University of Tsukuba

Environmental Diplomatic Leader Education Program

EDL Annual Symposium 2012

February 15, 2013

Strategic Funds for the Promotion of Science and Technology

Contents

Awards in 2012

Outstanding Contribution Award:

From "*Coping with Global Environmental Problems: My Action and Future Vision"*

Yudi SETIAWAN

-D3 student
-Title: Land Use Change in Regional Scale of Java Island, Indonesia

Anis CHEKIRBANE

-D3 student
-Title: An Environmental Decision-Support System to Remediate Stressed Coastal Aquifers

Best Poster Award:

From "*Poster Presentation"*

DAO Minh Khue

-M2 student
-Title: Sustainable Wastewater Management from Paper Making Activities in Vietnam: Case Study in Phong Khe Craft Village

TRAN Dang An

-M1 student
-Title: Groundwater Flows System at Cu Lao Dung Island, Soc Trang Province, Vietnam

Miki TODA

-D1 student
-Title: Assessing Medicinal Plants as a Linkage between Health Care, Biodiversity and Livelihoods: Cases in Peruvian Amazon

EDL Annual Symposium 2012

2012 年度環境ディプロマティックリーダー年次シンポジウム

Aim: The academic year of 2012 is the fourth year of the EDL program. The program has 51 master's and doctoral candidates from nine countries now. Last June, six students graduated from the program, and we are looking forward to another 11 candidates who will graduate next March. Most of the activities of this program, such as the training courses, domestic and international internships, EDL special seminars, and the EDL café and debate are were productive and useful in 2012. To make more progress in 2013, the Annual Symposium will both review and evaluate our activities during 2012 and request suggestions and comments.

目的：「環境ディプロマティックリーダーの育成拠点」プログラムは、2012 年度で 4 年目に入り、9 ヵ国から 51 名の学生が履修しています。2012 年 7 月に履修生 6 名が修了し、2013 年 3 月にはさらに 11 名が修了する予定です。プログラムの履修科目をはじめ、国内と海外インターンシップ、スペシャルセミナー、EDL カフェとディベートなどの活動は着実・効果的に実施されています。本シンポジウムは、2012 年度の取組を概観し課題と展望について意見交換を行うとともに、プログラム履修学生による活動・研究報告を行い、今後のさらなる発展を期待します。

Date & Time: February 15, 2013 (Friday) 10：00～17：30
日時： 2013 年 2 月 15 日（金）10：00～17：30

Place: Laboratory of Advanced Research B, room110 for oral presentation and room 112 for poster presentation, University of Tsukuba
場所： 筑波大学　総合研究棟 B110 公開講義室（口頭発表）、112 講義室（ポスター発表）

Contact: EDL office (TEL:029-853-4958　E-mail: edlep@envr.tsukuba.ac.jp)
問合せ： 筑波大学生命環境科学研究科持続環境学専攻内 EDL 事務局

Program

10:00-10:10	Opening Remarks **TSUJINAKA Yutaka**, *Vice President of University of Tsukuba*
10:10-10:25	Keynote Address: The Strategic Program for Fostering Environmental Leaders in Asia and Africa **YAMASHITA Koujun**, *Program Officer for the Strategic Program for Fostering Environmental Leaders, JST*
10:25-10:50	Invited Speech I: "Water Resources in Tunisia: Management and Constraints" **Jamila TARHOUNI**, *Professor, Institut National Agronomique de Tunisie (INAT)*
10:50-11:20	Invited Speech II: Global Environmental Leader Education Network **Mahesh PRADHAN,** *Chief of Environmental Education and Training Unit, United Nations Environment Program (UNEP)*
11:20-11:30	EDL Activities in 2012 **SUN Xiaogang**, *EDL Associate Professor, University of Tsukuba*
11:30-12:30	Reports of International and Domestic Internships in 2012 Kenya: **HA Nam Thang ,** Mongolia: **WANG Wenlong,** Vietnam: **Mahdi IKHKAYEL,** Minamata Unit: **YANG Wei,** Domestic Internship: **SINGH Kumar Rajeev**
12:30-13:30	Lunch
13:30-15: 00	Coping with Global Environmental Problems: My Action and Future Vision (1) Role of the Environmental Diplomacy in Bridging Fundamental Water Sciences and Decision Making **Anis CHEKIRBANE, Tatsuki SHIMIZU, Wataru YAMADA, NGUYEN Thi Thu, PUN Ishwar, Mizuho TAKAHASHI, CHEN Jie** (2) Integrated Assessment on the Loss of Biodiversity and Bio-resources **Yudi SETIAWAN, Kazuyo NAGAHAMA, Maria Ludia SIMONAPENDI, HUANG Wenyu**
15:00-17:00	Poster Presentation **All EDL students**
17:00-17:15	Comment **ENDO Takahiro**, *Associate Professor, Osaka Prefecture University*
17:15-17:30	Future Perspective **WAKASUGI Naomi,** *EDL Professor, University of Tsukuba*
18:00-20:00	Reception Party

Poster Presentation

Poster presenters will stand by their posters to share their research and answer questions.

15:00 – 16:00: uneven number poster (1, 3, 5, …)

16:00 – 17:00: even number poster (2, 4, 6, …)

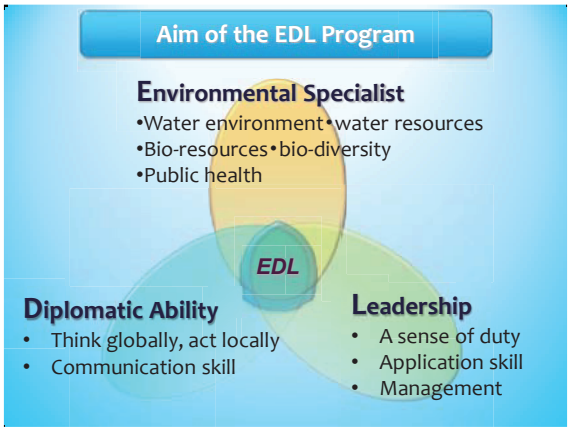
No.	Name	Title
1	Wanjun ZHANG	Dechlorination of Chloral Hydrate Is Influenced by the Biofilm Adhesin Protein LapA in *Pseudomonas putida* LF54
2	Nan XIANG	Comprehensive Evaluation of Socio-Economic and Environmental Policies Emphasizing Reclaimed Water Utilization to Effectively Achieve Sustainable Development in Tianjin, China
3	Yingxin ZHAO	Adsorption of Hexavalent Chromium from Aqueous Solution Using Natural Akadama Clay
4	Hao FANG	An Evolutionary Perspective of the *Pseudomonas* Quinolone Signaling
5	Shengjiong YANG	An Electrochemically Surface Modified Tablet Porous Material Developed for Phosphate Removal from Aqueous Solution
6	Mahdi IKHLAYEL	Towards an Integrated Municipal Solid Waste Management in Jordan A Life Cycle Assessment Study in Amman City
7	TOMIMATSU Kohsuke	Groundwater Recharge Process by Winter Precipitation in Tuul River Basin, Ulaanbaatar, Mongolia
8	VU Van Minh	Assessment of Impacts of Climate Change on Water Allocation on the Upper Cau River Basin-Vietnam
9	Syeda Masuma KHANAM	The Empowerment of Rural Women in Bangladesh for Environmental Conservation: Integrating Traditional Knowledge and Environmental Education
10	NGUYEN Thi My Quynh	Soil Erosion Prediction in the Watershed of Binh Dien Reservoir, Vietnam
11	NGUYEN Tu Anh	Estimating the Opportunity Costs of Forest Conservation and Management Policies Related to REDD+ Mechanism in Ba Be District, Bac Kan Province, Vietnam
12	DAO Minh Khue	Sustainable Wastewater Management from Paper Making Activities in Vietnam: Case Study in Phong Khe Craft Village
13	DANG Nguyet Anh	Economic Valuation of the Nha Trang Bay Marine Protected Area (MPA): A Willingness-to-pay Survey
14	HA Nam Thang	Seagrass Mapping Using ALOS AVNIR-2 Data In Lap An Lagoon, Thua Thien Hue, Viet Nam
15	BADAMSED Delgermaa	Wetland Management and Waterbird Conservation in Mongol Daguur Strictly Protected Area and the Buffer Zone, Mongolia
16	YADMAA Tseveenkhand	Environmental Management through Tourism in Khan-Khentii State Special Protected Area, Mongolia
17	Jie ZHANG	Interaction between Shallow and Deep Groundwater in Baiyangdian Lake Watershed, North China
18	Wansheng SHI	The Effect of Thermal Hydrolysis on Toxicity and Leachability of Heavy Metals in Sewage Sludge
19	Dahu DING	Modification of Nickel Oxide into an Andic Soil for Efficient Cesium Removal from Aqueous Solution

20	Shuhong LI	Utilization of Soybean Curd Residue for Polysaccharides by *Poria Cocos* and the Antioxidant Activities *in Vitro*
21	Wenlong WANG	Enhancing Aerobic Granulation for Nitrogen Removal By Combining with Electrochemistry
22	SINGH Rajeev Kumar	Solid Waste Management in Kathmandu City
23	DINH Thu Hang	Current Status and Solutions for Municipal Solid Waste Management in Gia Lam District, Hanoi City, Vietnam
24	Xiaojie TIAN	Inheritance of Indigenous Ecological Knowledge in a Changing World -A Case Study of Maasai Pastoralist Children in Kenya
25	BANU Yasin	Choices of Water Resources by the People in Relation with Water Borne Diseases in Kathmandu, Nepal
26	Yu LIU	The Anti-diabetic Activity of Actinidia Kolonikta Roots in the Experimental Hyperglycemic Rats
27	Xiaocun LIN	The effect of photocatalytic oxidation of Geosmin using TiO2-coated carbon
28	VO Thi Thu	Community-based mangrove forest management in Xuan Thuy National Park, Nam Dinh, Viet Nam
29	ERDENEBADRAKH Munkhjargal	Snow Cover Variation and It Is Change
30	NGUYEN Thi TAM	Assessing Livelihood Activities and Proposing Solutions for Adaptation to Climate Change in Vinh Giang Commune, Phu Loc District, Thua Thien Hue Province, Vietnam
31	TRAN Dang An	Groundwater Flows System at Cu Lao Dung Island, Soc Trang Province, Vietnam
32	Nurymkhan MARJANGUL	Biological Treatment of Tannery Wastewater Using Halophilic Bacteria
33	BUI Thi Tuyet Van	Evaluation of Groundwater Resources in Quality and Quantity at Binh Chanh District, Ho Chi Minh City, Vietnam
34	MIAH Md Tofail	Mitigation of Socio-Environmental Effects Created by the Large Developing Projects
35	Miki TODA	Assessing Medicinal Plants as a Linkage between Health Care, Biodiversity and Livelihoods: Cases in Peruvian Amazon
36	Qian ZHOU	Comprehensive Analysis of the Renewable Energy Promotion Policy to Reduce SO_2 and GHG Emission in Chongqing, China
37	YANG Wei	Comprehensive Evaluation of Policies for Water Quality Improvement and Effective Water Resource Utilization in Headwater Region of Liao River
38	Junping LIU	Evaluation of Nitrate Groundwater Remediation at a Long Term Running Permeable Reactive Barrier System Using Stable Isotopic Analysis
39	Yuto HAMAJIMA	Examination of Clean Water Technology: The Assessment of Main Reactions of Aerobic Granular Sludge within High-strength Organophosphate-contaminated Waste Water

EDL Activities in 2012

Sun Xiaogang
EDL Associate Professor, University of Tsukuba

1



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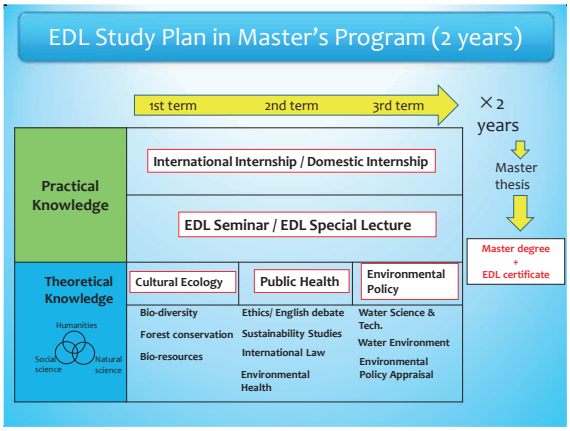

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International Internship in 2012

- **Kenya Internship** (Jul. 7th – 21st)
  - Urbanization and waste problems
  - Forest conservation and local NGO
  - Conservation and community-based management
- **Mongolia Internship** (Jul. 28th – Aug. 4th)
  - Air and water pollution in Ulaanbaatar
  - Mining industry and environmental problems
  - Biodiversity, conservation, and eco-tourism
- **Vietnam Internship** (Aug. 5th – 12th)
  - Public health
  - Aquaculture, eco-tourism, and conservation

5

Minamata Unit & Domestic Internship

- **Minamata Unit** (Nov. 21st – 25th)
  - Five Universities joint program
  - Learn Minamata Disease issues from different perspectives
  - Group work and PCM method
- **Domestic Internship** (Nov. 26th – 29th)
  - Minamata Disease and advanced research on mercury
  - Biodiversity conservation, fishing and farming in relation to the Isahaya Reclamation Project
  - History of modern industry and atomic bombing in Nagasaki

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EDL Special Seminar: Meet the Leaders

- **Responsibility and vocation to be a leader**
- **Global and local responses to various environmental problems**

Lecturer	Institute	Theme
Mr. Kohei Nakamura	Senior Negotiator for climate change, **Ministry of Foreign Affairs, Japan**	**Climate Change Negotiation and Japan's Diplomacy**
Dr. Koki Maruyama	Executive Research Scientist, **Central Research Institute of Electric Power Industry**	**Global Warming, Now and Future**
Ms. Yuri Itoh	Manager of Environment Planning Center, Environmental Strategy Office, **Hitachi, Ltd.**	**Environment and Business**
Dr. Sarantuyaa Zandaryaa	Specialist, International Hydrological Programme, **UNESCO**	**Water in an Urbanized World**
Dr. Arata Kochi	Former Director of the WHO Global Malaria Programme	**Leading Global Malaria Control**
Dr. Kunihiko Hirabayashi	Director, **UNICEF** Tokyo Office	**Children in Changing World**

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PCM (Project Cycle Management) Workshop Jan. 11th-12th

Instructor・Moderator：Mr. Ohsako Masahiro (PCM Tokyo)

Purpose	Improvement of ability for problem finding, project planning, project implementation and policy making
Theme	Safety and Security of Drinking Water
Accomplishment	Students learned the **methods of problem analysis, objectives analysis, project selection and project design** through group discussion.

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EDL Cafe and Debate

Date	Event
2012.4.10	EDL Café to welcome fresh students
2012.5.25	**Debate**: "How can we maintain the balance between hunger and obesity?"
2012.6.20	**Debate**: "Do animals have right?"
2012.9.26	EDL Café to welcome fresh students
2012.10.31	**Debate**: "Should local citizen welcome the Eco Town Project in Minamata?"
2012.11.7	**Debate**: "Should the water gate of the Isahaya Bay salt pan embankment be opened?"
2012.11.14	**Debate**: "Should the government close down the Chisso company in Minamata?"
2012.12.21	EDL Christmas Party

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EDL Writing Center Use

EDL Writing Center offers proofreading of materials written in English such as thesis, research papers, presentation materials, and class reports, and so on.

Proofreader	Devena Haggis (Australia)
Office hours	9:00 AM to 4:00 PM, Mon - Fri

Writing Center Use 2012 - 2013

Document	Apr - Sep	Oct - Jan
Correspondence, applications and document review	48	15
Abstracts	7	8
Reports	1	4
Masters/Doctoral theses	8	4
Journal Submission	17	14
Power Point Presentations	5	6
Oral Presentations	1	0
Total	87	51

In most cases all submissions are reviewed and read at least twice sometimes more depending on the language level of the author.

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Students Presentations

11:00-12:00
Reports of International and Domestic Internships

13:30-15:00
Coping with Global Environmental Problems: My Action and Future Vision

(1) Role of the Environmental Diplomacy in Bridging Fundamental Water Sciences and Decision Making
Anis CHEKIRBANE, Tatsuki SHIMIZU, Wataru YAMADA, NGUYEN Thi Thu, PUN Ishwar, Mizuho TAKAHASHI, CHEN Jie

(2) Integrated Assessment on the Loss of Biodiversity and Bio-resources
Yudi SETIAWAN, Kazuyo NAGAHAMA, Maria Ludia SIMONAPENDI, HUANG Wenyu

15:00-17:00 **Poster Presentation**

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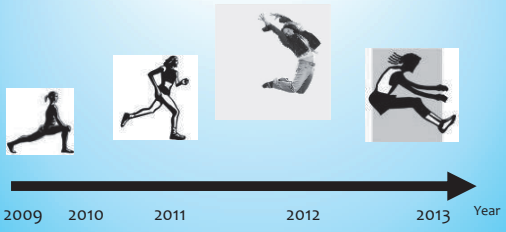
What has the EDL Program achieved and where are we?



Hop, Step, Jump, and reach the goal

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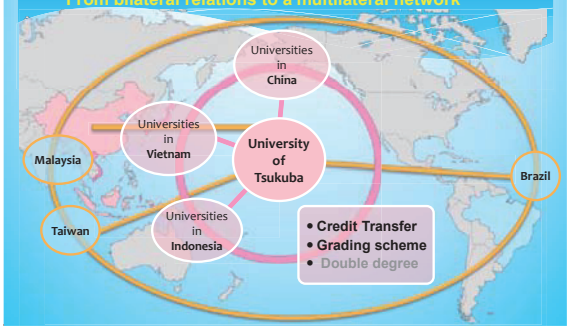
SUSTEP : A New Graduate Program in

Sustainability, Sciences, Technology and Policy

From bilateral relations to a multilateral network



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Kenya Internship (Jul. 8 – Jul. 21)

HA Nam Thang, Li Shuhong, Zhou Qian, VU Van Minh, NGUYEN Thi My Quynh, NGUYEN Tu Anh, KHANAM Syeda Masuma, BADAMSED Delgermaa, YADMAA Tseveenkhand, Tian Xiaojie

We focused on three broad issues for our internship in the Republic of Kenya which lies astride the equator on the eastern coast of Africa. These are: Urbanization, economic development, and environmental problems in Nairobi, Nature Conservation in Kenya, and National Park Community Based Conservation and Environmental Education in Kenya. These topics were distributed among the group members and through literature review and power point presentations we gained theoretical knowledge prior to our trip.

During our internship, we visited slums and a waste dump site, Karura reserved forest in Nairobi, Amboseli National Park, and Community Based Conservation at Kuku group ranch in Kimana. We attended briefing sessions, talked directly with local people and officials of the Kenya Wildlife Service (KWS), Friends of Karura Forest (FKF), and, Maasai Wildlife Conservation Trust (MWCT). We also travelled through Amboseli National Park and Kimana Sanctuary to observe the problems of wildlife and nature. Thus we experienced the current situation regarding environmental problems in Kenya. Urbanization is causing increased energy demand, pollution, and waste problems in Nairobi. In the case of wildlife conservation, even though there are major policy documents- Wildlife (Conservation and Management) Act, wildlife still faces major challenges such as: human wildlife conflicts; habitat fragmentation and blockage of migration corridors, and poaching. In Amboseli National Park the main driving forces for deforestation and vegetation loss are: illegal logging, invasive and alien plant species, the density of elephants, and intensification of human activities outside the park. Although a Community Based Conservation strategy has been adopted by MWCT, complaints about benefit sharing suggests that local people are not satisfied with the wildlife policy as local people lose their customary land, wild animals cause harm to their cattle and agricultural produce. On the other hand, some cultural practices of many tribes are unfriendly to the environment. Policies and programs such as Environmental Education and Environmental Movements have been designed and organized to face environmental problems. But EE is curricular based failing to address the goal of Sustainable Development. Environmental Movements are highly dependent on international donations. Poverty, political conflict and the ethnic background of various tribes are also some challenges in this regard.

Despite these challenges, some progess has been gained in Kenya. Karura Forest management and conservation facilitated by the idea of multi-stakeholders cooperation and the distribution of responsibilitiy between stakeholders, the Green Belt Movement, and outreach Environmental Education programs are strategies that useful for other developing countries.

Key Words: Environmental problems, urbanization, nature conservation, wildlife conservation, environmental education, environmental movement, community based conservation

KENYA
A DISCOVERY JOURNEY

Group leader: Sun sensei

Group members:
- HA Nam Thang
- NGUYEN Thi My Quynh
- NGUYEN Tu Anh
- VU Van Minh
- Masuma Khanam
- Badamsed Delgermaa
- Yadmaa Tseveenkhand
- Qian Zhou
- Li Shuhong

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CONTENTS

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1. TRACKS

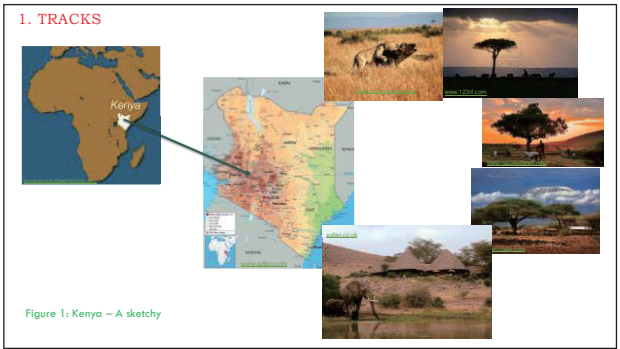

Figure 1: Kenya – A sketchy

3

KENYA: JEWEL OF EAST AFRICA

Tracks by Google Earth.

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DAILY TOPICS

Date	Topics
July 11st	Karura forest
July 12nd	Karura forest
July 13rd	Amboseli National Park
July 14th	Kimana sanctuary
July 15th	Olarin Swamp and Draja restoration
July 16th	Kuku group ranch
July 17th	The Massai people

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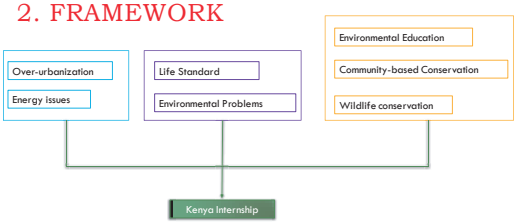
2. FRAMEWORK



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3. LAND COVER CHANGE AND URBANIZATION

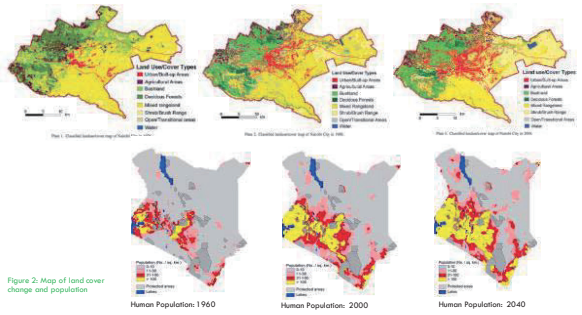

Figure 2: Map of land cover change and population

Human Population: 1960 Human Population: 2000 Human Population: 2040

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4. ENVIRONMENTAL PROBLEMS AND EDUCATION

◆Waste composition in residential area

◆Waste composition in Markets

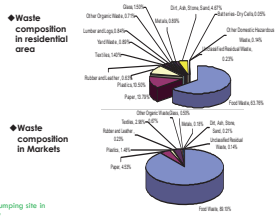

Figure 3: Dumping site in Nairobi city

Recycling projects:

Plastics : community based recycling

Food waste : community based compost activities, animal feeding(livestock :49%)

Others :Glasses Paper, metal, etc..

❖ ***The only one official dumping site: Dandora***

- Location : 7km from center Nairobi
- Area: 46 ha (only 2ha stone quarry filled-in)
- Waste Generation: 3,500,000 tons Around 1.8 million m³

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4. ENVIRONMENTAL PROBLEMS AND EDUCATION (CONT.)

More than **100 slums** in Nairobi

- ✧ **Lack of infrastructure**: water, electric supply & toilet
- ✧ **Natural disaster**: drought, flood

Slums in Nairobi-Huruma Slum

Environment improvement activities:

From outside:
water purification programs, School construction, Bio-fuel utilization programs, etc.

By Local People
- ❖ Vegetation planting
- ❖ Environmental education--waste collection

Strong community- family tie, share, exchange

Figure 4: Environmental issues in Nairobi city

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4. ENVIRONMENTAL PROBLEMS AND EDUCATION (CONT.)

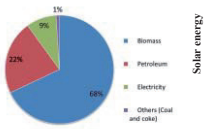
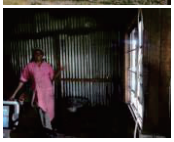


Figure 5: Energy distribution in Kenya

Solar energy



Biogas energy

Traditional biomass energy

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4. ENVIRONMENTAL PROBLEMS AND EDUCATION (CONT.)

Problems

1. EE fails to target the goals of Sustainable Development
2. Political activities do not go with the moral of EE and EM
3. Indigenous Ecological Knowledge is not included in the curricular.
4. Environmental NGOs are dependent on International donors, cultural values and local needs are not addressed sincerely.
5. From our visit to Kuku Group Ranch we learnt that the success of this GR is very much dependent on donors' contribution.

Solutions

1. Effective curricular for EE inclusion of IEK to address Sustainable Development
2. EE for all including political leaders
3. The environmentalist NGOs should reflect more on the issue of balancing the local needs of the people against the protection of forests and conservation of wildlife for sustainable development.

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4. ENVIRONMENTAL PROBLEMS AND EDUCATION (CONT.)

LEARNING POINTS

- Common peoples' cooperation can make environmental movement successful;
- Peoples participation is ensured by Forest Act,2005;
- Local people and their subsistence economic activities should be addressed by environmentalist NGOs
- EE is disseminated through out reach programs with local people
- Using local radio station for EE

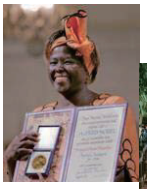

Figure 6: Environmental education

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5. FOREST MANAGEMENT AND CONSERVATION

1932 1954 1964 1993 Now

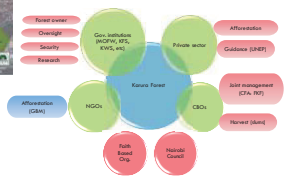
1061.1 ha 1041.1 ha 1041.3 ha 956.2 ha

Figure 7: Karura forest

Green lung of Nairobi capital, Kenya.

Threats: overexploitation – land grabbing.

Green Belt Management



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5. FOREST MANAGEMENT AND CONSERVATION IN AMBOSELI NATIONAL PARK (CONT.)

Deforestation and vegetation cover losing
- Illegal wood logging
- Alien plant species migitation ?
- High elephant population
- Land cover transferring
- Overgrazing
- High population

Restoration efforts
- Invasive plants removing
- Establish security road-blocks and patrols in logging hostspot
- Indigenous planting
- Nursery implementation
- Electric fences
- Science research

Figure 8: Mechanical control of invasive plants in Amboseli National park

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6. WILDLIFE CONSERVATION

Objectives and priorities:

- Conserve WL as a national heritage
- Provide a legal and institutional framework
- Develop methodologies and tools for effective assessment and monitoring
- Promote partnerships, incentives, positive attitudes

• Including:
- 22 National parks
- 28 National reserves
- 5 National sanctuaries
- 4 Marine National parks
- 6 Marine National rserves

Figure 9: Kenya protected areas

1898 Hunting Law → 1907 Game Department → 1945 Royal National Park → 1975 Sessional paper on future wildlife management → 1976 The conservation and Management Act → 1989 Amendment to the Act KWS Establishment

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6. WILDLIFE CONSERVATION (CONT.)

CHALLENGES FOR WILDLIFE CONSERVATION

1. Human population growth and encroachment
2. Human wildlife conflicts
3. Habitat fragmentations and blockage of migration corridors through subdivisions of land and fencing
4. Mushrooming tourist facilities
5. Livestock incursions
6. Poaching
7. Illegal wood logging
8. Climate change

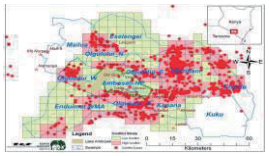

Figure 9: Human life and wildlife harmony

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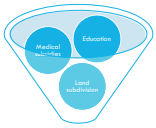
6. WILDLIFE CONSERVATION (CONT.)

COMMUNITY BASED CONSERVATION CASE STUDY: KUKU RANCH

Figure 10: Kimana sanctuary: A flagship CBC



African Safari Club

Figure 11: Community based management

Goal: To contribute wildlife conservation by protecting habitat with restrictions local resource use, improve rural livelihoods by encouraging tourism.

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Mongol Internship (Jul. 28 – Aug. 4)

WANG Wenlong, SAKAKBARA Kochi, DINH Thu Hang, DAO Minh Khue, DANG Nguyet Anh

The internship focused on air and water pollution in Ulaanbaatar city, water resources, solid waste management, natural conservation and eco-tourism and coal mining in Mongolia. From these aspects, we learn much information about nature resources and issues in Mongolia and knowledge about resource conservation and management.

Air pollution and waste management in Ulaanbaatar

The expansion of Ulaanbaatar, the capital city of Mongolia lead to a rapid increase in population. 40% of the total population lives in this city, and most of the increasing population settles in the Ger areas. As a result, waste generation is rising dramatically, especially in Ger areas due to a shortage of waste collection services. People throw solid waste everywhere causing many serious environmental problems. Moreover, Ulaanbaatar is facing serious air issues as a result of this increasing population and relatively disinterested management. Black carbon, Sulfur dioxide (SO2), Nitrogen dioxide and dust are the main contributors to air pollution, as well as power plant pollution, stoves, vehicular traffic and dust.

Water resources in Mongolia

Water resources in Mongolia are very limited and people in Mongolia mainly use groundwater and some surface water as water resources. However, growing urbanization and the mining industry have significantly polluted surface water and groundwater recently and excessive pumping in urban areas will possibly decrease the groundwater level.

Conservation and eco-tourism in Mongolia

At present, Mongolia stands at the crossroads between conservation and development. Eco-tourism in the Nature Reserves could provide a trend for sustainable development in Mongolia. The eco-tourism model implemented in the Red Rock Camping Site located in the Ikh Nart Nature Reserve is a good example of the harmony between development and conservation in the country.

Coal Mining in Eldev

We had a chance to visit the Eldev Coal Mine, located 300 km South East of the Mongolian capital Ulaanbaatar, run by the Mongolyn Alt Corporation LLC (MAK), the third largest domestic coal producer in Mongolia. The mine has resources estimated at 51 million tons with an area of 180 ha, and currently exports 500,000 tons of coal per year. Many environmental issues are caused by mining.. The issues should be managed, a better monitoring system applied and more effective concrete mitigation solutions developed.

EDL INTERNSHIP IN MONGOLIA

28th July to 4th August 2012

Environmental Diplomatic Leader
Annual Symposium 2013

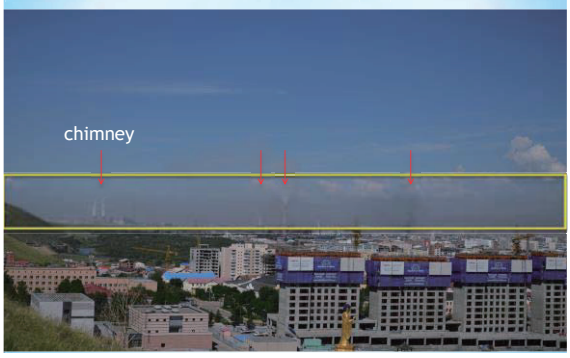
1

CONTENT

- Air Pollution in Ulaanbaatar
- Solid waste management in Ulaanbaatar
- Water Resources of Mongolia
- Nature conservation & Ecotourism potential
- Eldev Coal Mining site

2

1. Air Pollution in Ulaanbaatar



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Resource 1: Stove

- Sixty percent of the 220,000 registered households in total, of which approximately 130,000 households live in the Ger areas.
- Per year, each household is estimated to use 5 tons of raw coal and 3.0 m^3 of fuel wood.

Resource 2: Power Plant

- Power plant consume ~3.5 million tons of coal per year and emitted 33.3 ktons of PM, 35.7 ktons of NOx and 19.8 ktons of SO_2 (2005)

4

Resource 3: Vehicular traffic

- 92706 vehicles were counted in Ulaanbaatar and 43.6% of them were 4-6 years old, 41.2% 7-10 years old and 5.9% were over 11 years old cars which are highly tend to be polluting the environment.

Resource 4: Dust

5

2.Solid waste management in Ulaanbaatar

- Ulaanbaatar city was expanded

➡ Population increases rapidly; 40% of the total live in city; The most of increased people settle in the Ger areas.

-Solid waste generation increase especially in Ger areas.
- There is no proper solid waste management practice is existing in Mongolia

Fig.1. Ulaanbaatar city

Fig.2. Ash from heating fuel in winter
http://mongolianeconomy.mn/en/p/1811

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Solid waste treatment and landfill

- There is no waste recycling activities
- Some types of wastes (plastic, can, bone, etc) are collected for export.
- There are only 2 landfill sites in the city and many dumping sites in Ger areas

➡ Inadequate waste disposal system creates huge problems on the environment and human health.

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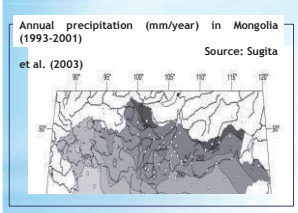
3. Water Resources of Mongolia



Arid, Semi Arid

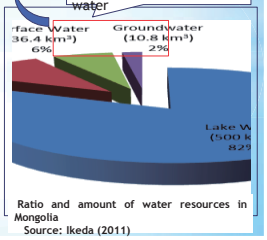
Precipitation Small amount

→ 50 mm ~ 400 mm / year

90 % of population use groundwater

・only 8 % of water resources → utilizable

except unavailable lake water



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Kinds of water in Mongolia

Tuul river at UB

Recharge groundwater

Very important role

No Tuul river No UB City

Well at UB (Ikeda 2011)

well → distribution point → Local people

If excessive pumping → Seriously affect

Spring and river at Gobi

nomadic people, wild animal

Well at Gobi

・one of the water resource
・very clean

・for live stocks
・drinking water

If overgrazing

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4. Nature conservation & Ecotourism potential

*Mongolia stands at the crossroads between conservation & development

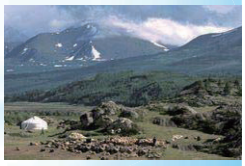
*Rare & endangered species: snow leopard, Argali and Ibex…

*11.6% of the country as protected areas

* Foreign visitors to Mongolia's protected areas: 15 000/year

*Total revenue: US$30 000.

*"Wild nature" → tourist attraction



Source: Mongolia Destination Guide, 2008

http://www.wipo.int/wipolex/en/text.jsp?file_id=204024#LinkTarget_314

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Ikh Nart Nature Reserve (NR)

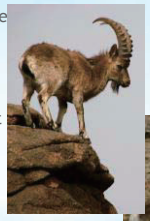
*Located East Gobi Province of Mongolia

*Established in 1996

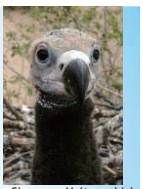
*Area: 66,000 ha

*Grassland and semi-desert steppe environments

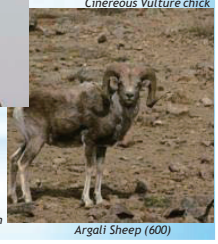
*Rare wild species: Argali, Ibex… are threatened by poaching for their meat and horn



Siberian Ibex (200)



Cinereous Vulture chick



Argali Sheep (600)

Source: www.ikhnart.com

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Eco-tourism at the Red Rock Camping Site

- Green energy: solar panels and wind mill supply the basic lighting demand of tourists
- Animal dung: for heating the Gers
- Waste is collected twice a week to take to the station for disposal
- Library with information about the NR and conservation for tourists (many English books) to raise awareness of conservation
- Tourists learn how to live in harmony with the nature and live an eco-life

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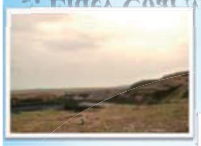
5. Eldev Coal Mining site



•40-50 of 120 ton trucks/day
•Train periods in transporting the coal for consumption and export
•Arbitrary routes created by coal trucks

•300 km far from the capital Ulaanbaatar
•Run by MAK, 3rd biggest company in Mongolia on coal exploretation
•Area: 180 ha
• 51 million tons of reserved coal
•Exports: 500,000 tons/year

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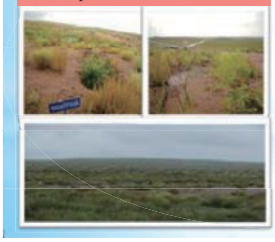
Eldev Coal Mining site

Dust Pollution
influencing on daily life activities of human and animal, damaging on pastureland and landscape.

Solutions:
The Mongolian Ministry of Nature and Environment issued policies on environmental protection and recovery after completing coal explotation.



Recommendations:
A better mornitoring system
Improving roads
Requiring trucks (loading and speed limits)
develop the sustainable exploitation and use of coal resources.

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THANKS FOR YOUR ATTENTION

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Vietnam Internship (Aug. 5 – Aug. 12)

Mahdi Ikhlavel, Lin Xiaocun, Singh Rajeev Kumar, Xiang Nan, Miki Toda, Liu Yu, Banu Yasin, Yuto Hamajima

The EDL Internship in Vietnam was held from August 5th to 12th, 2012. Eight students; Xiang Nan, Toda Miki, Mahdi Ikhlayel, Lin Xiaocun, Rajeev Kumar Singh, Liu Yu, Hamajima Yuto and Banu Yasin participated in the internship led by Prof. Naoko Kaida, Prof. Naomi Wakasugi and Prof. Rie Murakami. During the five day stay in Vietnam, the members visited three cities; Hanoi, Nha Trang, Hue and nearby areas and learned about waste water management, wastewater treatment, public health activities and biodiversity protection.

On the first day, participants learned about water issues and management in Hanoi through a visit to Thang Long Industrial Park and its wastewater treatment facility located on the outskirt of Hanoi City and to JICA Hanoi office followed by a technical visit to the second Hanoi drainage project for environmental improvement, established by JICA. Next day in Hanoi, the focus was on public health issues, and we became much more aware of the link between health and environmental issues through the visit to WHO Vietnam office and Bach Mai Hospital, one of the most important hospitals in Vietnam. On the following day, the members moved to Nha Trang, located on the South Central Coast and the Nha Trang Bay Marine Protected Area (MPA), the first comprehensively developed and managed MPA in Vietnam. The members also visited the Pasteur institute in Nha Trang and Alexandre Yersin Museum and learned other aspects of infectious disease control activities and history. On the fourth day, the members moved to the city of Hue, visited the Tam Giang Cau Hai Lagoon, which has unique geographic and environmental properties and learned the practices of bio-diversity conservation and livelihood improvement programs. On the last day, the members visited the office of Genetic Counseling and Disabled Children (OGCDC), whose main focus is to help children with disabilities in all parts of Vietnam, especially with the high rates of poverty as a consequence of the war.

Besides all these visits, two events held were (1) JDS-EDL Reunion Seminar at the Ministry of Natural Resources and Environment (MONRE) with a lecture by the Director General of International Cooperation from MONRE and (2) International seminar with Hue University of Agriculture and Forestry where students and faculty from each university gave presentations on their research topic.

The Vietnam Internship was a great opportunity for members to better understand the relationship between public health and the environment as well as the link between technology and social aspects in order to solve environmental issues.

Internship to Vietnam
2012 Summer
Aug. 5th – 12th

Environmental Diplomatic Leader Program
University of Tsukuba,

1

Vietnam

- Location: South East Asia
- Population:87.84 million
- Area:331.212 km²
- GDP: $USD 124 billion
- Capital: Hanoi
- Major Cities & Population(2009):
  - Ho Chi Minh City 5.976 million;
  - Hanoi 2.668 million;
  - Haiphong 1.941 million;
  - Da Nang 807,000
- Currency: Vietnam Dong

Economic growth has been seen in the recent years, which made Vietnam as a mid-developed country

2

The route and participants of Vietnam Internship

Main cities visited: Hanoi, Nha Trang, and Hue

Participants:
Prof. Naoko Kaida, Prof. Naomi Wakasugi, Prof. Rie Murakami, Xiang Nan, Toda Miki, Mahdi Ikhlayel, Lin Xiaocun, Rajeev Kumar Singh, Liu Yu, Hamajima Yuto, Banu Yasin

Contributors:
Dr.Wu Guogao, Dr.Akiyama, Dr.Chien, Professor Nguyen Quang Linh, Mr.Nguyen Trung Thuan, Mr.Tadashi Suzuki
Mr. Nakahara, Mr. Sasaki, Ms. Nguyen Thi Bich Huong
Mr. Truong Kinh, Mr.Ty, Mr. Dang Nguyet Anh, Mr. Ha Thang

3

Day 1: Hanoi

8/6	Mon	Hanoi	9:00	WATER	Water environmental management (Mini lecture and wastewater treatment in Thang Long Industrial Park)
			13:00-14:00	WATER	JICA Vietnam Office: Guidance on Japanese ODA in environment and health in Vietnam
			15:00-17:00	WATER	JICA Second Hanoi Drainage Project for Environmental Improvement (II): Yen So pumping station and Truc Bach wastewater treatment plant

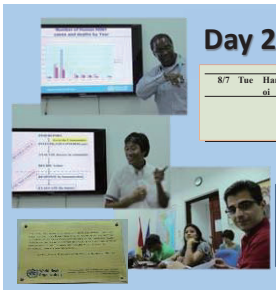
JICA Vietnam Office

Environmental contribution of JICA Vietnam Office
- pollution (BOD)control of Water
- Management structure
- Law enforcement which can achieve environmental standard
- Waste management case studies

JICA Second Hanoi Drainage Project
- protection of rivers, lakes and water basins
- provides drainage and security in case of emergency

4

Day 2: Hanoi



8/7	Tue	Hanoi	9:00-12:00	HEALTH	WHO Vietnam Office
			13:30-15:00	HEALTH	Bach Mai Hospital
			16:00-17:00	EVENT	JDS-EDL Reunion Seminar at MONRE & Dinner

WHO Vietnam Office

Lessons in WHO Vietnam Office
- Decrease in patients of non-communicable/ **sexually transmitted diseases**
- Medicine usage and regulation

Bach Mai Hospital

Activities of Bach Mai hospital
- Food, waste and drug security to protect patients and civilians
- Cooperation with federal facilities

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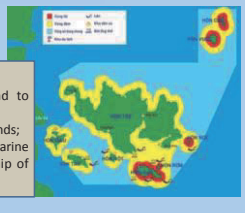
Day 3: Nha Trang

8/8	Wed	Nha Trang	4:00	-	departure from Hanoi to Nha Trang
			10:00-14:00	BIODIVERSITY	Marine biodiversity and sustainable tourism in MPA (Hon Mun Island by boat)
			15:00	HEALTH	Pasteur Institute and Alexandre Yersin Museum

Marine Protected Area

The Nha Trang Bay Marine Protected Area is the first comprehensively developed and managed MPA in Vietnam which was found in 2001.



The objective of MPA:
- To protect marine biodiversity environment and to enable local island communities;
- To improve livelihoods of local people living in islands;
- To effectively protect and manage the marine biodiversity in Nha Trang Bay with the partnership of other stakeholders."

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Day 3: Nha Trang

8/8	Wed	Nha Trang	4:00	-	departure from Hanoi to Nha Trang
			10:00-14:00	BIODIVERSITY	Marine biodiversity and sustainable tourism in MPA (Hon Mun Island by boat)
			15:00	HEALTH	Pasteur Institute and Alexandre Yersin Museum

Pasteur Institute

The Pasteur Institute, Nha Trang was founded in May, 1975. Now taking care of the 11 provinces as well as 99 districts in the central part of Vietnam, 11 million people are covered by Pasteur Institute.

Activities taking by Pasteur Institute:

- Surveillance and **epidemic prevention Vector control**, Clinical biology and vaccination Surveillance of water quality and environmental contaminants,
- Food safety testing,
- Hygiene at school Occupational health.

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Day 4: Hue

8/10	Fri	Hue	7:30-9:00	BIODIVERSITY	Community-based tourism
			9:00-13:00	WATER	Environmantal and socio-economic impact of aquaculture and fisheries on the Tam Giang Cau Hai Lagoon (by boat)
			14:30-18:00	-	International seminar with Hue University of Agriculture and Forestry

Ngu My Thanh hamlet at Tam Giang Cau Hai Lagoon

People traditionally **live on the boats** in Tam Giang Lagoon. Due to the annual storms in the area and severe damages caused by flood, in the late 1980s, the government **moved people to live on the land.** Various projects to improve livelihoods and maintain biodiversity around the Lagoon has been conducted.

Livelihoods of Ngu My Thanh Hamlet

- engaged in fishery
- the life on the land is, yet, the economy is not good enough
- shrimp aquaculture began in 2001 without specific technology -since 2004, aquaculture began bring profit.
- cultured shrimps (Black Tiger Shrimp) faces White Spot Syndrome
- eco-tourism established to protect ecosystem in 2010

8

Day 5:Hue

8/11	Sat	Hue	Morning	HEALTH	Rehabilitation hospital for victims of Agent Orange (chemical defoliants)

Office of Genetic Counseling and Disabled Children

Office of Genetic Counseling and Disabled Children is a private initiative (quasi NGO) under the management of Hue College of medicine and pharmacy.

Activities of Offce of Genetivc Counseling and Disabled Childre

- **Its main focus is to help children with disabilities** in all parts of Vietnam where have high rates of poverty as a consequences of the war.
- It has implemented a range of programs that provides vital assistance to stick and disabled children and their families in central Vietnam and central highlands.
- It has special twelve programs under which they are working. Such as ; **Heart operation Program, Treatment and Other Supports, Rehabilitation Program and so on**.

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Day 5:Hue

8/11	Sat	Hue	Morning	Visiting at Healing wounded shop

Healing Wounded Shop

Healing Wounded Shop which is run by with the collaboration of SPIRAL Foundation and OGCDC

Activities of Healing Wounded Shop

- In this shop they sell handicrafts made by disabled artisans using recycled materials.

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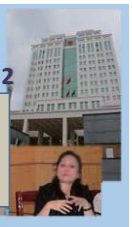
Events

JDS-EDL Reunion Seminar@ Hanoi, Day 2

The seminar was held at the newly built MONRE offic.

- Lecture from the director general of International cooperation of MONRE.
- Discussion with JDS-EDL graduates in various environmental Environmental Issues



International seminar in the University of Agriculture and Forestry @ Hue, Day 4

University of Agriculture and Forestry

- Explanation of their areas of interest and current research.
- Presentation of research by students and faculty from each university

11

Summary

- In the recent years, Vietnam witnessed a rapid economic growth development which negatively contributed to serious environmental issues & public health problems (e.g. **water contamination & air pollution**).
- The major environmental issues in the country's national agenda are: **air pollution control, wastewater treatment, water improvement, solid waste management & biodiversity conservation**.
- The internship was a great opportunity to learn about those issues & to better understand the links between **the environment, public health, technology & the social aspects** in order to tackle the environmental problems.

