en);

I(t): Column vector of transfer product between provinces in China(en);

My research aims to construct **comprehensive evaluation model of effective reclaimed water utilization and optimal environmental policies** in catchment area.

The model should be established based on our society and economic facts, and it should be simulated our real world. Therefore, this evaluation I constructed content one object function—Maximize GDP, and three sub-models—water cycle model, water pollution flow balance model and social and economic model.

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