12

Minamata Unit (Nov. 20-25)

Yang Wei, Dinh Thu Hang, Banu Yasin, Adrianus AMHEKA, Nurymkhan Marjangul

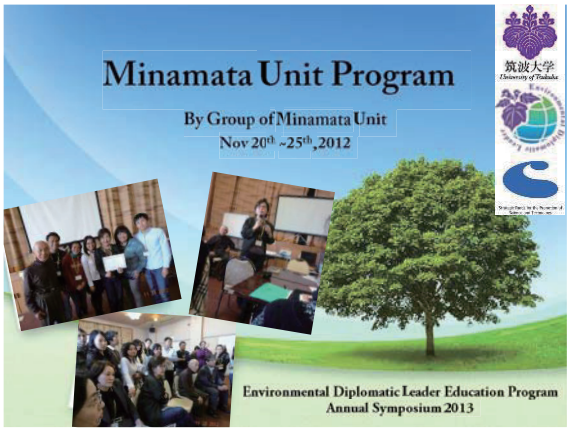
The Minamata Unit Program was organized by the University of Tokyo with the help of four other universities. I think everyone definitely enjoyed this internship. There were not only reports, stories of past experiences and visits, but also some group work using the Project Cycle Management Method. Why this disease occurred only in Minamata, why it occurred suddenly after 20 years of normality, how it affect local environment, local residents and the economy, why it has lasted so long, why Minamata disease issues have not been not solved yet. All of these questions are helpful for us to gain an integrated and deeper understanding of this environmental event.

Group work is essential to improve our ability as an Environmental Diplomatic Leaders, because everyone could join the group discussion to express their ideas and viewpoint. The most important thing was that the group members should possess the ability to express their own ideas, to convince others to agree with their point of view, to reach a unified conclusion. This means that we should possess negotiation skills. Otherwise, some big obstacles will appear in the group.

The information from different stakeholders is indispensable. Meetings and idea exchange with different stakeholders including victims, patients, scholars, research institutions, local media, social institutions, government and so on could be achieved during Minamata disease internship. We could understand this event from different perspectives deeply and comprehensively. However, sometimes we found out that some information was conflicting or inconsistent, especially the inconsistencies between government and other stakeholders. Sometime government officials didn't answer the questions from students and teachers directly. I think government officials should consider a lot of factors before making a decision or answer a question. However, it is unconscionable to control local media to publish real news. The right to know the Minamata disease situation is essential to everyone.

The government showed discrimination by using the law to reject applications for symptoms which were not included in the statutes. Only the patients who simultaneously, had the five symptoms that could be certified. The Chisso Company didn't cooperate very well with the local people, sometimes, they wanted to evade responsibility, and refused to provide some aid. Throughout the event, we should not only focus on sadness, but also pay more attention to human beings such as; what is right, what is wrong, how to face difficulties, how to face this situation and how to avoid such things from happening in the future.

It is necessary for developing countries governments and companies to learn the lessons from Minamata disease. If the governments only focus on economic development without paying enough attention to environmental protection, they will lose out, not only in the economy, but also in the environment, trust and lives of local people.


Minamata Unit Program
By Group of Minamata Unit
Nov 20th ~25th,2012
筑波大学
University of Tsukuba
Environmental Diplomatic Leader Education Program
Annual Symposium 2013

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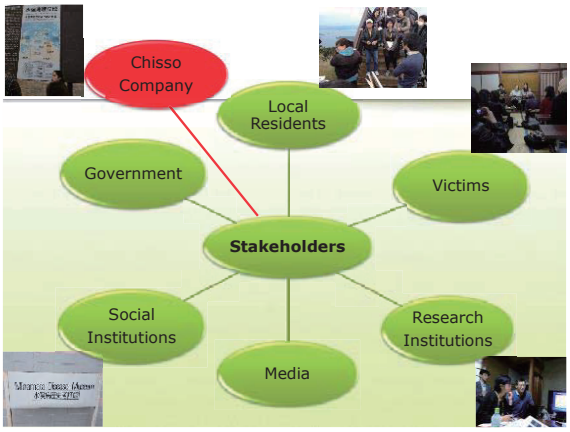
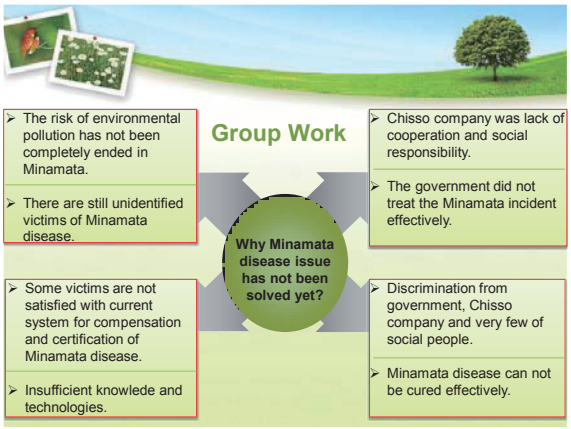

Chisso Company
Local Residents
Government
Victims
Stakeholders
Social Institutions
Research Institutions
Media

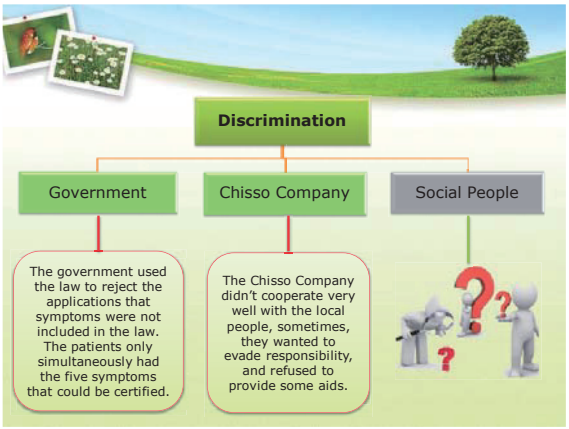
2


Group Work
The risk of environmental pollution has not been completely ended in Minamata.
There are still unidentified victims of Minamata disease.
Chisso company was lack of cooperation and social responsibility.
The government did not treat the Minamata incident effectively.
Why Minamata disease issue has not been solved yet?
Some victims are not satisfied with current system for compensation and certification of Minamata disease.
Insufficient knowlede and technologies.
Discrimination from government, Chisso company and very few of social people.
Minamata disease can not be cured effectively.

3


Group Work
Why Minamata disease issue has not been solved yet.
1
Knowledge
Ideas
Viewpoints
2
Expressing Ability
Negotiation Skills
Convincing Ability
3
Respect
Brave to Express
Acceptance

4


Discrimination
Government
Chisso Company
Social People
The government used the law to reject the applications that symptoms were not included in the law. The patients only simultaneously had the five symptoms that could be certified.
The Chisso Company didn't cooperate very well with the local people, sometimes, they wanted to evade responsibility, and refused to provide some aids.

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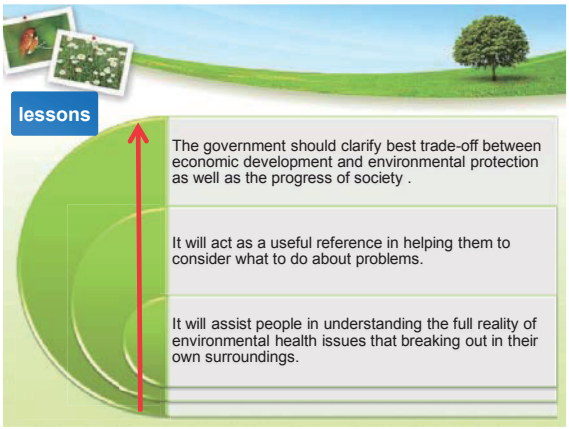
lessons
The government should clarify best trade-off between economic development and environmental protection as well as the progress of society .
It will act as a useful reference in helping them to consider what to do about problems.
It will assist people in understanding the full reality of environmental health issues that breaking out in their own surroundings.

6

Domestic Internship (Minamata, Isahaya, Nagasaki, Nov. 26-29)

Singh Rajeev Kumar, Dao Minh Khue, Dang Nguyet Anh, Wang Wenlong, Vu Van Minh, Nguyen Tu Anh, Ha Nam Thang, Miah Md Tofail, Liu Junping, Erdenebadrakh Munkhjargal, Zhou Qian, Yang Wei, Dinh Thu Hang, Banu Yasin, Adrianus AMHEKA, Nurymkhan Marjangul

The domestic Internship to Minamata gave the opportunity for all participants to visit and learn about Minamata Eco-Town, Isahaya bay and Minamata disease which broke out in 1956 at Minamata Bay, the huge consequences of which are still being felt now. Minamata Eco-Town is one of 26 projects approved by the Ministry of Economy, Trade and Industry and the Ministry of Environment and was officially established in 2001 with the aim to promote the establishment of a sound material-cycle society through citizen involvement. Similarly, the Isahaya Land Reclamation Project was started in November 1989 to facilitate reclaimed farm land and disaster prevention.

After having experienced the serious consequences of industrial pollution caused by Chisso Company to the environment and human health by Minamata disease, the local government and its citizens would like to improve and enhance the city by making it more environmental friendly through the Minamata Eco-Town plan. The concept in the Eco-town includes multi-stakeholders to create a sound recycling society, through a community based approach to achieve the 4R (refuse, recycle, reuse and reduce) by utilizing firsthand material and technologies and models for middle scale cities which differs from conventional styles such as complexes in big cities. On the other hand, the Isahaya Land Reclamation Project we visited cost a total of JPY 253.3 billion (USD 2.4 billion) to close the tidal dam gates for the separation of sea water and fresh water. The fishermen said that the Reclamation Work caused serious disturbance to the fisheries resulting in a decrease in fish catch. They appealed the case to the high court to open all the gates of sea dyke. However, the Project officer provided evidence that the sea dyke helped to enhance disaster prevention, and create highly productive agriculture land. The Isahaya Bay land reclamation project is a typical example of a public works project that is unable to be stopped once it is started. A number of debatable issues remain before the project can come to a satisfactory end for all the stakeholders with conflicting interests.

The EDL Domestic Internship in 2012 was very informative as we visited lots of places which taught us lessons regarding the risk of environmental pollution and its long term consequences. The visit to Minamata Eco Town taught us about the awareness among people and government to build a more environmentally friendly Eco-town. The visit to Isahaya Bay gave us an idea about conflict and the consequences created between farmers and fisherman after the closure of the dam gate to separate sea water and fresh water. So, the EDL Domestic Internship was very productive in providing skills to analyse different situations, learn how to act accordingly and provide lea

EDL Domestic Internship 2012

Minamata and Nagasaki

(26-29 November 2012)

Prepared by Domestic Internship Group

EDL Annual Symposium 2012
15th February 2013

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Content

1. Minamata eco-town
2. Minamata Disease Municipal Museum and Minamata Disease Information Center
3. National Institute for Minamata Disease
4. Yue fishery harbour and Ariake fishery association
5. Isahaya-bay Reclamation Office
6. Gunkanjima Island
7. Nagasaki Atomic Bomb Museum

2

Minamata eco-town

Separated E-waste

Wastewater Treatment

Television Dismantling

Recycle home appliances

Sludge dehydration
Process human waste and septic tank sludge and generate organic fertilizer

Minamata Environmental Techno Center

3

Minamata Disease Municipal Museum
Minamata Disease Information Center

Wastewater discharge Gate at Chisso Company

Minamata's Eco Park

Minamata Disease Information Center

4

National Institute for Minamata Disease (experiments and discussion)

Take hair experiments on mercury concentration

5

Yue fishery harbour
Ariake fishery association

Fishing facilities and tools have not used much anymore

Explanation at Isahaya bay

6

Agricultural Development in Isahaya Bay under Land Reclamation Project

Source: [1]

7

General Information about the Project and Local Agricultural Status

- 2 out of the main objectives of the Isahaya Bay Reclamation Land Project (IBRP) [3] [4]
  - Creating a new highly productive agricultural land; and
  - Securing water for agricultural and domestic use
- 600 ha of the reclamation land: good quality and has higher yield than other surrounding areas. two main activities implemated by the gov.:
  - Land for sale by lease system; and
  - Enhancing environmental-friendly agriculture [5].

8

Agricultural Activities and Development

- Farming activities: rice cultivation, vegetable cultivation, livestock raising, dairy production.
- Local government is encouraging researches - three main issues, [6]:
  - Large-scale agricultural production system > enhance environmental conservation technology;
  - High quality agricultural products and stable production technology ;
  - Recycling agricultural substance.
- Agricultural business inside the reclamation land has been run smoothly & developed (IBRP Office,2012)

Source: [1]

Source: [1]

9

Discussion

- Controversies between stakeholders: open or keep closing the water gates
- Very difficult question: related to both livelihood of many stakeholders and environmental protection issues.
- Keeping and following the current project would provide higher social benefits than turn it back to the wetland area [7].

=> Should recognize: any issue has its both advantages and disadvantages -> solving a problem is not to ignore all its advantages and turns it into something new but to reduce the disadvantges in a multi-benefit approach.

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NAGASAKI

Gunkanjima Island

Nagasaki Atomic Bomb Museum

11

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12

Coping with Global Environmental Problems: My Action and Future Vision

1) Role of Environmental Diplomacy in Bridging Fundamental Water Sciences and Decision Making
   Anis CHEKIRBANE, Tatsuki SHIMIZU, Wataru YAMADA, NGUYEN Thi Thu, PUN Ishwar, Mizuho TAKAHASHI, CHEN Jie

2) Integrated Assessment on the Loss of Biodiversity and Bio-resources
   Yudi SETIAWAN, Kazuyo NAGAHAMA, Maria Ludia SIMONAPENDI, HUANG Wenyu

(1) Role of Environmental Diplomacy in Bridging Fundamental Water Sciences and Decision Making

Introduction

Anis CHEKIRBANE
Senior EDL Candidate (D3)

Water problems are recently becoming a global critical issue especially in areas where this resource is no longer sufficient in quantity and quality, notably in arid and semi-arid regions. These environments are continuously expanding and covering a bigger fraction of the earth's land surface (Schlesinger et al., 1990). They represent 30% of the global terrestrial surface area (Dregne, 1991; Scanlon et al., 2006) and include some of the fastest-growing population areas in the world (Brown et al., 2005). Most of the scenarios for future water resources predict water scarcity, a decrease in precipitation and limitation in groundwater recharge for the next five decades (Milly et al., 2005; Doll and Florke, 2005). In these areas, people and ecosystems are particularly vulnerable to decreasing and more variable precipitation due to climate change. Thus, clarifying the water cycle on both a global and local scale is becoming a necessity. Understanding the exchange of water, material, and energy between the different components of the hydrologic cycle is critical to effectively address water quality and supply problems as well as to maintain ecosystem diversity and functioning (Wright, 1980; Winter et al., 1998; Sophocleous, 2002). The traditional water management approaches have reached their limits in coping with water scarcity; new competencies linking fundamental knowledge to decision making can succeed to provide a green solution guaranteeing water resources sustainability.

Water shortage, pollution and treatment are some of the main global water issues that need to be solved in an integrated and sustainable way. The water and environment group within EDL dealt with a large variety of water problems in different landscapes and climates. Studying and understanding the evapotranspiration processes of plants in the Nile Delta in Egypt provided practical and economic countermeasures for irrigation water saving. The application of isotopic mapping was an effective tool to identify the recharge and discharge zones of groundwater in Tunisia and provided important information about the water cycle. The study of interaction between surface water and groundwater in humid (Vietnam) and semi-arid regions (Tunisia) highlighted the connectivity between these two resources and the necessity to apply conjunctive management methods. Identifying the groundwater contamination sources and processes in the coastal aquifers of Tunisia facilitated the proposal of an adaptive remediation plan. The assessment of surface water and soil water contamination by radionuclides in Fukushima, Japan can constitute an early warning for the different stakeholders. Finding a suitable treatment for Chromium (IV) in wastewater in China can increase the safe water potential and its reuse for agricultural, industrial or domestic purposes.

Despite their local scale, these studies constitute an important asset in the decision-making processes for the sustainability of water resources in the entire globe.

An Approach of Water Science Research for a Decision Making to Water Shortage: A Case of the Nile-delta, Egypt

Tatsuki SHIMIZU

EDL Candidate (M2)

There are many kinds of global issues present in the world. One of the most severe issues is water shortage. This issue mainly can be seen in African regions, and it has been caused by both rapid population growth and arid climate. In African regions, especially arid climate areas such as Egypt and Tunisia, the amount of variable water resources have been limited for generations, and currently, the population has been increasing in such regions. Because of these situations, a new decision making process is required to increase the amount of variable water resources in such limited water resource regions. In Egypt, a project named NWRP (National Water Resources Plan) aimed to increase variable water resources through a reduction in water losses from the agricultural sector was established in 2005 by the Ministry of Water Resources and Irrigation of Egypt. As new challenges like those mentioned in these examples emerged new decision making processes have begun in some countries throughout the world. However, opinions and data from water science research have not overcome or supported these new challenges. In Egypt, the planting of windbreak trees is seen as one solution that reduces water loss in the agricultural sector. Windbreak trees prevent wind blowing into agricultural land, and reduce evaporation , which is one of the causes of water losses.. As evaporation is reduced, variable water resources that can be used in other agricultural lands could be increased. Thus in this manner, windbreak trees might produce a solution for water shortage in Egypt.

Additionally, the NWRP project report contained the following guidelines:. "NWRP is based on an Integrated Water Resources Management (IWRM) approach and considers all components of Egypt's water resources system and all functions and water user sectors. This means that NWRP includes also the policy areas of other ministries and that this document is 'owned' by all stakeholders involved. To this end there has been an intensive interaction between the NWRP project and the stakeholders, in particular within the inter-ministerial Technical Committee for Water Resources Management. The resulting plan and policies have been discussed and agreed upon in the inter-ministerial Technical and High Committees for the National Water Resources Plan project." This report also mentioned that other important results are the Policy Document and the supporting Technical Reports, and actually, these are complementary in the sense that,

- ✓ "The Policy Document presents the broad policy guidelines for the development and the management of water resources in Egypt",
- ✓ "The National Water Resources Plan describes the specific actions to be taken to implement the policy and provides the necessary background information"
- ✓ "The supporting technical reports contain the detailed information and data underlying the plan and describe also the analytical process that has been followed to develop the policy and the plan."

Thus, the NWRP project needs not only technical studies, but also political guidelines for broad management and development of water resources in Egypt. To support the decision making of the policy sector, technical reports must identify the situation and provide background information. Furthermore, technical reports must contain detailed information and data.

In this study, the effectiveness of windbreak trees for evaporation reduction was proven through measurement and model analyses, and according to the results, windbreak trees might significantly reduce the amount of evaporation in agricultural land. However, to get the best effects from windbreak trees, a decision making process is necessary, as the end result is influenced by the maintenance of the trees. For example, it is necessary to monitor windbreak trees suitable porosity, balancing cost and benefits, time lag between when the effect is required and the growth rate of trees. Therefore, this study finally proved the effectiveness of windbreak trees and characteristics of windbreak trees during this period.. Based on this research and other case studies, the optimum maintenance conditions for windbreak trees could be clarified, providing Egypt with a solution for water shortage through use of windbreak trees.

Keywords: Water shortage, Reduction of evaporation, Windbreak trees, NWRP project

Estimation of Spatial Distribution of Stable Isotopic Compositions in River Water, Northern Tunisia

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The Intergovernmental Panel on Climate Change (IPCC) warned that temperature will increase and rainfall will decrease especially in the Mediterranean coastal areas of North Africa including Tunisia with a global warming increase (IPCC, 2007). Tunisia depends on groundwater use for irrigation. To establish sustainable groundwater use, it is essential to understand the quantitative aspects of the groundwater system.

Stable isotopes (δD, $\delta^{18}O$) are useful tracer to estimate the groundwater recharging process. In general, the isotopic compositions vary with evaporation effect. If the water is not affected by evaporation, the isotopic compositions could be maintained until the water is discharged on the ground. Then, comparing the groundwater with rainfall in the recharging area enables us to estimate the recharging area of groundwater.

However, it is difficult to collect large scale rainfall data.. Kendall et.al (2001) showed the effectiveness of large-scale isotopic mapping by river water. Large rivers can integrate rainfall from huge watersheds, and reduce the large spatial variability of isotopes in rainfall. However, these kind of isotopic studies are few in Tunisia.

The purpose of this study is to construct a surface water isotopic map of Tunisia, and to identify parameters to express variation in isotopic compositions.

Field survey was conducted in July 2010 and 2011 during the dry season, November 2011, and March 2012 during the rainy season. Water samples were taken mainly from rivers and wells. In Tunisia, even during the rainy season, it was difficult to find surface water below the midland area. Therefore, this study concentrates on the northern area.

To estimate isotopic composition on a large scale, multiple regression analysis was undertaken using topographic parameters that average altitude in the watershed and flow length. These parameters have a good correlation with isotopic compositions. As a result, an interpolated isotopic map based on regression was constructed for Madjerda watershed located in northern Tunisia. This map seems to represent the isotopic values well.

Then, the isotopic map was applied to another watershed, the Sbiba area located on the southern side of the Madjerda watershed. The isotopic map was constructed based on multiple regression analysis using samples from Madjerda watershed in July 2012. Meanwhile, the samples from Sbiba were taken in July 2010. Even though, the estimation was conducted during different periods and in a different area with the Sbiba samples, the result seems to be reasonable. The estimated compositions around the ridgelines surrounding Sbiba area were relatively close to the observed isotopic compositions of deep groundwater in Sbiba. It is reasonable to assume that this kind of ridge area is a groundwater recharging area. This suggests that a large-scale isotopic map could help identify groundwater recharging areas.

Groundwater Flow System in Tay Island, Dong Thap Province, Southwest Vietnam

NGUYEN Thi Thu
EDL Candidate (M2)

Tay Island is located in the north of the Mekong River Delta, Dong Thap province, southwest Vietnam. Previous field research on Tay Island showed that surface water and groundwater are important water resources for daily use and agriculture. However, limited research has been undertaken on the groundwater flow system. Although groundwater levels relate closely to the Mekong River, the quantitative process of exchange between groundwater and river water has not been clarified. Therefore, research on the groundwater flow system on Tay Island was undertaken to clarify the process of interaction between groundwater and surface water, especially the process in relation to the seasonal fluctuation of the Mekong River.

Water samples were collected from the Mekong River water, the channel water, and the groundwater in shallow and deep aquifers in January (dry season) and October (rainy season) to analyze stable isotopes of Hydrogen (δ^2H) and Oxygen ($\delta^{18}O$), solute ion concentrations for the water samples. Measurement of Electrical Conductivity (EC), pH and water temperature were carried out on the field.

Analyzed tracing elements were classified with multiple aquifers which were identified based on hydrological classification, with the groundwater system on Tay Island at depths of 0 to 360 m classified into 5 aquifers. Geochemical composition of shallow groundwater at a depth of 0 to 150 m is classified into 3 aquifers. The 1st aquifer is characterized by Ca-HCO_3 type, is similar to river water. The 2nd aquifer

is characterized by Na-Mg-HCO_3. The water composition of the 3rd aquifer is characterized by the presence of Na-Cl, and is similar to fossil sea water. The deep aquifer, deeper than 150 m is clearly classified into the 4th and 5th aquifers being characterized by the presence of Na-HCO_3. The stable isotopic compositions of groundwater suggests that groundwater flows from the central area of the island to north and south of the island due to the effect of the pumping for irrigation during the dry season.

The stable isotopic compositions of water samples were affected by evaporation in the dry season and by precipitation in the rainy season due to the monsoon climate in the region. In addition, the interaction process between groundwater and the Mekong River water was clearly observed by the isotope and solutions tracers along with a seasonal fluctuation of the Mekong River water level. During the dry season the groundwater table of Tay Island was higher than that of the Mekong River leading to groundwater discharging out to the river, whereas, the groundwater was recharged by the Mekong River water due to the lower groundwater level than that of the Mekong River during the rainy season. Especially, the surface water and the groundwater interaction were dominant in the 1st and 2nd aquifers and partly in the 3rd aquifer which is located in the north of Tay Island.

Keywords: Tay Island, groundwater flow system, Mekong River, stable isotopes, interaction between groundwater and surface water.

Radionuclide Behavior of Subsurface Water in Small Catchments, Covered by Different Vegetation in Kawamata Town, Fukushima Prefecture

PUN Ishwar
EDL Candidate (M2)

The study was conducted after the catastrophic earthquake and tsunami triggered on March 11, 2011 and the Fukushima Dai-ichi Nuclear Power Plant (FDNPP) accident in Fukushima Prefecture. The accident resulted in the deposition of a huge number of radionuclides into the environment. This study was undertaken in three different places covered by grassland, farmland and forest (mature and young conifer trees).

For this study, suction lysimeters at three different depths 10 cm, 30 cm and 50 cm were installed. The soil water was collected in a conical flask. At the same time, soil moisture loggers were also installed in three places to understand the soil water movement in different vegetation types. Significant changes after a rainfall event were shown in Iboishiyama Watershed (grassland) at every depth of 10, 30 and 50 cm. However, in forest areas covered by conifer trees and some litter, the soil water movement was not so effective. The presence of litter in forest areas provides resistance to the infiltration process, and this results in the overland flow.

The soil water was analysed in a Gamma ray detector. Gamma ray emissions at the energies of 604 keV (Cs 134) and 662 keV (Cs 137) were measured. The first samples were measured at Tsukuba Meteorological Institute and the University of Tsukuba. The rest of the sample was measured at Hiroshima

University. The cesium (Cs-134 and Cs-137) concentration values varied during the study period from 0.009 Bq/Kg ~ 2.38 Bq/kg and 0.021 Bq/Kg~2.48Bq/kg respectively. The study shows that Cesium is strongly attached to soil at a depth of 2 cm in Kawamata town (Kato et al., 2012). Relatively little radiocesium entered the soil water with a preferential path of root channel or wormhole. The level of Cesium in soil water has a very low concentration.

Keywords: Radionuclides, Watershed, Vegetation, Soil Water, Fukushima

Assessment of Aquifer Salinization and Proposal of a Remediation Plan in an Irrigated Coastal Watershed, Cap-Bon, North-East Tunisia

Mizuho TAKAHASHI
EDL Candidate (M2)

The Lebna watershed is located in the Cap-Bon peninsula, Northeast Tunisia, an area comprising 230km^2 including the Lebna dam. This dam provides irrigation water for agriculture and drinking water for domestic animals, supplementing GW. Annual mean precipitation is 420 mm and annual mean temperature is 24°C. The rainy season is from November through March and the dry season is from July through August. In the summer-dry season, water demand becomes high due to irrigation needs so the rate of groundwater pumping is larger than in other periods. A large shallow aquifer called the Korba aquifer exists in the area. Successive field surveys were conducted in July 2010, July and November 2011 and June 2012. During each field season, water samples were collected from rivers, dams and the wells in the Lebna watershed, and pH, electrical conductivity, water temperature, and the GW table depth were measured in situ. GW level was determined using the observed GW depth and altitude of the ground a.s.l. Spatial distribution of GW level is shown in a contour map. The obtained GW contour map is combined with data on the spatial distribution of stable isotopic composition and chemistry to clarify the GW and SW interaction. Also the GW level was continuously monitored at 7 wells from March 2012 to July 2012.

The deep depressions of GW were observed on both sides of the Lebna wadi in July and November 2011. During the dry season, the piezometric depression seems to be expanding inland along the wadi due to excessive pumping of GW to irrigate pepper, tomato and corn plantations. Consequently, sea- water can easily intrude into the aquifer. GW long-term monitoring data also indicated the same situation. SW and GW's isotopes have different values; measurements of SW indicate evaporation effects. And GW around the central area between the dam and the coast has a relatively high isotopic value compared with other areas. This area seems to be in accord with irrigation area use of dam water. Analysis indicates GW is affected by the influence of seawater, evaporation, and geology. The seasonal GW fluctuation and flow system is clarified in the Lebna watershed and isotopic and inorganic data show the seawater, geological, and irrigation water effects.

Finally, some policy proposals are; installations in the coastal part of the aquifer; increasing the awareness of the local population and their vulgarization (explaining the risks and threats of overexploitation); possible remediation (artificial recharge and desalination plant)

Keywords: semi-arid area, groundwater, irrigation, seawater intrusion, Tunisia

An Environmental Decision-Support System to Remediate Stressed Coastal Aquifers

Anis CHEKIRBANE
Senior EDL Candidate (D3)

Anthropogenically induced groundwater salinization, as consequence of its interaction with surface water is a serious problem threatening the safe use of water especially in arid regions. In Wadi Al Ayn and Daroufa plain, a sudden increase of groundwater salinity was registered in 2002. Nevertheless, the origin and processes of groundwater salinization are still poorly understood. The aim of this study is to propose a multi-approach environmental decision support system to remediate aquifer salinization in Wadi Al Ayn and Daroufa plain, northeast Tunisia.

Groundwater mineralization in the study area is not a homogenous process, but it is related to different sources and dynamics with space variation. The fresh shallow and deep groundwater chemistry is mainly controlled by the natural conditions of rock – water interaction. However, groundwater salinization is due to the discharged oilfield brine in the sandy bed of wadi Al Ayn up until late 2009 as well as the seawater intrusion occurring in the Daroufa area.

The hydrodynamic, hydrochemical and geophysical data served to build a conceptual model and constituted the input of a numerical model constructed with VISUAL MODFLOW and SEAWAT code in order to retrace the salt dynamics and to predict its behavior under remediation scenarios. The effect of oilfield brine and seawater intrusion in groundwater salinization were successfully reproduced and confirmed by the 3D numerical model. The oilfield brine plume needs at least 5 years to be naturally reduced to less than the half of its actual size, while the seawater – fresh groundwater interface can reach an inland extent of 1.3 km with a TDS more than 10 g/L if no countermeasures are taken in the next 3 decades.

The tested remediation plan by model prediction demonstrated that artificial recharge with treated wastewater seems to be the best solution to stop seawater intrusion just after 2 years of percolating 1 m / day with TDS of 1.5 g / L of recharge water. The natural remediation of the oilfield brine plume can be enhanced by imposing optimized pumping rates and the installation of a restricted pumping perimeter in the transition zone between Wadi Al Ayn and Wadi Daroufa.

Keywords: Salinization, multi-tracer, numerical simulation, SEAWAT, remediation

Adsorption of Chromium Cr (VI) from Industrial Wastewater Using Heat-treated Akadama Clay

CHEN Jie
EDL Candidate (M2)

Due to the widespread applications of various heavy metals in industrial fields, the load of toxic metal pollutants in the environment has become of increasing worldwide concern during the last few decades. Growing attention is being paid to the health hazards caused by the existence of heavy metals in the environment; their accumulation in living tissues and cells via the food chain leads to serious health problems. Chromium, which is on the top-priority list of toxic pollutants defined by the U.S. Environmental Protection Agency (EPA), exhibits a wide range of possible oxidation states. The chromium in hexavalent compounds attracts more public concern, because these compounds are toxic to humans, animals, plants and microorganisms. Hexavalent chromium in industrial wastewaters mainly originates from tanning and painting as chromate pigments in dyes, paints, inks, and plastics industries and most leather is tanned by chromium compounds which become the largest source of Cr (VI) emissions to the environment. These industries are booming in some countries, causing serious heavy metal pollution. As the maximum allowed amount of Cr (VI) is only 0.1 mg/L in industrial water, and 0.05 mg/L in drinking water, it is essential to employ different techniques to purify industrial effluents containing Cr (VI) before discharge into the environment.

It is urgent to find some effective and economic methods to cope with this Cr issue and the adsorption method which is simple, effective, easy and low-cost, is attracting more and more attentions as one of the most powerful separation and purification alternatives to remove the Cr (VI) from industrial wastewater. In this study, natural Akadama clay was modified by heat treatment and the Cr (VI) ions adsorption capacity of Akadama clay was investigated by batch experiments. The heat-treated Akadama clay proved to be a promising adsorbent for the effective removal of Cr (VI) ions from aqueous solution. The natural Akadama clay was pretreated by calcination at different temperatures ranging from 100°C to 400°C for 30 minutes with the maximum Cr (VI) removal ratio reaching at 250°C. The maximum Cr (VI) removal of 86.5% was achieved when the initial pH value was adjusted to 2.0 under conditions of an initial Cr (VI) concentration of 100 mg/l and dosage of 40 g/l. In industry, the effluent pH of most electroplating wastewater is around 2, hence the electroplating wastewater could be treated directly by heat-treated Akadama clay to remove Cr (VI). When the initial concentration of the solution was lower than 20 mg /l, the Cr (VI) ions were almost removed from the solution.

EDL Annual Symposium 2013

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Role of the Environmental Diplomacy in Bridging Fundamental Water Sciences and Decision Making

Water & Environment Group
Environmental Diplomatic Leaders Program
Graduate School of Life and Environmental Sciences
University of Tsukuba

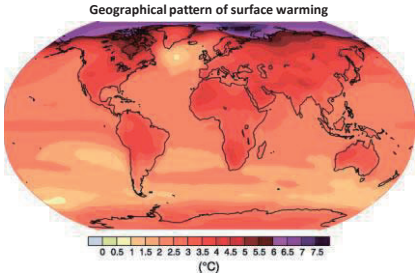
1

INTRODUCTION

2

Impacts of the climate change

Geographical pattern of surface warming

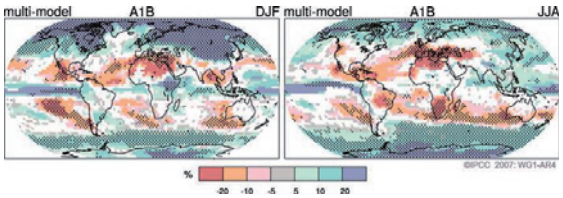


Projected surface temperature changes for the late 21st century (2090-2099). The map shows the multi-AOGCM average projection for the A1B SRES scenario. Temperatures are relative to the period 1980-1999 (IPCC, 2007) .

3

Impacts of the climate change

PROJECTED PATTERNS OF PRECIPITATION CHANGES

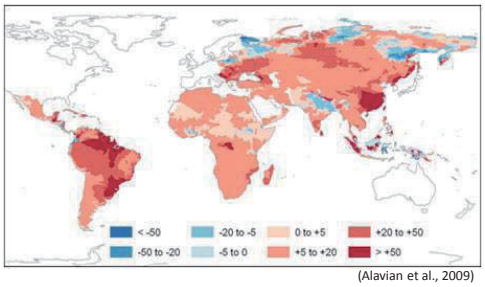


Relative changes in precipitation (in percent) for the period 2090–2099, relative to 1980–1999. Values are multi-model averages based on the SRES A1B scenario for December to February (left) and June to August (right). White areas are where less than 66% of the models agree in the sign of the change and stippled areas are where more than 90% of the models agree in the sign of the change (IPCC, 2007)

4

Climate change and water resources

Projected percent change in water deficit index for 2030



(Alavian et al., 2009)

5

Water consumption problems

Usable water Is limited in the earth

Population **Growth**

Water Consumption
Water Demand **Increase**

Climate Change
Less Precipitation

Usable Water Resources
Decrease

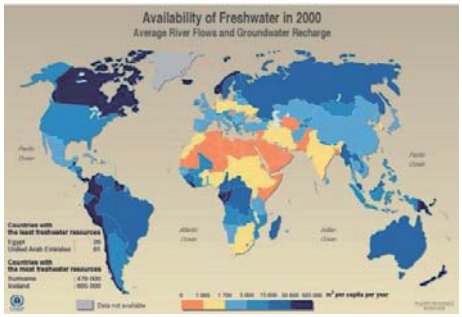
In semi arid & arid regions…

Water resources are **overexploited**

Resource decrease
Quality deterioration

6

Freshwater availability



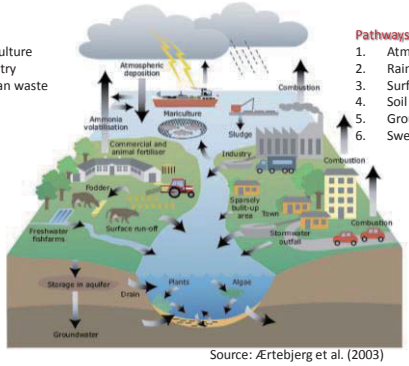
Source: UNEP-GPA, 2004

7

Water pollution

Sources:
1. Agriculture
2. Industry
3. Human waste

Pathways:
1. Atmosphere
2. Rain
3. Surface water
4. Soil water
5. Groundwater
6. Sweater



Source: Ærtebjerg et al. (2003)

8

GW salinization in coastal environments

In coastal area…

High density of population

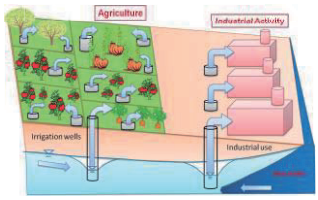
High activities
- **Agriculture**
- **Industry**

Over exploitation of GW
GW Level depression

(Paniconi, 2001)

Sea water intrusion

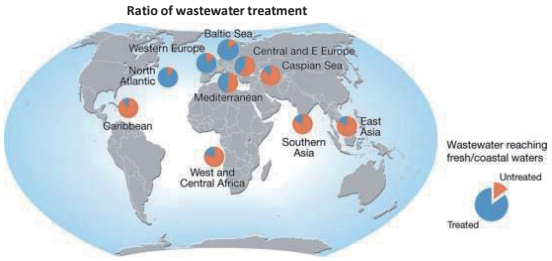
Arid and semi-arid coastal areas of **South Europe, North Africa, Middle East**



Coastal aquifers are vulnerable systems
- Intense urbanization → reduce the recharge possibilities → anthropogenic recharge sources (Bernd & Kreitler, 1993)
- Overexploitation → GW depression → seawater intrusion (Werner et al, 2012)
- Geological materials of alluvial coastal aquifers: facilitate the seawater intrusion

9

Globe situation of wastewater treatment



Source: UNEP-GPA, 2004

10

Importance of wastewater treatment to cope with water scarcity & security

- Water **scarcity** and **security**: a serious worldwide problem
- Rapid population, economic growth and industrial developments have increased the amounts of wastewater and the demand of water usage
- Auto-epuration is suitable for small polluted water amounts
- Treatment plants reduce pollutants in wastewater to a level that nature can handle

Wastewater :
Threat for the environment & public health

- pathogens
- nutrients
- hazardous substances
- Harm to wildlife

Treatment / Recycling

Proper & effective technology

Solution:
Profitable resource to cope with water scarcity and security

- Save the wildlife & human health
- Reuse in farming activities
- Reuse in industry
- Reuse in artificial recharge

11

Global water management challenges

Main challenges:

- Water shortage
- Water pollution
- Wastewater treatment

Millennium Development Goals (MDG's):

7C: Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation

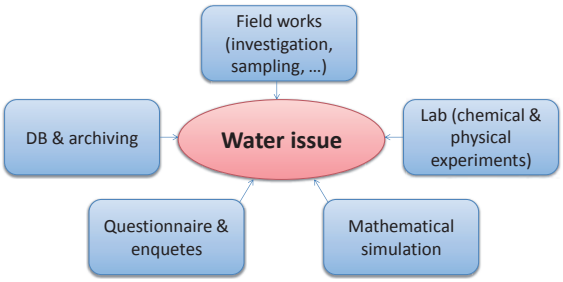
New competencies linking fundamental knowledge to decision making can succeed to provide green solutions guaranteeing the water resources sustainability

12

Study areas

13

Methods



14

Individual presentations

Mr. Tatsuki SHIMIZU
Mr. Wataru YAMADA
Mrs. Thi Thu NGUYEN
Mr. Pun ISHWAR
Miss. Mizuho TAKAHASHI
Mr. Anis CHEKIRBANE
Miss. Jie CHEN

15

An Approach of Water Science Research for a Decision Making to Water Shortage ~ A case of the Nile-delta, Egypt ~

Environmental Diplomatic Leaders Program
The Graduate School of Life and Environmental Sciences,
The University of Tsukuba

Tatsuki SHIMIZU

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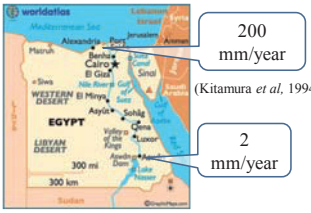
Introduction

Egypt
- Arid (Dry) climate
- Population growth

→ Food and water shortage

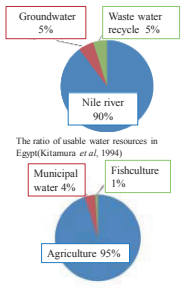


200 mm/year

(Kitamura *et al*, 1994)

2 mm/year

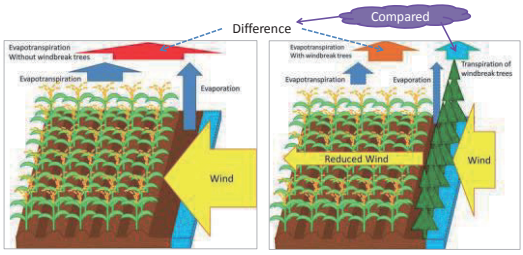
http://www.worldatlas.com/webimage/countrys/africa/eg.htm



The ratio of usable water resources in Egypt(Kitamura *et al*, 1994)

Water use in Egypt (from Ministry of Water Resources and Irrigation of Arab Republic of Egypt, 2005)

17



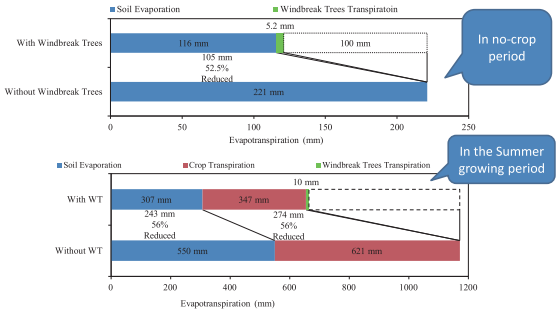
Objectives

✓ To investigate into the effectiveness of windbreak trees to reduce evaporation from an agricultural land

- Estimation of windbreak trees' transpiration by models.
- Measurement of windbreak trees' transpiration in Egypt.
- Estimation of water losses from an agricultural land.

18

Effectiveness of Windbreak Trees for evaporation reduction
in no-crop period (in May, 2011)
and in the Summer growing period (from June to September, 2011)

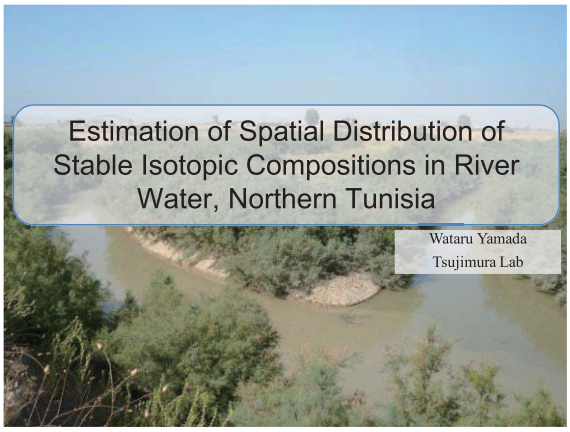


19

Conclusions

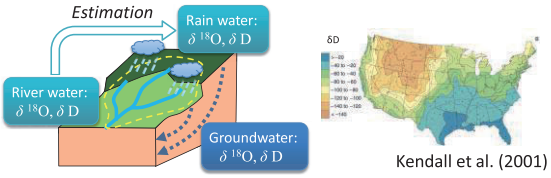
- The effectiveness of windbreak trees was estimated that they are very effective to reduce evaporation.
- As one of the solutions to reduce water loss in agricultural sector, it can be said that windbreak trees might stop water shortage.
- In decision making process, the possibility must be considered, such as the grow speed of trees, cost of settings, maintenance and so on.

20



21

Isotopic mapping by surface water



Kendall et al. (2001)

- Spatial distribution of $\delta^{18}O$ and δD of rain water
  - groundwater recharge information.
- Large river can integrate water in watershed.
  - Surface water ≒rain water
- Isotopic Mapping by surface water
  - groundwater recharging process in large area.

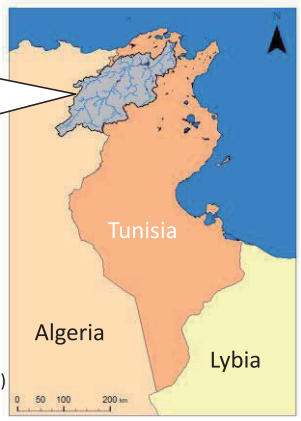
22

Objectives

- To construct stable isotopic map of surface water for understanding hydrological process in Tunisia.
- To determine effective parameters governing spatial distribution of isotopic composition.

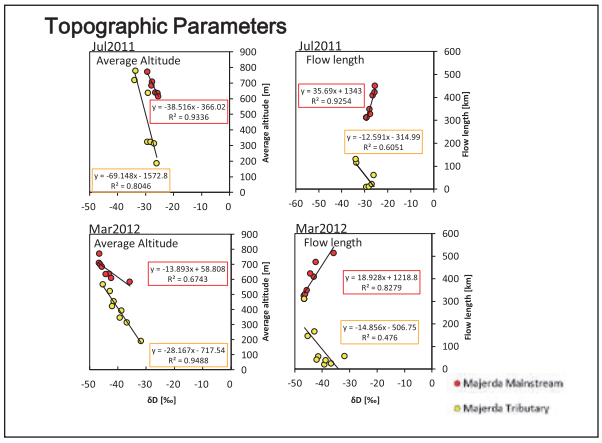
23

Madjerda watershed



- Northern area in Tunisia
- Important water resource
- Precipitation : 600 m/year
- Field survey
  - July 2011 (rainy season)
  - March 2012 (dry season)

24



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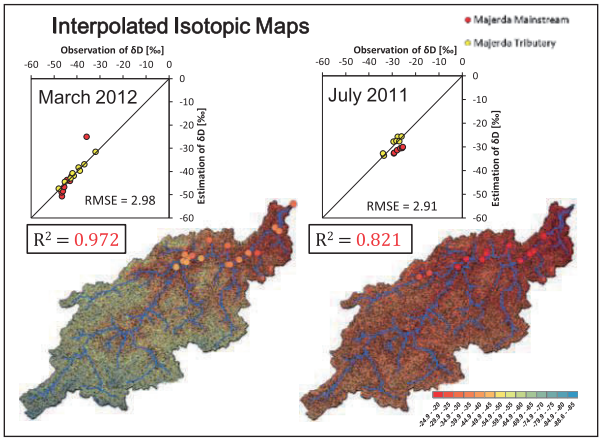

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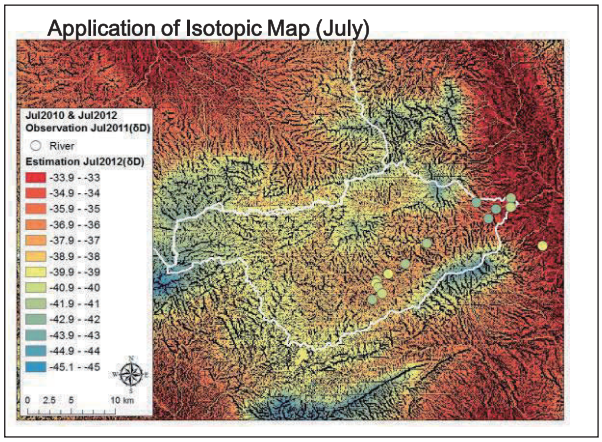

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Conclusions

- Isotopic mapping in one watershed
  - Topographic parameters (average altitude & flow length) have a good correlation with isotopic compositions.
  - Interpolated isotopic map represents isotopic compositions well.
- Application to another area
  - Estimating recharging area of groundwater reasonably.
  - Possibility that isotopic map contribute to sustainable groundwater management.

28

Groundwater Flow System in Tay Island, Dong Thap Province, Southwest Vietnam

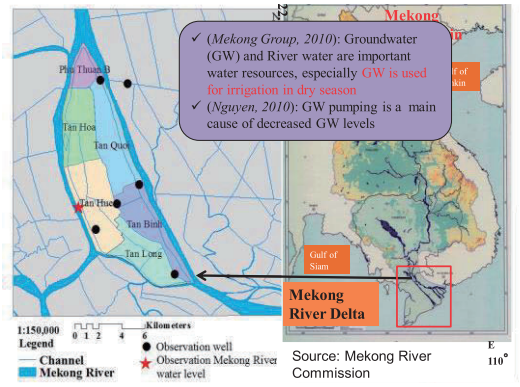
Presenter : NGUYEN THI THU

2nd grade of Master's Program in Environmental Sciences

Tsujimura's Laboratory

29

1. Introduction



30

1. Introduction

Problematic (unsolved problems)

- ✓ Little research has been performed on the GW flow system in Tay Island
- ✓ The process of exchange between GW-SW has not been researched

Objectives of master thesis

1. To investigate GW flow system of Tay Island (deep GW and Shallow GW)
2. To clarify the interaction process between GW and SW: Recharge and Discharge process in relation with seasonal fluctuation of Mekong River.

2. Method

1. **Field survey**: 2 times in 2012
2. **Water sample**: GW, river water, channel water
3. **Measurements on field**: EC, ORP, pH, water temperature, GW levels depth

4. Analysis in laboratory
- Inorganic ions by IC& ICP
- Stable isotopes (δ^2H/ $\delta^{18}O$) by Mass Spectrometer

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Water sampling activities

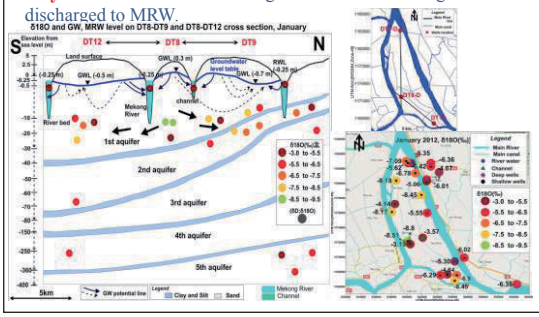
Survey in January 2012

32

3. Results

All time of year: GW is dominantly recharged in central area of Island GW flows from central area toward north and south river bank of Island by effect of pumping for irrigation in the dry season.

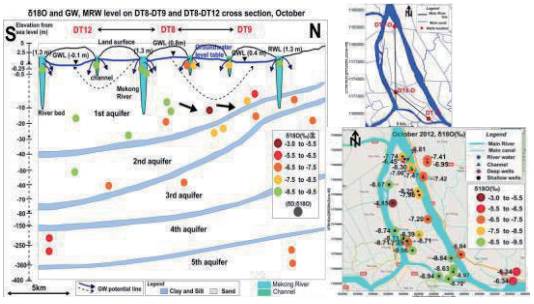
Dry season: GW table was higher than MRW leading to GW discharged to MRW.



33

3. Results

Rainy season: GW table was lower than MRW level, and GW is recharged from Mekong River.



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4. Recommendation

- **Groundwater management**

➢ The effects of pumping for irrigation activities is as a leading cause of GW level decreased in the north and south of Tay Island.
➢ Thus, in the future it is necessary to think deeply more the appropriate management of groundwater resource for irrigation use.
➢ It is necessary to study deeply more about the study on the groundwater system includes the depth of groundwater, which has been limited on Tay Island and the Mekong River delta.

5. Future

The study on Tay Island should be extended at a much larger scale and focused on :

➢ GW flow system including deep groundwater
➢ The interaction between groundwater and the Mekong River water from the upstream to downstream to evaluate the effects of seasonal fluctuation.
➢ The change of water quality from upstream to the downstream on the Mekong River

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Radionuclides Behaviour of Subsurface Water in Small Catchments, Covered by Different Vegetations in Kawamata Town, Fukushima Prefecture

PUN Ishwar
Master's Program in Environmental Sciences & Environmental Diplomatic Leader (EDL),
Graduate School of Life and Environmental Sciences,
University of Tsukuba

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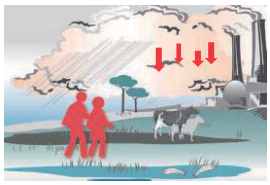
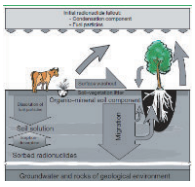
Problematic & background

- The Fukushima Daiichi nuclear power plant accident in Japan triggered by a magnitude 9.0 earthquake and resulting tsunami on March 11, 2011 caused the month-long discharge of radioactive materials plume into the atmosphere.
- It is estimated that approximately 1.5×10^{17} Bq cesium was release from Fukushima Nuclear plant accident.
- Those radioactivity amounts account for 7% of the 5.2×10^{18} Bq released from the Chernobyl NPP accident in April 1986 (Chino et al., 2011)





Research Objective:
To investigate the soil water contamination by radionuclides (Isotope of Cs-134 &Cs-137) from the Fukushima Dai ichi Nuclear power.
Three sites are selected: -Kotaishi Watershed (Grassland) -Iboishi Yama Watershed (Grassland) - Conifer Forest (Young and Matured)

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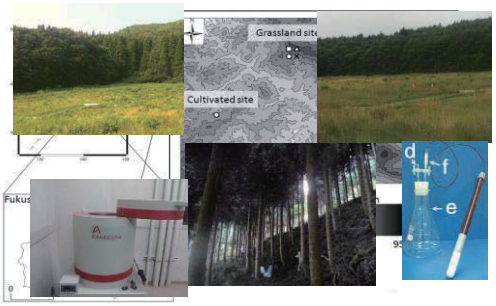
Methodology and Site Description

Sampling Points (Soil Water) in Kawamata, Fukushima



Soil water was sampling from July 7th 2011 to Dec 5th 2011 (Once a month) and filtered using 0.45 µm membrane filter measured at Gamma Spectrometry

38

Cesium concentration Result (1)

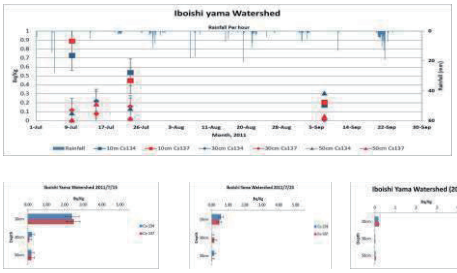


Figure: Temporal Variation of Cesium Concentration in Iboishi Yama watershed grassland (up) and vertical profile of Cesium concentration in soil water (down)

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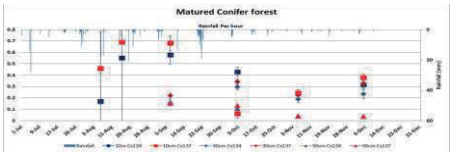
Cesium Concentration Result (2)



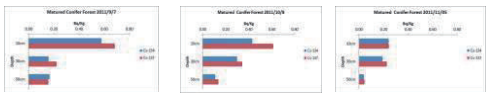


Figure: Temporal Variation of Cesium Concentration in Matured Conifer Forest (up) and vertical profile of Cesium concentration in soil water (down)

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Conclusion and Recommendation

- The contamination of Cesium concentration in soil water is very low. During the study period of July ~ Dec 2011, Cesium concentration varies from (Cs-134 and Cs-137) 0.009 Bq/Kg ~ 2.38 Bq/kg and 0.021 Bq/Kg~2.48Bq/kg respectively.
- The half life of Cs-134 is almost 2 year and Cs-137 is 30 years. The temporal cesium concentration shows that the values are decreasing with the time period.
- The previous study in the same sites shows that 80% of radiocesium strongly deposit in the top soil of upper 2 cm soil surface, only few portion can inter in soil water hydrological process.

- The decaying of Cesium in environment takes place a long time period depending on the half life. The remediation of such kind of large scale of radioactivity dispersion in environment is very difficult.
- *The radiation dose has been increasing from artificial (human made) such as nuclear weapon test and Nuclear energy. The atmospheric test of Nuclear weapon has been already banned.*
- In case of Nuclear energy, it is the only sustainable energy for large scale of industrial society. Only the important is that it should be proper maintained and assessed of safety and security when it is building.

41

Assessment of Aquifer Salinization and Proposal of a Remediation Plan in an Irrigated Coastal Watershed, Cap-Bon, North-East Tunisia

M2: Mizuho TAKAHASHI

Objectives

- **Previous reserches** (Kerrou et al., 2000; MacDonald et al., 2000)
  - Groundwater environment investigation in semi-arid regions
  - Effect of pumping for Irrigation on groundwater environment
- **Issues to be solved**
  - GW flow system and seawater effect on GW in coastal area

To make clear the groundwater flow system in semi-arid coastal area, focusing on spatial and temporal variations of irrigation activities

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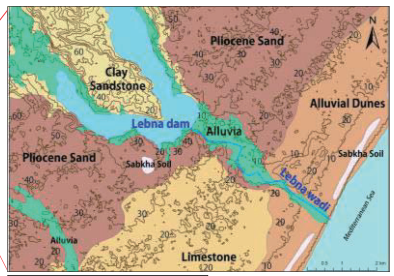
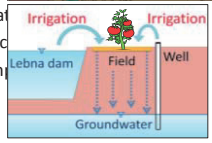
fig. Lebna area, Cap-Bon Geological map

Lebna watershed

- Agriculture: Tomat
- Annual mean prec
- Annual mean tem





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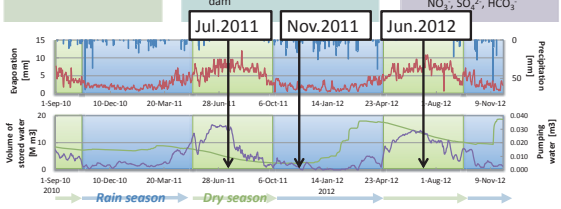
Field Survey	Long term Observation	Water Quality

• Groundwater level
• pH, Temperature, EC
	• 7wells GW monitoring
	• Dam reserved in water level
	  • Date (Sep2010-Dec2012) provided by the office of Lebna dam
		• Stable Isotopes
		  • $\delta^{18}O$, δD
		• Inorganic Ions
		  • Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, NO_3^-, SO_4^{2-}, HCO_3^-



- Groundwater contour maps of each season
- Spatial distributions of water quality parameters

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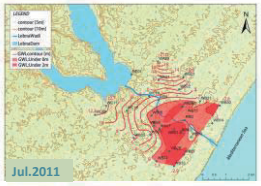
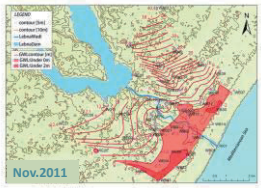
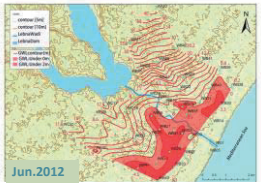
GW contour (Jul2011, Nov2011, Jun2012)







GW depression area extends to inland in dry season due to excessive pumping for irrigation.

Larger area faces sea water intrusion.

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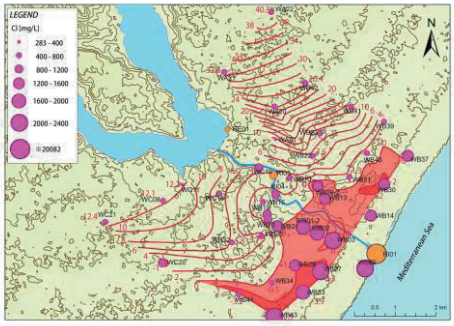
GW contour vs. Cl^- (November2011)



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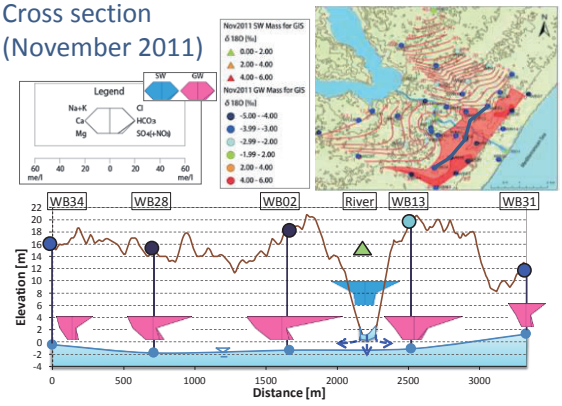
Cross section (November 2011)



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Conclusions

- Groundwater table varies in time and space due to anthropogenic effect.
  - Typical GW depression is observed along Wadi in dry and rainy seasons
  - GW depression area (< 0m) extends to inland in dry season due to excessive pumping for irrigation
- Sea water affects on GW chemistry around coast and river mouth
  - Cl^- and Na^+ concentrations are higher near the coastal line
  - GW recharge from Lebna wadi occurs near river mouth

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Policy proposal

① Installation of a safeguard perimeter in the coastal part of the aquifer

② Increasing the awareness of the local population and their vulgarization (explaining the risks and threats of overexploitation

③ Possible remediation

- Artificial recharge
- Desalination plant

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An Environmental Decision-Support System to Remediate Stressed Coastal Aquifers

CHEKIRBANE ANIS
(Senior EDL Candidate)

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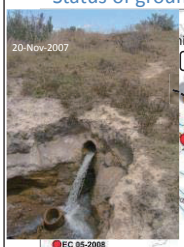
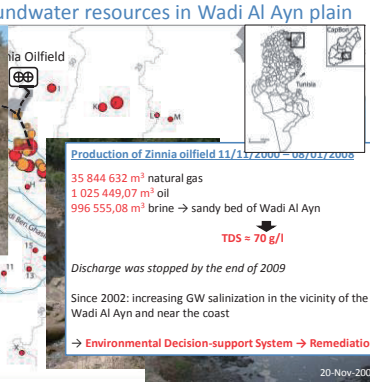
Study area & problematic

Status of groundwater resources in Wadi Al Ayn plain





Production of Zinnia oilfield 11/11/2000 – 08/01/2008

35 844 632 m³ natural gas
1 025 449,07 m³ oil
996 555,08 m³ brine → sandy bed of Wadi Al Ayn

TDS = 70 g/l

Discharge was stopped by the end of 2009

Since 2002: increasing GW salinization in the vicinity of the Wadi Al Ayn and near the coast

→ Environmental Decision-support System → Remediation

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Methodology

Fundamental Knowledge:
-Hydrogeology
-Geophysics
-Geochemistry
-Mathematics / statistics

Field & DB skills:
-Sampling / measurement
-DB construction (GIS)
-Questionary
-Communication with stakeholders

Environmental problem:
GW salinization

Identification of GW salinization **origins**

Spatial and temporal characterization of GW salinization

Clarifying the GW **salinization processes**

Numerical model of GW flow and salt transport

Simulation of different **scenarios**

Adaptive management & remediation plan

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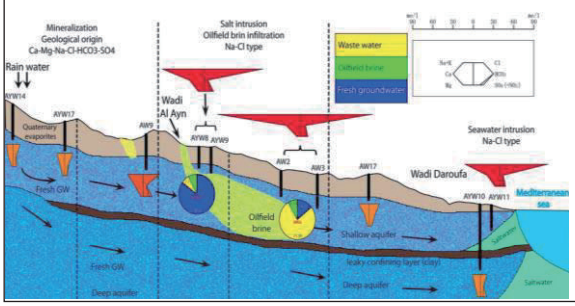
Result 1: Conceptual model

Geology + Geophysics + Hydrochemistry

Hydrogeochemical functioning of the groundwater flow system at Wadi Al Ayn and Daroufa plains



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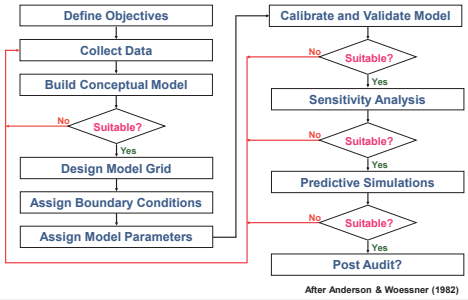
Result 2: Modeling of the GW flow and solute transport

Modeling objectives & approach

Objectives:

-To retrace the hydrodynamic functioning of the groundwater flow system
-To predict the temporal changes of groundwater flow and saltwater dynamics

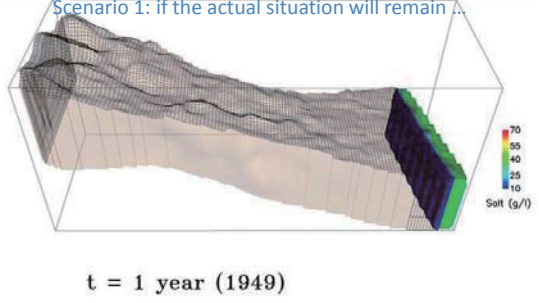


After Anderson & Woessner (1982)

54

Modeling of the GW flow and solute transport

Scenario 1: if the actual situation will remain ..



t = 1 year (1949)

Scenario 1: Non regulated pumping rate + Saltwater can reach 1.5 km inland → aggravated situation

55

Modeling of the GW flow and solute transport

Simulation scenarios 2

Optimized pumping rate (FAO method)

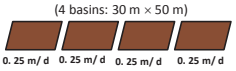
$ET_{crop} = ET_0 \times Kc$

ET_{crop}: crop water need (mm/day); Kc: Crop factor; ET_0: Reference evapotranspiration (mm/day)

Artificial recharge of groundwater with treated wastewater

Central Arizona Project, USA

(4 basins: 30 m × 50 m)



Q_{Total} = 1 m/ d

TDS = 1.5 mg/L

Available resource: Maamoura WWP :

- Capacity = 8435 m^3 / day
- Quality: TDS = 1.3 g/L

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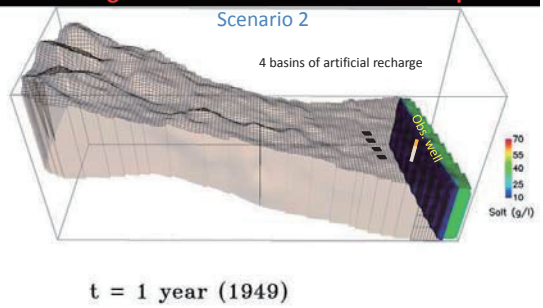
Modeling of the GW flow and solute transport

Scenario 2

4 basins of artificial recharge



t = 1 year (1949)

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Policy proposal

Short tem countermeasures: remediation management plan

-**Artificial recharge** with treated wastewater: effect just after 2 years of application

-**Natural remediation** of the OFB plume: optimized pumping rates + controlled Wadi effluent + restricted pumping zones → enhance the reduction of the saltwater plume

Long term countermeasures:

-**Legislation**: water legislation exists in Tunisia and it needs to be updated and activated to take in consideration the vulnerability of the coastal ecosystems and their easy contamination

-**Monitoring**: long term monitoring of coastal GW and surface water resources is crucial for the sustainable management

-**Stakeholders** :

-Involve them while taking decision

-Vulgarization of water stakeholders in coastal regions (farmers, industrial, touristic)

-Enhancing the communication and data exchange between the authorities involved in coastal management

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Adsorption of Chromium (VI) from Industrial Wastewater Using Heat-treated Akadama Clay

Jie CHEN
Master's Program in Environmental Sciences
at University of Tsukuba

Supervisor: Professor Zhang Zhenya

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Introduction

Due to the widespread applications of the various **heavy metals in the industrial fields**, growing attention is being paid to **the health hazards** caused by them and **their accumulation in living tissues and cells via the food chains leads to a serious health problem .**

The Top Six Toxic Threats

Top Six Toxic Threats:	Est Population at Risk at Identified Sites* (million people)	Est Global Impact** (million people)
1. Lead	10	18-22
2. Mercury	8.6	15-19
3. Chromium	7.3	13-17
4. Arsenic	3.7	5-9
5. Pesticides	3.4	5-8
6. Radionuclides	3.3	5-8

These industries are booming in some countries, causing serious heavy metal pollution. According to the 2010 China Environmental Bulletin, by the end of 2010 there was still about 1 million tons of chromium slags piled in 12 provinces of China.

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Cr (VI) is the most toxic form as a powerful **carcinogenic** agent which modifies **DNA** transcription.

As the maximum allowed amount of Cr (VI) is only **0.1 mg/L** in the **industrial water**, and **0.05 mg/L** in **drinking water**, different techniques are being employed for the purification of industrial effluents.

A pond in Qujing, Yunnan province, heavily contaminated by illegally dumped toxic industrial waste full of chromium.

Lake addled with chromium from tannery, India

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Introduction

Adsorption is one of the most efficient processes for Cr (VI) removal from wastewater.

Clay minerals, due to **large quantity**, **high surface area**, and **cation exchange capacity**, have great potential applications as **low-cost and efficient** adsorbent in disposal of high-level heavy metal wastes.

►common and inexpensive in Japan
►widely utilized as a cultivating mud
►volcanic clay
►porosity, stability and osmotic properties

In this study, the natural Akadama clay was modified by heat treatment and the Cr (VI) ions adsorption capacity of Akadama clay was investigated by batch experiments.

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Material and method

Heat-treated Akadama clay

Metal solutions (100 mg/l) were prepared by dissolving the $K_2Cr_2O_7$ in appropriate amounts in distilled water.

Adsorption experiments

0.2 g of clay was added to 5 ml of solutions containing 100 mg/l Cr (VI) ion and stirred for 24 hours.

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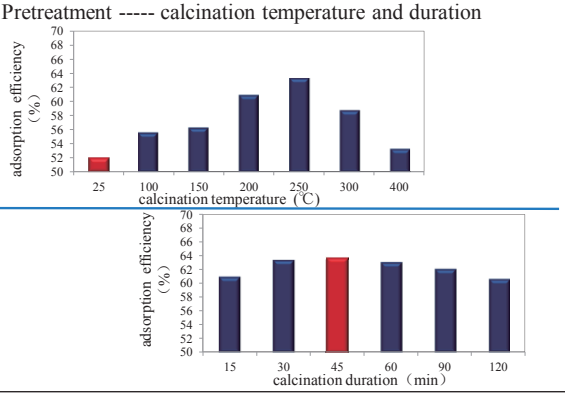
Results and discussion

Pretreatment ----- calcination temperature and duration



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Results and discussion

Optimum pretreatment conditions:

Calcination temperature: **250℃**

Calcination duration: **45 min**

Maximum Cr (VI) removal efficiency : **63.2%**

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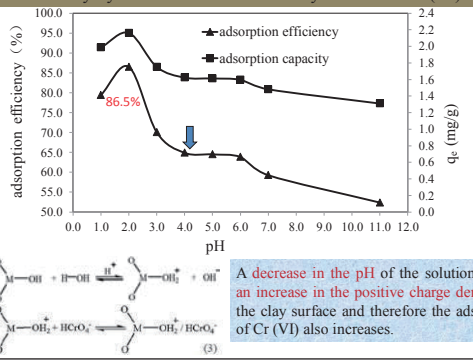
In the field of industry, the effluent pH of most electroplating wastewater is around 2, hence the electroplating wastewater could be treated directly by heat-treated Akadama clay to remove Cr (VI).



A decrease in the pH of the solution causes an increase in the positive charge density on the clay surface and therefore the adsorption of Cr (VI) also increases.

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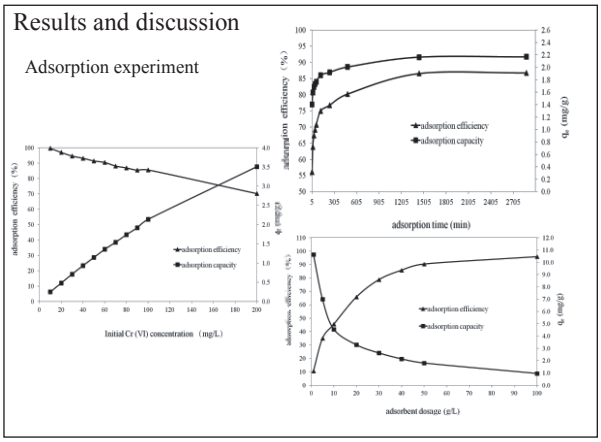
Results and discussion

Adsorption experiment



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Conclusions

The modified **Akadama clay** by heat-treatment was proved to be a **promising adsorbent** for the effective removal of Cr (VI) ions from aqueous solution. The electroplating wastewater could be treated directly by heat-treated Akadama clay to remove Cr (VI).

Cr (VI) adsorption was a **pH-dependent** process and the maximum Cr (VI) removal of **86.5%** was achieved at initial **pH 2.0, initial concentration of 100 mg/l, adsorbent dosage of 40 g/l after 24 hours.** The Cr (VI) was almost completely removed when the initial concentration was lower than 20 mg/l at dosage of 40 g/l.

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Importance of wastewater treatment

Water scarcity and **security** is the major problem that is faced by all across the world. **Proper wastewater treatment methods** and recycling is the key to curb the shortage of clean water and to meet current water quality demand.

Considering the effective and economical aspects, the **adsorption method**, **simple**, **effective**, **easy handling** and **low-cost**, is attracting more and more attentions as one of the most **powerful separation and purification alternatives** to remove the pollutant from industrial wastewater.

An ideal adsorbent
large quantities, easily separated, low cost and regenerable

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Synthesis:
Role of the Environmental Diplomacy in Bridging Fundamental Knowledge and Decision Making

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Definition

Environmental diplomacy: definition

Diplomacy (from Latin *diploma*, meaning an official document, which in turn derives from the Greek δίπλωμα, meaning a folded paper/document) is the art and practice of conducting negotiations between representatives of groups or states (Wikipedia, 2013).

Environmental diplomacy: study and practice of techniques that resolve destructive environmental conflicts and the use of ecological processes as tools of peace-building

"Many global environmental problems such as the impact of climate change, the preservation of biological diversity and transboundary air pollution demand multilateral responses"

(Paul Hagen, The Environmental Forum, 2010)

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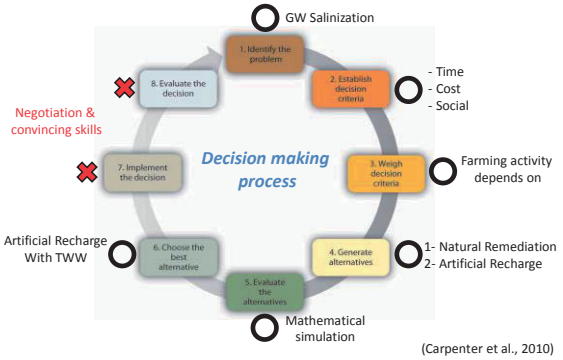
The decision making process



(Carpenter et al., 2010)

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Summary of policy proposals

- ✓ **Wind-break trees** = effective countermeasure to reduce the soil evaporation and consequently contributing in irrigation water saving.
- ✓ **Isotopic mapping** = important tool to identify the recharge and discharge zones of groundwater + important information about the water cycle in arid environments.
- ✓ **Interaction between SW & GW** in humid (Vietnam) and semi-arid regions (Tunisia) → evident connectivity → necessity to apply a conjunctive management.
- ✓ **Artificial recharge with TWW** of stressed coastal aquifers = solution to recycle the TWW and to remediate the seawater intrusion.
- ✓ **The assessment of surface water and soil water contamination by radionuclides** in Fukushima, Japan → early-warning to safe human health.
- ✓ **Finding a suitable treatment of the Chromium (IV) in wastewater** in China can increase the safe water potential and its reuse for agricultural, industrial or domestic purposes.

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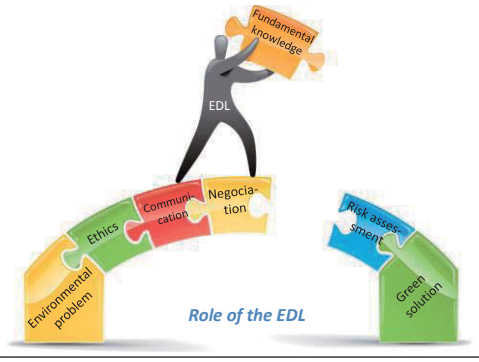
Role of the Environmental Diplomacy in Bridging Fundamental Knowledge and Decision Making



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(2) Integrated Assessment on the Loss of Biodiversity and Bio-resources

Background

Loss of biodiversity and bio-resources as well as global warming and nuclear radiation issues are a major environmental problem at a global level. High population growth is an important factor that affects change in biodiversity and bio-resources; even the impact is site-specific. Specifically for many developing countries, a high population rate can be seen as a critical factor that will significantly affect the forest cover change and land use conversion due to the increase in demand for food and forest resources, which finally impact on the loss of biodiversity and bio-resources.

Moreover, economic development programs to fulfill people's needs might affect water and soil pollution, especially when their management and assessment are not appropriate; through water used for domestic, industrial and commercial purposes.

Many studies have assessed the loss of biodiversity and bio-resources at specific sites under different environmental conditions. Furthermore, the relationship between land use conversion, deforestation and forest degradation as well as waste management under different socio-economic conditions may be important for making a more integrated assessment on the loss of biodiversity and bio-resources. Discussion from this EDL group will focus on the interface of this environmental problem: land use conversion and deforestation and forest degradation, located in three different countries, Indonesia, India, and Nepal. Moreover, waste management in an urban area of China will also be discussed in relation to bio-resources issues.

Land use change in regional scale of Java Island, Indonesia

Yudi SETIAWAN
Senior EDL Candidate (D3)

The island of Java has a long history of agriculture and settlement, and is characterized by high population density and high productive land. About 70.62% of Java is considered to be agricultural land use as follows: paddy fields, mixed gardens, uplands/dry lands, open grass, fishponds, and plantations, with as much as 5.43% of the area covered by settlements.

The awareness on land use information has increased considerably in global and regional scales, since it is the key to a wide range of environmental issues including land degradation, loss of biodiversity, food security and environmental sustainability. On the other hand, in tropical regions such as Java Island, Indonesia, many land use databases and maps exist in various places and in diverse forms, but they are still far from being sufficient for current needs. A large amount of the land use and its change information that exists are not accurate enough over large geographic areas. Most are limited to an inconsistent mixture of land use and land cover classes. These themes indicate that the technical issues related to data, such as classification and scale of land use land cover, are still considered to be an important issue.

The objectives of this study are: (1) to examine the feasibility of using long-term satellite datasets for detecting and quantifying the change in land use, (2) to identify systematically the process or pathway of such changes, and (3) to provide insight information about the future role of the land use change in Java based on their biophysical-environment characteristics. Achievement of these objectives will improve the understanding of land use and land cover dynamics on Java Island.

The results indicate that paddy rice with irrigation system (double cropping), especially in upland areas has a high positive spatial autocorrelation with the change areas. Residential area, paddy rice, and upland with intensive cropping have a high effect to the probability of change occurrences. Meanwhile, barren lands/dry land, bush-shrub and mixed garden give a negative impact to the change occurrences in agricultural lands. In the case of forestland, the results show some land use types such as upland with intensive cropping and plantation have positive contribution to the change of land.

Keywords: Land use change, temporal vegetation dynamics, MODIS EVI, Java Island

Forest management, utilization, and people's perception of a Van Panchayat in Garhwal, Uttarakhand, India

Kazuyo NAGAHAMA
EDL Candidate (M2)

Van (forest) *Panchayat* (VP) is one of the largest and most diverse experiments in common property management developed in collaboration with the state of Uttarakhand in India. The idea of establishing VPs originated in conflicts between the people and the state government for control of resources. VPs were created in response to a people's movement for utilization of forest resources at beginning of the 20th century. The Uttarakhand state has two sub-divisions of forested mountainous regions – Kumaon and Garhwal. In the Kumaon hills, there is a steady decline in VP practice in these once dense and well-managed forests.

This research targets the VP system to ascertain the extent to which local institutions have successfully achieved sustainable forest management. This study clarifies forest management and utilization, and analyzes perceptions within forestry in relation to the Management Committee (MC) in the Garhwal hills.

The VP examined was Village D– a newly constituted VP in 1993 – in the Tehri Garhwal district. Field surveys were conducted in 2011 and 2012. The VP in D village has an area of about 20 ha, and is a freely accessible forest. However, the five year plan prepared by the MC and Forest Department (FD) does not clearly describe the management of the forest. Moreover, most members of the MC did not change and the chairperson has held his post, since the VP was established.

This study consisted mainly of interviews on various aspects of the VP management and perception. Although the MC manages the VP, the context of forest management was not clear between the MC and non-MC members. Non-MC members as respondents assumed there might be few

forest-derived benefits for the MC. On the contrary, 15% of respondents answered that the MC benefitted from VP. With regards to the state of the forest, 90% of the participants in VP were satisfied with the forest vegetation. It was also determined that among numerous factors for people's participation, use of firewood was important, as 78% of the respondents depended on firewood for fuel for daily use. Furthermore, only 29% of the respondents had participated in preparing the micro-plan for the VP.

Overall, the VP in village D is assumed to be active and successful. Moreover, the people are satisfied with the current situation, in particular for the utilization of firewood and in maintaining their livelihood. Nevertheless, there are several issues and challenges associated with the forest management. From this study, certain issues in the VP can be highlighted. These are: i) most of the MC members have not changed in the last seven years, ii) unfair selection of the MC members and chairperson, and iii) proper utilization of forest products. In the case of point iii, the villagers consumed firewood daily and did not shift to using liquefied petroleum gas and the other renewable energy sources, proposed and provided by the government and NGOs under various schemes to increase modern access; this is also necessary for forest conservation.

Keywords: Community-based Forest Management, Joint Forest Management, Forest Department, Van Panchayat, Management Committee

Forest management and utilization in a community forest user group, Chitwan District, Nepal

Maria Ludia SIMONAPENDI
EDL Candidate (M2)

Community Forestry (CF) is a successful participatory approach to protect forest in Nepal. The concept of CF is the government hands over accessible national forest to local community called Community Forest User Group (CFUG) to mange and use the forest in a sustainable way. To understand how CF can help forest reforestation in Nepal, I'm trying to understand the forest management and utilization system of CFUG.

From my research I found that the equal rights given by CFUG to local users to access forest and forest products makes the users feel they own the forest. This feeling of ownership makes the users willing to protect the forest in order to support forest product demand and for future generations. Even though the CFUG had given rights to the users to retrieve excess forest products, they still control and implemented strict rules for the collection system. With strict control the CFUG has successfully protected the forest while also supplying forest products to its users. As a result, the forest is gradually recovering year by year.

Keywords: Community forest, forest reforestation, Nepal

Life Cycle Assessment of Municipal Solid Waste Management in Chinese Urban Areas: Case Study in Chong Qing City

HUANG Wen Yu
EDL Candidate (M2)

With rapid economic growth and industrialization China's urban areas have experienced a huge increase in the amount of solid waste generation. Chongqing city, with a population of 7.45 million (2011), has experienced a rapid increase in municipal waste generation reaching 309kg/capita/year in 2010. Landfills are the main method of disposal in Chongqing, but pollution caused by simple landfills and a lack of backup municipal solid waste (MSW) disposal capacity is causing water, air and soil pollution in the urban areas of Chongqing. Currently only 32.8% of the waste is treated through incineration and bio-treatment, 60.2% is directly sent to the landfill site and the remainder 7% is sent for open dumping. Since the landfill site, located near the Changing River, is reaching its capacity it is urgent to introduce alternative waste management options to minimize the amount of final disposal waste. In order to address this problem, this paper proposes different viable alternatives based on an integrated waste management approach and evaluates their environmental and economic performance by means of Life Cycle Assessment (LCA) and Life Cycle Cost respectively.

The scenarios include different collection options, pre-treatment and treatment technologies that focus on material recycling, organic recovery and energy recovery as well as final disposal. In practice, four scenarios through a Waste Management Assessment Model focus on RDF, bio-treatment, and recycling. Through these different final disposals, the impacts and cost vary dramatically. Based on these analysis results, a sustainable waste management strategy that has environmental, economic and social advantages is recommended. All these results and analysis are derived from the Integrated Waste Management (IWM-II) model, which includes waste flow, final disposal amount, gas emission, human toxicity, and waste emission.

Keywords: Municipal Solid Waste Management, Life Cycle Assessment, Life Cycle Cost, Integrated Approach, Recycling

Conclusions:

A number of different studies have been done to determine biodiversity and bio-resources issues from many different perspectives. Our research themes in this group were undertaken at the interface of such kind of problems, and they were inter-related with underlying factors of the loss of biodiversity and bio-resources degradation.

The change detection method, which was developed on Java Island, Indonesia, will contribute to the improvement of land use change detection and assessment. Land changes in regional scale, including the actual change of land use and temporary changes of land cover have numerous consequences relevant to the environment as well as land degradation and loss of biodiversity.

The cases of community-based forest management in India (*Van Panchayat*) and Nepal (CFUG) have contributed to determining the mechanism and process of forest management in detail. This is the first step in understanding the environmental implications, for example of forest and biodiversity sustainability.

Meanwhile, a combination of anaerobic digestion, materials recycling and incineration, and resulting waste management in Chinese urban areas, would probably be a solution to avoid landfill increase considering high population growth.

ANNUAL SYMPOSIUM 2013 OF THE ENVIRONMENTAL DIPLOMATIC LEADER (EDL)
UNIVERSITY OF TSUKUBA
Tsukuba, Japan, February 15, 2013

Biodiversity and Bio-resources EDL Group

"Integrated Assessment on the Loss of Biodiversity and Bio-resources"

Group Member:
1. Yudi Setiawan
2. Kazuyo Nagahama
3. Simonapendi Maria Ludia
4. Wenyu Huang

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Contents

1. Background
2. Research theme of group members
   - ① Land use change in Java
   - ② Forest management in India
   - ③ Community forest group in Nepal
   - ④ Waste management of urban city in China
3. Conclusions

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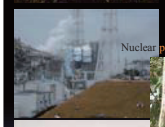
Background

Global environmental issues

Global climate change (Houghton *et al.* 1999, Chase *et al*, 2000)

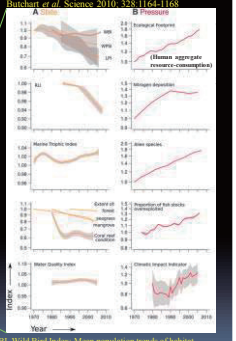


Nuclear power plant (Stone, 2011)

Biodiversity (Sala *et al*, 2000; Butchart *et al*, 2010)

Hydrological damage (Vitousek *et al*. 1997)

Indicator trends for (A) the state of biodiversity, (B) pressures upon it Butchart *et al*. Science 2010; 328:1164-1168



WBI Wild Bird Index Mean population trends of habitat specialists WPSI Waterbird Population Status Index RLI Red List Index Marine Trophic Index Shift in fishing catch from top predators to lower level

3

STUDY OF LAND USE CHANGE IN REGIONAL SCALE OF JAVA ISLAND, INDONESIA

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Doctoral Program in Sustainable Environmental Studies
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University of Tsukuba

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Background

Global biodiversity scenarios for the year 2100
(Sala *et al.* Science 2000; 287:1770-1774)

↓

The five major drivers of biodiversity change
1. Land use
2. Atmospheric composition CO_2
3. Nitrogen decomposition
4. Climate
5. Biotic exchange

Describing the existing condition on the land and human activities on it as the interface and interactions between human and environmental systems

- Land use & land cover change
- Forest management
- Community forest group
- Waste management (Urban development)

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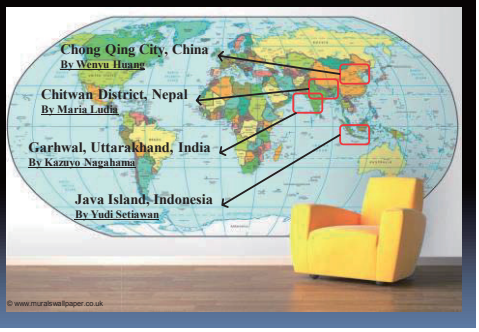
Background



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Background

Java island

General information

- High population (About 70% of the total population of Indonesia),
- High productive land (About 70% is considered to be agricultural land (paddy field, mixed garden, upland/dry-lands, fishponds, and state/private plantations) (Statistics of Indonesia, 2003)

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Background

- Many studies indicated that carrying capacity of Java Island has been overshoot (Rustiadi *et al.* 2008, KLH 2009)

:> Existing land use is not suitable with spatial plan
:> Spatial planning/plan is not suitable with spatial planning rules (principles)

Example: Case of *Ciliwung watershed - Jabodetabek;* the inconsistencies are mostly related with protected and agriculture area (green open space) (Rustiadi *et al.* 2011, Pawitan 2002)

- Most of land in Java Island has been allocated

:> Current land use and how land use changing is regarded on behavior principles of the landowners; e.g. government (forest), plantation companies (plantation), community/individual (paddy, upland, and settlement)

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Background

Land use and land cover change (LULCC)

A need of accurate information on LULCC as an interface to understand many aspect of environmental problems (Technical issues: classification and scale)

A need to understand important facts and mechanisms/processes of the LULCC

(Himiyama 1999, Verburg et al. 2009)

→ Understanding the trends /future role of LULCC, and

→ Useful to formulate adapted policy at regional and national level (incl. program/plan/ project of development)

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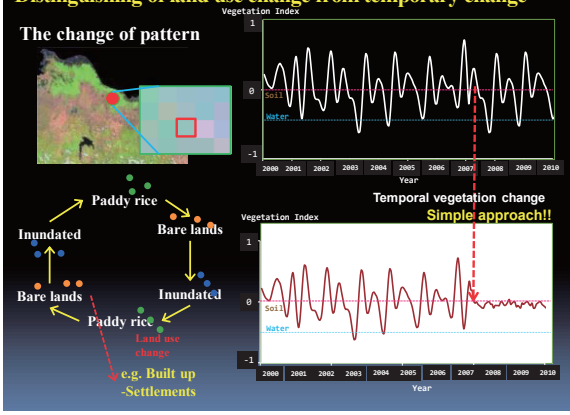
Distinguishing of land use change from temporary change

The change of pattern



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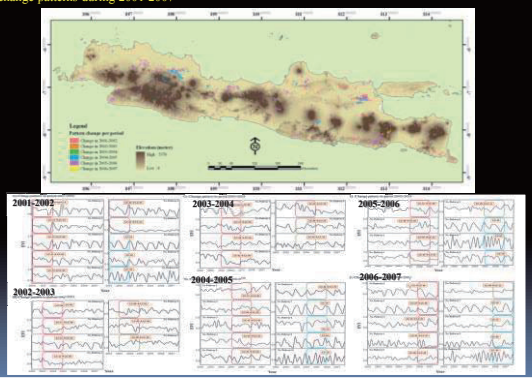
Detected pattern change

Distribution of temporal vegetation dynamics change on Java → 52 types of significant change patterns during 2001-2007



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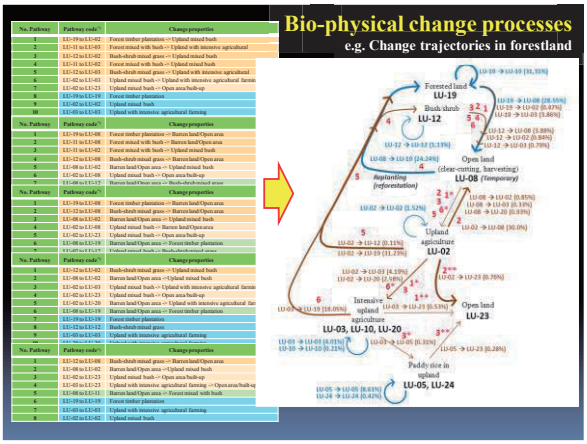
Bio-physical change processes

e.g. Change trajectories in forestland



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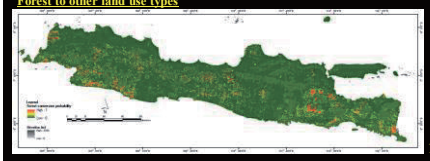
Change probability map

Probability change location

Forest to other land use types



Agricultural land uses to other types

1. Agricultural lands with irrigation system, in upland areas has a high positive auto-correlation with the change areas.
2. The results indicate that the agricultural land is predicted decreasing in the western and southern part.

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Policy implications

- Most of land in Java Island has been allocated
  :> Sustainable land use strategies
  e.g. agricultural land protection
  ↓
  Emphasizing on the Act No. 41/2009
- Many studies indicated that carrying capacity of Java Island has been overshoot
  :> Law enforcement
  ↓
  - Spatial planning is suitable with spatial planning principles,
  - Land use allocation is suitable with the plan

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Thank you for your kind attention..

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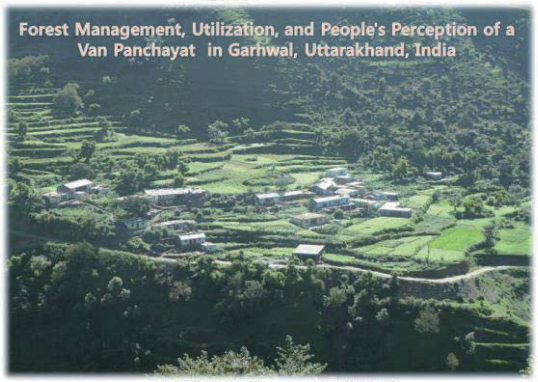
University of Tsukuba

Forest Management, Utilization, and People's Perception of a Van Panchayat in Garhwal, Uttarakhand, India



200921293 Kazuyo NAGAHAMA

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BACKGROUND

Van Panchayat (VP) : Community based forest management, self-governed institution of forestry in Uttarakhand state, India

Van Panchayat (VP) s are increasing the practice to gain people's confidence. (Gairola, H. & Negi, A.S. ,2011)

Van Panchayat

VPs are in qua… and qualitati… dense… Panch… …an hills. (…boni et al., 2007)

Forest degradation

Why? ➢ Why are VPs on the decline, although VP's number are increasing?
This is the case of VP forest on the Kumaon hills in Uttarakhand.

How is the forest management and utilization and people's perception in newly generated VPs on the Garhwal hills?

Background ⇨ Objectives ⇨ Method ⇨ Result

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OBJECTIVES & METHOD

〈Objectives〉
- 5.Management committee
- 4.Livelihood
- 2.Forest management
- 1.Forest utilization
- 3.People's perception

〈Data collection〉
- Uttarakhand (UK) Forest Department
- VP leader
- Local People

〈Methodology〉
- Interview Documents, Acts and Rules ↓ Review
- 41 household (HH) sampling from 51 HH in total ↓ Structured interview

〈Discussion〉
Impact of VP on sustainable forest management and livelihood improvement

Background ⇨ Objectives ⇨ Method ⇨ Result

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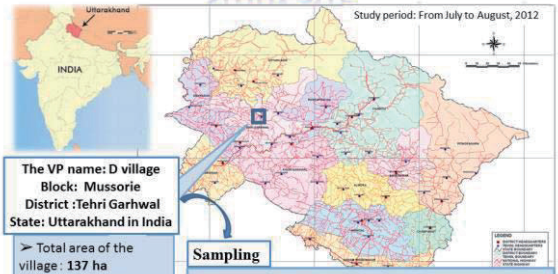
STUDY SITE



The VP name: D village
Block: Mussorie
District :Tehri Garhwal
State: Uttarakhand in India

- Total area of the village : **137 ha**
- Altitude : **1850 m**
- Year the VP established : **1993**
- Total VP area : **20 ha**
- Total HH : **51** (Population : **348**)

Sampling

- The reason of selection D village : Present Sarpanch (VP head) is a Block Committee leader of 151 VPs in Mussoire, supporting VP association and the assumption of active VP.
- Number of household (HH) interview : 41 HH data (80% HH in the village)

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RESULTS

1. Forest utilization in D village VP

Logging:	Ban on felling of living trees
Grazing animals	Unrestricted
Grass cutting	Unrestricted
Collection of dry and fallen branches, twigs and leaves	Unrestricted
Type of forest	Dominated forest With **Oak** (*Quercus* spp.), some patches of **Chir Pine** (*Pinus roxburghii*):

Oak(Author, 2012)

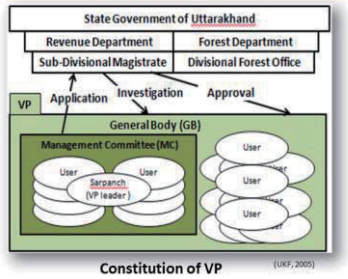
100% respondents utilize firewood which is necessary,
78% respondents collect firewood routinely,
for maintaining their livelihood.

Background ⇨ Objectives ⇨ Method ⇨ Result

20

... continued

2. Forest management



Constitution of VP (UKF, 2005)

MC has jurisdiction (duty) and responsible for managing to VP.

Background ⇨ Objectives ⇨ Method ⇨ Result

21

... continued

3. Livelihood activity

Forest is important to maintain people's livelihood, but not a direct source of income.

Agriculture is their main livelihood.

All of the People in D village are listed as Below Poverty Line.
(B.P.L. Survey, 2002)

4. People's perception

After VP was formed...

The current VP condition is highly improved.

Respondents are satisfied with the activities of MC.

Background ⇨ Objectives ⇨ Method ⇨ Result

22

... continued

5. Characteristics of Management committee (MC)

Relation between MC member's composition and the factors

Factors	Explained valuable : MC members or not		
	χ^2	Fishers *p*	Result
Caste	4.04	-	Rejected
Migrant	0.303	0.27	Accepted
Outside study	0.74	0.23	Accepted
Cell phone	-	0.50	Accepted
Dish TV	-	0.17	Accepted
LPG	-	0.0003	Rejected
VP distance	-	1.32	Accepted
Collecting firewood	-	0.37	Accepted
Grazing animals	-	0.29	Accepted

(Critical value: $\chi^2 > 4.06$ (5%), $p<0.05$)

The consistence of caste is not fair to consider the proportion of the villagers.
-LPG is the indicator of the independence of firewood,
MC members depend on firewood.

Background ⇨ Objectives ⇨ Method ⇨ Result

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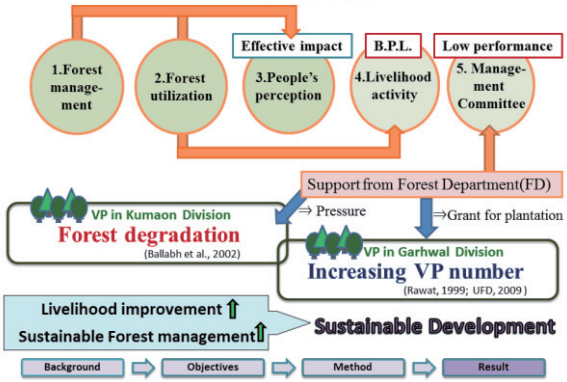
DISCUSSION



Background ⇨ Objectives ⇨ Method ⇨ Result

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Forest Management and Utilization in a Community Forest User Group, Chitwan District, Nepal

Supervisor: Prof. MASUDA Misa
201121320 SIMONAPENDI Maria Ludia

26

Deforestation and Community Forestry

Deforestation rate per year:

1978/79-1994/95 **1.7%**

1990/91- 2000/01 **0.06%**

Macro level studies and visual interpretations proved that forest cover in Nepal was significantly improving due to the successful implementation of Community Forestry (CF) (MoFSC 2009).

Bagh Devi CF Forest, August 2012

CF has supported forest restoration

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Objectives and Method

Objectives: equity in CF management and utilization	
Management Committee	**Users**
Forest production and distribution	Social conditions and forest consumption
Interview with Executive Committee	Interview with 72 HH from 1,051 HH using structure questionnaire.

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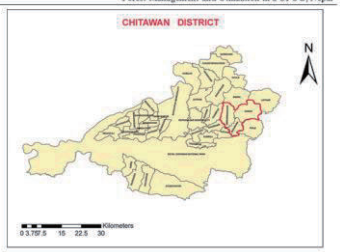
Study Site

Chitwan district

- One of the districts in *Terai*
- High Population density (255 persons km^{-2} in 2011)
- Population flow in the late 1960s caused deforestation.
- In 2007 ± 60 CFUGs was formed.

CFUG: Community Forest User group



Bagh Devi CFUG

- Established in 1997 (one of the oldest CFUGs in Chitwan).
- 531 ha was managed by 1,051 HH (0.50 ha/HH).
- Natural mixed forest, Sal (*Shorea robusta*) as the dominant species.
- Deforestation took place in 1960s - 2002, and now forests are recovered.

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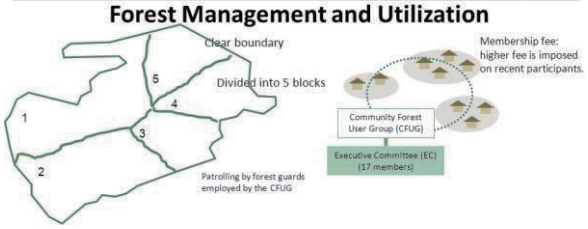
Forest Management and Utilization



Forest product	Collector		Payment		Remarks
	User	EC	Ticket*	Purchase	
Timber		✔		✔	Lower price for poor people.
Firewood	✔	✔	5 Nrs	✔	CFUG members can collect during specified periods decided by the EC.
Grass/fodder	✔				

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Executive committee selling firewood

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Discussion and Future Plans

- Equal right to access for forest products reveals the equity in forest management and utilization.
- Equity in forest management and utilization increase people awareness to protect forest.
- Forest recover since 2003 reveals that forests are under good management.

- Focus not only on one CFUG
- Learn from Nepal case study to improve forest management and utilization in Indonesia.

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Thank You for Kind Listening

Sal (Shorea robusta) stands, photo by L. B. Prasetyo, 2011

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Life Cycle Assessment of Municipal Solid Waste Management in Chinese Urban Areas: Case Study in ChongQing City

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

34

Introduction

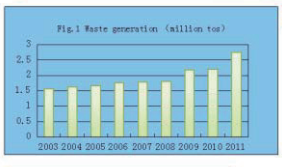
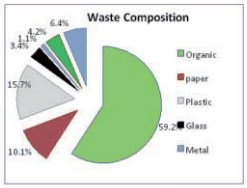


Fig.2 Waste compositon in ChongQing urban areas (2011)



Population(2011):
Main urban areas:
7.5 million(2333household)
Area ocupatation:
Main urban areas: 4403 km2
Household waste generation:
Main urban areas: 1.08kg/capita/day

In 2011, approximately 2.94 million tons waste was generated.Total commerical food waste is 0.6 million tons.

Waste treatment facilities	year	Capacity(t)	location
Tongxing Incineration	2005	1200	Bei'bei
Fengsheng Incineration	2012	2400(300)	Ba'nan
Heishizi kitchen waste Treatment	2010	500	Yubei
Heishizi Landfill	2006	1000	Jiang'bei
Changshengqiao Landfill	2003	1500	Nan'an

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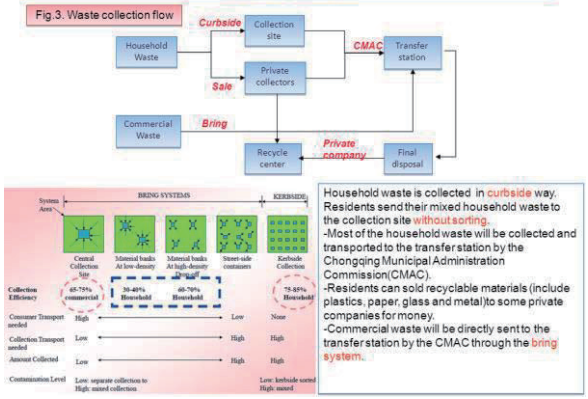
Waste flow

Fig.3. Waste collection flow



Household waste is collected in curbside way. Residents send their mixed household waste to the collection site without sorting.
-Most of the household waste will be collected and transported to the transfer station by the Chongqing Municipal Administration Commission(CMAC).
-Residents can sold recyclable materials (include plastics, paper, glass and metal)to some private companies for money.
-Commercial waste will be directly sent to the transfer station by the CMAC through the bring system.

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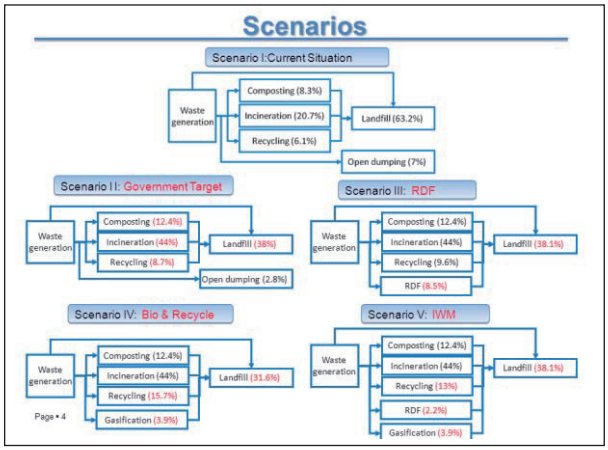

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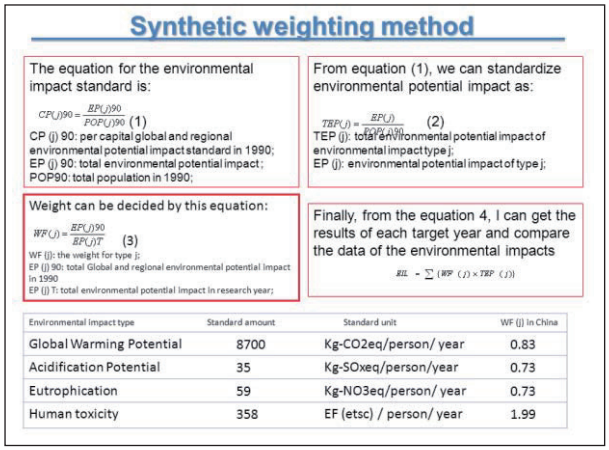

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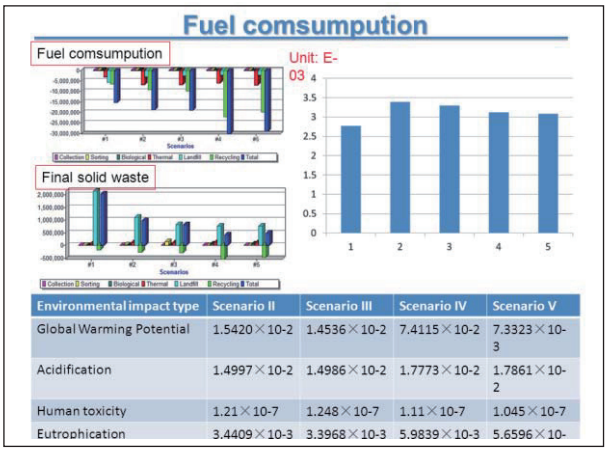

Environmental impact type	Scenario II	Scenario III	Scenario IV	Scenario V
Global Warming Potential	1.5420×10-2	1.4536×10-2	7.4115×10-2	7.3323×10-3
Acidification	1.4997×10-2	1.4986×10-2	1.7773×10-2	1.7861×10-2
Human toxicity	1.21×10-7	1.248×10-7	1.11×10-7	1.045×10-7
Eutrophication	3.4409×10-3	3.3968×10-3	5.9839×10-3	5.6596×10-

39

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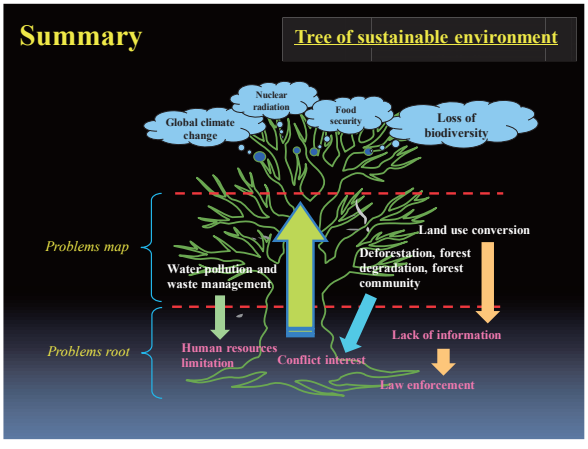

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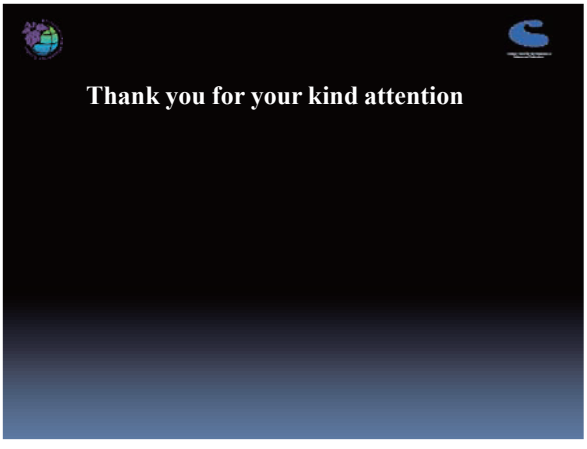

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Poster Presentation

Poster No.1

Dechlorination of Chloral Hydrate Is Influenced by the Biofilm Adhesin Protein LapA in *Pseudomonas putida* LF54

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University of Tsukuba

Chloral hydrate (CH) is synthesized by the chlorination of ethanol. As a sedative and hypnotic drug, CH is used in human and veterinary medicine. The anhydrous chemical, chloral, is used as an intermediate in the production of insecticides and herbicides. Drinking water is the major exposure route of CH to the public, as CH is the third by-product formed when drinking water is disinfected with chlorine. CH irritates the skin and mucous membranes and has been reported to be a potent genotoxic and carcinogenic compound. Because of the lack of enzymes in critical steps of catabolic pathways, CH is often recalcitrant to biodegradation. In our previous study, we isolated *Pseudomonas putida* LF54 (LF54), the first bacterium that has been shown to use chloral hydrate (CH) as the sole carbon source in an assimilation pathway, in which dechlorination is the critical step.

In this study, we identified a transposon (Tn) mutant that can render LF54 defective in CH dechlorination. The molecular characterization of Tn mutants revealed that the transposon insertion sites map to *lapA*. Additionally, induced expression of *lapA* in the conditional *lapA* mutant of LF54 further verified that defective *lapA* expression renders LF54 defective in dechlorination. The *lap* genes are conserved among environmental *Pseudomonads* such as *P. putida* and *P. fluorescens*. In *P. putida*, the LapA protein is one of the largest bacterial proteins (8,682 amino acids) with an estimated molecular weight of 888 kD. Recently, many studies have revealed that the largest cell-surface associated protein LapA, a biofilm adhesin, is able to initiate biofilm formation and achieve stable, “irreversible” binding to a large variety of surfaces in *P. fluorescens* and *P. putida*. This function was also verified in the induced conditional *lapA* mutant and in LF54.

These data indicate CH dechlorination, a critical step of CH biodegradation, is influenced by the biofilm adhesin protein LapA in *Pseudomonas putida* LF54 and this is also a novel function of *lapA*.

Keywords: Chloral hydrate, biodegradation, dechlorination, *lapA*, biofilm

Dechlorination of Chloral Hydrate Is Influenced by the Biofilm Adhesin Protein LapA in *Pseudomonas putida* LF54

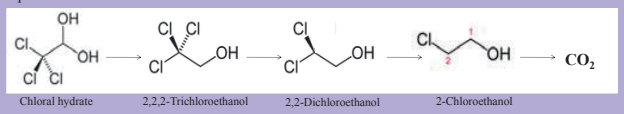
Zhangwanjun Hiroo Uchiyama
(EDL Doctoral Prog. Life and Environ. Tsukuba Univ)

Strategic Funds for the Promotion of Science and Technology

Introduction

Chloral hydrate (CH) is synthesized by the chlorination of ethanol. As a sedative and hypnotic drug, CH is used in human and veterinary medicine. The anhydrous chemical, chloral, is used as an intermediate in the production of insecticides and herbicides. Drinking water is the major exposure route of CH to the public, as CH is the third by-product formed when drinking water is disinfected with chlorine. CH is irritating to the skin and mucous membranes and has been reported to be a potent genotoxic and carcinogenic compound. Because of the lack of enzymes in critical dechlorination steps of catabolic pathways, CH is often recalcitrant to biodegradation. In our previous study, we isolated *Pseudomonas putida* LF54 (LF54), the first bacterium that has been shown to use chloral hydrate (CH) as sole carbon source by an assimilation pathway. This strain transforms CH to Trichloroethanol (TCAol), which is then dechlorinated to dichloroethanol (DCAol), and CO_2 was detected as the end product.

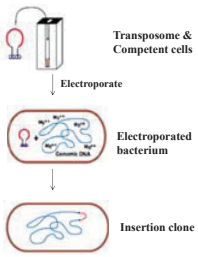
Biocatalysis dehalogenation:



In general, halohydrin dehalogenation is an intramolecular substitution in which enzymes convert vicinal halohydrins to an epoxide, a halide ion, and a proton. However, the dechlorination in LF54 is reduction, in which chlorine (Cl) is substituted by hydrogen (H). This novel pathway of halohydrin dehalogenation has not been reported previously. Therefore, further study of LF54 would prove advantageous in CH dechlorination and bioremediation.

Method

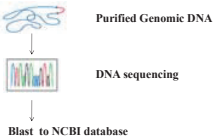
STEP 1 : Random transposon mutagenesis



STEP 2: Tn mutants screening

Find out the insertional inactivation mutant (two screening steps)
First screening: a multi-step colorimetric method.
Second screening: performed by capillary gas chromatography (GC)

STEP 3: Transposition site location



STEP 4: A conditional mutant construction and inducted expression

A 461 bp internal fragment of lapA was amplified then the fragments were digested with Nde I / KpnI and ligated into pSC200 to yield pSC200-lapA. The plasmid pSC200-lapA was introduced into the mobilizer strain E. coli S17-1 and then was transferred to LF54 by conjugation.
This strategy created conditional mutants in which the expression of lapA gene depended on the rhamnose concentration (0.1% wt/vol) in the medium.

Result

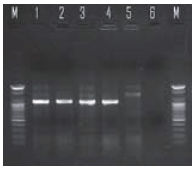
STEP 1: Random transposon mutagenesis

① **Electroporation**

Host	Sample	Efficiency (CFU/ug DNA)
LF54	H_2O	0
	pSUP104(9.5K)	1.92x10^6
	Transposome	7.61x10^5

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

② **Assay the transformation**



M: 100bp ladder
1-4 Mutant
5 LF54
6 Negative control

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.

A library of approximately 3800 mutants was generated using Tn mutants in LF54.

STEP 2: Tn mutants screening

① **First screening: a multi-step colorimetric method.**

a.Chloral hydrate (Residues)

MilliQ	70ul
Sample	5ul
Phosphate buffer	25ul
Color reagents	25ul
Total	125ul

98℃ 15min.
Formed red compound and measured by 480nm.

b. Chloridion (Production)

Sample	100ul
$Fe(NH4)(SO4)_2$	10ul
$Hg(SCN)_2$	10ul
Total	120ul

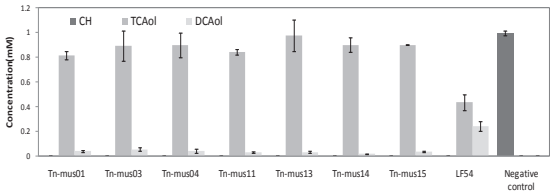
Room temperature 15min
Formed yellow compound and measured by 460nm.

In the first screening, we did not find a Tn mutant in which the process of transformation of CH into TCAol was inhibited And almost 100 Tn mutants released less chloride ions than LF54 were picked up.

Result

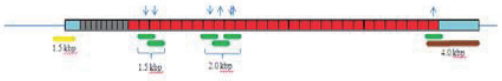
STEP 2: Tn mutants screening

② **Second screening: performed by capillary gas chromatography (GC)**



All strains can transform the whole CH into TCAol after 18hours, approximately 25% TCAol was dechlorinated into DCAol in LF54. DCAol of seven Tn mutants were obviously decreased than LF54, CH degradation was inhibited at TCAol stage.

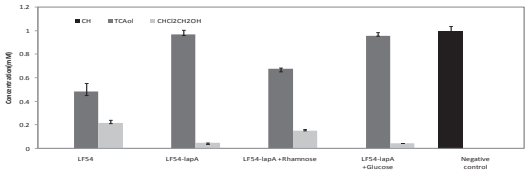
STEP 3: Transposition site location



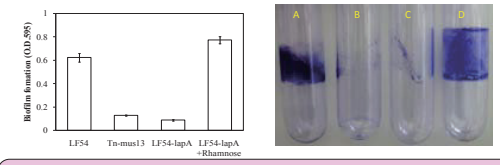
lapA in *Pseudomonas sp.* LF54 and *P. putida* KT2440. ↓: Forward direction, ↑: Backward direction. Bold line indicates *lapA* sequenced in LF54 chromosome. Yellow line indicates upstream fragment including a part of 5'region of *lapA*, sequence identity was 89 %. Green line indicates the sequence flanking the transposon insertions, sequence identity is 91-96 %. Brown line indicated Domain4 including part of Domain3, sequence identity is 93 %.

STEP 4: A conditional mutant construction and inducted expression

Recent studies have indicated that the LapA protein, a cell-surface protein, is able to initiate biofilm formation as a biofilm adhesin and achieve stable, "irreversible" binding to a large variety of surfaces. In this study, the initiation of biofilm formation by *lapA* was verified by induction of *lapA* expression in a conditional *lapA* mutant.



Conditional mutant (LF54-lapA) can transform the whole CH into TCAol irrespective of the rhamnose or glucose. CH dechlorination was inhibited in LF54-lapA in the absence of rhamnose, and recovered by rhamnose induction. The sample without rhamnose induction was similar to the glucose control and Tn mutants.



The start concention is 0.01OD; the culture was grown in LB mediun and shaken at 150rpm for 20 hours. Biofilm formation in conditional *lapA* mutant (LF54-lapA) was recovered by rhamnose induction as same as LF54. On the other hand, LF54-lapA without induction and Tn-mus13 were unable to initiate biofilm formation. A: LF54, B: Tn-mus13, C: LF54-lapA D: LF54-lapA +rhamnose.

Conclusion and Perspective

In this study, we observed that transposon (Tn) mutants can render LF54 defective in CH dechlorination. The molecular characterization of Tn mutants revealed that the transposon insertion sites mapped to an open reading frame designated lapA. Induction of lapA expression in the conditional lapA mutant of LF54 further verified that defective lapA renders LF54 defective in CH dechlorination. Additionally, assessment of biofilm formation in the induced conditional lapA mutant and LF54 verified the function of lapA. All these data indicate CH dechlorination, the critical step of CH biodegradation, is influenced by the biofilm adhesin protein LapA in Pseudomonas putida LF54 and this is also a novel function of lapA.

Over the last few decades, many bacterial cultures, both mixed and pure, have been described which are capable of dehalogenation. Although numerous reports and reviews on microbial dehalogenation activities are available, this process is not, as yet, completely understood. Mechanistic and structural information will allow us to investigate the structure activity relationships of dehalogenating enzymes, increase our understanding of the causes of recalcitrance of various problem compounds, at a molecular level, and also enable the construction of modified dehalogenases as biocatalysts for the transformation of specific problem compounds.

Poster No.2

Comprehensive Evaluation of Socio-Economic and Environmental Policies Emphasizing Reclaimed Water Utilization to Effectively Achieve Sustainable Development in Tianjin, China

中国天津市の持続可能な発展のための再生水有効利用に焦点を当てた環境政策の総合評価

Nan XIANG(相　楠)　(Student ID No. 201035011)
Doctoral Program in Sustainable Environment Studies
Graduate School of Life and Environmental Sciences, University of Tsukuba

Abstract

Currently, due to water shortages and pollution, we have been encouraged to use reclaimed water as an additional source of water. Utilization of reclaimed water is an efficient way to improve the water environment. Tianjin has experienced high economic development and has an annual growth rate more than 10% concurrent with the urbanization process. In 2009, the water resource utilization was 2,337 million m^3, or 190 m^3 per capita (which is only 1/4 of the average amount in China). This is still growing and serious water shortages have occurred. Sanitation coverage is only 82%, and the reclaimed water reuse rate in Tianjin in 2009 was only. The Tianjin government has realized the importance of improving sanitation coverage and the reclaimed water utilization ratio, and has proposed a series of plans to achieve a 50-60% reclaimed water recycling rate and 98% sanitation coverage by 2020.The purpose of this study is to comprehensively analyze the effects of water management policies including utilization of reclaimed water for improving trade-off between water environment and economic development by solving water shortage problem. An experimental simulation was undertaken initially focusing on how utilization of reclaimed water contributes towards achieving the government plan as well as effectively improving water environment protection during economic development.

Keywords: Reclaimed water, water pollution, water resources recycle, modeling

中国天津市の持続可能な発展のための再生水有効利用に焦点を当てた環境政策の総合評価

Comprehensive Evaluation of Socio-Economic and Environmental Policies Emphasizing Reclaimed Water Utilization to Effectively Achieve Sustainable Development in Tianjin, China

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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3年生

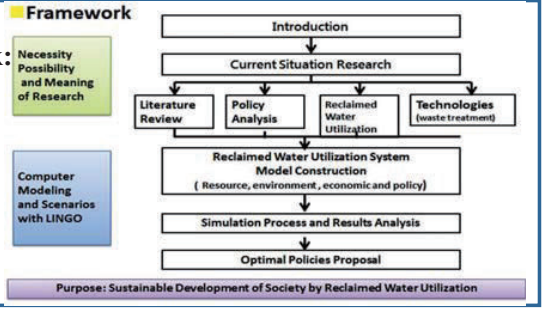
Research Background:

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 190m^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 2% of reclaimed water is used in Tianjin. While the waste water disposal rate is 82%, 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:



Model Frame:

Objective Function: Max GDP

1. Water Cycle Model

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

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

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

$$WD(t) = \sum_j \sum_m Ew_j^m \; X_j^m(t) + \sum_j \square \mathrm{Ewl}_j^{\square} z_j(t)$$

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

$$TP_{\square}^{p}(t) = \sum_i \sum_m Ep^{pm}_{\square} \cdot X_j^m(t) + \sum_j Ep^{1j} \cdot z_j(t)$$

$TP_{\square}^{p}(t)$: The total net load of water pollutant p at time t
$Ep_{\square}^{pm}$: Coefficient of water pollution p of industry m;
P=1(COD); P=2(T-N); p=3(T-P)

3. Social and Economic Model

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

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

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);
ε(t): Column vector of net export(en.);
Z(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—Maxmize GDP, and three sub-models—water cycle model, water pollution flow balance model and social and economic model.

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.

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Poster No.3

Adsorption of hexavalent chromium from aqueous solution using natural Akadama clay

Yingxin ZHAO
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University of Tsukuba, Ibaraki, Japan

Nowadays, with the rapid development of industries, such as metallurgy, dye and pigment, electroplating, leather tanning, refractory material, catalysts, and wood preservative, the discharge of chromium-contaminated wastewater into the water system has become more and more serious. In the aquatic environment, chromium primarily exists in trivalent form Cr(III) and hexavalent form Cr(VI), and the relationship between Cr(III) and Cr(VI) strongly depends on pH and oxidative properties of the location. However, the public is more concerned about Cr(VI), because its toxicity is 100 times higher than Cr(III), and can badly damage people's health due to its carcinogenicity, mutagenicity and teratogenicity in biological systems. The limit of Cr in drinking water proposed by the US EPA is 0.10 mg L^{-1}, the same as recommended by WHO.

Akadama clay is widespread and very cheap in Japan. It originates from volcanic activity and is widely used as a soil medium. Akadama clay is mainly utilized as cultivating clay for plants and flowers due to good soil osmosis, air permeability and water storage. It has excellent adsorption properties and some researchers have used it to remove arsenic effectively. In this study, natural Akadama clay was used to remove Cr(VI) from aqueous solution. The effects of temperature, contact time, initial concentration, and adsorbent dosage on Cr(VI) adsorption were investigated, and the adsorption process was also analyzed using various kinetics and isotherms.

Results show that pH was an important parameter which obviously affects the removal efficiency of Cr(VI) onto Akadama clay. The optimum removal efficiency was obtained at pH 2. The removal efficiency increased with increasing the dosages of Akadama clay, while the adsorption capacity decreased with the increase in the adsorbent dosages.

The kinetic data supported pseudo-second-order model (R^2 = 1) but showed a relatively low fit for pseudo-first-order model (R^2 = 0.9631), which indicated that the adsorption lead a chemical process for the Cr (VI) removal. The Cr(VI) adsorption process fitted with the Freundlich model (R^2 = 9870) better than the Langmuir isotherm model (R^2 = 0.8935). It was proved that the Cr(VI) removal from the aqueous phase did not occur on homogeneous surface by monolayer sorption, but was based on sorption onto a heterogeneous surface.

Keywords: Adsorption capacity, Akadama clay, Chromium (VI) adsorption, Isotherms and kinetics

Effective Adsorption of Cr (VI) from Aqueous Solution Using Natural Akadama Clay

Graduate School of Life and Environmental Sciences

University of Tsukuba, Japan

Exhibitor: Yingxin ZHAO

Introduction

Hexavalent chromium Cr (VI), discharged from various industries such as mining, tannery, and electroplating, are very dangerous to environment and human health due to its carcinogenicity, mutagenicity and teratogenicity in biological systems.

Dye

Leather tanning

Wood preservative

Materials and methods

Akadama clay

⇩ Ground

⇩ Sieved

⇨ Grain Size ≤ 105 μm

⇧ washed with distilled water

⇧ Dried in an air

⇧ Kept in an airtight bottle

Treatment methods

Physical | Chemical | Biological

- High operations cost
- Strict reaction conditions
- …

- Complex process
- Low efficiency
- …

⊖

⊕

Adsorption

- Low cost
- Simple operation
- High efficiency
- Reuse or recycle

Purpose

Use a new adsorbent

⇩

Evaluate its performance

pH | Contact time | Dosage | Initial concentration

⊕

Kinetics | Isotherms

Results

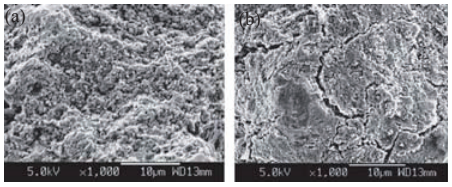
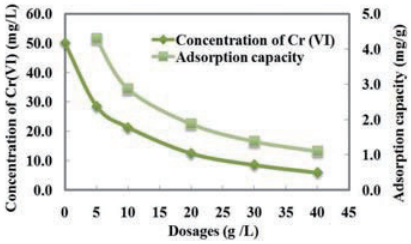


Fig.1 SEM images of natural Akadama clay (a) and after Cr (VI) adsorption (b)



pH : 2; Contact time: 3 h

Fig.2 Effect of adsorbent dosage

Table 1 Adsorption kinetics

Initial concentration: 50 mg/L; Dosage: 40 g/L

Pseudo-first-order model			Pseudo-second-order model		
K_1(min^{-1})	Qe(mg g^{-1})	R^2	K_2(g mg^{-1} min^{-1})	Qe(mg g^{-1})	R^2
0.0666	0.1064	0.997	3.4226	1.1561	1

Conclusions

- Cr (VI) adsorption equilibrium time was 180 min and the optimum adsorption pH was 2.
- The adsorption capacity decreased when the dosages increased during the range of 5-40 g/L.
- The Cr(VI) adsorption onto Akadama clay was well described by pseudo-second-order model.
- The maximum adsorption capacity was 4.29 mg/g.

❖ Large adsorption capacity
❖ Low cost
❖ Abundant source
❖ Simple operation

Promising to treat Cr(VI) rich wastewater

Poster No.4

An Evolutionary Perspective of the *Pseudomonas* Quinolone Signaling

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Graduate School of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Ibaraki 305-8572, Japan

Pseudomonas aeruginosa is a ubiquitous Gram-negative bacterium that can produce cell-to-cell signal molecules in a cell density-dependent manner known as quorum sensing to regulate many social behaviors. Previous study revealed that both the *P. aeruginosa* cell-to-cell signal molecules 2-heptyl-3-hydroxy-4-quinolone (PQS) and its proximal precursor 2-heptyl-4-quinolone (HHQ) could bind a LysR-like transcription regulator PqsR and induce *pqsA* gene expression, although the former exhibited 100-fold more potency than the latter. In this study, a *P. aeruginosa* pathogenic strain D4, isolated from mouse blood, displayed a greater capability of utilizing HHQ as cell-to-cell signal than PAO1.

The D4 strain showed retarded pyocyanin virulence pigment production during aerobic shaking and a remarkable increase of pyocyanin during static culture condition compared with the wild type strain PAO1. Interestingly, the D4 strain produced pyocyanin even in a *pqsH* mutant whereas PAO1 did not, suggesting that D4 responded to HHQ. To investigate this phenomenon further, *pqsA* expression, which is under the regulation of PQS, were assayed in PAO1 and D4 wild types as well as their *pqsH* mutants. Intriguingly, *pqsH* mutant of D4, which does not produce PQS but produces HHQ, triggered higher *pqsA* expression than the PAO1 *pqsH* mutant, indicating D4 possessed greater capability of utilizing HHQ in cell-to-cell signal than PAO1. Under anaerobic conditions, PQS is not synthesized since oxygen is required and HHQ accumulates. However, it is not clear whether HHQ is used as a signal under these conditions. In this study D4 *pqsH* mutant showed *pqsA* expression while little was expressed in PAO1 *pqsH* mutant. These results along with the genomic information provide the novel hypothesis that *P. aeruginosa* may originally have utilized HHQ as a signal and gradually evolved the ability of producing PQS to adapt to the change from anaerobic to aerobic environment on earth.

Keywords: quorum sensing; PQS; HHQ; *Pseudomonas aeruginosa*; pyocyanin

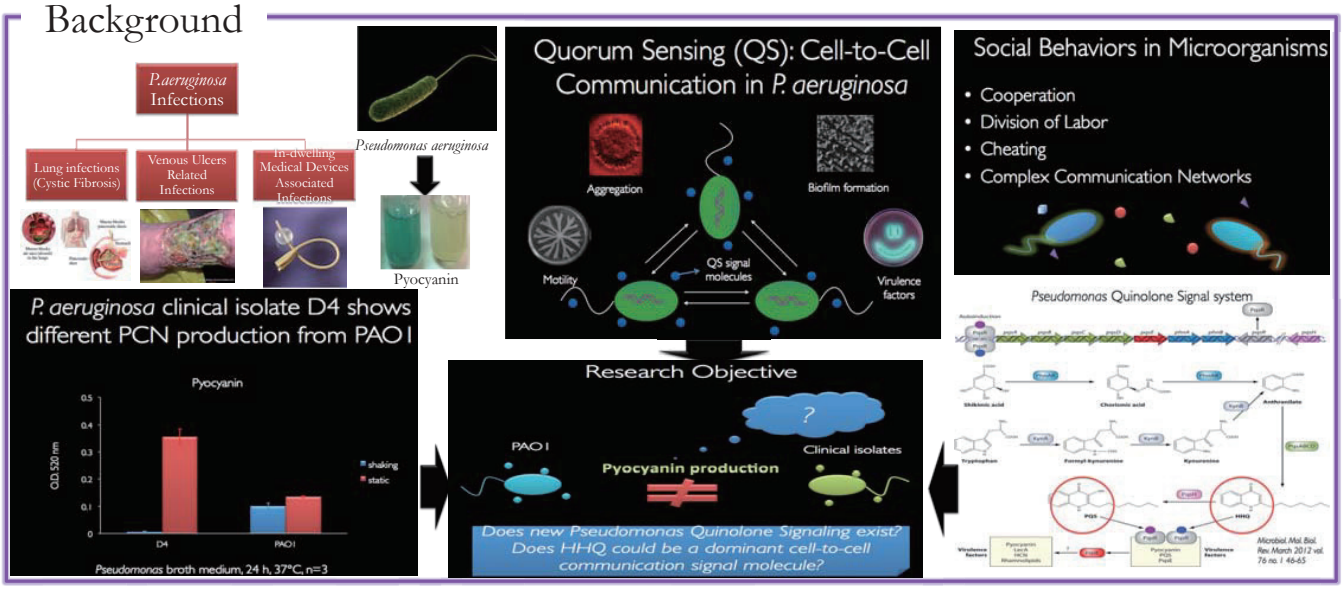
Study of the *Pseudomonas* Quinolone Signaling and Pyocyanin Production in *Pseudomonas aeruginosa* Clinical Isolates

○ Hao Fang

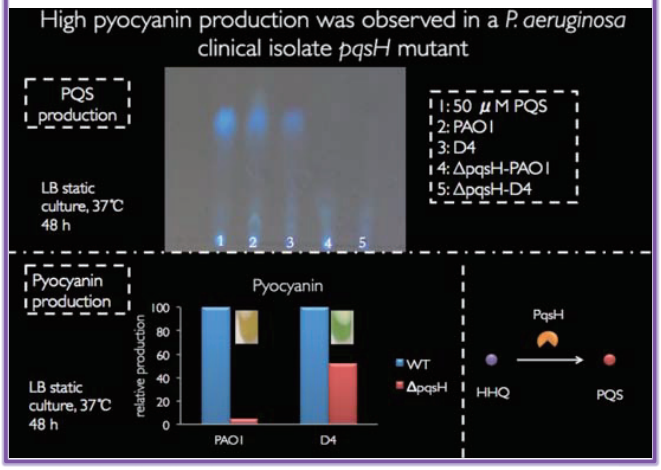
Graduate School of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Ibaraki, Japan

Strategic Funds for the Promotion of Science and Technology

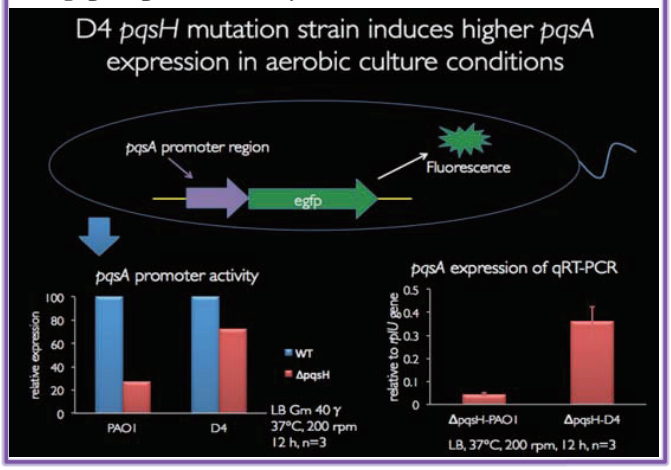
Background



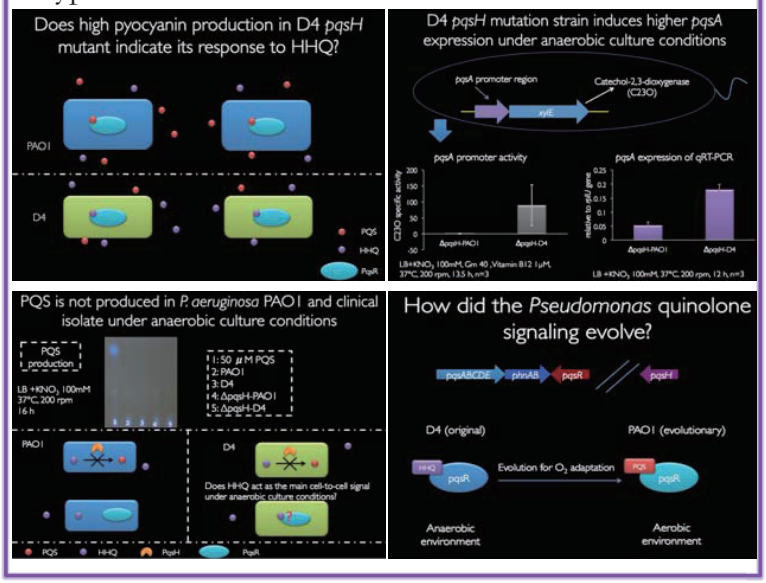
PQS assay and Pyocyanin



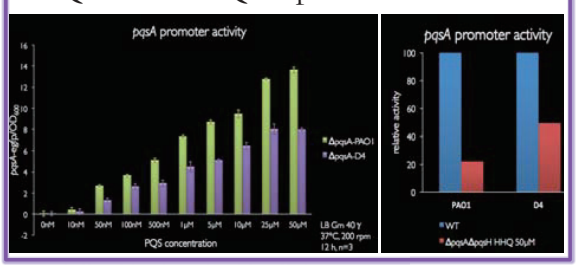
Egfp reporter assay and RT-PCR



Hypothesis



PQS and HHQ response



Conclusions

The *P. aeruginosa* clinical isolate D4 shows high response to HHQ in activating *pqsA* gene expression in *Pseudomonas* quinolone signaling system, indicating until now HHQ's function as a quorum sensing signal molecule was severely underestimated in *P. aeruginosa* and may play a more important role in cell-to-cell communication.

Poster No.5

An Electrochemically Surface Modified Tablet Porous Material Developed for Phosphate Removal from Aqueous Solution

Shengjiong YANG
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University of Tsukuba, Ibaraki, Japan

Food production requires diverse fertilizers such as phosphorus and nitrogen. In past decades, accelerated growth of the world population resulted in a large consumption of natural resources and increased the burden of food shortage [1].

Phosphorus is an essential element and irreplaceable in agriculture; it is an un-renewable resource and conclusive evidence reports that current global reserves of P may be depleted in 100 years [2]. Further, the wide utilization of P-fertilizers in agriculture and industry enhances the nutrient element load when P residue and waste is discharged into water bodies without any treatment. It causes many environmental issues, one of the most severe problems is eutrophication in surface water bodies [3]. It causes the deterioration of aquatic ecosystems and the death of aquatic animals Therefore; the removal of phosphorus has become the focus of investigation by many researchers. In phosphate treatment, adsorption can be regarded as a good method for phosphate removal.

In this study, a tablet porous material (TPM) consisting of Kanuma clay, cornstarch, white cement, iron powder and calcium oxide was developed. It was modified by an Electrochemical Surface Modification (ESM) process and then utilized to remove phosphate. It exhibited excellent phosphate adsorption ability, and the ESM process could also be applied for adsorbent surface modification.

Keywords: eutrophication, tablet porous material, Kanuma clay, Electrochemical Surface Modification

Reference

[1] A. Avni, M.A. Blázquez, Can plant biotechnology help in solving our food and energy shortage in the future?, Current Opinion in Biotechnology, 22 (2011) 220-223.
[2] D. Cordell, J.-O. Drangert, S. White, The story of phosphorus: Global food security and food for thought, Global Environmental Change, 19 (2009) 292-305.
[3] V. Istvánovics, Eutrophication of Lakes and Reservoirs, in: E.L. Editor-in-Chief: Gene (Ed.) Encyclopedia of Inland Waters, Academic Press, Oxford, 2009, pp. 157-165.

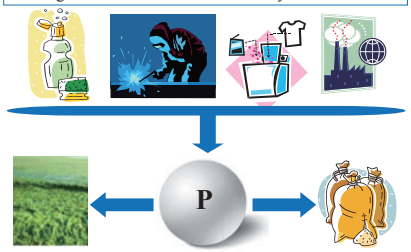
An Electrochemically Surface Modified Tablet Porous Material Developed for Phosphate Removal from Aqueous Solution

Shengjiong Yang, Zhenya Zhang, Yingnan Yang, Zhongfang Lei,
Graduate School of Life and Environmental Sciences
University of Tsukuba, Japan

Strategic Funds for the Promotion of Science and Technology

Introduction

The wide utilization of P in agriculture and industry enhances the nutrient element load when P-waste discharged into water bodies without any treatment.



Background

Many techniques were developed for phosphorus removal, such as chemical precipitation, crystallization, electrochemistry and membrane bioreactor. Effective efficiency was achieved, but still drawbacks, including high cost, complex operation, difficult in practical utilization.

In this situation, adsorption can be regarded as a good method for phosphate removal. In this study, a tablet porous material (TPM) consisting of Kanuma clay, corn starch, white cement, iron powder and calcium oxide was developed. It was modified by an ESM (electrochemical surface modification) process and then utilized to remove phosphate.

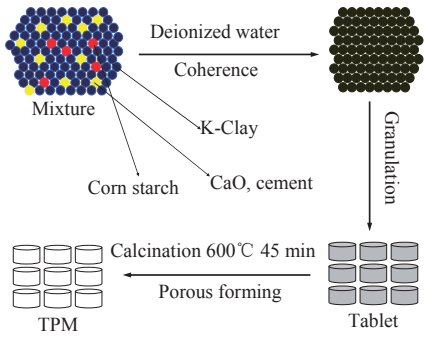
Materials

Kanuma clay White cement Corn starch

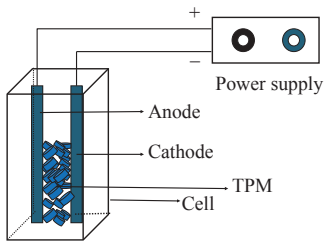
Iron powder CaO

Produced tablet porous materials (TPM)

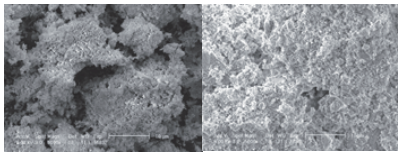
The Procedure of TPM Synthesis



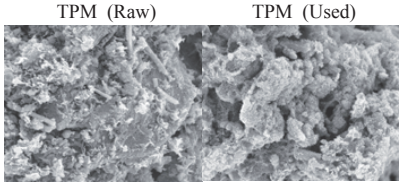
ESM Modification



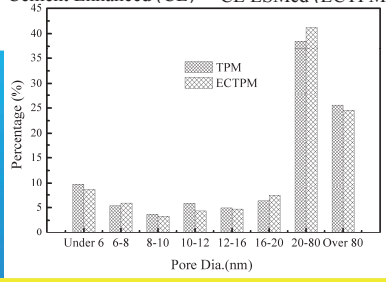
Characteristics



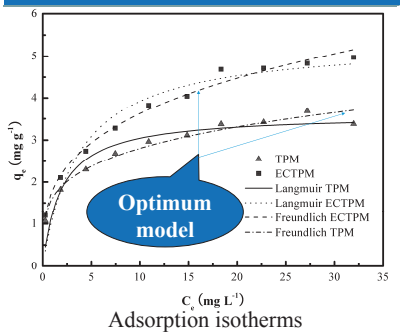
TPM (Raw) TPM (Used)



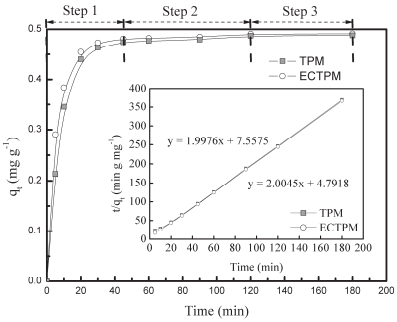
Cement Enhanced (CE) CE ESMed (ECTPM)



Behaviors

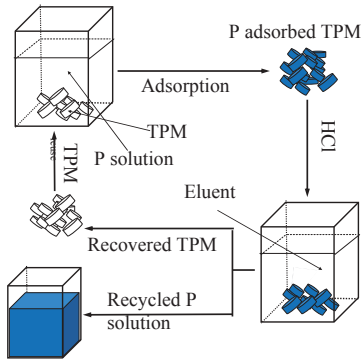


Adsorption isotherms



Kinetics and effect of contact times

Phosphorus recycling



Acknowledgement

The authors wish to express their thanks to National Institute for Materials Science (NIMS), Tsukuba, Japan, and EDL (Environmental Diplomatic Leader) for providing chemical/surface characterization and manuscript proof reading, respectively.

Poster No.6

Towards an integrated municipal solid waste management in Jordan A life cycle assessment study in Amman City

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Abstract

This research analyzes Municipal Solid Waste Management (MSWM) in Jordan from the cradle to grave based on life cycle assessment (LCA) techniques. The goal is to achieve a sustainable waste management system that is environmentally effective, socially acceptable and economically affordable. In order to achieve this goal, different alternative waste management scenarios were carefully designed and modeled based on specific waste collection and treatment technologies used. Through LCA techniques, the overall environmental burden associated with each scenario was estimated, comprehensively evaluated and compared to the existing modeled waste management system (the baseline scenario). For environmental impacts, the indicators used for this research were: Global Warming Potential (CO_2 and CH_4 emissions), acidification potential, ground water pollution from landfill, recycling credits, and final disposal waste as indicators.

The initial results show that integrated waste management scenarios based on the concept of sustainability would potentially minimize environmental impacts, increase recycling levels and decrease the amount of final disposal waste.

Waste management issues are not only related to technical matters, they are also correlated with policies (legislations) and the active participation of society and public awareness, therefore this research will address such aspects in order to achieve the promotion of an environmentally sound waste management system from lessons learned by Japan's experience.

Keywords: Waste Management, Municipal Solid Waste, Life Cycle Assessment, Global Warming Potential

Towards sustainable Municipal Solid Waste Management in Jordan

A life cycle assessment study

University of Tsukuba

Mahdi Ikhlayel, Yoshiro Higano, Helmut Yabar, Takeshi Mizunoya

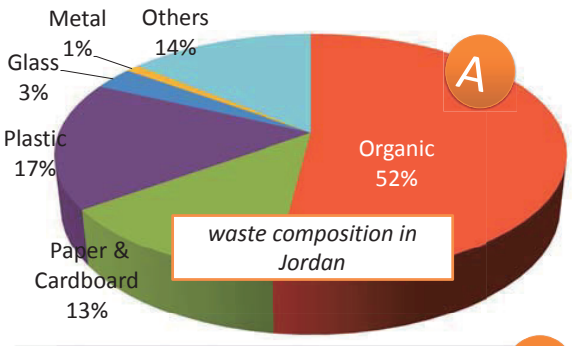
1: Objective

This research analyzes the Municipal Solid Waste Management (MSWM) system in Jordan from the cradle to the grave and is based on life cycle assessment (LCA) techniques using Amman City as a case study. The purpose is to achieve a sustainable MSWM system that is environmentally effective, and economically affordable.

2: Methodology

- Based on secondary data collection and literature review, ten alternative waste management scenarios are proposed and modeled based on specific waste collection, treatment, and final disposal methods. The alternative scenarios included different waste treatment technologies optimized for landfill minimization, recycling, waste-to-energy and global warming emission reduction.
- Through the use of LCA techniques, the overall environmental burden associated with each scenario is estimated, comprehensively evaluated and compared to the existing modeled waste management system (the baseline scenario). The research applied Global Warming Potential (CO_2 and CH_4 emissions), landfill use, acidification potential (SOx and NOx emissions) as major indicators to assess the environmental impacts.

3: Current situation



Mixed waste B
- 2500 ton/day equivalent to 912,500 ton/year

Per capita per person per day: 0.9 Kg on average

Waste collection

Municipalities collect waste in cites (curbside & house-to-house collection).

100% collection coverage in urban areas and 90% in rural areas

Transfer stations

The purpose is to reduce the cost of transportation

Final disposal

Sanitary Landfill 50% (with electricity generation)

Unsanitary landfill 35%

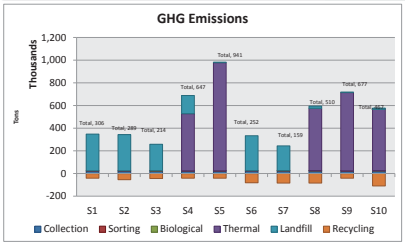
Recycling 10%

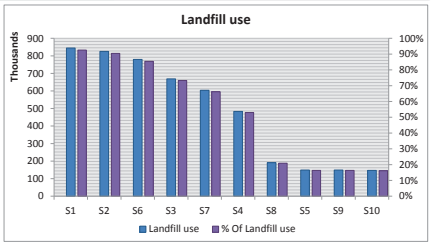
Open dump 5%

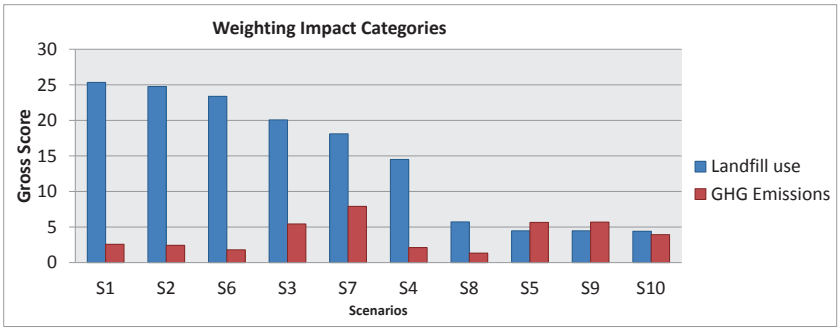
4: Scenarios

S1	**Baseline (the current situation)**
S2	Baseline + Sorting
S3	Baseline + 10 % Composting
S4	Baseline + 50% Incineration of the rest waste
S5	100% Incineration of the rest waste
S6	2x the current recycling rate
S7	2x the current recycling rate + 10% Composting
S8	2x the current recycling rate + 100% Incineration of the rest waste
S9	100% Incineration of the rest waste + Energy recovery from incineration
S10	10% Composting + 2x the current recycling rate + Sorting + 100% Incineration + Energy recovery from incineration

5: Results







The initial research results show that Integrated Solid Waste Management (ISWM) could potentially minimize environmental effects, increase recycling levels, and decrease final disposal waste. Scenarios that are based on the idea of sustainability would be the most environmental and cost-effective ones. Moreover, the results show that waste separation at source, if applied, would potentially increase the recycling rate by up to 23 percent compared with recycling without waste separation.

Poster No.7

Groundwater recharge process by winter precipitation in Tuul River basin, Ulaanbaatar, Mongolia

TOMIMATSU Kohsuke

Groundwater plays an important role in our life. In arid and semi-arid regions, groundwater is often the major source of water supply for industrial, agricultural and domestic uses. Recently, industrialization and population growth have caused excessive groundwater pumping to lower the groundwater table. Mongolia is located in the semi-arid region of north East Asia. Groundwater is the most important water resource, and approximately 90 % of the population uses groundwater for domestic purposes. Now, four wells supply 241000 m^3 of water a day in Ulaanbaatar (UB) city for domestic use. However, excessive over exploitation of the groundwater quality and quantity caused serious problems. Improvement of the integrated water management system is necessary in UB. However, little attention has been paid to groundwater in UB except for a few studies.

Davaa (2002) studied the interaction between groundwater and surface water in UB using stable isotopes. At the end of the spring, O18/H2 isotope in wells in UB showed quite small valuations following the decrease in the Tuul River. This result might be influenced by snow melting.

Also, Ikeda (2011) investigated the interaction between surface water and groundwater with special focus on the Tuul River basin in Ulaanbaatar city. As a result, he shows the Tuul River is dominates the groundwater in the flood plains. In addition, the groundwater in mountains to the north and south partly contribute to groundwater recharge in Ulaanbaatar. In addition, his work indicates that an extremely small amount of precipitation in winter might affect groundwater in Ulaanbaatar, though the mechanism of groundwater recharge by winter precipitation is not clear.

Therefore, my purpose is to estimate the contribution of groundwater via precipitation in winter around Ulaanbaatar in Mongolia and make clear the flow systems of groundwater recharge.

My research plan is still being considered however I have the following options:

1) To clarify the process of precipitation in winter for recharging the groundwater in Tuul River Basin
2) To construct a model to represent the recharge process via precipitation in Tuul River Basin

Investigation on groundwater flow system in Ulanbaatar, Mongolia

Kohsuke TOMIMATSU

Graduate School of Life and Environmental Science, Univercity of Tsukuba. Ibaraki.Japan

1. Introduction

Mongolia has limited water resources. 20 % of Mongolia`s water consumption comes from surface water resources and 80% from groundwater resources. The specific aspect of groundwater resources of Mongolia is that the groundwater resources are unevenly distributed and groundwater resources are limited in many areas. Mongolia is using the groundwater resources for sources of agricultural, industrial and domestic water supply. In recent years, water consumption has been increasing rapidly, particularly due to industry development and population growth. (Jamsran, 2009)

2. Study Area

Basic environmental condition of Mongolia

Mongolia has severe climatic conditions. The average annual precipitation is 250 mm, ranges from 400 mm in the north, to less than 50 mm in the southern Gobi region.

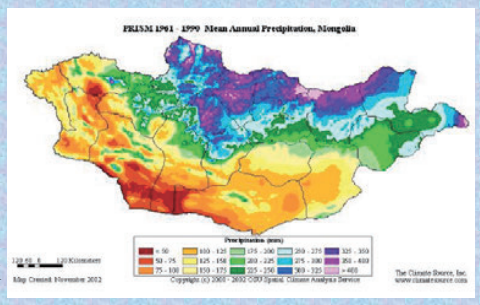


Fig.1. Mean annual precipitation of Mongolia (Jamsran, 2009)

Water resources

Mongolia is divided into three basin in the Central and Eastern Asia.

- Northern Arctic Ocean Basin (16.9 km^3)
- Pacific Ocean Basin (13.9 km^3)
- Central Asian Internal Drainage (3.8 km^3)

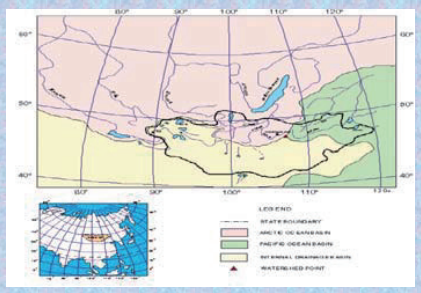


Fig.2. The main basins in Mongolia (Jamsran, 2009)

Ulanbaatar

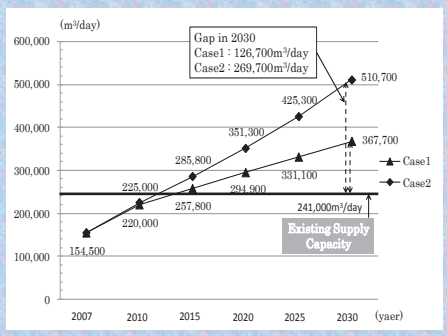


Fig.3. Water use amount , Ulanbaatar (JICA, 2006)

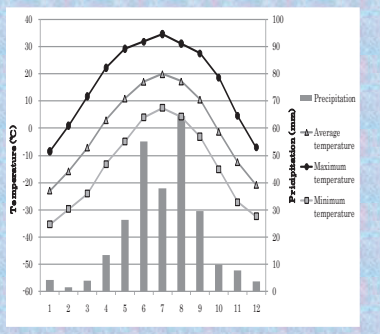


Fig.4. Precipitation and Temperature, Ulanbaatar (JICA, 2003)

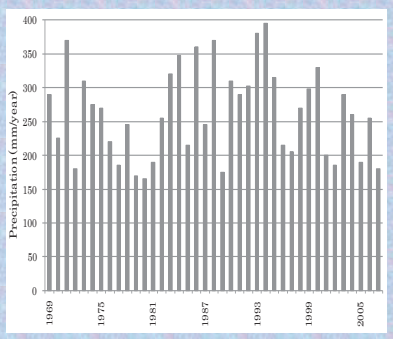


Fig.5. Annual precipitation, Ulanbaatar (Yoshizawa, 2010)

3. Previous Study (Ikeda, 2011)

Ikeda (2011) investigated interaction between surface water and groundwater with focus on Tuul River basin in Ulanbataar. As a result, he shows Tuul River is dominant notice of the groundwater in the flood plains, also the groundwater in the north and the south mountains contribute partly groundwater recharge in Ulanbaatar. In addition, he shows an extremely little precipitation in winter might affect on the groundwater in Ulanbaatar,

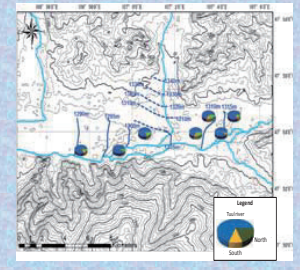


Fig.6. Spatial distribution of relative contribution rate (Ikeda, 2011)

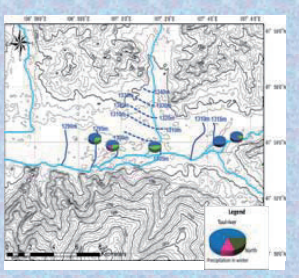


Fig.7 . Spatial distribution of relative contribution rate to consider precipitation in winter (Ikeda, 2011)

4.Objectives

- To estimate the contribution of groundwater by the precipitation in winter around Ulanbataar
- To make clear flow systems of groundwater recharge

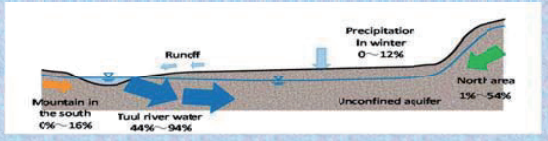


Fig 8: The concept of groundwater recharge in Ulanbaatar (Ikeda,2011)

Poster No.8

Assessment of impacts of climate change on water allocation on the Upper Cau river basin-Vietnam

VU Van Minh
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Water is one of the most important inputs for socio-economic development activities such as domestic life, agriculture, industry, hydropower, the environment, and tourism. Climate change is one big challenge that humankind faces in the 21st century. As the IPCC technical paper VI-Climate change and water (2008) states: freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems.

Vietnam is likely to be one of the most significantly impacted nations in the world from climate change, due to its very long coastline, high dependence on agriculture, and relatively low levels of development in rural areas (The Social Dimensions of Adaptation to Climate Change in Vietnam (World Bank, 2010)). Because of understanding the risk of climate change, the government of Vietnam ratified the United Nations Framework Convention on Climate Change, approved the National Target Program to Respond to Climate Change (2008), and announced the Climate Change and Sea Level Rise Scenarios for Viet Nam (2009).

Assessment impacts of climate change on water resources are important steps to implement the National Target Program to Respond to Climate Change. My research focus is on water allocation in the Upper Cau river basin in the northern part of Vietnam. The Upper Cau river basin includes the territories of 2 provinces of Vietnam (Bac Kan, Thai Nguyen). In these areas, water from the Cau River has a vital role for socio-economic development currently and in the future.

In my research, based on data sources about climate change scenarios from the Ministry of Natural Resources and Environment of Vietnam, and the Vietnam Institute of Meteorology, Hydrology and Environment, mathematical models will be applied to estimate the impacts of climate change on water resources: CROPWAT to calculate crop water demand, NAM to calculate natural flow, and MIKE BASIN to calculate water allocation. The results from the above models will be inputs for my analysis and assessment of the change of water supply for the water use sectors under the impact of climate change.

Keywords: Climate change, water allocation, Cau river, mathematical model

ASSESSMENT OF IMPACTS OF CLIMATE CHANGE ON WATER ALLOCATION ON THE UPPER OF CAU RIVER BASIN-VIETNAM

Student name: Vu Van Minh
Student ID : 201125018

Strategic Funds for the Promotion of Science and Technology

INTRODUCTION

Vietnam is likely to be one of the most significantly impacted nations in the world from climate change, due to its very long coastline, high dependence on agriculture, and relatively low levels of development in rural areas (*The Social Dimensions of Adaptation to Climate Change in Vietnam (World Bank,2010)*). Because of understanding the risk of climate change, the government of Vietnam ratified the United Nations Framework Convention on Climate Change, approved the National Target Program to Respond to Climate Change (2008), and announced the Climate Change and Sea Level Rise Scenarios for Viet Nam (2009, 2012).

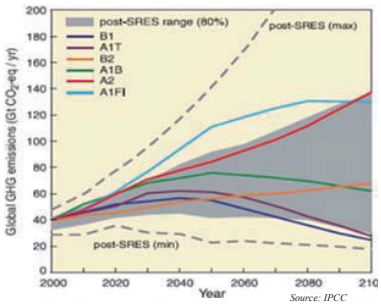
Assessment impacts of climate change on water resources are important steps to implement The National Target Program to Respond to Climate Change. My research focus is on water allocation in the Upper of Cau river basin in the Northern Part of Vietnam. The Upper of Cau river basin includes the territories of 2 provinces of Vietnam (Bac Kan, Thai Nguyen). In these areas, water from the Cau River has a vital role for the socio-economic development in currently and in the future. .

In the research, based on data sources about climate change scenarios from the Ministry of Natural Resources and Environment of Vietnam, and the Vietnam Institute of Meteorology, Hydrology and Environment, mathematical models will be applied to estimate the impacts of climate change on water resources: CROPWAT for calculate crop water demand, NAM for calculate natural flow, and MIKE BASIN for calculate water allocation

OBJECTIVES

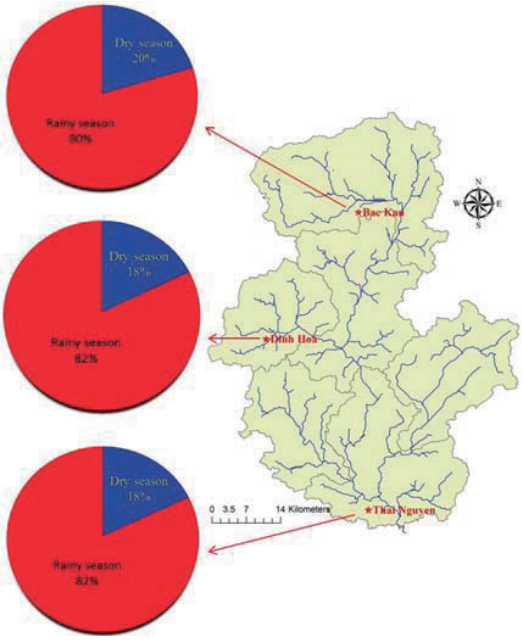
1. Assess impacts of climate change (CC) on river flows in the Upper of Cau river basin to CC scenarios for Vietnam (A2, B1, B2)

2. Assess impacts of CC on water allocation (surface water) in the Upper of Cau river basin to CC scenarios for Vietnam (A2, B1, B2)



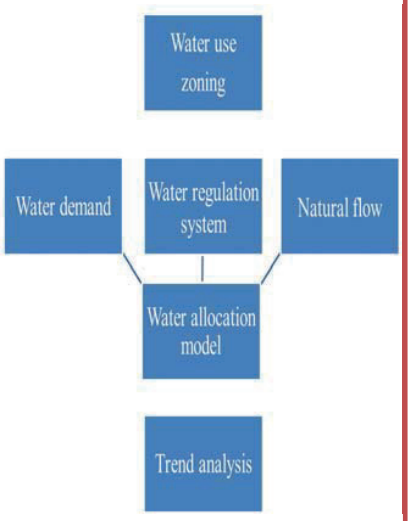
STUDY SITES

- Population in the basin: 670,972 (2004)
- Total area: **30.8** km^2
- Annual rainfall: 1500-2000mm, **more than 80%** in rainy season (V-IX)



METHODOLOGIES

Mathematical models will be applied following steps:



WATER DEMAND

Calculated by:

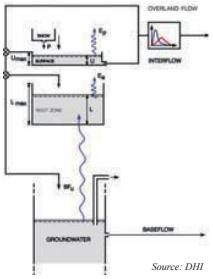
1. Irrigation: Cropwat 8.0 model
2. Livestock
3. Industry
4. Domestic use
5. Public services

} Standard water use per day

NATURAL FLOW

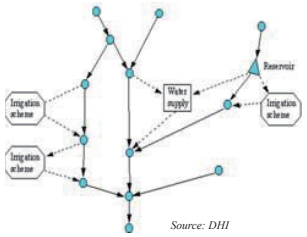
Rainfall-runoff model will be applied:

NAM model



WATER ALLOCATION

MIKE BASIN model will be applied



MIKE BASIN is structured as a network model in which the rivers and their main tributaries are represented by a network consisting of branches and nodes. The branches represent individual stream sections while the nodes represent confluence, locations where certain water activities may occur or important locations where model results are required.

Poster No.9

The Empowerment of Rural Women in Bangladesh for Environmental Conservation: Integrating Traditional Knowledge and Environmental Education

Student ID#201125019; Name: Syeda Masuma KHANAM

Abstract: In Bangladesh, rural women have maintained their livelihood by using and conserving natural resources. They have more intimate relationships with the environment than men and are fully aware that their livelihood and family welfare depend on sustainable resource use; therefore, the environment is to be conserved for their long-term needs. Thus, the rural women of Bangladesh must be recognized as appropriate actors in conserving the environment and coping with natural disasters.

The important roles rural women play in improving their financial position has been recognized by the international community after their participation in Grameen Bank (2006 Nobel Prize laureate) and other NGO-led micro credit programs. The women have successfully improved their financial conditions in rural areas since the 1980s. Taking into account this success story, my hypothesis is that the marriage of rural women's traditional knowledge and contemporary environmental education will empower them to cope with environmental degradation and environmental conservation. For a long time, male-centered social, cultural, political and religious norms have marginalized rural women's knowledge for environmental conservation-related tasks such as kitchen gardening, agriculture and animal husbandry. Though rural women have conserved natural resources, some new causes of environmental degradation have threatened their livelihood. These problems include (1) synthetic chemical contamination by agribusiness, (2) mechanized agricultural practices, (3) the cultivation of high yield variety crops, (4) water shortage due to excessive irrigation, (5) arsenic contamination of ground water, (6) pollution from brick-fields, (7) increased use of plastic products and polythene bags, (8) over-population, and (9) the effects of climate change.

Unfortunately, both men and women do not always value their traditional knowledge regarding the environment because of decades-long patriarchal dominance that has been buttressed by religious beliefs. Environmental education that integrates traditional knowledge will help rural women feel more confident. My thesis itself is also a part of the empowerment process because it follows one of the objectives in the 2011 National Women Development Policy of the Bangladesh government. Thus, my research plan is policy relevant and has potential to be implemented in the future.

Keywords: *Empowerment, rural women, environmental degradation, traditional knowledge, environmental education, environmental conservation, National Women Development Policy, Bangladesh.*

The Empowerment of Rural Women in Bangladesh for Environmental Conservation: Integrating Traditional Knowledge and Environmental Education

Khanam Syeda Masuma
ID#201125019
Supervisor: Kenichi Matsui
Graduate School of Life and Environmental Sciences, University of Tsukuba

Research Background:

- Nearly 82% of women live in rural areas in Bangladesh (Khan, 1995:60);
- These women constitute 45.6% of the farming population (FAO);
- Environmental policy and law target only pollution control;
- Weak environmental administration can be complemented by grass root level involvement of rural women.

Theoretical Approaches:

- ✓ Gender: Rural women's perspectives help better understand environmental conservation in Bangladesh;
- ✓ Agency: Women are not always victims, but active agents of conservation;
- ✓ Governance: They are recognized as the best manager of food security and microcredit programs.

Research Purpose:

To examine the potential of integrating rural women's traditional knowledge into environmental education and empowering them for environmental conservation (National Women Development Policy2011, art. 36)

Research Framework:

The important roles rural women play in improving their financial strength have been recognized by the international community after their participation in Grameen Bank (2006 Nobel Prize laureate) and other NGO-led micro credit programs. With the integration of rural women's traditional knowledge and contemporary environmental education rural women will be able to make direct and indirect economic contribution. This will enhance their decision making role which, consequently will empower them for environmental conservation.

Data Collection:

- ➢ **Place:** Three villages of Dohar Subdistrict: (1)Bilashpur(2) Mahmudpur(3)Dubli
- ➢ **Methods** : (1) Direct observation,(2) Informal interviews (3)Group discussion, and (4) documents and books (secondary source).

Research Findings: 1) Rural Women's Resource Governance:

- ✓ Subsistence kitchen gardening;
- ✓ Commercial vegetable gardening;
- ✓ Pre- and post-harvesting of crops and oil seeds;
- ✓ Seed preservation;
- ✓ Drinking water management;
- ✓ Fuel management for cooking;
- ✓ Taking care of livestock;
- ✓ Use of natural fertilizer;

2)Potential Roles of Rural Women:

- ✓ Environment friendly NRM activities with rich Traditional Ecological Knowledge;
- ✓ Strong network for seed storage and exchange;
- ✓ Protection of species, preservation of agro-biodiversity, and optimum use of Natural Resource;
- ✓ Shape societal values and attitudes of the young towards the environment;
- ✓ More positive about environmental conservation;
- ✓ RW can transfer their knowledge to their peers & the next generations through their tight-knit social networks.

My thesis itself is also a part of the empowerment process because it goes with one of the objectives in the 2011 National Women Development Policy of the Bangladesh government. Thus, my research plan is policy relevant and has potential to be implemented in the future.

Poster No.10

Soil Erosion Prediction in the Watershed of Binh Dien Reservoir, Vietnam

NGUYEN Thi My Quynh[1] (Student ID: 201125021)
Kunihiko YOSHINO[2]
1 – Graduate School of Life and Environmental Sciences, University of Tsukuba, Ibaraki, Japan
2 – Faculty of Engineering, Information and Systems, University of Tsukuba, Ibaraki, Japan

ABSTRACT

Soil erosion by water is one of the most critical problems due to its negative impacts on the environment and results in high economic costs due to its effect on agricultural production, infrastructure, and water quality (Lal 1998; Pimental et al. 1995). An efficient approach to assess soil erosion risk is a method that integrates remotely sensed data and the Revised Universal Soil Loss Equation (RUSLE) within the Geographical Information System (GIS). The RUSLE, a well tested model for erosion prediction, is often used to model the risks of water erosion within GIS platforms. Remote sensing data is a very useful tool to obtain information about vegetation, which is considered a protective layer from soil erosion by water (Pham 2008). Although this approach has many advantages in assessing the water erosion risk, it is mostly applied on a large region scale. This study aims to apply this method to predict the soil erosion rate in Thua Thien Hue province, where there is a high risk of soil erosion by water because of severe climatic conditions and steeply sloped topography. The watershed of Binh Dien's reservoir was selected as the study site in order to check the potential of this approach when applied on a small catchment scale. Moreover, the role of the vegetation types on reducing soil erosion risk by water can be used as an empirical reference in forming a detailed implementation plan for the national policy "Payments for Environmental Services" at the provincial level.

Keywords*: soil erosion by water, GIS, remotely sensed data, RUSLE, NDVI*

University of Tsukuba
Environmental Diplomatic Leader (EDL) Education Program
ANNUAL SYMPOSIUM
February 15, 2013

科学技術戦略推進費
Strategic Funds for the Promotion of Science and Technology

SOIL EROSION PREDICTION IN THE WATERSHED OF BINH DIEN RESERVOIR, VIETNAM

NGUYEN THI MY QUYNH[1], KUNIHIKO YOSHINO[2]
1 - Graduate School of Life and Environmental Sciences, 2 – Faculty of Engineering, Information, and Systems

INTRODUCTION

World wide soil eroded 75 bil. tons per year (Pimentel, 1995)

Cost $400 bil. per year (Pimentel, 1995)

Investment costs

$1 invested - $5.24 saved (Pimentel, 1995)

Reducing costs due to soil erosion

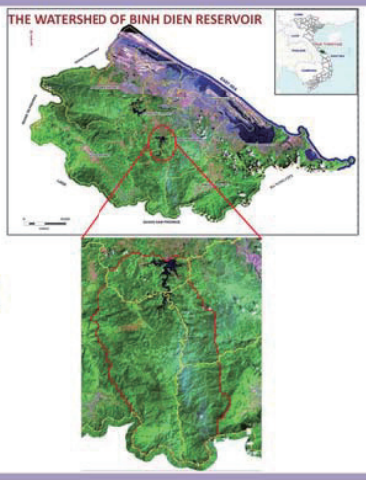
Soil conservation practice

Reduced erosion rate 2 – 1000 fold (Pimentel, 1995)

Necessary to apply soil conservation practice at high erosion risk sites

Where has high risk of erosion?

RUSLE: widely used, many year tested (Renard et al., 1997), validated with acceptable accuracy (Risse et al., 1993)

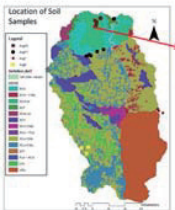


OBJECTIVE

To figure out where has high risk of soil erosion in the for applying countermeasures of soil erosion control.

METHODOLOGY

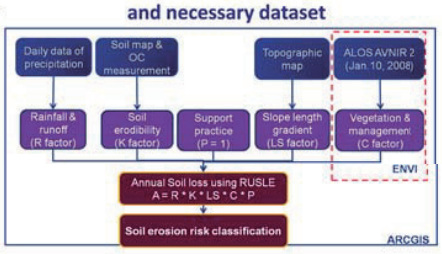
1. **Field survey:** collecting soil samples, checking out vegetation cover type



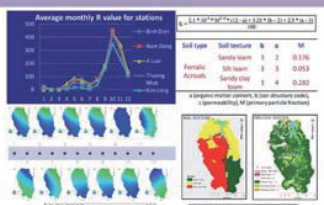
2. **Soil analysis:** using Turin's method to determine organic matter content

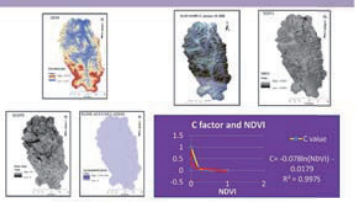
3. **GIS and RS application:**
- Image classification, vegetation index.
- Spatial analysis:
  - Interpolation,
  - Overlapping.

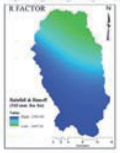
The flow chart of the RUSLE parameters and necessary dataset

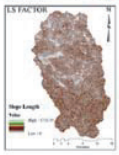


RESULTS





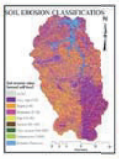




R factor | K factor | P = 1 | LS factor | C factor

Annual Soil loss A = R * K * LS * C * P → Erosion risk classification (Morgan, 2005)

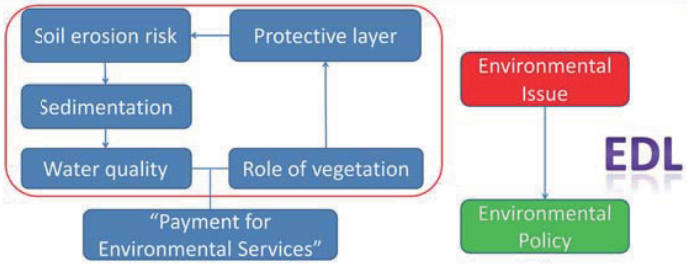
Soil erosion rate (t/ha)*	Erosion risk classes*	Area (km^2)	Percentage (%)
0	Nil	94.436	18.73
< 2	Very slight	161.6	32.06
2 - 5	Slight	106.416	21.11
5 - 10	Moderate	68.901	13.67
10 - 50	High	65.587	13.01
50 - 100	Severe	4.759	0.94
100 - 500	Very severe	2.059	0.41
> 500	Catastrophic	0.32	0.06



FUTURE WORKS

- Validating accuracy of soil erosion map;
- Proposing countermeasures for soil erosion control;
- Writing thesis.

RELATIONSHIP TO EDL PROGRAM



Poster No.11

ESTIMATING THE OPPORTUNITY COSTS OF FOREST CONSERVATION AND MANAGEMENT POLICES RELATED TO REDD+ MECHANISM IN BA BE DISTRICT, BAC KAN PROVINCE, VIETNAM

NGUYEN Tu Anh - 201125022
Supervisor: Prof. Misa MASUDA

Rational of the study

According to the UNFCCC, the Reducing Emissions from Deforestation and Forest degradation plus Forest Conservation in Developing Countries (REDD+) mechanism is considered to be a good option to use in responding to climate change. Vietnam is identified as one of the countries most vulnerable to climate change. Thus, the Government of Vietnam has struggled with international community to respond to climate change and committed to REDD+. On the other hand, the carbon stock of rich natural forest is estimated to be 5-10 times higher than that of planted forest. Therefore, an increase in forest area alone cannot ensure the expected emission reduction (Ha, et al., 2010). Vietnam is one of the forest gain countries. However, the area of natural forest decreased by 10.2% and 13.4% from 1999 to 2005 (Ha, et al., 2010). Encroachment and illegal logging are the main causes of deforestation (Hoang, et al., 2009).

Hence, Vietnam is a sufficient site to study about the implementation of REDD+ mechanism from the perspective of forest degradation mitigation.

Objectives and expected result

The appropriate approaches for the country to gain benefits from REDD+ implementation are emission reduction from forest degradation and enhancement of forest carbon stocks. Furthermore, recognizing that economic approach is a sufficient tool to assess policy effectiveness, the study aims to:

- To clarify the linkage between forest degradation and human activities and government policies, and;
- To estimate the impacts of those activities and policies on current and future forest resources.

Accordingly, recommendation for forest conservation and management policies will base on two main expected results of the study as following:

- Local opportunity costs of forest conservation in Ba Be District, Bac Kan Province, and;
- Carbon stock baseline for the Reference Emission Level of REDD+.

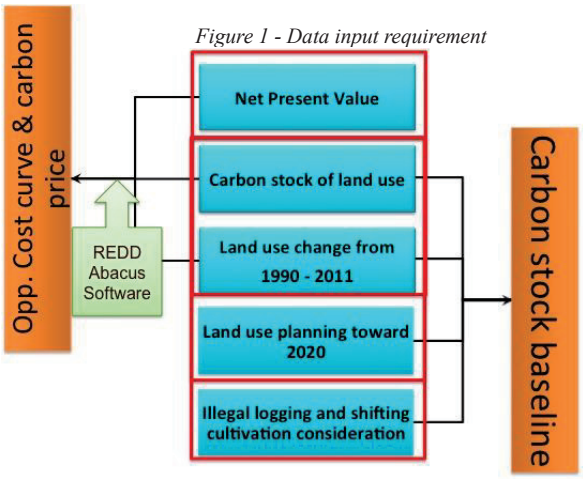
Study area

Ba Be District, Bac Kan Province has been designated as one of the study sites for the implementation of REDD+ in Vietnam. Located in the North East region of Vietnam, the total area of Ba Be is 68,412 ha with high and increasing forest cover of about 84%. It has the highest protection forest area in Bac Kan province. However, forest degradation in the area caused by illegal logging and shifting cultivation still remains at a high rate. Ba Be National Park was recognized as an ASEAN heritage site and benefits from a high rate of biodiversity. Ba Be is identified as one of the three districts in Vietnam where more than more than 50% of the population falls into the highest poverty rate.

Methodology

- Secondary data: collection and review of National forest policies and strategies, implementation reports, and reports, studies, and publication related to Vietnam's forestry sector, REDD+, and other related documents.
- Primary data: interview local people and authorities about household economy; forest status, causes of forest degradation, forest exploitation in the area; benefit sharing, income, and other necessary information.

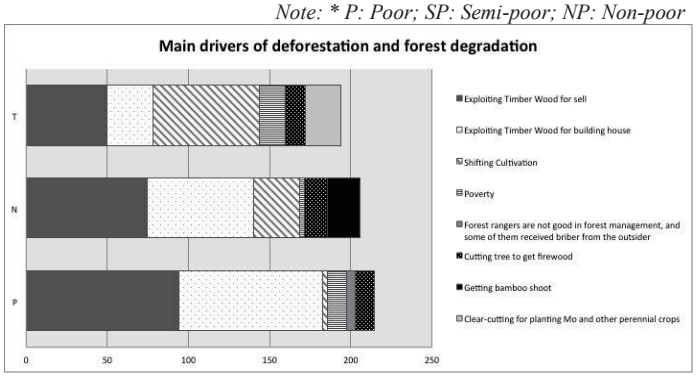
Figure 1 - Data input requirement



Household survey and data collected:

Village	Location	HH number	Economy		Inter viewed (HH)
			Classification*	Rate (%)	
P	Core zone	86	P	15	5
			NP	85	29
N	Buffer zone	86	P	53	18
			SP	32	11
			NP	15	5
T	Outside BBNP	51	P	46	16
			SP	23	8
			NP	31	11
Total number of interviewed household:					103

*Note: * P: Poor; SP: Semi-poor; NP: Non-poor*



Source: Author's Field Survey (August-2012)

Keywords: *REDD+ implementation, Vietnam, Babe National Park, opportunity cost curve, carbon stock baseline*

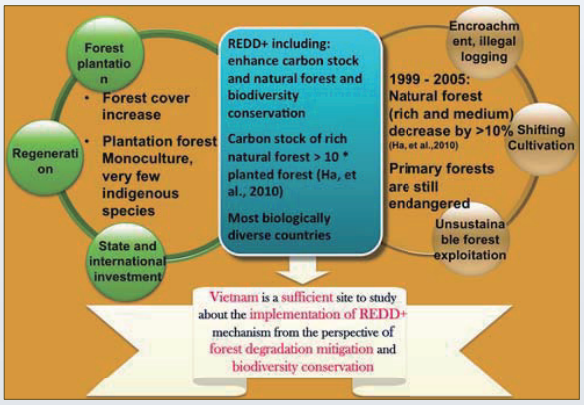
ESTIMATING THE OPPORTUNITY COSTS OF FOREST CONSERVATION AND MANAGEMENT POLICIES RELATED TO REDD+ MECHANISM IN BA BE DISTRICT, BAC KAN PROVINCE, VIETNAM

Student: NGUYEN Tu Anh - 201125022
Supervisor: Prof. MASUDA Misa
Graduate School of Life and Environmental Sciences, University of Tsukuba

Strategic Funds for the Promotion of Science and Technology

RATIONAL OF THE STUDY

According to the UNFCCC, the Reducing Emissions from Deforestation and Forest degradation plus Forest Conservation in Developing Countries (REDD+) mechanism is considered to be a good option to use in responding to climate change. Vietnam is identified as one of the countries most vulnerable to climate change. Thus, the Government of Vietnam has struggled with international community to respond to climate change and committed to REDD+.



OBJECTIVES AND EXPECTED RESULTS

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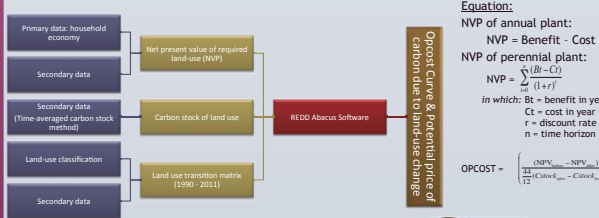
Accordingly, recommendation for forest conservation and management policies will base on two main expected results of the study as following:

- Local opportunity costs of forest conservation in Ba Be District, Bac Kan Province, and;
- Carbon stock baseline for the Reference Emission Level of REDD+.

METHODOLOGY

This study uses both primary data and secondary data. Secondary data is collected from related report and information provided by local authorities and research institutes. Primary data is from household survey in August, 2012 by randomly selecting 103 household in three villages in Ba Be District (P village in the core zone, N village in the buffer zone and T village outside of the Ba Be National Park) according to the rate of household economic classification.



Equation:

NVP of annual plant:

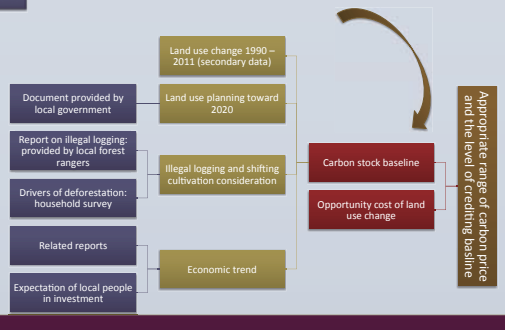
NVP = Benefit - Cost

NVP of perennial plant:

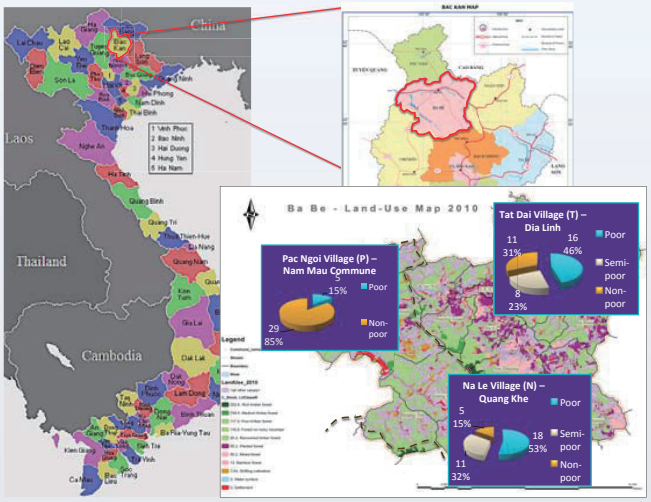
$$NVP = \sum_{t=1}^{n} \frac{(Bt - Ct)}{(1+r)^t}$$

in which: Bt = benefit in year t
Ct = cost in year t
r = discount rate
n = time horizon

$$OPCOST = \left(\frac{(NPV_{alter} - NPV_{ini})}{\frac{44}{12}(Cstock_{ini} - Cstock_{alter})} \right)$$

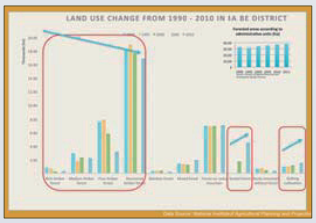


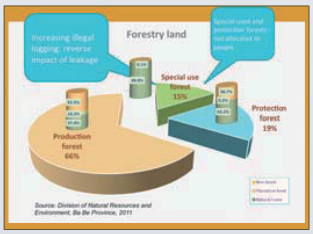
STUDY AREA

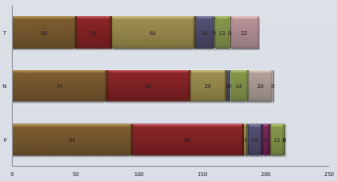


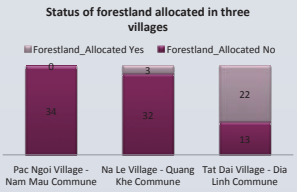
Data Source: National Institute of Agricultural Planning and Projection

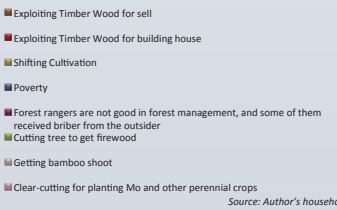
TENTATIVE RESULTS

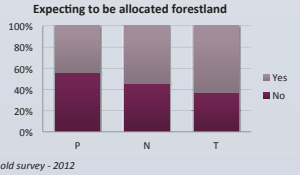












Source: Author's household survey - 2012

According to the household survey (2012) in 3 villages of Ba Be District, 100% interviewed households use firewood as their main energy source for cooking. Using the median of the amount of consumed firewood per person, it is showed that the consumption of firewood per person is increase from 1.07m^3/person/year in P village (core zone), to 1.27m^3/person/year in N village (buffer zone), and 2m^3/person/year in T village (outside of National Park).

UP COMING WORK

Continue to analyze collected data -> Compare between 3 villages and within each village

- Household income total
- Household income sources and their contribution
- Firewood consumption and explanation ….

=> Generating appropriate income from forest conservation activities

Generating Opp. Cost curve

Estimating carbon stock change toward 2020

Illegal logging and shifting cultivation consideration

Carbon Stock Baseline

Poster No.12

Sustainable Wastewater Management from Paper Making Activities in Vietnam: Case Study in Phong Khe Craft Village

DAO Minh Khue
Graduate School of Life and Environmental Sciences
University of Tsukuba, Tsukuba, Ibaraki

Craft villages play an important role in Vietnam's economy, not only bringing prosperity to many households in rural areas but also causing serious environmental pollution. While there have been undeniable economic benefits, activities from craft villages have caused serious environmental pollution, which affected the environment and resident's health not only within the craft villages but also in surrounding areas.

In Phong Khe village of Bac Ninh province, Vietnam, there are currently 180 households engaged in paper production (40,000 ton/year). Tar, pulp and chemicals used in production have directly affected local people's health. Over 5,000 m3 of untreated wastewater that contains high levels of organic pollutants (measured in COD, BOD, and SS) are discharged from this village every day. This wastewater then runs directly into canals and Ngu Huyen Khe River. Wastewater pollution in the village has led to a high incidence of ailments such as headaches, backaches, respiratory diseases, skin irritation, stomachaches, sore eyes, and cancer.

This study aims to (i) provide an overview of the waste paper recycling activities in Phong Khe Village, (ii) identify the environmental consequences of wastewater discharge from waste paper recycling activities; (iii) assess the cost-effectiveness of wastewater management options in the village; and (iv) clarify implications for pollution control activities to mitigate negative impacts on environment in Phong Khe village.

The study undertook a cost-effective assessment to evaluate three options for pollution control including (i) a small treatment plant for every household; (ii) a treatment plant for a group of households; and (iii) a treatment plant for the whole village. Group discussion and consultation with technical experts are also used for analysis in this study. Data collected from previous reports and research, survey questionnaires are used in the analysis.

The results will help us determine the most cost effective and environmentally friendly option. They will also serve as policy recommendations for an effective sustainable wastewater management system in Vietnam.

Keywords: Wastewater, Water Pollution, Cost effectiveness analysis, Craft village, Bac Ninh.

Sustainable Wastewater Management from Paper Making Activities in Vietnam: Case Study in Phong Khe Craft Village

DAO Minh Khue*, *Yoshiro HIGANO, Helmut YABAR and Takeshi MIZUNOYA*
Graduate School of Life and Environmental Sciences, University of Tsukuba

Strategic Funds for the Promotion of Science and Technology

INTRODUCTION

Craft village is a particular production model of Bac Ninh rural area, that plays an important role in the local economic growth and creates jobs for many local citizens. While craft villages provides many economic benefits, we must also take into consideration the environmental impacts associated with their activities.

Phong Khe is a waste- paper recycling craft village, which has polluted the water environment seriously due to directly discharging wastewater into the adjacent river. It has significant impacts on residents' life activities in this area. Therefore, it introduces an integrated wastewater management system for paper making in Phong Khe and propose corresponding measures to ensure a sustainable production and development.

OBJECTIVES

Provide — Overview of paper making activities in PK

Find out — Water Environmental Problems

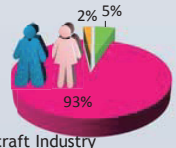
Suggest & Access — Cost Effectiveness Pollution Control options

Recommend — Policy Implications for a Sustainable WW Managment

STUDY AREA: PHONG KHE CRAFT VILLAGE

Area: 5.49 km²
Population: 9,522 people
Households: 2,227 hh(2010)
Annual temperature: 23°C
GDP/person/year: 1,683 USD/person (2008)
High urbanization speed

Economic Struture of Phong Khe Craft Village



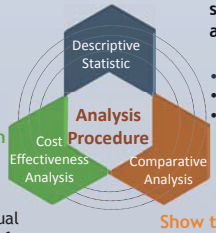
Handicraft Industry
Number of HH involving in Paper Recycling at 4 hamlets:
1. Duong O (75)
2. Cham Khe (8)
3. Ngo Khe (1)
4. Dao Xa (34)

ANALYSIS PROCEDURE

Data collection:

• Secondary data: socio-economic situation, paper production activities, environmental situation evaluation, etc. In addition, data on common wastewater treatment technologies

• Primary data: collected from household survey, discussions among residential-group-leaders, and consultations with a technical expert on wastewater treatment technologies



Describe the general situation of processing activities and its effects

•Performance of recycling paper
•Environmental consequences
•Resident health situation, etc

Choose the most cost effective solution option

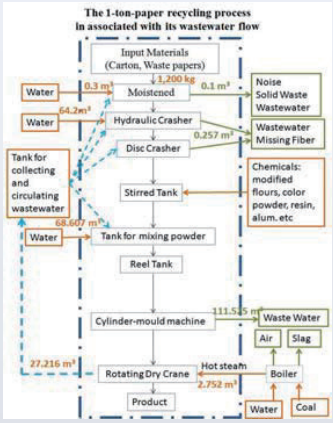
•Identify wastewater treatment options
•Calculate the rate of annual cost and treated amount of environmenal indicator(s) of each options (USD/year/tons)
•Recommend the most appropriate option based on concrete cases

Show the development of the processing activities by year and differences on wastewater volume

•Production volumes
•Number of workers
•Discharged wastewater volumes

TENTATIVE FINDINGS AND CHALLENGES

1.The Paper Making Process (*)



(*) the common model for most of recyled papers

2. Water Environmmental Probblems

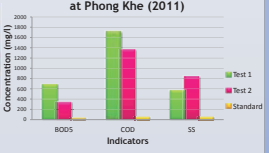
Water channels at Phong Khe

Through the residental drainage system

Through the comon channel to a WW treatment center (small amount)

Directly to Ngu Huyen Khe river (most of amount of wastewater of PK)

Observation Results of Water Quality at Phong Khe (2011)



Total amount of Wastewater without treatment: 5,000m³/day

3.Pollution Control Options

Each of technology option will be considered its effectiveness and affordability for the socio-economic condition of the village and production households. The rate of costs of options (C1, C2, C3) and corresponding treated amount of COD are calculated and compared in order to select the most effective one through sensitive analysis.

DISCUSSION AND RECOMMENDATION

Economic side
• Develop Culture Tourism of recycling and making traditional papers
•Apply subsidy for clean paper making process, etc

Institutions
•Issue certified standards on papers with clean processes to promote clean production, etc

Communication
•Raise awareness of local residents on using Eco-labeled product, cleaner production technologies, etc

Technology
•Install the selected technology for wastewater treatment
•Apply monitoring system during paper making processes, etc

CONTACT

The author would like to receive idea contributions and comments from you for improvement of her research. Please, feel free to contact me if you have questions or comments:

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Poster No.13

Economic Valuation of the Nha Trang Bay Marine Protected Area (MPA): A willingness-to-pay survey

Student name: DANG Nguyet Anh Student ID: 201125025
Graduate School of Life and Environmental Sciences

Supervisor: Naoko KAIDA

The Vietnamese government has recognized the role of marine protected areas (MPAs) as an effective tool for conserving marine resources and developing sustainable livelihoods for communities in and around MPAs. However, the lack in identifying economic values of the protected area and the lack of financial sources for enforcing the MPA policies remain as challenges for the sustainable management of MPAs. The overall objective of the present study is to provide firm evidence of economic benefits provided by the Nha Trang Bay MPA, the first and largest MPA in Vietnam, to propose a sustainable finance mechanism for the MPA. The study firstly aims at estimating the economic value of the NTB-MPA to propose a reasonable *marine conservation fee* as an entrance fee to visit the islands of the bay. The second objective is to recommend the sustainable allocation of money collected from conservation fees. A contingent valuation survey was carried out in NTB-MPA in August 2012, in which the target respondents were asked about their willingness to pay (WTP) to visit the MPA's islands. Respondents' opinions about the allocation of the collected fee were also surveyed using program evaluation questions. 165 responses (83 Vietnamese and 82 foreign tourists) were obtained from the survey. The first rough estimation of WTP indicates that there is no significant difference between Vietnamese and foreign tourists regardless of income gap (average monthly income: USD445 and USD2, 355 for Vietnamese and foreign tourists respectively). One of the potential reasons for this result may be the difference in awareness about the MPA (Vietnamese: 55%, foreign: 8.5%). As for suggested financial allocation based on program evaluation, Vietnamese tourists consider that supporting local livelihood and environmental education are important while foreign tourists are more concerned about coral reef and fish stock recovery.

Keywords*: WTP, tourism, marine biodiversity, marine conservation fee, Nha Trang*

EDL SYMPOSIUM 2013

Graduate School of Life and Environmental Sciences - University of Tsukuba

Tsukuba, Japan, February 15, 2013

Strategic Funds for the Promotion of Science and Technology

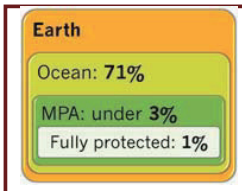
ECONOMIC VALUATION OF NHA TRANG BAY MARINE PROTECTED AREA (MPA), VIENAM: A WILLINGNESS-TO-PAY SURVEY

Student: DANG Nguyet Anh ***Advisor: Naoko KAIDA***

I. BACKGROUND

What is MPA?

"A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values' (IUCN, 2008)"



WHY 1% ?

- *Poor management*
- *Lack of finance*
- *Underestimation of MPA value*

MPAs in Vietnam

- Fledgling development of MPAs
- Unclear legislation on MPA management
- Limited public awareness on MPAs
- Government subsidy
- Inadequate funding
- Few economic valuation study on MPAs

II. STUDY SITE

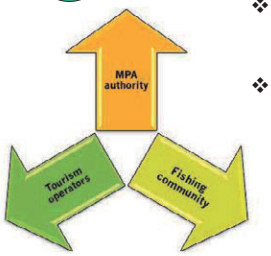
Nha Trang bay MPA:

- Located in Khanh Hoa province
- Established in 2001
- 9 islands/ 15,000 ha
- 5,300 inhabitants
- Main livelihood: fishing
- First, biggest & most diverse coral reef MPA in Vietnam
- Member of 29 world most beautiful bay club

(nhatrang-travel.com)

Tourism and service industry: 45.09% provincial economy
Tousism revenue: USD 112mil.
(Report on Socioeconomic Development Khanh Hoa 2011)

- Decrease of fish catch, limited livelihood
- Poor management and financial shortage
- Potential threats by tourism on marine ecology



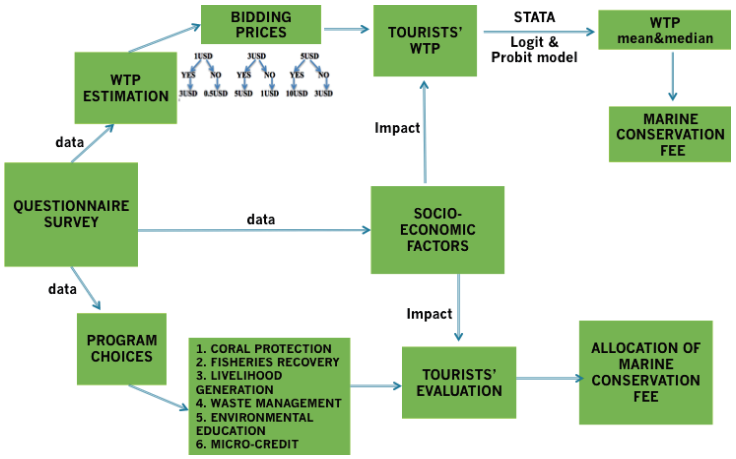
Tourism revenue from collecting fee

Funding marine conservation & local livelihood

III. OBJECTIVES

- To estimate tourist's willingness-to-pay (WTP) to visit the MPA
- To propose a reasonable level of marine conservation fee
- To recommend the sustainable allocation of financial source collected from the marine conservation fee

IV. RESEARCH FRAMEWORK



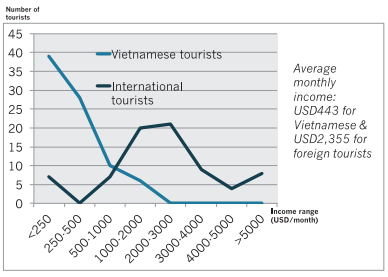
V. WTP QUESTION Double Bounded Dichotomous Choice (DBDC)

*Are you willing to pay **USD3.0** as "**Conservation fee**", given that your income will be deduced and you may have to scarify other demands. (Please make ✔ in the box).*

Yes ☐	No ☐
Go to (A) below	Go to (B) below
(A) If the "conservation fee" has increased to USD5.0, are you willing to pay?	(B) If the "conservation fee" has decreased to USD1.0, are you willing to pay?
Yes ☐ No ☐	Yes ☐ No ☐

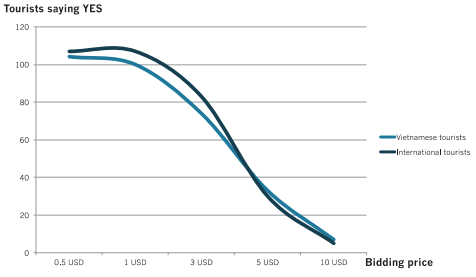
IV. INITIAL RESULTS

Income comparison

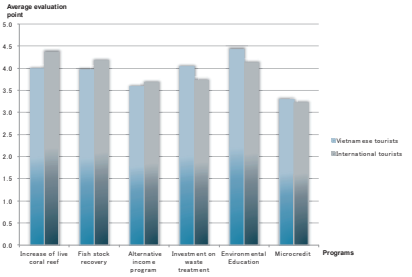


Average monthly income: USD443 for Vietnamese & USD2,355 for foreign tourists

WTP Trend



Program Choices



Poster No.14

Seagrass Mapping Using ALOS AVNIR-2 Data In Lap An Lagoon, Thua Thien Hue, Viet Nam

HA Nam Thang*[a], Kunihiko YOSHINO[b]
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[b]Professor, Faculty of Engineering, Information and System, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki, 305-8577 Japan – sky@sk.tsukuba.ac.jp

ABSTRACT

Seagrass canopy plays a critical role in the ecological functions of coastal zones. They supply nursery and juvenile habitats for fisheries, stabilize sediment and provide direct food for dugongs and green turtles. Lap An is a semi-enclosed lagoon in the South of Thua Thien Hue province with a large area of mangrove and seagrass. This lagoon significantly supports local aquaculture, and is highly important nursery for economic fisheries. However, the reclamation activities of local farmers have disturbed the aquatic habitats, and diminished the seagrass canopy (more than 60% has disappeared from the lagoon).

The objective of this research is to detect the distribution of the seagrass, and propose a seagrass-based protected area for conservation purposes. ALOS AVNIR 2 data was utilized to detect the scattered small patches of seagrass in the conditions of turbid and deep water. DII (Depth Invariant Index) is compared with BRI (Bottom Reflectance Index) method for water column correction. Beside DII-based neural network classification, we propose BRI-based enhanced index toward better seagrass detection in Lap An lagoon.

Preliminary results confirm that there are 3 seagrass species, *Halodule pinifolia* (Miki) Hartog (small leaf size seagrass), *Halophyla ovalis* (R.Br) Hook.f and *Thalassia hemprichii* (Ehrenberg) Ascherson respectively. According to 2010 classification, seagrass area is approximately 44.26 ha, mainly distributes in the East, Southwest, and South of Lap An lagoon. Almost all canopies are healthy with an average coverage of 58 - 86.7% and fresh weight gains 650 – 1,820 g/m^2. BRI corrected water column better than DII method in terms of higher accuracy classification. BR-NDVI will be proposed as the enhanced index, which assists in detecting seagrass more precisely.

Keywords: ALOS AVNIR 2, seagrass, small leaf, turbid water, Lap An, lagoon, neural network, principle component, Depth Invariant Index, Bottom Reflectance Index, BR-NDVI.

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Environmental Diplomatic Leadership (EDL) Annual Suymposium
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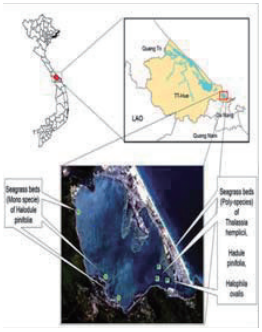
Seagrass Mapping Using ALOS AVNIR-2 Data in Lap An lagoon, Vietnam

HA Nam Thang, Kunihiko YOSHINO
Graduate school of Life and Environmental Science

1.Background



Lap An lagoon degradation

Seagrass area decreases from 250 ha (1995) to 120 ha (2004)
Nguyen Van Tien (2005)

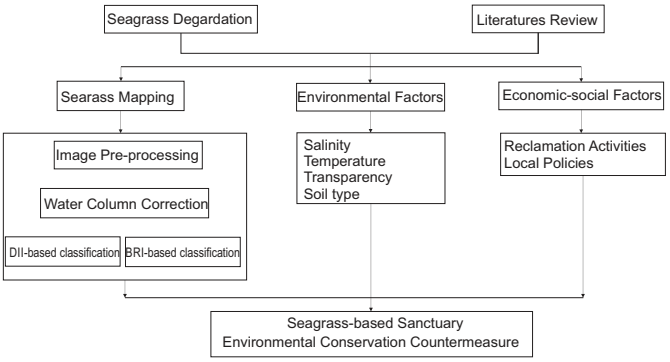
(1) Oyster culture; (2), (3): Lime production; (4), (5): Aquaculture

Seagrass canopy plays a critical role in the ecological functions of coastal zones. They supply nursery and juvenile habitats for fisheries, stabilize sediment and provide direct food for dugongs and green turtles. Lap An is the semi-enclosed lagoon in the South of Thua Thien Hue province with a large area of mangrove and seagrass. This lagoon significantly supports local aquaculture, and is highly important nursery for economic fisheries. However, the reclamation activities of local farmers have disturbed the aquatic habitats, and diminished the seagrass canopy (more than 60% has disappeared from the lagoon).

Mapping and monitoring is essential for understanding the extend, condition and temporal change of seagrass canopies. As a cost-effective tool, remote sensing provides the appropriate approach toward better management and sustainable usage of coastal zone resources.

This study attempts to detect the sparse and small size seagrass community in the conditions of turbid and deep water. On the other hand, there is no research which apply remote sensing to mapping the habitat in Lap An lagoon. Therefore, this study will be the new approach toward sustainable management of aquatic resources in the coastal zones.

2.Research Framework



3.Objectives

3.1.To compare DII (Depth Invariant Index) with BRI (Bottom Reflectance Index) method about seagrass distribution detection
3.2.To evaluate seagrass community distribution in Lap An lagoon
3.3.To propose environmental countermeasure toward better management in Lap An lagoon

4.Methodology

4.1.Water column correction

- Depth Invariant Index: $DII = Ln(L_i) - [(k_i/k_j)*Ln(L_j)]$

  where: L_i, L_j: pixel radiance of band i and band j
- Bottom Reflectance Index: $BRI = L_i/\exp(-k_i*g*z)$

  where: L_i: pixel radiance of band i
  ki: attenuation coefficient of band i
  g: geometric factor, depending on solar zenith angle and satellite nadir angle
  z: water depth

4.2.Bathymetry

- Water depth was measured by sonar instrument at the field survey.

4.3.Field survey

- Manta-tow rapid assessment method.
- GPS measurement.
- On-farm observation and laboratory analysis.

4.4.Seagrass classification

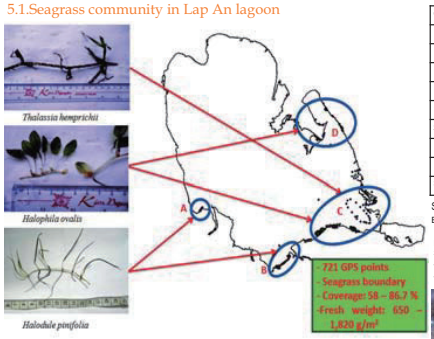
- Morphology: Pham Hoang Ho, 2001; Nguyen Huu Dai, Nguyen Van Tien, 2002.
- Density: Saito, Atob, 1970; Margarita, 2003.
- Seagrass ecology: M.A.Hemminga, 200; F.T.Short, 2001.

4.5.Environmental parameters

- Measured directly at the field site and laboratory analysis

5.Preliminary Results

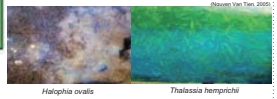
5.1.Seagrass community in Lap An lagoon



Order	Latin name	English name
	Magnoliophyta	
	Liliopsida	
	Potamogetonales	
	Hydrocharitaceae	
1	*Halophila ovalis* (R. Br.) Hook.f.	Spoon seagrass
2	*Thalassia hemprichii* (Ehrenberg) Ascherson	Turtle seagrass
	Cymodoceales	
	Cymonoceaceae	
3	*Halodule pinifolia* (Miki) Hartog	Special code: Hp

Seagrass area: 250 ha (1995) 120 ha (2004)
Ecological distibution
Substrata: Fine sand to muddy-sand
Depth: Low tide to 3 m
Salinity:
- Euryhaline species: 5 - 32‰: Halodule pinifolia, Halophila ovalis
- Euhaline species (over 25‰): Thalassia hemprichii

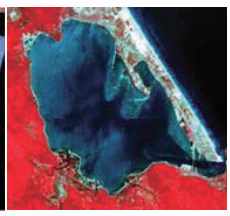
(Nguyen Van Tien, 2005)



Halophila ovalis *Thalassia hemprichii*

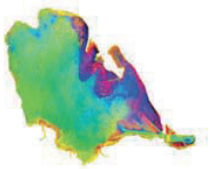
5.2.DII-based seagrass detection

Raw ALOS AVNIR-2 data



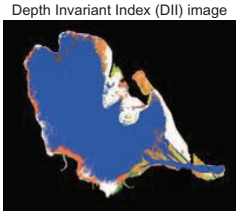
Atmospheric corrected

Depth Invariant Index (DII) image



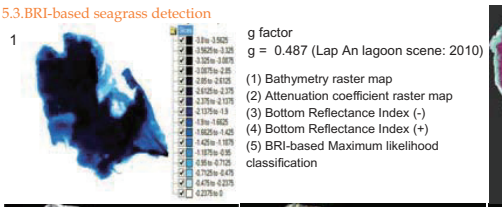
Principle Component Analysis (PCA) image

7 bands image: 3 first bands from PCA and 4 bands from DII image



Seagrass detection with Neural Network method

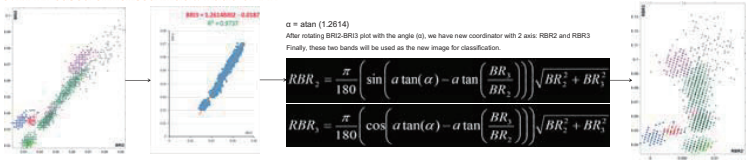
5.3.BRI-based seagrass detection



g factor
g = 0.487 (Lap An lagoon scene: 2010)

(1) Bathymetry raster map
(2) Attenuation coefficient raster map
(3) Bottom Reflectance Index (-)
(4) Bottom Reflectance Index (+)
(5) BRI-based Maximum likelihood classification

5.4.BRI-based enhenced index: Ratio of BR

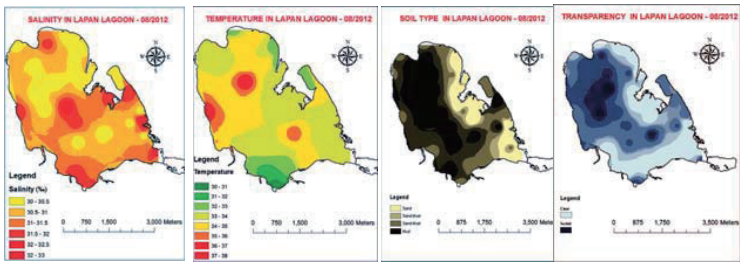


α = atan (1.2614)
After rotating BRI2-BRI3 plot with the angle (α), we have new coordinator with 2 axis: RBR2 and RBR3
Finally, these two bands will be used as the new image for classification.

$$RBR_2 = \frac{\pi}{180}\left(\sin\left(a\tan(\alpha) - a\tan\left(\frac{BR_3}{BR_2}\right)\right)\right)\sqrt{BR_2^2 + BR_3^2}$$

$$RBR_3 = \frac{\pi}{180}\left(\cos\left(a\tan(\alpha) - a\tan\left(\frac{BR_3}{BR_2}\right)\right)\right)\sqrt{BR_2^2 + BR_3^2}$$

5.5. Environmental factors



6.On-working Contents

- New index based classification.
- Classification accuracy assessment.
- Propose seagrass-based sanctuary as environmental conservation countermeasure for Lap An lagoon.
- Validate the index algorithm.

Poster No.15

Wetland management and Waterbird conservation in Mongol Daguur Strictly Protected Area and buffer zone, Mongolia

BADAMSED Delgermaa

Wetlands are one of the most important habitats for waterbirds. My research focused on the Mongol Daguur Strictly Protected Area (SPA) located in northeastern Mongolia. This area is characterized by vast temperate grassland steppe, with low mountains and rolling hills and with numerous small and medium sized steppe lakes and wetlands (Nyambayar, 2011). It is an important stopover and breeding area for the Swan goose, six species of cranes and many wetland dependent bird species in Northeast Asia (Birdlife international, 2005).

Recently, the effects of global warming (drought), steppe fire, livestock overgrazing, mining, human disturbance and livestock have had a negative impact on the region, especially habitat, population sizes, and breeding activities of birds. (Tseveenmyadag, 2002; Goroshko, 2007; Bradter, 2007; Gombobaatar, 2011). However, main problems are the lack of finance and properly trained human resources, which prevent the appropriate protection of the wetland ecosystem in Eastern Mongolia. The objectives of my research were to elucidate the natural resource utilization by local people and identify the threats to water birds caused by local people. Through the identification of these problems, I will offer recommendations on how local people and their knowledge can help conserve the wetlands and waterbirds in this area.

My study was based on primary and secondary data collection. Primary data was collected by conducting a semi structured questionnaire survey on the herders in the Mongol Daguur area (74 HHs). As there was no available population census and location data, I tried to visit all the summer settlements in the selected areas. In addition, open-ended interviews to key informants from relevant government and non- government organizations were also undertaken.

Interviewees owned between 32 and 1,630 livestock with an average of 395.8 livestock per household. While livestock numbers near the lakes have increased compared to 2011, 76% of the respondents indicated that fire, drought and overgrazing are the main challenges in this area. During the survey I observed that the herder's summer camp movement pattern to the lakes overlaps the waterbird breeding period. Traditionally, the herder families used to shift places at least once each season on a rotational basis (spring, summer, fall, winter). The study revealed that 16% of the families now move only twice a year and 70% of the families move more than twice a year especially during early spring and summer time as herders need to move near the wetlands.

Likewise in the past, they used to herd their livestock on foot and travel by horse. Now the livestock herding method is changing rapidly, with herders preferring to use motorbikes and other techniques that can be a disturbance for cranes. According to the survey, 89% of the interviewed herders agreed that they mainly use motorbikes to herd their livestock.

The future research assignment aims to analyze household economic activity, perception of the Protected Areas and the environment. These research results may provide effective recommendations for improving wetland conservation and protected area management in the study site.

Keywords: wetland management, water bird conservation, strictly protected area, local people, herders and livestock

WETLAND MANAGEMENT AND WATERBIRD CONSERVATION IN "MONGOL DAGUUR" STRICTLY PROTECTED AREA AND THE BUFFER ZONE, MONGOLIA

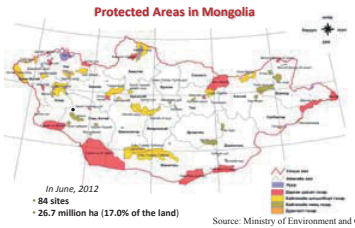
BADAMDED DELGERMAA
Graduate School of Life and Environmental Sciences, University of Tsukuba, Ibaraki, Japan

Strategic Funds for the Promotion of Science and Technology

Introduction

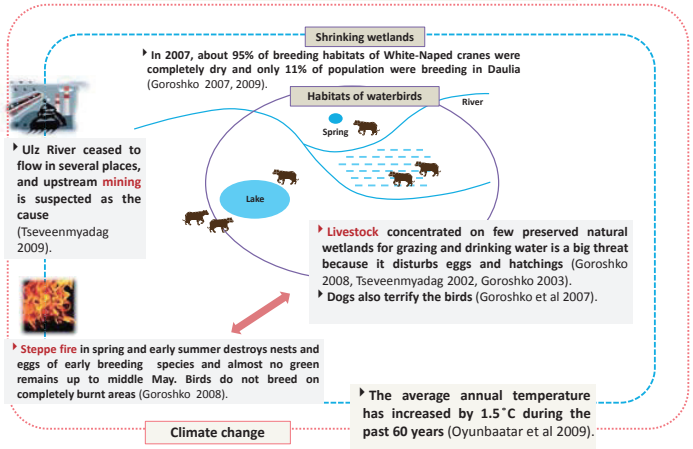
Mongolia's steppe habitats form the heart of the Daurian Steppe, which is recognized by WWF as a Global 200 Ecoregion. The Daurian Steppe forms the best and most intact example of an undisturbed steppe ecosystem in the world, and is one of the last areas in the Palaearctic to still support stable herds of larger vertebrates (WWF 2008). The steppe region has many freshwater and saline wetlands of international importance, which support large numbers of breeding and migratory water birds.

Mongolia joined the Convention on Wetlands of International Importance, specially as Waterfowl Habitat on 1998, and has been fulfilling its Convention mandated, internationally accepted requirements, and participating in Convention activities ever since. Currently, there are 11 wetlands in Mongolia which have been designated as Ramsar sites. Of the above mentioned site, seven are included in the current Protected Area (PA) network in the country and thus the necessary conservation activities are undertaken in accordance with Protected Area conservation regimes. (Gombobaatar et al 2011) My research focused on the Mongol Daguur Strictly Protected Area (SPA) located in northeastern Mongolia.



Source: Ministry of Environment and Green Development, Mongolia

Threats on PAs in the steppe of Mongolia



Tentative results

Traditionally, the herder families use to shift places at least once each season on a rotational basis (spring, summer, fall, winter). The study revealed that 16% of the families now move only twice a year and 72% of the families move more than two times a year especially during early spring and summer time herders need to move near the wetlands. Especially herder's summer camp movement pattern to the lakes overlaps the waterbird breeding period.

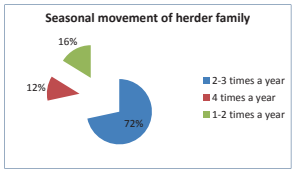


Figure 4: Seasonal movement pattern of herder family in study area (n=74)

In the past, they used to herd their livestock on foot and travel by horse. Now the livestock herding method is changing rapidly, with herders preferring to use motorbikes and other techniques that can give a big disturbance for cranes. According to the survey, 89% of the interviewed herders agreed that they mainly use motorbikes to herd their livestock.

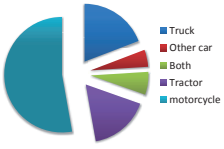


Figure 5: Technique property of herder family in study area (n=74)

Objectives and methods

Focus: Human induced impacts
Traditional herding
Steppe fire

Objectives:

Conservation policy → Compatible?

- To elucidate basic demographic and socio-economic information of the herders
- To examine current and past pastoral practices and changes
- To determine herders' attitudes and perceptions toward wetland and waterbirds conservation

Study site: **Mongol Daguur Strictly Protected Area**

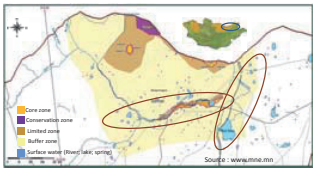
- Open-ended interviews to relevant government and non-government organizations
- Secondary data collection

Questionnaire survey to:
- Herders living nearby lakes (54 HHs), (limited and buffer zone)
- Other herders (20 HHs),(buffer zone)

Interviews were conducted by visiting available *gers* one by one.

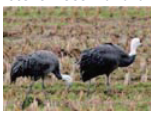
Background of study area

Mongol Daguur SPA

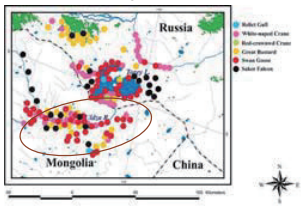


- Established : 1992
- Total area: 103,016 ha (210,000 ha including buffer zone), (EMPAA, 2010)
- Important breeding, stopover, and feeding ground of to 260 bird species, and home of 6 crane species.

- 1994: Joint Mongolia-Russia-China International Protected area
- 1997: International Network for the protection of Northeast Asian cranes
- 1997: RAMSAR site
- 2005: UNESCO Man and Biosphere Reserve



Rare breeding birds



Source: DIPA, 2012

Tentative results

Interviewees owned between 32 and 1,630 livestock with an average of 395.8 livestock per household. While livestock numbers near the lakes have increased compared to 2011, 76% of the respondents indicated that fire, drought and overgrazing are the main challenges in this area.

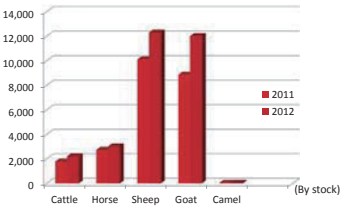


Figure 1: Number of livestock in the study area (n=74)

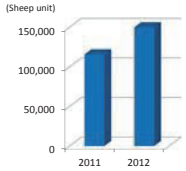


Figure 2: Total number of livestock in the study area (sheep unit)

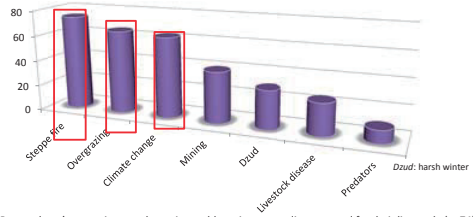


Figure 3: Respondents' perceptions on the major problems in surrounding area and for their livestock (n=74)

Poster No.16

Environmental Management through Tourism in Khan-Khentii State Special Protected Area, Mongolia

YADMAA Tseveenkhand

Abstract:

Since the 1990s Mongolia has promoted tourism as the most important sector for economic development. Khan-Khentii Protected Area has become the second most popular destination of tourists largely due to its proximity to the capital city and it has recently experienced a number of environmental problems on an alarming scale, including soil erosion and littering. Tourism, therefore, has gained the image of being a destructive agent, especially among some environmental protection promoters. This paper discusses the state of conservation in this area, and proposes some workable options, including environmental education and capacity building.

Tourism has affected and will affect the status of protected areas in this country. For example, the National Program of Protected Areas has announced that at least 30 percent of the territory of Mongolia (currently 17 percent) will be specially protected by 2030 in order to conserve nature, sustain the ecological balance, enrich natural resources, and protect natural heritage as well as historical and cultural remains. More than 80 percent of tourism activities are related to protected areas. Recent studies on sustainable tourism have argued that the introduction of a proper in-situ tourism mechanism can prevent environmental degradation and, at the same time, improve local livelihood and raise public awareness.

Acknowledging the soundness of these studies, this paper addresses some effective options, including environmental education and capacity building, which can lay the foundation for sustainable tourism in Khan-Khentii State Special Protected Area. It also discusses the soundness of applying some well-established theories and methods to control visitor impacts in this protected area. This case study can also contribute to the implementation of the "2009 Program to Develop Tourism in Protected Areas of Mongolia."

Keywords: *Protected area, sustainable tourism, impact, environmental education, capacity building*

Environmental Management through Tourism in Khan-Khentii State Special Protected Area, Mongolia

Student: YADMAA Tseveenkhand
Supervisor: MATSUI Kenichi

Graduate School of Life and Environmental Sciences , University of Tsukuba

Strategic Funds for the Promotion of Science and Technology

Introduction

Since the 1990s Mongolia has promoted tourism as the most important sector for economic development.

PAs are closely associated with ecosystem conservation and tourism

More than 80% of tourist camps are on special protected areas

Khan-Khentii SSPA

A main tourist destination since 1960s

- Proximity to the capital city;
- Natural beauty;
- Historical remains;

- Overcrowding;
- Soil erosion;
- Littering;

Sustainable tourism

Study Area

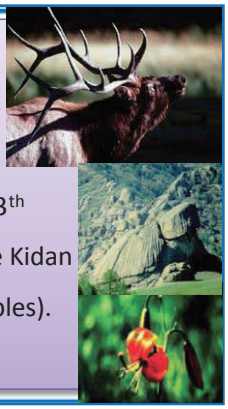
Map of Mongolia

Central Asia Map

http://www.mapsofworld.com/asia/

Khan-Khentii SSPA

- ✓ 1 523 318 ha
- ✓70 km from UB
- ✓1992: designated StPA
- ✓ Cultural/Historical sites (13th century, rock paintings of the Kidan period, ancient mound, temples).
- ✓Source of big rivers

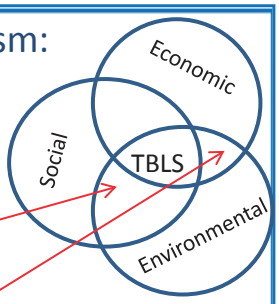


Objectives

- To discuss the state conservation in this area.
- To propose some workable options for long-term management, including EE and capacity building .

Principles of Sustainable Tourism:

- ✓ Respecting natural and cultural values
- ✓Achieving conservation outcomes
- ✓Having good content ('telling the story')
- ✓Providing mutual benefits to visitors and hosts
- ✓Building local capacity



Environmental Ethics

Environmental Economics

Elements of triple-bottom-line- sustainability (TBLS)

Methods

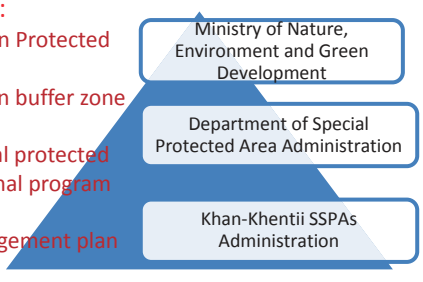
❑ Field surveys/ Questionnaire and interview

❑Literature review, data/ information collection

Environmental management:

PA Policies:

1994: Law on Protected Area;
1997: Law on buffer zone of PA;
1998: Special protected areas' national program 2005-2015;
2010: Management plan 2010-2015 ;



Tourism policies:

1995: The Government formulated tourism policies;
1999: The 'Mongolian Tourism Master Plan';
2000: National Tourism Law;
2010: Tourism Law Amendment

Summary and Conclusion

- Tourism expansion
- Environmental problems
- Necessity to raise public awareness

EE can be greatly contribute to sustainable tourism if researchers, traditional knowledgeable holders, trained teachers, and administration staffs are actively involved.

The collaboration and networking among these people can enhance public awareness and respect to nature.

Poster No.17

Interaction between Shallow and Deep Groundwater in Baiyangdian Lake Watershed, North China

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jeokey@hotmail.com

In arid/semi-arid regions, consumption of deep groundwater resources is increasing due to increasing water demand in every sector. An intensive groundwater survey was performed in Baiyangdian Lake Watershed (BLW), central area of North China Plain, because BLW is suffering serious water issues of quality and quantity due to high economic growth and agricultural activities. The objective of this study is to clarify the groundwater flow regime in the research area, especially focusing on the interacted relationship between shallow and deep groundwater.

For this purpose, a total of 127 water samples from surface water and groundwater in different aquifers with approximate depths of:1st aquifer 0 to 120m ; 2nd aquifer 120 to 300 m: 3rd aquifer ranging to more than 300 m were taken, and major tracing elements of solute ion concentrations and stable isotopes of $\delta^{18}O$ and $\delta^{2}H$ were determined for all water samples. Chemical compositions of water show that water taken in mountainous areas and Dingzhou area (southwest of the plain) was characterized by Ca-HCO_3 type, which is different from those in Baoding area (northeast of the plain). Solute ion concentrations and stable isotopic compositions indicate a possible interaction of groundwater between different aquifers, whereas nitrate was not detected in the deep aquifers. The stable isotopic compositions of the groundwater show that the 1st and 2nd aquifers were affected by evaporation before infiltration, and the 3rd aquifer was mainly recharged by precipitation falling on the mountainous area.

In a specific area near the urbanized city, anthropogenic activity might induce a recharge from the 1st and 2nd aquifers into the 3rd aquifer proved by similarity of the chemical tracers of ions and isotopes.

Keywords: interaction, deep groundwater, shallow groundwater, Baiyangdian

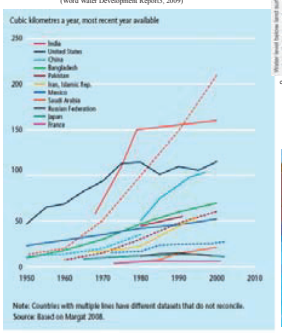
Interaction between shallow and deep groundwater in Baiyangdian Lake Watershed, China

ZHANG Jie, TSUJIMURA Maki , SAKAKIBARA Koichi (Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan)
SONG Xianfang (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China)

Background

Groundwater use has grown rapidly in many countries

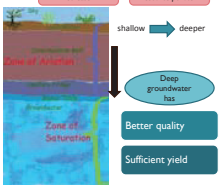
(Word Water Development Report3, 2009)



Groundwater problems

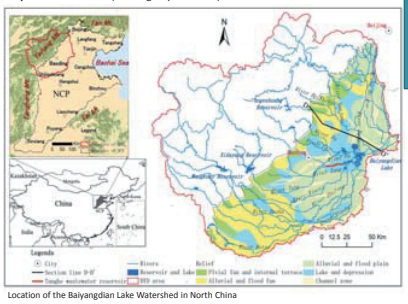
Groundwater level decreased

Groundwater resource polluted



Research area

Baiyangdian Lake Watershed (39.4˚ -40.4˚ N, 113.39˚ -116.11˚ E)
Area: 31200 km²(Mountain area 64.1%)
Average annual(AA) temperature: 12℃,
AA precipitation:580.78mm **AA evaporation** (lake surface) :1581.24mm
Population:12 million (Baoding City: 8 million)



Location of the Baiyangdian Lake Watershed in North China

Water resource

Average annual total water resources: 15.14×10⁸m³

More than 90% water supply is supported by Groundwater

Objective & Methodology

Objective

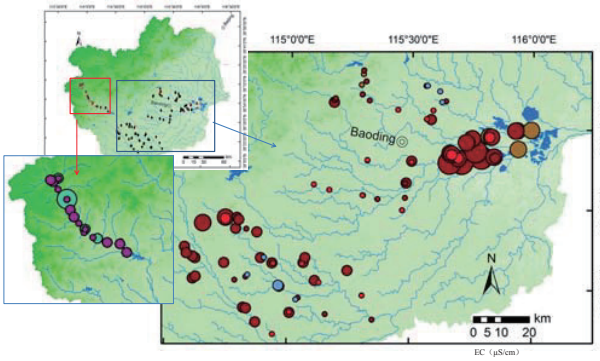
Clarify the mechanism of the interaction between shallow and deep groundwater by using geochemical and isotopic method

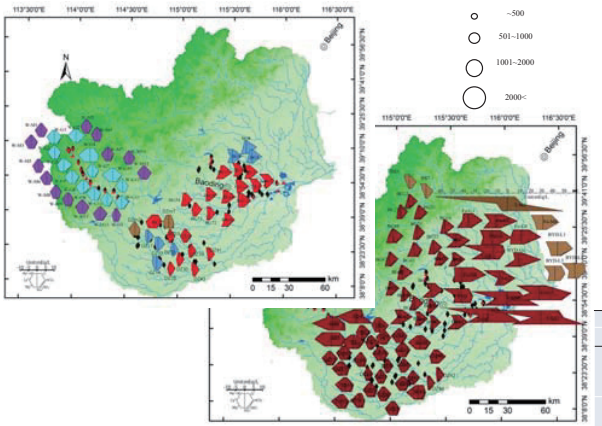
Propose suggestions to groundwater resource policy maker.

Methodology

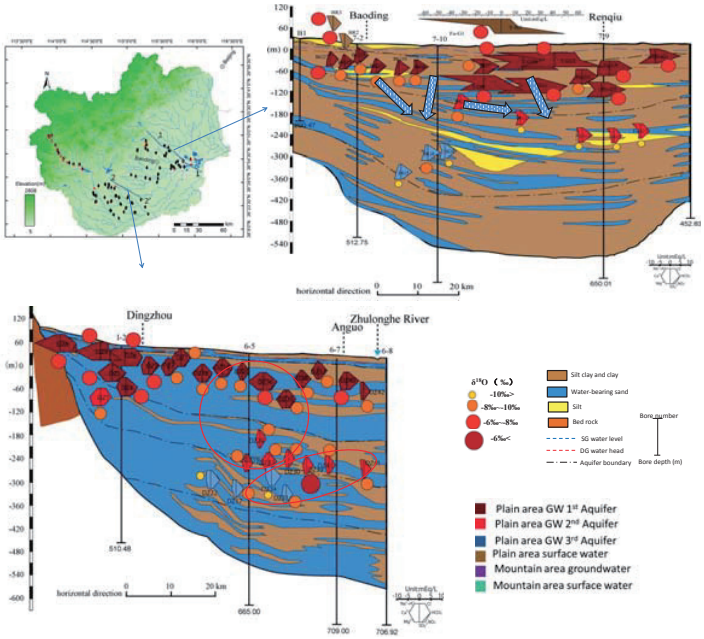
Preparation	Field work	Lab analysis
• References • Hydrogeology information collection • Sampling practices	• Measurement on filed EC, pH, Water temperature, water table depth etc. • Information collection well depth • Taking samples back	• Geochemical characteristics measurement titration IC & ICP • Isotopic analysis MASS • Statistic analysis PCA, EMMA

Results- Spatial distribution of EC and Hexa-diagram





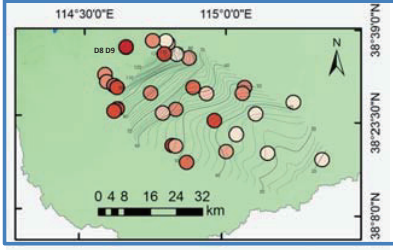
Results-Profile distribution of Hexa-diagram and $\delta^{18}O$

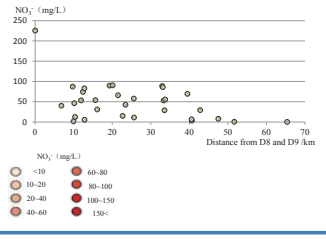


Correlation coefficient of EC value with main ions and pH in plain area

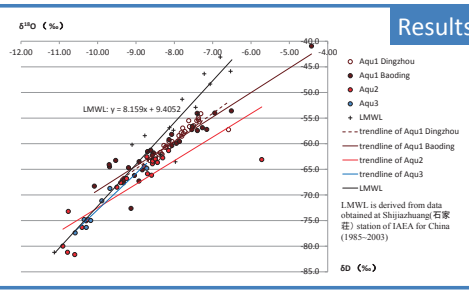
		Main ions								
		HCO_3^-/(mEq/L)	Cl(mEq/L)	NO3(mEq/L)	SO4(mEq/L)	Na(mEq/L)	Ca(mEq/L)	Mg(mEq/L)	K(mEq/L)	pH
Baoding EC	Aquifer1	0.795	0.926	-0.349	0.946	0.948	0.782	0.923	-0.444	-0.509
	Aquifer2	0.230	0.593	-0.333	0.490	0.579	0.127	-0.040	0.264	-0.005
	Aquifer3	0.475	-0.131	-0.272	-0.517	0.911	-1.000	-0.922	0.784	-0.316
Dingzhou EC	Aquifer1	0.747	0.879	0.694	0.946	0.679	0.957	0.833	-0.076	-0.747
	Aquifer2	0.986	0.987	0.023	0.969	0.189	0.976	0.984	-0.471	-0.955
	Aquifer3	0.827	0.991	0.487	0.954	0.917	0.949	0.975	0.207	-0.690

Results- Spatial distribution of Nitrate





Results-$\delta^{18}O$ vs. δD



CONCLUSIONS

- The possible communication existing between shallow groundwater and deep groundwater was found in both Dingzhou area and Baoding area.
- The connection existing between surface water and shallow groundwater is very clear. And Waste water influences the quality of both surface water and groundwater largely.
- High nitrate points was found in Dingzhou area, and nitrate concentration decreased when diffused in 1st aquifer but no signs showed they reached to the deeper aquifers.

Poster No.18

The effect of thermal hydrolysis on toxicity and leachability of heavy metals in sewage sludge

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The disposal of excess sewage sludge that is generated from municipal wastewater treatment plants has been a big problem. The traditional methods usually can cause some secondary problems, such as air pollution, soil and groundwater contamination. Land use is one of the most economic ways for sewage sludge disposal because the sludge can provide many easily available nutrient sources like N, P, K and organic matter. However, accumulated heavy metals (HMs) and their leachability are often the limiting factors. In order to reduce the toxicity and leachability of HMs to the environment, two main methods have been developed, removing the metals from sludge or the immobilization of HMs in sludge. After being removed from sludge the total concentrations of HMs can be reduced. However, this method is not practical and cost-effective due to the long contact time and difficulties in removal efficiency control. Immobilization provided a promising way to decrease the toxicity and leachability of heavy metals from sludge, because of the fractional transformation of HMs from easily leachable state to stable forms.

In this study, the thermal hydrolysis method was applied for sewage sludge treatment, and the objective of this study was to evaluate the leachability and leaching toxicity of HMs after this process.

The results showed that thermal hydrolysis has a positive effect on HMs dissolution into liquid phase, while majority of the HMs were accumulated in the solid phase. The toxicity of HMs was greatly decreased, and the leaching toxicity of HMs declined after the thermal hydrolysis process and the best result was obtained at 280 ℃ with their concentrations in the leachate decreased by 97.46%, 93.91%, 86.14%, 73.67%, 71.93% and 10.71% for Cu, Cd, Zn, Cr, Ni and Pb, respectively.

Keywords*: sewage sludge, thermal hydrolysis, heavy metals, leachability*

The effect of thermal hydrolysis on toxicity and leachability of heavy metals in sewage sludge

Wansheng Shi

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

1. Introduction

Waste water treatment plant | Sewage sludge | Soil contaminated by sludge | Toxic food because of heavy metals | Cause damage to health

(1) The disposal of excess sewage sludge that generated from municipal wastewater treatment plants had been a big problem. Accumulated heavy metals (HMs) and their leachability are often the limiting factors.
(2) The mobility, eco-toxicity and bioavailability of HMs in sludge depend not only on the total concentration but also on their existing forms.
(3) Immobilization process provided a promising way to decrease the toxicity and leachability of heavy metals from the sludge, because of the fractional transformation of HMs from easily leachable state to stable forms.
(4) Thermal hydrolysis treatment was adopted and its effect on leachability of HMs in sludge was investigated.

Objectives: Reducing the toxicity and leachability of heavy metals in sludge by thermal hydrolysis treatment.

2. Methods

2.1 Experiment procedure

➢ Treatment procedure ➢ HMs sequential extraction procedure

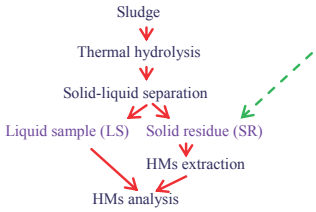

Fig.1 Treatment procedure

Table 1 Sequential extraction procedure for HMs analysis

Fractions	Form of heavy metals	Extraction reagent
F1	Exchangeable	$MgCl_2$
F2	Bound to carbonate	CH_3COONa (pH 5.0)
F3	Bound to iron and manganeseoxides	NH_2OH HCl
F4	Bound to organic and sulfide	(1) H_2O_2, HNO_3 (2) CH_3COONH_4
F5	Residual	HCl + HNO_3 + HF

2.2 Risk evaluation methods

➢ RAC ➢ Leaching test

Table 2 Risk assessment code (RAC)

Category	Risk	(F1+F2) (%)
I	No risk	<1
II	Low risk	1–10
III	Medium risk	11–30
IV	High risk	31–50
V	Very high risk	>50

3. Results

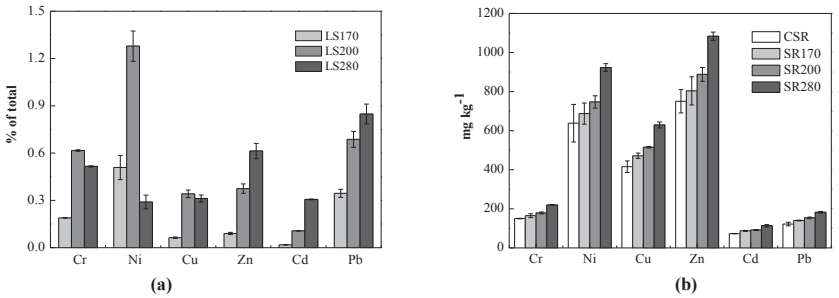

Fig. 2 The contents of HMs in (a) liquid phase (LS) and (b) solid residue (SR) after thermal treatment

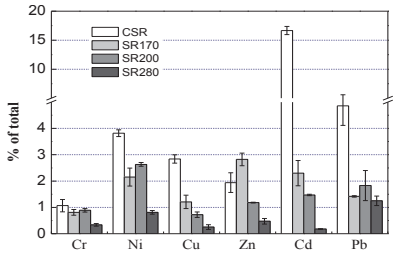

Fig.3 RAC of HMs in solid residue

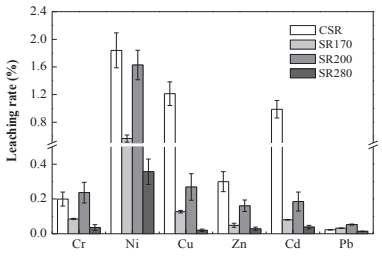

Fig. 4 Leaching rate of heavy metals

Results from Fig.2:

(1) HMs could be dissolved from solid sludge particles into liquid phase and the dissolution of Zn, Cd and Pb increased with treatment temperature.
(2) The HMs contents increased in SR with the increase of temperature, i.e. HMs were accumulated in SR after treatment.

Fig. 3:

(1) The risk of HMs decreased after treatment; the best effect was obtained when the sludge was treated at 280℃.
(2) Except for Pb, the risk of other metals was decreased from low risk or medium risk to no risk.

Fig. 4:

HMs bounded to leachable fraction were at the lowest proportions in sludge after treatment at 280℃, clearly showing the reduced leaching toxicity after this process.

4. Conclusions

(1) The toxicity and leachability of heavy metals in sludge can be reduced by using thermal hydrolysis process.

(2) The best effect can be obtained in treatment at 280℃.

Poster No.19

Modification of nickel oxide into an andic soil for efficient cesium removal from aqueous solution

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Despite the serious nuclear accident caused by the earthquake and tsunami in Fukushima, nuclear electricity net generation decreased to 15.478×10^6kW in 2011, which still occupied the top five position in the world and comprised approximately 14.7% of the total electricity net generation in Japan (USEIA 2012). Therefore, it is urgent to find a proper way to treat the large amount of radioactive waste in Japan, especially after this big nuclear accident.

An andic soil, akadama clay, was modified with nickel oxide and tested for its potential application in the removal of cesium from aqueous solution. Scanning electron microscope (SEM), energy dispersive X-ray spectroscopy (EDS) and powder X-ray diffraction (XRD) results revealed the nickel oxide was successfully grafted into akadama clay. N_2 adsorption-desorption isotherms indicated the surface area decreased remarkably after modification while the portion of mesopores increased greatly. Thermogravimetric-differential thermal analysis (TG-DTA) showed the modified akadama clay had a better thermostability than pristine akadama clay. Decrease of cation exchange capacity (CEC) and zeta potential were also detected after modification. Adsorption kinetic and isotherm studies indicate the adsorption of Cs^+ on modified akadama clay is a monolayer adsorption process. Adsorption capacity was greatly enhanced after modification probably due to the enhancement of negative surface charge. The adsorption mechanism of Cs^+ on modified akadama clay probably contains electrostatic adsorption and ion exchange.

Keywords: Andic soil; cesium; adsorption isotherm; electrostatic adsorption; ion exchange

Modification of nickel oxide into an andic soil for efficient cesium removal from aqueous solution

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Strategic Funds for the Promotion of Science and Technology

Abstract— Despite the serious nuclear accident caused by earthquake and tsunami in Fukushima, the nuclear electricity net generation decreased to 15.478×10^6kW in 2011, which still occupied the top five all over the world and contained approximately 14.7% of the total electricity net generation in Japan (USEIA 2012). Therefore, it is urgent to find a proper way to treat the large amount of radioactive wastes in Japan, especially after the big nuclear accident. An andic soil, akadama clay, was modified with nickel oxide and tested for its potential application in the removal of cesium from aqueous solution. Scanning electron microscope (SEM), energy dispersive X-ray spectroscopy (EDS) and powder X-ray diffraction (XRD) results revealed the nickel oxide was successfully grafted into akadama clay. N2 adsorption-desorption isotherms indicated the surface area decreased remarkably after modification while the portion of mesopores increased greatly. Thermogravimetric-differential thermal analysis (TG-DTA) showed the modified akadama clay had a better thermostability than pristine akadama clay. Decrease of cation exchange capacity (CEC) and zeta potential were also detected after the modification. Adsorption kinetic and isotherm studies indicate the adsorption of Cs^+ on modified akadama clay is a monolayer adsorption process. Adsorption capacity was greatly enhanced after modification probably due to the enhancement of negative surface charge. The adsorption mechanism of Cs+ on modified akadama clay probably contains electrostatic adsorption and ion exchange.

Introduction

The nuclear electricity net generation decreased to 15.478×10^6kW in 2011, which still occupied the top five all over the world and contained approximately 14.7% of the total electricity net generation in Japan (USEIA 2012). Therefore, it is urgent to find a proper way to treat the large amount of radioactive wastes in Japan, especially after the big nuclear accident. Natural zeolite is well believed as an efficient adsorbent for radioactive wastewater treatment and has been put into practice for the environmental remediation after the Fukushima nuclear accident. However, the main disadvantage of its application is the competitive interactions of other monovalent cations, in particular Na^+ and K^+ in waste effluents that can considerably block Cs^+ adsorption. On the other hand, Japan is an island country with limited natural resources. Therefore, the most valid strategy to treat the large amount of radioactive wastewater in Japan is to find or develop another abundant and low cost clay material as an alternative adsorption material.

Objective

The objective of this study is to investigate the adsorption performances of pristine and modified akadama clay in removing Cs^+ through batch adsorption experiments. The reason for the possible different adsorption behaviors is also investigated along with the surface characterization. Besides, much effort is undertaken to determine the adsorption mechanism of Cs^+ on modified akadama clay, which is especially important for the further performance improvement and practical application, through adsorption kinetic, isotherm and desorption studies.

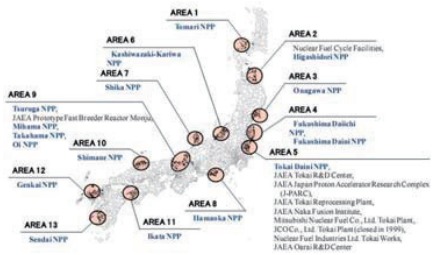
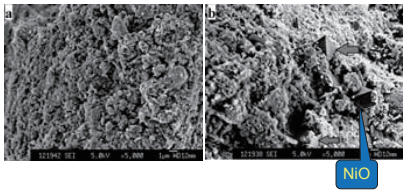


Fig. 1 Distribution of Nuclear Power-Related Facilities in Japan. (Fumihiro Yamane et al. / *Energy Procedia* (2011) 619–629)

Materials and methods

Results and discussion

1. Surface modification results



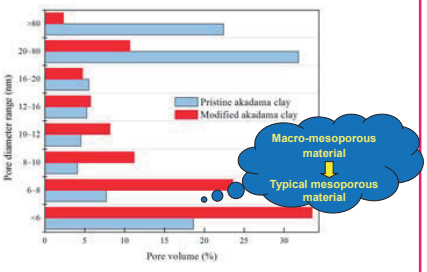


Fig. 2 Surface characteristics of pristine and modified akadama clay (SEM images and pore size distribution results).

2. Adsorption performance

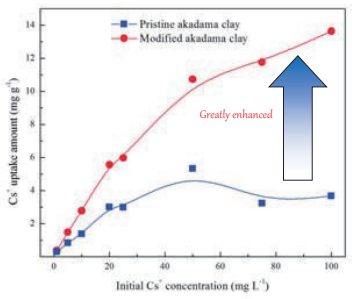


Fig. 3 Comparison of Cs^+ uptake amount on pristine (square) and modified (circle) akadama clay at the dosage of 2.5g L^{-1}.

3. Adsorption isotherm

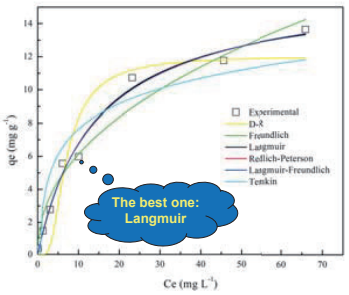


Fig. 4 Application of adsorption isotherms to cesium adsorption on modified akadama clay (2.5g L^{-1}).

Conclusions

The results of this study indicate that akadama clay could be transferred into an efficient adsorbent for cesium removal from aqueous solution through nickel oxide modification. BET surface, total pore volume, cation exchange capacity and zeta potential are decreased after modification while the quantity of Ni and proportion of mesopore increased. The maximum adsorption capacity of modified akadama clay for Cs^+ is above 16mg g^{-1}, much higher than pristine akadama clay probably due to the enhancement of negative surface charge. High pH value is preferred for Cs^+ adsorption on modified akadama clay for the negative surface charge. Adsorption isotherms indicate the Cs^+ adsorption on modified akadama clay is a monolayer adsorption process. Electrostatic adsorption and ion exchange are found to be the probable mechanisms during the Cs^+ adsorption process on modified akadama clay.

Future Plan

- ☐ Evaluation the removal performance of modified akadama clay in various conditions.
- ☐ Evaluation the feasibility of modified akadama clay in removing heavy metals.
- ☐ Evaluation the effect of different modification process on the performance.

Acknowledgements

This work was supported in part by Scientific Research (A) 22248075 from the Japan Society for the Promotion of Science (JSPS).

Poster No.20

Utilization of soybean curd residue for polysaccharides by *Poria cocos* and the antioxidant activities *in vitro*

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

Soybean is one of the most important cereals in the world and is the main staple food in many countries, especially Asian countries such as Japan. About 1.1 kg of fresh soybean curd residue (SCR) is produced from every kilogram of soybeans processed into soymilk or tofu. Currently, SCR is used as stock feed, fertilizer or dumped in landfill and the expense for its disposal costs around 16 billion yen per annum. SCR is a suitable supporter and carrier because of its porosity and nutrition.

Poria cocos is a popular fungus of the family polyporaceae which grows on the roots of old, dead pine trees. It has been used in traditional Chinese medicine for many centuries. Polysaccharides isolated from the mycelia of *P. cocos* has recently attracted considerable attention for its various physiological activities, such as anti-tumor, anti-inflammatory, anti-oxidant, hypoglycemic, hypocholesterolemic and immuno-stimulating activities.

In this study, response surface methodology (RSM) was employed to optimize the fermentation conditions of *Poria cocos* for the enhancement of polysaccharide using SCR, including fermentation temperature, fermentation time and inoculum size.

The optimal fermentation conditions were obtained by response surface methodology as follows: fermentation temperature 23.7 °C, fermentation time 7.46 days, and inoculum size 15.5 mL. Under optimized conditions, the polysaccharides yield reached 88.93 mg/g, which was in close agreement with values predicted by the mathematic models. Furthermore, polysaccharides exhibited positive antioxidant activities. The research provides references for the large-scale production of polysaccharides by P. cocos and points to a new direction for the utilization of SCR.

Keywords : *Poria cocos*, Polysaccharides, Soybean curd residue, Response surface methodology, Antioxidant activity

Utilization of soybean curd residue for polysaccharides by Poria cocos and the antioxidant activities in vitro

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

Strategic Funds for the Promotion of Science and Technology

Introduction

Why choose soybean curd residue and *Poria cocos* to study ?

1
1.An important cereal
2.Feed & fertilizer & waste
3.High disposal costs
4. Environmental pollution

2
1.Porosity
2.Nourishing
3.Cheapness
4.Wide sources

3
1.Traditional medicine
2.Antitumor activity
3.Antiinflammatory activity
4. Antioxidant activity

Soybean curd residue (SCR)

Poria cocos (*P. cocos*)

Objective

Fermentation conditions

1.Optimize fermentation condition by response surface methodology.

2.Determine the fermentation temperature, time and inoculum size.

Objective

Antioxidant activities

1.ABTS radical-scavenging.

2.Ferrous metal ions chelating.

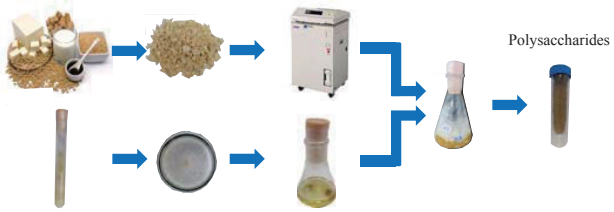
3.Hydroxyl radical scavenging.

Provide references for the large-scale production of polysaccharides and point to a new direction for the utilization of SCR.

Material and method

Procedure

Soy products | Soybean curd residue | Sterilization | Polysaccharides



Poria cocos | Plate cultivation | Liquid culture | Fermentation

Method

Phenol sulfuric acid method → Total sugar

3,5-dinitrosalicylic acid (DNS) method → Reducing sugar

Method

Antioxidant activity → ABTS radical-scavenging; Ferrous metal ions chelating; Hydroxyl radical scavenging

Polysaccharides → Total sugar-Reducing sugar

Results

Table 1 Analysis of variance (ANOVA) for the selected model

Source	Sum of squares	d.f.	Mean square	F- value	Probability > F
Model	3374.48	9	374.94	204.49	< 0.0001
X_1 (Temperature)	274.52	1	274.52	149.72	< 0.0001
X_2 (Time)	289.89	1	289.89	158.11	< 0.0001
X_3(Inoculum size)	20.74	1	20.74	11.31	0.012
X_1X_2	57.2	1	57.2	31.2	0.0008
X_1X_3	22.75	1	22.75	12.41	0.0097
X_2X_3	2.6	1	2.6	1.42	0.2721
X_1^2	459.08	1	459.08	250.38	< 0.0001
X_2^2	1882.88	1	1882.88	1026.91	< 0.0001
X_3^2	155.79	1	155.79	84.97	< 0.0001
Residual	12.83	7	1.83		
Lack of fit	10.34	3	3.45	5.33	0.0611
Pure error	2.5	4	0.62		
Corrected total	3387.32	16			

R^2= 0.99

$$Y=86.62-5.86x_1+6.02x_2+1.61x_3-3.78x_1x_2+2.38x_1x_3-10.44x_1^2-21.15x_2^2-6.08x_3^2$$

where Y is the predicted response that is the yield of polysaccharides, where x_1, is fermentation temperature; x_2, fermentation time and x_3, inoculum size.

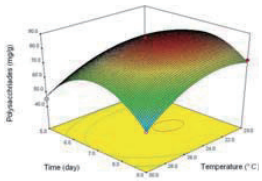


Fig. 1. Response surface plot showing the interactive effects of fermentation time and temperature on the production of polysaccharides.

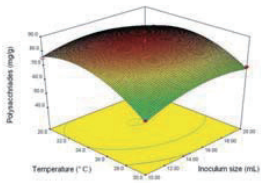


Fig. 2. Response surface plot showing the interactive effects of fermentation temperature and inoculum size on the production of polysaccharides.

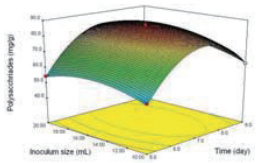


Fig. 3. Response surface plot showing the interactive effects of fermentation time and inoculum size on the production of polysaccharides.

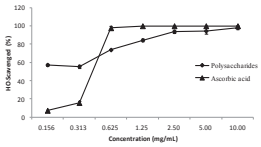


Fig. 4. Hydroxyl radical scavenging activities of polysaccharides.

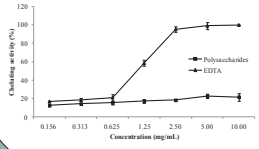


Fig. 5. Ferrous metal ions chelating activity of polysacchriades.

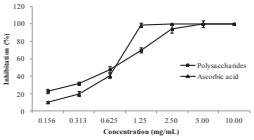


Fig. 6. Inhibition of polysaccharides on the stable ABTS·⁺.

Conclusion

Fermentation temperature: 23.7℃, fermentation time: 7.46 days, inoculum size: 15.5 mL, the yield of polysaccharides reached 88.93 mg/g.

The good fit between the predicted and experimental values confirms the validity of the model and the existence of an optimum point.

Polysaccharides exhibited a concentration-dependent HO scavenging activity; the chelating ability on ferrous ion was weaker; significant ABTS radical scavenging activity.

Practical significance

The results obtained provide references for the large-scale production of polysaccharides by *P. cocos* and point to a new direction for the utilization of SCR.

Poster No.21

Enhancing Aerobic Granulation for Nitrogen Removal by Combining with Electrochemistry

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Because of high efficiency and low cost, SBR (Sequencing batch reactor) has been widely used for treating not only industrial but also domestic wastewater. Activated sludge in SBR can digest nutrients such as N, P in wastewater. However, the relatively long settling time of activated sludge requires a large sedimentation tank to separate water and sludge. As we know, land resources in Japan are very scarce so it is necessary to decrease usage of land resources.

GSBR (granulation sequencing batch reactor) a novel environmental biotechnology is tailored for treating a wide variety of wastewaters. Compared to the conventional activated sludge process, granulation sludge is stable and flexible; it has excellent settling properties indicating that a smaller secondary sedimentation tank will be necessary, which means a lower surface requirement for the construction of the plant; moreover, higher biomass concentration inside the reactor can be achieved, therefore it can improve the efficiency of wastewater treatment.

This technology is significant in its application:

- An installation based on aerobic granulation requires 20% of the surface area needed for a conventional activated sludge system.
- Economic analysis based on a full-scale design showed significantly less investment costs and lower operational costs compared to conventional systems.
- The energy requirement is 30% less than an activated sludge system, and because of compact construction, less building material is needed.

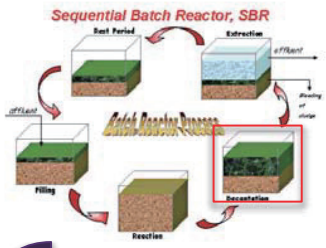
My research combined an electrochemical method with the aerobic granulation process. As we know electrochemical methods can remove nitrogen and phosphorus effectively, it is reported that divalent metal ions such as Mg^{2+}, Ca^{2+} have a positive effect on EPS production of aerobic granule to form more stable complexes. Therefore, the electrochemical process can promote the formation of aerobic granules So far, there is no report concerning the influence of aerobic granulation under conditions of electric stimulation. The objective of this study is, therefore, to investigate the process of aerobic granulation under electric stimulation and compare the difference between them, including changes in treatment efficiency and granule morphology and so on.

Enhancing Aerobic Granulation for Nitrogen Removal By Combining with Electrochemistry

WANG Wenlong
Graduate School of Life and Environmental Sciences

Strategic Funds for the Promotion of Science and Technology

Background

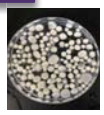


Traditional

Using activated sludge

GSBR

Using Aerobic granular



Comparison

SBR	GSBR
Long settling time	Short settling time
Large land usage	Less land usage
Biomass retention	Better biomass retention
High removal efficiency	Higher removal efficiency

SBR

GSBR

Land resource in Japan is very scarce especially in urban area → Necessary

However → *The aerobic granulation is not stable*

My research is combining the electrochemistry method with aerobic granulation process to research whether electrochemistry can enhance the morphology of aerobic granulation.

Material and Method

Wastewater

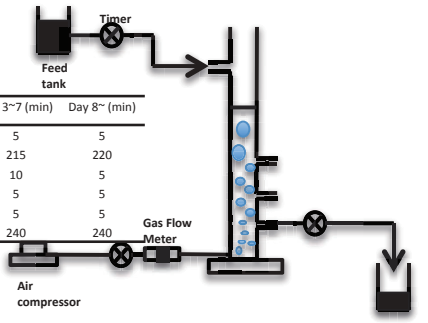
Peptone	400 mg/L
Yeast extract	250 mg/L
NH_4Cl	3.74 mM
KH_2PO_4	4.85 mM
$CaCl_2$	0.27 mM
MgSO4	0.21 mM
FeSO4	0.13 mM
NaHCO3	0.15 mM

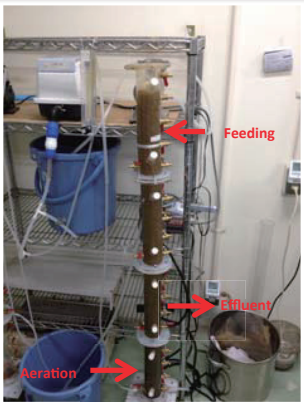
Carbon resource

Stimulating the aerobic granulation process by neutralizing negative charges on bacterial cell surface, thus creating relatively strong "van der Waals" attractive force

Experiment Set-up for granulation

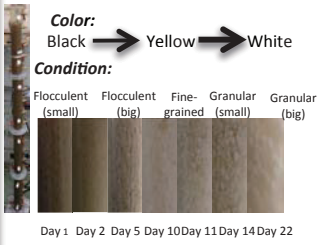
	Day 1~2 (min)	Day 3~7 (min)	Day 8~ (min)
Feeding	5	5	5
Aeration	205	215	220
Settling	20	10	5
Discharge	5	5	5
Idle	5	5	5
Total	240	240	240



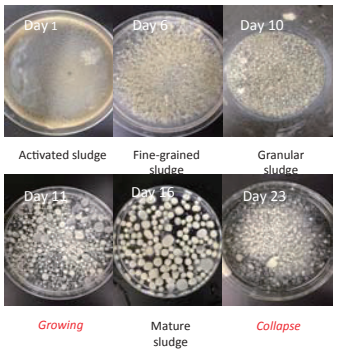


Result

1.Transformation in SBR reactor



2. Morphological changes of aerobic granular sludge



3. Nutrient Removal of aerobic granular sludge

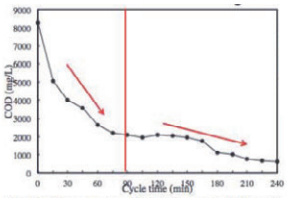
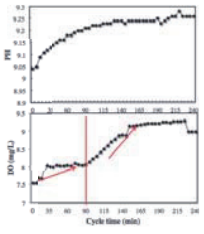


Fig.3 COD removal in R2 during one cycle(Day 9)

The COD decreased dramatically from 8240 mg/L to 590 mg/L. Removal efficiency is 92.83%. Moreover, the average removal efficiency for NH-N is 80.7%

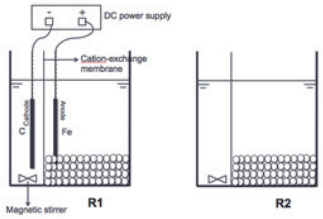


pH increased from 9.04 to 9.06

Before 90min, the increase of DO is relatively slow from 7.54 to 8.07. And after that it increased dramatically into 9.28.Because COD was almost removed before 90min, during which the microbe consumed O2 in the water

Further Research

- Aerobic granulation can removal COD and NH_3-N efficiently. However, the instability and relatively low removal capacity for TN restrict the development.
- Electrochemistry method can remove the nitrogen efficiently.
- Electrochemistry process produce divalent metal ions such as Fe^{2+} , they have positive effect on EPS production of aerobic granule to form more stable complexes. (M. Coma, et al, 2011)
- Reaction of electrochemistry could help to maintain a near neutral pH and lower ORP lever, which were beneficial to the growth of methanogens. (Yiwen Liu et al, 2010).



Poster No.22

Solid waste management in Kathmandu city

SINGH Rajeev Kumar (201221193)
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Abstract:

Kathmandu metropolitan city (KMC) is the urban core of the Kathmandu Valley that consists of two sister cities; Lalitpur to the south and Bhaktapur to the east. It is located in a bowl shaped valley at an elevation of 1400 meters above sea level. Due to fast growing population, there is an increased pressure towards the waste disposal problem. Out of all the disposed waste, the management of solid waste has been one of the biggest problems in Kathmandu city.

This research will follow both quantitative and qualitative methods for research methodology utilizing various data provided by the metropolitan city office and the central government of Kathmandu such as waste collection and dumping locations, transportation, logistics, number of active personnel, current waste and waste disposal methods. Furthermore, I will interview some of the locals as well as government personnel working in the field to get their views on the progress made so far in solid waste management procedures in the city.

As most of the solid waste generated in Kathmandu city consists of organic matter, the objective of the research is to find out whether the biological treatment of waste would be an effective way of solid waste management in the city. Moreover, alternative ways such as modern landfill and incineration can also be used to treat solid waste though the application of these methods could be costly. As well as the above, this research will also try to use information related to Geographical Information Systems (GIS) to find out the cost efficient waste collection route for the transportation of waste to the landfills.

This study will provide recommendations to both the government and various projects closely associated with non-governmental agencies in order to create sustainable approaches to manage solid waste in Kathmandu city.

Keywords: Waste management, Organic waste, Modern landfill sites, Geographical Information system & Government Policy

WASTE MANAGEMENT IN KATHMANDU CITY

Singh Rajeev Kumar, Helmut Yabar, Yoshiro Higano

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Introduction

Nepal is one of the developing countries in Asia located between China and India; where people are still unaware of many emerging problems. One of these emerging problems is "Waste management". Kathmandu metropolitan city(KMC) is the capital of Nepal and most densely populated city with 989,273 people (CBS 2011) in an area 50.76 km^2.

Figure 1 shows the public opinion on main environmental problems in urban areas which is "Solid waste". Waste production is directly proportional to increase in the population in Kathmandu city and it is shown in the figure 2.

Research Question

Can the use of Biological waste treatment of the organic waste be the effective way of solid waste management in Kathmandu city?

Methodology

The research will follow both quantitative and qualitative methods for research methodology utilizing various data provided by the metropolitan city office and the central government of Kathmandu such as waste collection and dumping locations, transportations, logistics, number of active personnel, current waste and waste disposal methods. Furthermore, I will interview some of the locals as well as the government personnel working on the field to get their views on the progress made so far in the solid waste management procedures in the city.

For the secondary source of data, I read few books written by both the Nepali and foreign writers related to waste management. Further, I also read some journals and other publications published online and I will read more books and papers related to waste management.

Previous Results

- Waste Generated - 0.3 kg/person/day
- Total domestic waste generated Approximately -246 ton/day
- Commercial waste (12%) Approximately- 30 ton/day
- Street Waste (12%) Approximately-30 ton/day
- Waste from VDC (12%)-30 ton/day
- **Total Generation – 336 ton/day**
- **Collection - 306 ton/day**
- **Uncollected- 30 ton/day**

The figure 3 shows the proportions of the solid waste in the Kathmandu city. About 70% waste in the city is organic.

Waste Collection

- Kathmandu municipal corporation(KMC)
- Many private limited companies and NGOs
- Some of the community based organizations (CBOs) as well as youth organizations.

All the waste generated in the city and collected by these organization are either taken directly to the landfill sites or to the Teku transfer station and then to the landfill sites which is shown in the figure 4.

Problem

Organic waste are mixed along with other solid waste and are taken to the landfills. Very few people make compost with the organic waste but it is not practiced in large scale due to lack of knowledge among people, busy life style and lack of enough space in cities.

Future work

As most of the solid waste generated in the Kathmandu city consists of organic matter the future work of the research is as follows:

- Collect secondary data related to waste collection and dumping locations, transportations, logistics, number of active personnel, current waste and waste disposal methods
- Collect primary data with the help of questionnaire for selected area in the city
- Analysis the data and compare the results with the previous published result.
- Try to find the alternative ways to treat solid waste in the city like modern landfills and incineration.
- Try to use information related to Geographical Information System (GIS) to find out the cost efficient waste collection route for the transportation of waste to the landfills.
- Recommendation to both the government and various projects closely associated with non-governmental agencies in order to have sustainable approaches to manage the solid waste in the Kathmandu city

Reference

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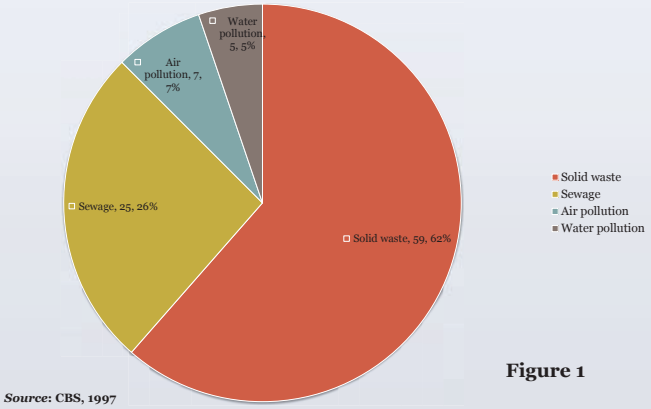
- (B.Dangi, R.Pretz, Urynowicz, & Kenneth G.Gerow, 2010) Municipal solid waste generation in Kathmandu, Nepal, Retrieved June 17, 2011 from Journal of Environmental Management 92 (2011) 240-249
- (R. Alam , M.A.I. Chowdhury, G.M.J. Hasan, B. Karanjit, L.R. Shrestha) Generation, storage, collection and transportation of municipal solid waste – A case study in the city of Kathmandu, capital of Nepal, Retrieved June 24,2011 from Journal of Science Direct waste management 28(2008)1088-1097
- Mohan B. Dangi , Christopher r. Pretz, Michael A. Urynowicz,Kenneth G.Gerow, J.M. Reddy,2010. Municipal solid waste generation in Kathmandu, Nepal. Journal of Environmental Management 92(2011)240-249

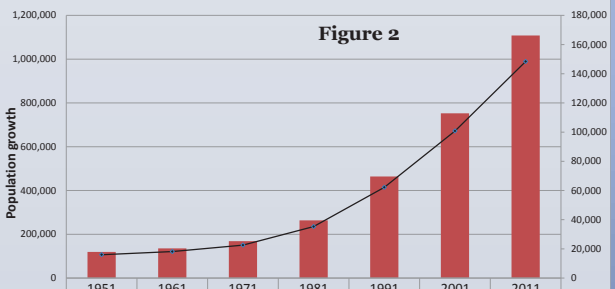
Public Opinion on main Environmental Problems in Urban Areas



Source: CBS, 1997

Figure 1

Waste generation along with the population growth



	1951	1961	1971	1981	1991	2001	2011
waste production	17,905	20331	25,268	39,507	69,596	112,869.7	166,197.1
population	106,579	121,019	150,402	235,160	414,264	671,846	989,273

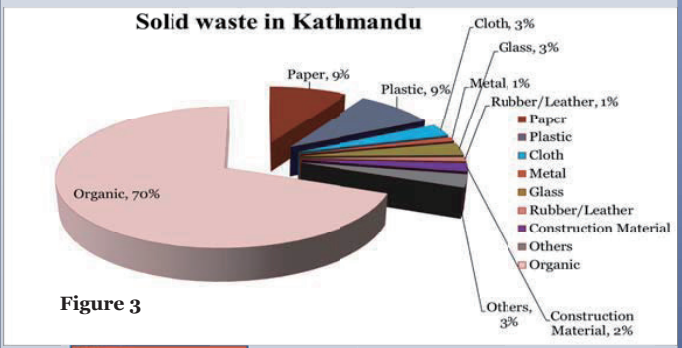


Figure 3

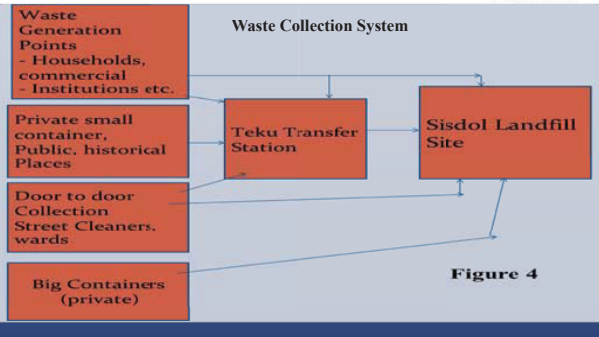


Figure 4

Poster No.23

Current status and solutions for municipal solid waste management in Gia Lam district, Hanoi city, Vietnam

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University of Tsukuba, Ibaraki, Japan

Introduction

Municipal solid waste management (MSWM) is a serious problem in Vietnam in general and in big cities in particular due to population growth and rapid economic development. Hanoi is the capital and a mega city in Vietnam. The amount of solid waste generated in Hanoi has been increasing steadily, pushing waste management to the forefront of environmental challenges with which it must contend. However, Hanoi is still missing a lot of necessary information on the status of solid waste, especially in e suburban areas where there is rapid development but lack of management and investment in solid waste management systems. Therefore, it is necessary to examine the current MSWM situation, determine future challenges and propose effective solutions to solve these problems.

Study site

Gia Lam is a typical suburban district that is located in the northeast of Hanoi city with favorable conditions for socio-economic development. Thus, meeting domestic demand, building infrastructure and managing solid waste are the most difficult issues in the district. Domestic waste from the district was about 210 tons/day but only 150 tons/day was collected and waste transported to Kieu Ki landfill was 80 tons/day in 2010. The rest has been dumped in simple landfill or anywhere around the district. There are all 34 simple landfills that are not sanitary. These problems have affected community health. Although the district has already undertaken some environmental improvement projects many solid waste management issues still take place and need to be solved in order to improve living standards.

Methodology

The data will be collected from related documents, environmental organizations in Gia Lam, Hanoi as well as from a field survey through questionnaires, structured, and semi-structured interviews. Based on these data, the current municipal solid waste management system and its components will be considered: generation and components, collection system, transportation, pre-treatment, treatments, final disposal, recycling, reduce and reuse. After that, several different solid waste management system scenarios will be developed and compared by using the Integrated Waste Management (IWM) Model-II and the Life Cycle Assessment (LCA) methodology to determine the most feasible option for a MSWM system for Gia Lam district.

Contribution of the research

Since 2008, Hanoi city has expanded; the government has focused on more investment for suburban districts to serve socio-economic development. However, this rapid growth has led to serious environmental problems related to solid waste. Therefore, this study will be a useful reference to help policy makers make immediate solutions and future strategies for MSWM systems. At the same time, effective models can be applied in other areas that have similar conditions and provide data and information as well as practice for government to have better solid waste management system in the future.

Keywords: Municipal solid waste management (MSWM), integrated waste management (IWM), life cycle assessment (LCA), Gia Lam, Hanoi

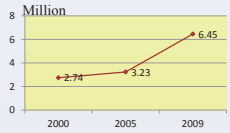
Current status and solutions for municipal solid waste management in Gia Lam district, Hanoi city, Vietnam

Dinh Thu Hang

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

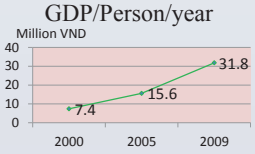
INTRODUCTION

Population

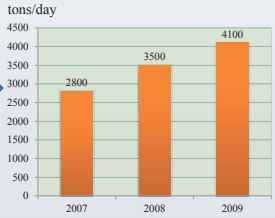


Urbanization

GDP/Person/year



Solid waste management in Hanoi



OBJECTIVES

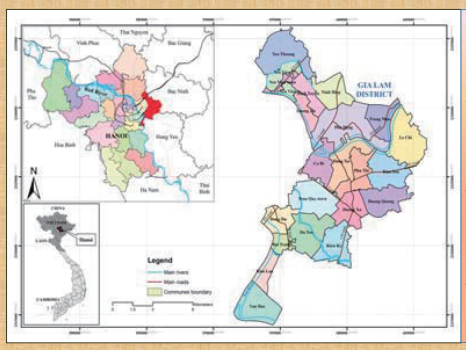
①To analyze current solid waste management system in Gia Lam district in all sectors;

②To assess the difficulties and challenges for solid waste management in Gia Lam district;

③To propose potential and effective solid waste management systems.

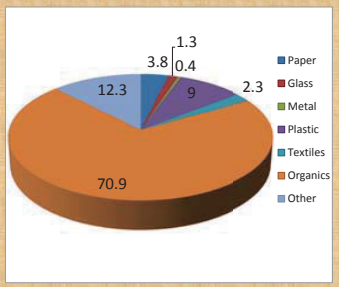
STUDY AREA

Gia Lam district, Hanoi city, Vietnam



- Population: 237.000 (2011)
- Area: 114 Km^2
-22 administrative units
- 1000 enterprises
- 10.000 household businesses

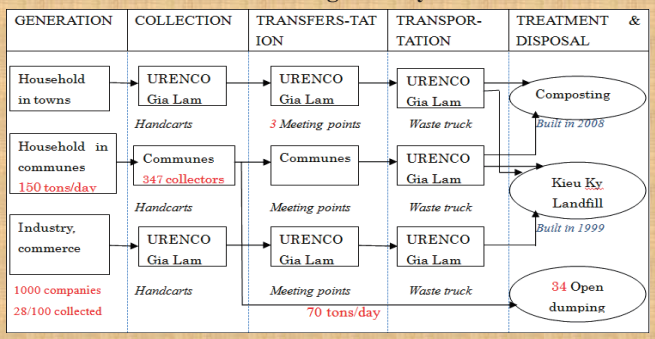
Household waste composition



Solid waste collection

Waste type	Generation (Tons per day)	Collection (tons per day)
Household waste in 2 towns	40	38
Household waste in 20 communes	170	150
Construction waste	150	0
Trade village waste	70	0
Industrial, commercial waste	-	-
Total	430	188

Solid waste management system



METHODOLOGY

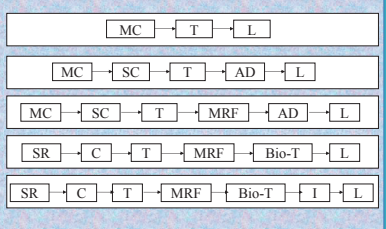
-Field survey: structured and semi-structured interview.

- Integrated waste management (IWM) model
- Scope definition:

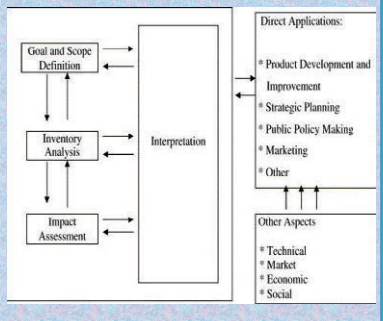
+ SWMS components: generation and components, collection system, transportation, pre-treatment, treatment, final disposal, recycling, reduce and reuse;

+ Environmental impacts: water emissions, air emissions, final solid waste produced, energy consumption, and economics.

Scenarios



Life cycle assessment (LCA)



EXPECTED RESULTS

-Describes the current status of solid waste management system in Gia Lam district;

- Identifying the challenges and potential of solid waste management system in Gia Lam district;

- Recommendation of potential and effective solid waste management systems.

Poster No.24

Inheritance of Indigenous Ecological Knowledge in a Changing World -A Case Study of Maasai Pastoralist Children in Kenya

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Introduction

In Kenya, along with fast growing urbanization and commercialization, nomadic Maasai, like other pastoralist tribes, are rapidly transforming from seminomadic subsistence pastoralists to agropastoralists, ranchers, and urban workers whose wealth differentials from rich to poor resemble the larger national picture of both extremes (Fratkin 2003). In particular, the younger generations have started to go to school following the implementation of national education, and at the same time, take responsibility for inheriting indigenous knowledge of the traditional pastoralist lifestyle.

Indigenous environmental knowledge (IEK) is an integral part of local knowledge systems for environmental classification, assessment and management (Stevenson, 1996; Bolling & Schulte, 1999; Godgil et al., 2000; Mapinduzi, 2001). It contributes to human's environmental perceptions and historical knowledge of adaptation to environmental changes. Despite understanding the importance of indigenous knowledge, studies that aim to discover the process of indigenous knowledge inheritance, especially under the condition of current rapid polyphyletic changes are rare. This study aims to find out how IEK of the Maasai is inherited generation to generation within the context of rapid social, cultural and environmental changes.

Method

Fieldwork was conducted from July to August 2012. The study area is located in, the Maasai group ranch-Kuku, Kenya, near the Kenya-Tanzania border. A questionnaire survey was undertaken with the cooperation of primary school grade 4 students (Maasai children 9 to 14 years old). Data on life outside school was collected through informal interview, and participant observation.

Results and Conclusion

Results from the current study show that children around 9 to 14 years old have already started receiving IEK combined with scientific understanding from both outside and inside school life. Traditional wild plants' medicine and daily utilization occurs through participation in social and daily family activities. Environmental knowledge related to school education supplements their perception of the surrounding environment via scientific explanation. Despite abundant traditional and scientific ecological knowledge, the future goals of all students show significant similarity with urban children, and no student gave becoming a pastoralist as their future goal. This raises the concern of the possibility of losing IEK in the future through life style and future goal changes among young generations in the long term.

Keywords: indigenous ecological knowledge (IEK), inheritance, pastoralists, Maasai, children

Inheritance of Indigenous Ecological Knowledge in a Changing World -A Case Study of Maasai Pastoralist Children in Kenya

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Graduate School of Life and Environment Science, Tsukuba University

Strategic Funds for the Promotion of Science and Technology

Introduction

Indigenous Ecological Knowledge (IEK) is an *integral part* of local knowledge systems for *environmental classification, assessment and management.*

Like other **indigenous** people, nomadic Maasai people has abundant **ecological knowledge** of their surrounding environment

e.g.
- Indigenous perception of Savanna ecosystem
- Livestock Management
- Ethnobotany

** The Maasai are Pastoralists occupying savanna areas of Northern Tanzania and Southern Kenya.*

- **Social Changes**
  - ✓ Urbanization
  - ✓ Commercialization
  - ✓ Land Privatization etc.
- **Environment Changes**
  - ✓ Desertification
  - ✓ Unpredictable drought etc.

→
- ➢ Conflicts of land use
- ➢ Conflicts of human and wildlife
- ➢ Losing pasture land
- ➢ Losing mobility (Both people and wildlife)
- ➢ etc.

↓

Life style Changes of Maasai:
Agripastoralists, Ranchers, Urban workers, etc...

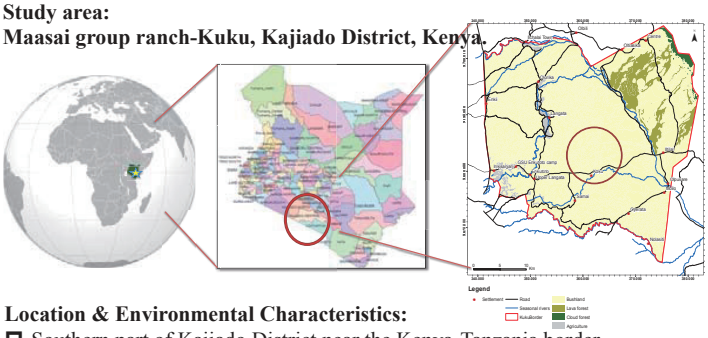
How do IEK inherit to next generations in polyphyletic changing world ?

Method & Study Area

Method:
- ❖ **Intensive Fieldwork**
- ❖ Formal and informal **interview**
- ❖ **Participation Observation**

**First field work was contacted from July to August 2012 with questionnaire survey in primary school 4th grade.*

Study area:
Maasai group ranch-Kuku, Kajiado District, Kenya.



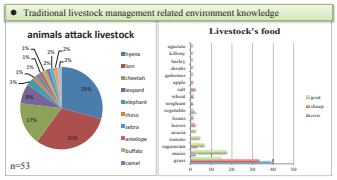
Location & Environmental Characteristics:
- ☐ Southern part of Kajiado District near the Kenya-Tanzania border
- ☐ Approximately 96000 hectares
- ☐ **Semi-arid climate** area with two main rainy seasons per year (250-600 mm annually)
- ☐ Population: 7512 (Registered)

- ☐ Typical **savannah ecosystem**
- ❖ **Water resource**: Mt. Kilimanjaro &Chyulu hills
- ❖ **Dominate vegetation**: Grasslands, bush land and riverine woodlands
- ❖ An important **wildlife dispersal area** for species like Africa elephant, Thompson's, Grant's gazelle, Maasai giraffe, etc.

Results

Children's perception of surrounding environment outside school

- ➢ IEK of Maasai is **learned progressively throughout one's life** (Sankan, 1995)
- ➢ children around **9 to 14 years old** have **already start succeeding IEK** through their **daily practice** in both **social** activities **and family** daily life.
- ➢ **Herding and traditional health care usage** of plants and vegetation have been learned by children using **local language**.

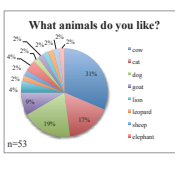


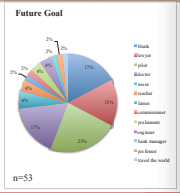
Children's Knowledge of Surrounding Savanna Ecosystem	Trees	Mountain	Animals
No. in Maa	18	56	13
No. in Kiswahili	6	0	13
No. in English	7	0	13

Children's perception of surrounding environment influenced by school education

- ✧ Environmental knowledge related school education supplements children's perception of surrounding environment with **scientific explanation**.
- ✧ More and more **environment related materials** have been taken into education programs and subjects.

However...
Despite of abundant traditional and scientific ecological knowledge, future goals of all students show significant similarity with urban children, and no student set pastoralist as future goal.





Continuation

Raise the concern of the possibility of losing IEK in the future

For understanding current situation more comprehensively:

- ⌘ Intensive fieldwork is planned to conduct this year
- ⌘ Review of previous studies through different disciplines are needed for more comprehensive study of Maasai's IEK

Poster No.25

Choices of water resources by the people in relation with water borne diseases in Kathmandu, Nepal

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Introduction

Globally, more than 1 billion people still have no access to improved drinking water sources although the coverage has increased from 78% in 1990 to 83% in 2004. Consequently about two billion people in the world suffer with diarrheal disease, and it kills 1.5 million children every year, and is the second leading cause of death in children under five years old (UNICEF, 2009).

In Nepal about 15% of 42800 deaths of children (0-14 years old) in 2008 were attributed to diarrhea (WHO, 2011). Access to household tap water in Nepal increased both in urban and rural areas to 53% and 10% respectively during the last 20 years, but the coverage of other improved sources is fell in urban from 53% in 1990 to 40% in 2010 (WHO/UNICEF, 2012). Kathmandu, the capital city of Nepal has faced quantitative and qualitative chronic water problems as a result of different factors such as rapid population growth, industrial pollution, shortage of water resources, aging infrastructures, inefficient water management, lack of finance etc. Facing such situations, people are obliged to choose multiple water resources to run their daily life. The main concern of this research is to clarify the conditions under which people choose water from different sources and utilize it in daily life. The research will also aim to investigate the association between household water situation and choice of water use with how often and how severely people suffer from diarrheal diseases.

Keywords: -, Safe water access, Waterborne disease, Child mortality.

Objectives

- ✧ To clarify the basic situation of water resources in households in a targeted area in
- ✧ Kathmandu.
- ✧ To examine the conditions and the reason how people choose water from different sources and utilize it in daily life.
- ✧ To investigate the association of household water situation and choice of water use with morbidity and mortality due to diarrheal diseases

Methodology

- ✧ A cross-sectional household survey will be conducted in a study area in Kathmandu city in Nepal. Research will be based on quantitative methods.
- ✧ Examination of water situation in the targeted households and interviews will be conducted using semi-structured questionnaire on the people in each household to identify their choice of water resources, the reasons for choice, their background knowledge and perceptions related with water use, and their socioeconomic/ demographic factors.
- ✧ The secondary data will be collected from various publications such as National Planning Commission, the Central Bureau of Statistics of Nepal, and different government bodies in Nepal.
- ✧ Prior literature and publications concerning this subject will be reviewed.

CHOICES OF WATER RESOURSES BY PEOPLE IN RELAION WITH WATER BORNE DIEASE IN KATHMANDU

Banu Yasin, Graduate School of Life and Environmental Sciences
EDL Program, Tsukuba University, Ibaraki, Japan

Objectives

- To clarify basic situation of water resources in the households in a targeted area in Kathmandu.
- To examine the conditions and the reasons how people choose water from different resources and utilize it for daily life.
- To investigate the association of household water situation and choice of water use with the morbidity and mortality due to diarrheal diseases.

Introduction

People has been facing chronic water problems both quantitatively and qualitatively

Rapid population growth

Shortage of water resources

Industrial pollution

Inefficient water management

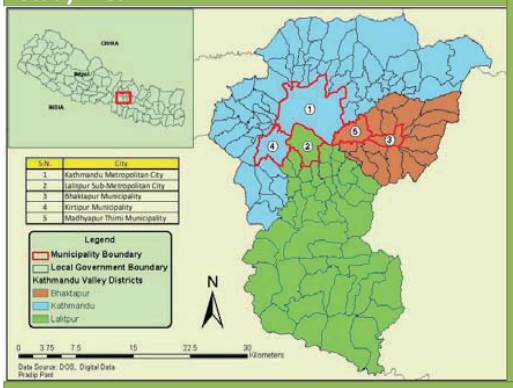
Aging infrastructure

Kathmandu, capital city of Nepal

people are obliged to choose multiple water resources to run their daily life

People are affected seriously from water borne diseases (Diarrhea disease)

Study Area



- Kathmandu is the Capital city of Nepal. More than 3 million people are living in the capital city.
- The total demand of water in Kathmandu is estimated 320 million liters per day but distribution only 90 million liters.
- More than 22% of the under 5 years population has been suffered from various water born diseases every year
  Source: (Rauniyar, 2011).

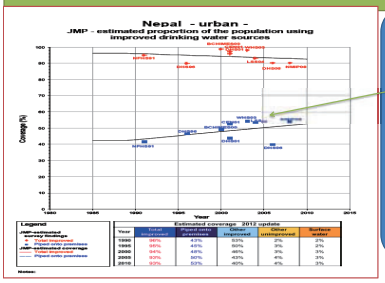
Methods

- Cross-sectional households survey will be conducted in a study area in Kathmandu city of Nepal.
- Research will be based on quantitative method.
- Examination of water situation in the targeted households.
- Interviews will be conducted using semi-structured questionnaire to the people in each household.

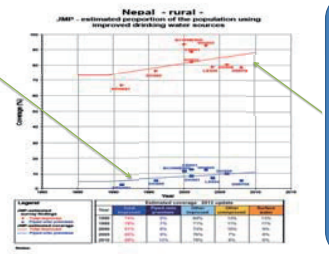
Purpose

- To investigate the association of household water situation and choice of water use with how often and how severely people suffer from diarrheal diseases.
- To find out the solution to solve out the problems.

Scenarios of drinking water resources and occurrence of diseases caused by poor water quality



Proportion of population using Improvement of drinking water sources is increasing more in urban areas.



- But the total improvement of using drinking water resources is decreasing in urban areas and increasing in rural areas.

Future Plan and Discussion

- Water scarcity and the occurrence of water borne diseases by poor water quality is the huge problem in Kathmandu city.
- Gather information from different resources like book, newsprint, internet and others about related topic.
- Field Survey in March and August

Table 5.12: Diarrhoeal and worm infestation diseases

Area	Total OPD visits	Patients with diarrhoea		Patients with worms	
		No.	%	No.	%
Nepal	8,642,852	816,481	9.4	666,362	7.7
Bhaktapur	31,988	2,265	7.1	1,787	5.6
Kathmandu	173,042	15,144	8.8	9,193	5.3
Lalitpur	94,655	7,263	7.7	5,745	6.1

Source: Department of Health Services 2003

- People are suffering from the occurrence of diseases caused by poor water quality.

Table 5.8: Bacteriological water quality of different water sources, Kathmandu Valley

Parameters	Water Sources				WHO GV
	PTW	PUTW	Well	SS	
pH	6.5-8.2	6.5-7.5	7.5	7.5	6.5-8.5
Temp (°C)	13-18	12-15	15-18	15-18	25
Iron (mg/l)	ND-0.2	0.2	0.2	0.3	0.3-3.0
Chlorine (mg/l)	ND	ND	ND	ND	0.2
Chloride (mg/l)	10-30	22-45	26-27	23-45	250
N-NH_4 (mg/l)	ND-0.2	0.2	0.2	0.2	0.04-0.4
PO_4 - P (mg/l)	0.1	0.1	0.1	0.1	0.4-5.0
Coliform bacteria (source points)	+/-	+	+	+	-
Coliform bacteria (consumption point)	+				-
E. coli cfu/100 ml	10-131	3-20	48-200	58	0

Source: Pradhan et al. 2005
Note: PTW = private tap water, PUTW = public tap water, SS = stone spout, WHO GV = World Health Organisation guideline value

References

- People are suffering by the occurrence of diseases caused by poor water quality.
- Palikhe, B.R. (2005) Pesticide Management In Nepal: In View of Code of Conduct: Country Report. Kathmandu: Department of Agriculture.
- NWSC (2001) Annual Report 2001. Kathmandu: Nepal Water Supply Corporation.
- **WHO / UNICEFJoint Monitoring Programme** for Water Supply and Sanitation Estimates

Poster No.26

The Anti-diabetic Activity of *Actinidia Kolonikta* Roots in the Experimental Hyperglycemic Rats

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University of Tsukuba, Ibaraki, Japan

Introduction

Diabetes mellitus is a metabolic disorder resulting from a defect in insulin secretion, insulin action or both. Insulin deficiency in turn leads to chronic hyperglycemia with disturbance of carbohydrates, fat and protein metabolism. Globally, the estimated incidence of diabetes projection for year 2030, as given by International Diabetes Federation is 350 million. Currently available drugs do not restore normal glucose homeostasis and are not free from side effects.

The genus *Actinidia* consists of over fifty-eight species widely distributed throughout the Asian continent. Specific *Actinidia* species, such as *A. arguta* and *A. chinensis* are used as health foods and medical agents for cancer treatment. The *Actinidia kolomikta* plant has many biological effects, such as anticancer, anti-microbial, anti-oxidative properties, hypoglycemic and anti-hydrotic effects. The vitro experiments show it has a significant hypoglycemic effect.

Objective

The determination of the anti-diabetic effects of extracts from *Actinidia kolomikta* in diabetic rats will be undertaken in this experiment.

Methodology

Male Wister rats (200-250g) will be used in this research. Type 2 diabetes will be induced by the feeding of high-cholesterol diet and a final single injection of Streptozotocin (30mg/kg b.w.). Six groups of animals will be used in this experiment. The first group will serve as normal control, the second group will serve as the diabetic control and the third and fourth groups will be administrated with the extract in different concentrations. Finally the last group will be treated with an anti-diabetic drug Glibenclimate. Body weight, fasting blood glucose, insulin level and α-glucosidase level will be monitored during the experimental period.

Keywords: Diabetes, Anti-diabetic activity, Hyperglycemic rats

Anti-diabetic Activity of *Actinidia Kolonikta* Roots in Experimental Hyperglycemic Rats

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Strategic Funds for the Promotion of Science and Technology

Background

Diabetes mellitus is a metabolic disorder resulting from a defect in insulin secretion, insulin action or both. Insulin deficiency in turn leads to chronic hyperglycemia with disturbances of carbohydrates, fat and protein metabolism. Globally, the estimated incidence of diabetes and projection for year 2030, as given by International Diabetes Federation is 350 million. Currently available drugs do not restore normal glucose homeostasis and they are not free from side effects.

The genus *Actinidia* consists of over fifty-eight species widely distributed throughout the Asian continent. Specific *Actinidia* species, such as *A. arguta* and *A. chinensis* are used as health foods and medical agents for cancer treatment. The *Actinidia kolomikta* plant has many biological effects, such as anticancer, anti-microbial, anti-oxidative properties, hypoglycemic and anti-hydrotic effects. The vitro experiments shows it has a significant hypoglycemic effect.

347 Million
347 million people worldwide have diabetes

80%
More than 80% of people with diabetes live in low and middle-income countries

2030
WHO projects that diabetes deaths will double between 2005 and 2030

Objective

- The determination of the anti-diabetic effects of extracts from *Actinidia kolomikta* in diabetic rats will be take out in this experiment.
- The comparison of anti-diabetic effects between extracts from AK and anti-diabetic drug will be take out in this experiment

Materials

Ethanolic Extraction

Aqueous Extraction

Two kinds of extract will be mixed after the extraction.

Animal: Male Sprague-Dawley rats
Condition of Acclimatization:
22±2° C
12h light 12h darkness cycle
Standard laboratory feed and tap water

Induction of Type2 diabetes:
Type2 diabetes will beinduced by five weeks' feeding with high-cholesterol diet and a final single injection of STZ (30mg/kg b.w.)

Methods

Pre-experiment
Oral glucose tolerant test will be done during the pre-experimental period. In this test, solution of glucose with the dose of 2g/kg b.w. will be administrated to experimental rats, after the administration, different doses of extract will be fed to the animals. From the OGTT result of this period, the doses (AK1 and AK2)which will be used in the further experiment will be determined.

Evaluation of AK extract in type 2 diabetic rats

GroupI	Non-diabetes control	Distilled water
GroupII	Diabetic control	Distilled water
GroupIII	AK1	Extract with dose 1
GroupIV	AK2	Extract with dose 2
GroupV	Anti-diabetic drug	5mg/kg b.w.

All the rats will be weighted during the experimental period(28 days). And the fasting blood glucose, insulin level and the level of α- glucosidase in serum will be measured every 7 days during the experiment.

Oral glucose tolerant test
All of the rats will be subjected to an oral glucose tolerance test on the 15th day. Blood samples of all rats will be collected from the tail vein after fasting for 12h. Then, the rats will be given a glucose solution by gavage(2g/kg) and tail blood will be collected at 30, 60, 90 and 120 min after the administration of glucose. Blood glucose in each time point will be test.

Insulin tolerance test
On the 22nd day of experimental period, insulin tolerance test will be performed. Blood samples of all rats will be collected from the tail vein after fasting for 12h. Then, the rats will be given a glucose solution by gavage and tail blood will be collected at 40, 80 and 120 min after the administration of glucose. Blood glucose in each time point will be test.

Poster No.27

The effect of photocatalytic oxidation of Geosmin using TiO_2-coated carbon

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Taste and odour (T&O), the primary factors of drinking water, are mainly caused by geosmin. Even though these compounds are non-toxic, they must be removed to sustain the acceptability of drinking water. Conventional treatment is inefficient in removing these odour-causing substances. Effective treatment methods to remove MIB/geosmin are absorption by activated carbon or oxidation by strong oxidant. Photocatalytic oxidation using TiO_2 powder, as a kind of advanced oxidation processes (AOPs), has proved an effective way to deal with MIB/geosmin. But it can't be applied in practical use due to the separation problems. In order to solve this problem, a fluidized bed reactor utilizing TiO_2-coated carbon will be used in this research. In addition, the high surface area of activated carbon will improve the degradation of MIB/geosmin. A modified sol-gel preparation method will be employed.

Keywords: Taste and odour (T&O), Photocatalytic oxidation, activated carbon, fluidized bed reactor, sol-gel

The Effect of Photocatalytic Oxidation of Geosmin Using TiO_2-coated Carbon

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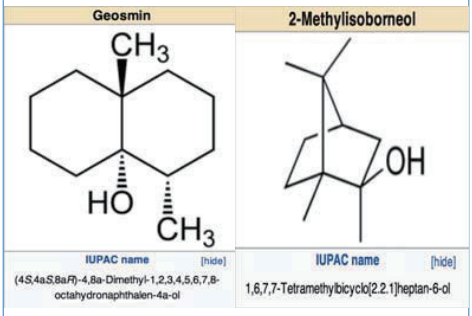
Strategic Funds for the Promotion of Science and Technology

INTRODUCTUON

Taste and Odour (T&O)

Geosmin and 2-MIB

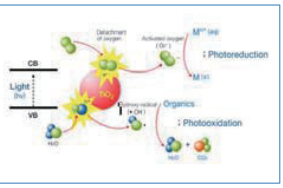


threshold：10ng/L non-toxic but un-acceptable

method	challange
conventional treatment	inefficient
activated carbon	Best available method But influenced by NOM(natural organic matter)
Oxidation (ozone, bydrogen peroxide and UV)	expensive Harmful by-products(DBPS)
Biological methods	Long reaction time

A promising advanced oxidation process (AOP)

Reaction mechanism of Photocatalytic oxidation



Visible light

1, Ion implantation using Cr or V ions
2, doping of non-metals such as N

Separation

1，TiO_2-coated hollow glass beads
2，TiO_2 based on thin film
3，TiO_2 deposited on activated carbon

WAYS TO DEPOSIT

Electrodeposition, Sol–gel, Electro static sol-spray deposition, Aerosol pyrolysis

EXPERIMENTAL-Sol-gel method

Preparation of GAC

1. treated by nitric acid
2. washed by distilled water
3. being dried

TiO_2 -Gel

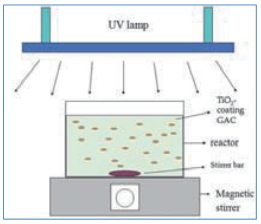
1. Dissolve tetrabutylorthotitanate in anhydrous alcohol
2. Add alkali, acetic acid, deionized water, aqueous solutions of nitric acid, stir vigorously

Coating

1. Impregnate prepared GAC
2. filter and wash by anhydrous alcohol and deionized water
3. Dry

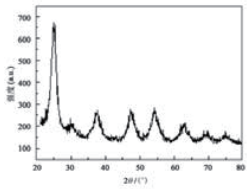
Study method

1. X-ray diffraction (XRD) patterns
2. Scanning electron microscopy (SEM)
3. transmission electron microscopy (TEM)

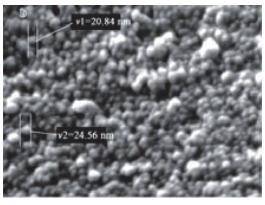


1. Maintained in the dark
2. irradiated under UV light by using a 690 W/m2 Xe-lamp

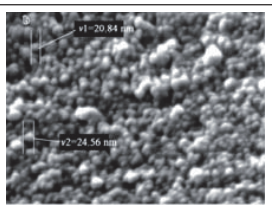
RESULT-TiO_2 is loaded on activated carbon evenly



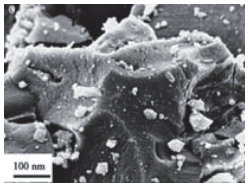
XRD pattern of TiO_2-C sample



SEM micrograph of naked activated carbon



SEM micrograph of TiO_2 prepared by sol-gel method



SEM micrograph of TiO_2-mounted activated carbon

STUDY IN THE FUTURE

Different concentration of Geosmin and 2-MIB	Different type of activated carbon	reaction kinetics	Reactor of practical application

Poster No.28

Community-based mangrove forest management in Xuan Thuy National Park, Nam Dinh, Viet Nam

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

Introduction:

Mangrove forest is regarded as a green wall to mitigate the impacts of climate change. According to IUCN, 2004, an undamaged mangrove forest can reduce wave height by 50-70% and wave force by 90%. As a result, people and their property are protected. Besides, the mangrove system provides important livelihoods for local people who are mainly poor.

However, the scale of mangrove forest in Viet Nam has continuously decreased, from 408,000 ha in 1943 to more than 200,000 ha in 2010 (Ministry of Agriculture and Rural Development, 2012). Ineffective management by local authorities and negative impacts of local people harvesting natural resources in mangrove forest are reasons of this loss.

In order to develop an effective model to manage mangrove forest, government has experimented with some solutions. Recently, the implementation of a community-based mangrove management approach was selected by the Prime Minister of Viet Nam. Xuan Thuy National Park was chosen as an experimental place for the community-based mangrove management model. As the pioneer in applying the model, Xuan Thuy National park can provide good lessons for model improvement, which could be applied to other areas.

Objectives:

My research is to find out the strengths and challenges/weakness of the model of community-based mangrove management in Xuan Thuy National Park; and then give recommendations to government and policy makers to improve the model that could be applied to other mangrove forests in Viet Nam.

Research site:

My research site is Giao An commune, Giao Thuy district, Nam Dinh province. This commune belongs to the buffer zone of Xuan Thuy National Park, which has successfully maintained mangrove forest through the years. It is also the first village to apply the model of community-based mangrove forest management according to the decision of the Prime Minister.

Methodology:

- Sampling and data collection: Primary data will be obtained from interviews with local people, key informants as well as group discussion. The sample size will be at least 30% of households. Primary data collection will be organized in July and August 2013. Secondary data will also be collected through sources including Xuan Thuy National Park management board, Giao An commune's People Committee, and various international and national research publications.
- Statistical analysis: the questionnaire data will be analyzed in Excel.

Future work:

- Literature review about research on community-based mangrove forest management models.
- Conduct field survey in July-August, 2013 to collect primary data. The interview sample of local people will include at least 30% of households. Interviews with key informants will be the Director of Xuan Thuy National Park, chairman of Giao An's People's Committee,etc..

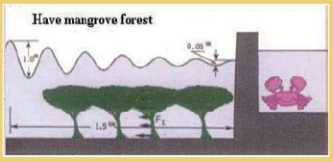
Keywords: Community-based, benefit sharing, livelihood, mangrove forest, Xuan Thuy National Park.

COMMUNITY- BASED MANGROVE FOREST MANAGEMENT IN XUAN THUY NATIONAL PARK, NAM DINH, VIET NAM

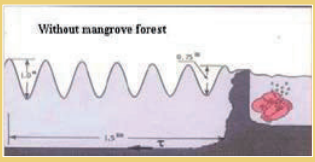
Vo Thi Thu - *Graduate School of Life and Environmental Sciences, University of Tsukuba*

Introduction

Mangrove forest is regarded as a green wall to mitigate impacts of climate change, to control the concomitant sea level rise and coastal erosion. The most obvious evidence is from the Idian Ocean tsunami in December, 2004 when different impacts of the tsunami on with-mangrove and without- mangrove ecosystem was observed.



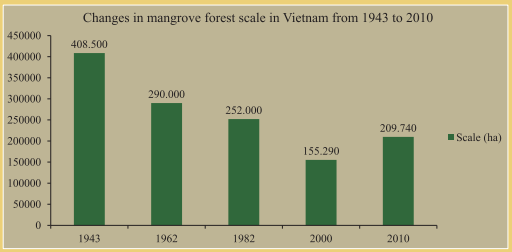
When mangrove forest is wide than 1.5km, height wave will reduce from 1m to 0.5m in lagoon coast. Therefore, ecosystems behind are protected.



When there is no mangrove forest, height wave is 0.75m and coast is eroded.

Source: [1]

Besides, mangrove system provides important livelihoods for local people who are mainly poor ones.
As one of countries that are affected by climate change, mangrove forest in Viet Nam plays an important role in this struggle. However, the scale of mangrove forest in Viet Nam has continuously decreased.



Source: [2]

An ineffective management of local authorities and negative impacts of local people when harvesting natural resources in mangrove forest are ones of reasons of this loss.

Community-based mangrove management model which is first applied in Xuan Thuy National Park could be answer for the management of mangrove forest in Viet Nam.

Objectives

Find out strengths and challenges of the model of community-based mangrove management in Xuan Thuy National Park,

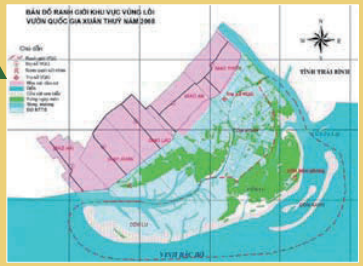
Give recommendations for government and policy makers to improve the model, which could be applied for other mangrove forests in Viet Nam.

Methodology

Sampling and data collection: Primary data will be obtained from interview with local people, key informants as well as group discussion. Secondary data from Xuan Thuy National Park management boarding, Giao An commune's People Committee, and various international and national researches.

Statistical analysis: the questionnaires data will be analyzed by Excel program.

Research site



Xuan Thuy National Park Map [3]

Located in the Giao Thuy District, Nam Dinh Province, Xuan Thuy National Park was declared Vietnam's first Ramsar site of Vietnam in January 1989.

The total area of the site is more than 15.000 ha with 7.100 ha allocated for the core zone and 8.000 ha as a buffer zone, of which 4.000 ha is mangrove forest.

Mangrove forest provides important livelihoods for local people such as timber, aquatic resources.etc…

Local people collecting natural resources in Xuan Thuy National Park [3]

Giao An commune is one of 5 communes of buffer zone of Xuan Thuy National Park, which has successful maintained mangrove forest through years. It is also the first village to apply the model of community-based mangrove forest management

Future work

Literature review about researches of model of community-based mangrove forest management

Conduct field survey in July-August, 2013 to collect primary data. The size of interview with local people would be at least 30% of households. Interviews with the Director of Xuan Thuy National Park, chairman of Giao An's People's Committee,etc..

References

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2. Ministry of Agriculture and Rural Development, 2012
3. Xuan Thuy National Park Board Management, 2010

Poster No.29

Snow cover variation and its change

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Abstract

Continental-scale snow cover extent is a potentially sensitive indicator of climate change, since it is an integrated measure of multiple hydro-climatologically processes, and it is the most prominent seasonal land surface feature in the extra tropical Northern Hemisphere. Snow is related to the surface energy budget, the water cycle, sea level change and the surface gas exchange.

In Mongolia, in the last 40 years certain impacts of climate changes have already been observed. The impact of global warming is observed in our country more than most regions of the world. Snow cover of Mongolia shows clear periods in the cold season and dynamical variation at the parameters. A major reason for this study is that nomadic livestock husbandry is one of the important parts of Mongolian society. It is highly dependent on winter weather conditions (especially snow cover).

Generally annual total precipitation is 50-450mm and but 5-15% of snow falls in the cold season in Mongolia.

In Mongolia, snowfall is very closely related to synoptic disturbance embedded in the westerly jet stream. Therefore, this study aims to investigate the regulating mechanisms for snowfall in Mongolia by re-analysis of ERA-40 data (1981-2000), model output data and meteorological data: daily maximum and minimum temperature from 1969 to 2012, snow cover, depth, pressure from 1975 to 2012 at 40 meteorological stations throughout Mongolia.

Climate change associated with increased greenhouse gas emissions may indeed affect future snow cover extent over Mongolia.

Keywords: snow cover, depth, re-analysis data, maximum, minimum temperature, pressure

Snow cover variation and it is change

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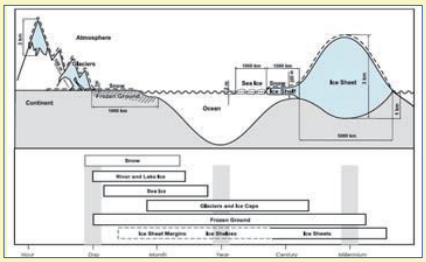
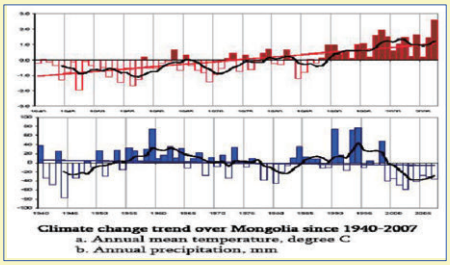
Strategic Funds for the Promotion of Science and Technology

Introduction

Continental-scale snow cover extent is a potentially sensitive indicator of climate change, since it is an integrated measure of multiple hydro-climatologically processes, and it is the most prominent seasonal land surface feature in the extra tropical Northern Hemisphere.

The main components of the cryosphere are snow, river and lake ice, sea ice, glaciers, ice shelves,, and frozen ground. The cryosphere is the second largest component of the climate system (after the ocean). Its relevance for climate variability and change is based on physical properties, such as its high surface reflectivity (albedo) and the latent heat associated with phase changes, which have a strong impact on the surface energy balance.





In Mongolia, in the last 40 years certain impacts of climate changes have already been observed. Impact of global warming is observed in our country more than most the regions in the word. Annual temperature is increased by 2.1^{0}C since 1940 and annual precipitation is decreased by 0.7% compare to climate normal since 1940

Snow cover of Mongolia shows clear period in the cold season and dynamical variation of the parameters. One major reason is to study that nomadic livestock husbandry is one of the important parts of the society of Mongolia.

Impact of snow

Nomadic livestock and herders live highly depends winter weather condition (especially snow cover) in Mongolia

Objective

The general objective of the research is to carry out the assessment of snow variation in MONGOLIA.

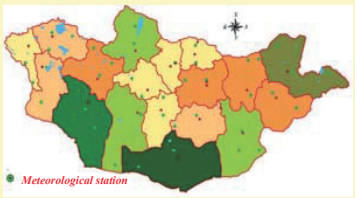
Specific objectives are the followings:

- *To perform snowfall and extreme heavy snowfall analysis*
- *To investigate regulating mechanisms for the snowfall in Mongolia*
- *To estimate change of year by year*
- *To assess future condition*

Methodology

- *Calculate cyclic activity using by thermodynamic equations*
- *The basic statistical analysis*
- *Compare the performance by Taylor`s method*

Study area and data



latitude - 47° 55' N , longitude -106° 53 E

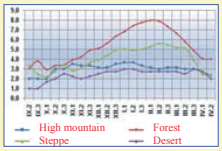
Mongolia is situated in the plateau of Central Asia at an average altitude of 1580 meters above sea level, which is one of the highest countries in the world.

- *40 meteorological station data:*
  daily maximum and minimum temperature (1969 -2012)
  snow cover, depth, pressure, wind speed (1975 – 2012)
- *re-analysis data ERA-40 (1981-2000),*
- *models output data (CLIM5)*

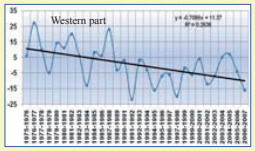
Current sduty

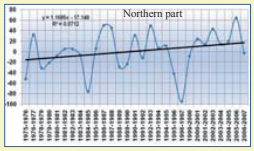
Generally annual total precipitation is 50-450mm and but its 5-15% is falls by snow in cold season over the Mongolia. Maximum snow cover depth is happened in mountain region (20-30cm), in steppe region (10-20cm) and in Gobi zone fall (10-20cm).

Continental-scale snow cover extent is a potentially sensitive indicator of climate change, since it is an integrated measure of multiple hydro-climatological processes, and it is the most prominent seasonal land surface feature. Climate change associated with increased greenhouse gas emissions may indeed affect future snow cover extent over Mongolia

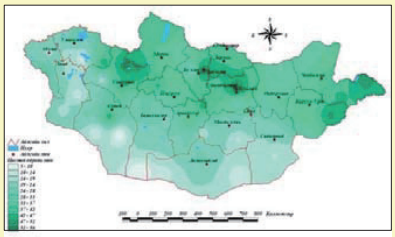


Monthly snow cover depth

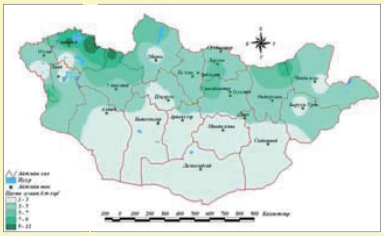




Long-term change and variation of numbers of days with stable snow cover



Distribution of the number of days with snow



Distribution of snow cover depth in the Mongolia

Natural zones	Day, Month				Days
	Date of first snow fall	Date of snow cover formation	Date of snow cover clear up	Formation of last snow cover	Duration of snow cover
Forest steppe	16 Oct	19 Nov	13 Mar	27 Apr	115
Steppe	22 Oct	28 Nov	6 Mar	15 Apr	100
Altai mountain	14 Nov	14 Nov	24 Jan	I26 Apr	70
Desert steppe	9 Nov	18 Nov	2 Feb	2 Apr	65

Starting and ending date of snow cover, number of days with snow cover

Expected output

- *Statistical analysis of snowfall*
- *The relationship between atmospheric circulation and snowfall*
- *Snows spatial and temporal analyze*
- *To determine future trend*

Poster No.30

Assessing Livelihood Activities and Proposing Solutions for Adaptation to Climate Change in Vinh Giang Commune, Phu Loc District, Thua Thien Hue Province, Vietnam

NGUYEN Thi Tam
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University of Tsukuba, Ibaraki, Japan

Currently, climate change is a hot topic all over the world. It impacts many issues, many fields, and many countries. Vietnam is one of the countries that are seriously affected by climate change. In Vietnam, poor people who live in the Northwest, Northeast, Central regions are the most vulnerable who are susceptible to the impacts of climate change. They have more difficult lives because of the sensitive terrain. "Assessing Livelihood Activities and Proposing Solutions for Adaptation to Climate Change in Vinh Giang Commune, Phu Loc District, Thua Thien Hue Province, Vietnam" is my research topic for finding and solving some problems related to the climate change issue. Vinh Giang commune is located in a sandy area in the north of Phu Loc district on the bank of the Tam Giang - Cau Hai lagoon. The local people have been poor for a long time. Many households have been living below the national poverty level. Furthermore, the quality of the surrounding living environment is not good in this area. For example, there is no wastewater treatment system and there is no waste collection system. For these reasons, I will examine the relationship between living environment and livelihood activities. The local people have livelihood activities but I propose to study whether the result they get is effective and why they have been poor for a long time and if their activities are affected by climate change. These questions are the problems I will solve in my research. As a result, I will propose solutions for the people to adapt to climate change after assessing the livelihood activities of the community.

Keywords: climate change, poor, sustainable livelihood activities, adaptation, Vinh Giang commune.

Assessing Livelihood Activities and Proposing Solutions for Adaptation to Climate Change in Vinh Giang Commune, Phu Loc District, Thua Thien Hue Province, Vietnam

Nguyen Thi TAM – Email: tam.ngthi@gmail.com
Misa **MASUDA** - Academic Supervisor
Graduate School of Life and Environmental Sciences - University of Tsukuba, Ibaraki, Japan

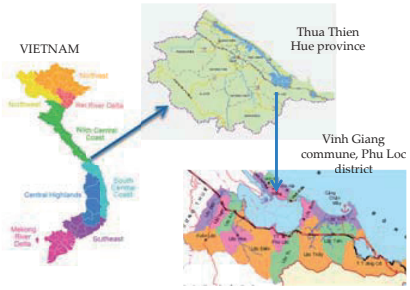
Strategic Funds for the Promotion of Science and Technology

OBJECTIVE

DO RESEARCH IN VINH GIANG COMMUNE, PHU LOC DISTRICT, THUA THIEN HUE PROVINCE, VIETNAM

- To examine the relationship between living environment and livelihood activities in the research site
- To propose to study whether the result they get is effective and why they have been still poor for a long time and if their activities are affected by climate change
- To propose solutions for the people to adapt to climate change after assessing the livelihood activities of the community

BACKGROUND AND RESEARCH SITE



Vinh Giang commune is located in a sandy area in the north of Phu Loc district on the bank of the Tam Giang - Cau Hai lagoon. The local people have been poor for a long time. Many households have been living below the national poverty level. Furthermore, the quality of surrounding living environment is not good in this area. With a sensitive location, Vinh Giang commune is affected by climate change and it impacts on the local people's living.

People's Committee of Vinh Giang commune

METHODS

- Primary data - Household survey - Structured interviews

- Secondary data
- GIS and Mapping
- Data analysis

THINK

STUDY PLANNING

- To learn the knowledge of climate change, environmental sustainability and related-issues

- To build the map of the study site – Vinh Giang commune, Phu Loc district, Thua Thien Hue province, Vietnam and show the distribution of livelihood activities' groups on the map

- To conduct some field trips to collect data and make interview for the local people

- To propose the solutions for the local people for adaptation to climate change

ACT

EXPECTED OUTCOMES

1. Expected learning/findings from the research:

- To understand the livelihood activities of the local people
- To recognize the impacts of climate change on the local people's life
- To have the solutions for the local people to adapt to climate change

2. Expected outcomes contribute to development of Vietnam:

The proposed-solutions will help the authority of Vinh Giang commune in particular and Vietnamese government in general better manage and control the local people's life in a sustainable manner in climate change situation.

CLIMATE CHANGE

LIVELIHOOD ACTIVITIES

CHANGE

Poster No.31

Groundwater flow system on Cu Lao Dung Island, Soc Trang Province, Vietnam

TRAN Dang An, M1
Graduate school of Life and Environmental Sciences,
Tsukuba University, Ibaraki, Japan

Abstract
The chemical and physical connection between surface water and groundwater is a complex issues and is largely controlled by the effects of physiography (topography and geology) and climate conditions. The understanding of this interaction mechanism plays a crucial role in the sustainable use and management of groundwater. In coastal areas, groundwater quality and quantity is frequently affected by many complicated factors, such as salt intrusion, pollution, abstraction and management. Furthermore, in areas with topographical homogeneity, groundwater movement significantly depends on river water fluctuation, temperature and abstraction rate. This research represents a case study at Cu Lao Dung Island, coastal district of Soc Trang province in the Mekong Delta region, Vietnam. In this area, groundwater characteristics may be influenced by seasonal fluctuation and tidal regime. Therefore, this research aims to examine the mechanism of interaction between groundwater and surface water as well as the effects of extraction on salt intrusion in coastal aquifers by using tracer isotope techniques and modeling. The field survey will be carried out in the dry and the rainy seasons in 2013 and 2014. Water samples will be collected/taken according to seasonal characteristics and tidal regime. Inorganic ions and stable isotopes H_2 and O_{18} will be analyzed by ICP and Isotope Ratio Mass Spectrometry technique, respectively. To enhance understanding of the spatial and temporal connectivity between surface water and groundwater, a conceptual model will be developed integrating the results and present data in a vertical cross-section. Based on the results of groundwater modeling simulation, the effects of pumping rate on seawater intrusion in aquifers will be revealed.

Keywords: CLD Island, Interaction, surface water, groundwater, environmental isotope.

Groundwater flow systems at Cu Lao Dung Island, Soc Trang Province, Vietnam

Tran Dang An, M1

EDL Education Program, University of Tsukuba, Ibaraki, Japan

Introduction

Groundwater is an important fresh water resource, and plays an extremely vital role for human's life, socio-economic development and the existence of ecosystems [1]. However, this water source is vulnerable by natural and human-induced pollutants. This situation put serious stresses on the sustainable use of groundwater.

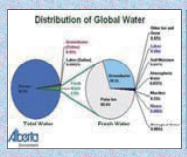


Fig 1. Global water distribution [2] Fig 2. Global water Scarcity [3]

Mekong Delta in Vietnam, a home of 17 million people, is an important food production provider of the country with 53%, 65% and 75% of the rice, fishery and fruit products respectively [4].

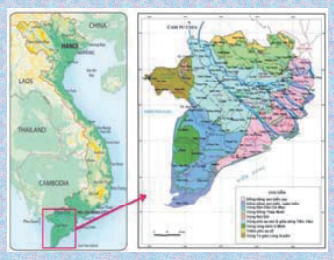


Figure 3. Mekong Delta Map [4]

In the Mekong Delta, groundwater is an essential fresh water of domestic, irrigation purposes for more than 100 years [5]. However, groundwater source now have to face many serious issues.

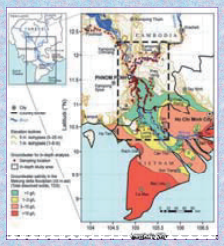


Figure 4. Salt intrusion in Mekong Delta [6]

This research presents a case study from Cu Lao Dung Island, Soc Trang, Vietnam as shown Fig.5. In this area, the fluctuation of river water and tidal regime may be main factors affecting on groundwater source.

Figure 5. Cu Lao Dung Island, Soc Trang Province, Vietnam

So, understanding the interaction between surface and groundwater plays crucial role in sustainable water resources management.

Methods

The interaction between surface water and groundwater takes place in three main ways [7]

(1)Streams gain from inflow of groundwater via gaining stream, (Fig.)

(2)Streams recharge to groundwater through losing stream (Fig.7).

(3)The above two processes occur at the same time: gaining in some reaches and losing in other reaches.

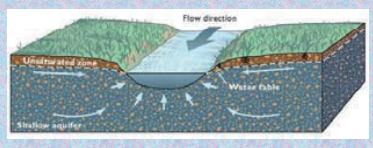


Figure 6. Gaining streams receive water from the groundwater system (Groundwater discharge into stream) [7]

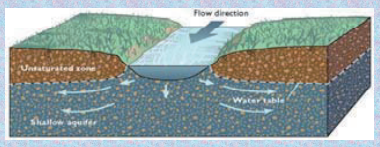


Figure 7. Losing streams lose water to the groundwater system (Streams recharge to groundwater) [7]

There are several methods to assess and identify the mechanism of interaction between surface water and groundwater as shown in the Fig.8 below.

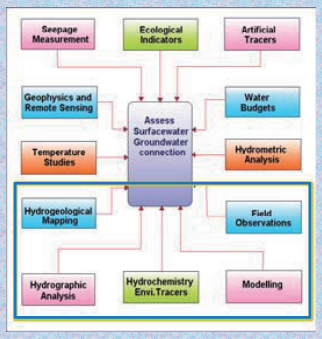


Fig 8. Approaches to assess the interaction between surface water and groundwater.

In this research, four methods will be deployed in this research, including: field survey, data collection and analysis, modeling (GMS Model) and stable isotopes analysis. The basic data such as meteorology, hydrology, geology, topography and Land use characteristics will be collected from national and local agencies. Water will be sampled during the surveys to on-site and laboratory tests in both seasons. Collected data will be used as input data for GMS Model (Fig.9).

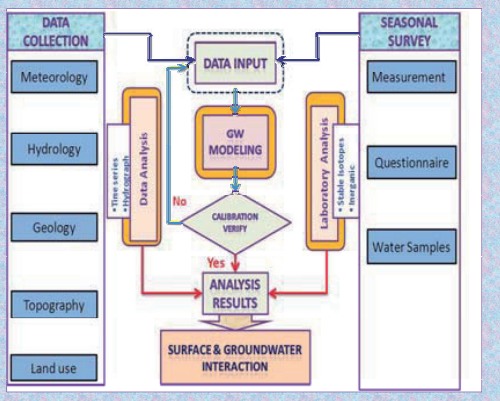


Fig 9. Flowchart to indentify the mechanism of the interaction between surface and groundwater at Cu Lao Dung Island, Soc Trang Province, Vietnam.

Objectives

This research aims to:

(1) To understand the interaction between surface water and groundwater.

(2) Assess the effects of exploitation, salt intrusion on groundwater source.

The above objectives will be done, if the questions following the Fig.10 below, should be answered.

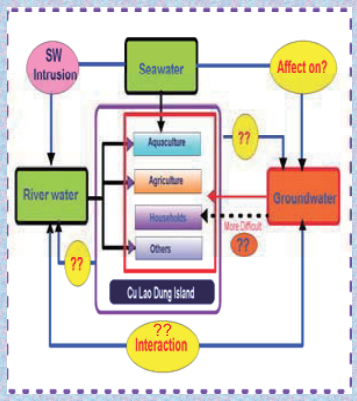


Figure 10. The water resources issues in Cu Lao Dung Island.

Future work

(1) Conduct field surveys to collect data and site investigation.

(2) Anaiyze inorganic ion and stable Isotopes.

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Acknowledgements

I would like to thank my supervisor , **Professor Tsujimura** who gave his kind supports to the author conducting this research. I also would like to express my sincere thankfulness to **Professor Vo Le Phu** *(Ho Chi Minh City University of Technology, Vietnam)* for his great comments and useful advices.

Poster No.32

Biological treatment of tannery wastewater using halophilic bacteria

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

The tanning industry is one of the oldest industries in the world and the problem of its waste and wastewater treatment is probably as old as the industry itself.

In recent years there has been gradual increase in tanneries in Mongolia, and currently over 30 small, medium and larger tanneries are running in the sector with the capacity of processing up to 9 million (pieces) hides and skins in Ulaanbaatar, the capital city of Mongolia. For the conversion of raw hides or skins into leather most tanneries illegally use hexavalent chromium. All of these tanneries are located near the Tuul River, which is the major water resource for the city. In Mongolia, all other tanneries don't have their own treatment facilities.

The Khargia Company is the only private company to treat wastewater from tanneries. The tanneries first filtrate their wastewater and send it to the private wastewater treatment plant. In the private treatment plant, solid waste is precipitated by adjusting its pH, the treated wastewater is transferred to a centralized effluent treatment plant.

From the status of tannery wastewater treatment in Mongolia, it's obvious that some additional treatment is necessary to deal with the wide range of toxic chemicals in untreated tanneries and their effects on the environment. In Mongolia, no wastewater treatment based on biological methods has been applied in practice.

The first step of my research work will be the taking of a sample from Mongolian tannery industries wastewater and isolate the bacteria that can be resistant to hexavalent chromium. Removal of hexavalent chromium will be carried out at different concentrations of Cr (VI) added as potassium dichromate (K2Cr2O7). My research work will be focused on bacteria having detoxification activity isolated from wastewater containing hexavalent chromium.

Keywords; halophilic bacteria; hexavalent chromium; wastewater; tannery industry

Biological treatment of tannery wastewater using halophilic bacteria

Nurymkhan MARJANGUL
Graduate School of Life and Environmental Sciences

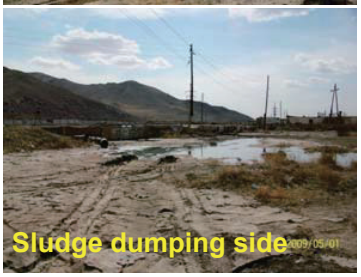
Strategic Funds for the Promotion of Science and Technology

Introduction

The tanning industry is one of the oldest industries in the world and the problem of its wastes and wastewater treatment is probably as old as the industry itself.
In recent years there has been gradual increase in tanneries in Mongolia, and currently over 30 small, medium and larger tanneries are running in the sector with the capacity of processing up to 9 million (pieces) hides and skins in Ulaanbaatar, capital city of Mongolia. For the conversion of raw hides or skins into leather most tanneries illegally use the hexavalent chromium.

Figure 1 Tannery waste water treatment plant in Mongolia

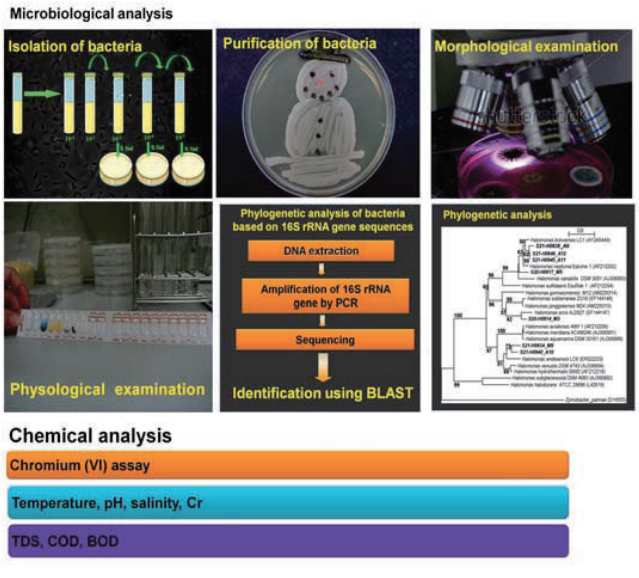
All tannery industries are located near the Tuul River which is the major water resource for the city. In Mongolia, all of these tanneries don't have their own treatment plant. The Khargia Company is the only one private company to treat wastewater from tanneries.



Objective

From the status of tannery wastewater treatment in Mongolia, it's obvious that some additional treatment is necessary to deal with the wide range of toxic chemicals in untreated tannery and their effects on the environment.
The first step of my research work will be taking a sample from Mongolian tannery industries wastewater to isolate the bacteria which can be resistant of hexavalent chromium.

Methods



Expected output

Removal of hexavalent chromium will be tested at different concentration of Cr(VI) added as potassium dichromate ($K_2Cr_2O_7$). My research work will be focused on the feasibility of treating tannery wastewater using bacteria having detoxification activity isolated from wastewater containing hexavalent chromium in addition to other environmental effects.

Poster No.33

Evaluation of groundwater resources in quality and quantity at Binh Chanh district, Ho Chi Minh City, Vietnam

BUI Thi Tuyet Van
Graduate School of Life and Environmental Sciences,
University of Tsukuba, Ibaraki, Japan

Binh Chanh district is one of the suburban districts of Ho Chi Minh City (hereafter HCMC), Vietnam with a high-density population and urban – industrial expansion. It is located in the west-southwestern area of HCMC. The climate of this area is influenced by a monsoonal regime and seasons clearly divided into rainy and dry. An average annual precipitation is about 2.000 mm. The rainy season accounts for 80-85% of yearly rainfall.

In the context of the increase in water demand, groundwater is the best alternative source of water supply for domestic and industrial activities for some areas without piped water in Binh Chanh district. Currently, however, the inadequate domestic and industrial wastewater control system and the over abstraction of groundwater from aquifer sources have resulted in land subsidence and quantitative and qualitative degradation of groundwater. Especially, under conditions of climate change – sea level rise, Binh Chanh district is also impacted by salt water intrusion. Therefore, it is important to clarify the mechanism of interaction between surface water/river water and groundwater and evaluate the quality and quantity of groundwater resource, which is fundamental for the sustainable management of water resources.

Up to now, no detail research on the interaction between surface water/river water and groundwater and the effect of urbanization and industrialization on groundwater have been done here. This is the reason that I undertook this research. I will implement two field surveys in both the dry and rainy seasons. Some parameters of water including EC (electrical conductivity), pH, TDS, and temperature were measured in the field, whereas major ions, heavy metals (Fe, As), and stable isotopes ($\delta^{18}O$, δD) were analyzed in the laboratory. I also collected hydrometeorology data, land use map and pollution sources.

Collected data, analyzed results and stable isotopes show where the important recharges for groundwater are in the case study. It is very necessary to regulate the processes of urbanization and industrialization for conservation of groundwater resources. This research will also propose some water management solutions in HCHC.

Keywords: Binh Chanh, interaction, groundwater, surface water, urbanization.

Evaluation of groundwater resources in quality and quantity at Binh Chanh district, Ho Chi Minh City, Vietnam

Bui Thi Tuyet Van
Supervisor: Professor Maki Tsujimura
Graduate School of Life and Environmental Sciences
University of Tsukuba

Strategic Funds for the Promotion of Science and Technology

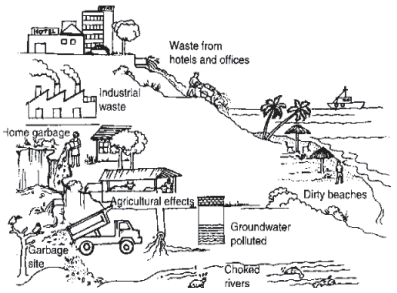
Introduction

- Groundwater, a renewable and finite natural resource, vital for human life, for social and economic development and moreover a valuable component of the ecosystem, is vulnerable to natural and human impacts [1]. In the context of many challenges that people have been facing such as the rapid population growth, urbanization and industrialization, water demand increases remarkably. Moreover, the existing water supply network from surface water treatment plants are unable to meet the domestic and industrial water demand and the waste water control system is inadequate. Therefore, there is the overexploitation of groundwater, as the result of drawdown of water table, land subsidence, saltwater intrusion and groundwater degradation, especially in the condition of climate change – sea level rise.
- The total amount of water use in Ho Chi Minh City (HCMC) is over 1,200,000 cubic meters per day (m^3/d), which includes 770,000 m^3/d from the Sai Gon - Dong Nai rivers and about 500,000 m^3/d from groundwater [2]. An uncontrolled rate of groundwater abstraction in HCMC has resulted in a large drop in the water table, deteriorating water quality, and increasing land subsidence.
- It is important to understand the interaction between groundwater and surface water and access the impact of the urbanization process and industrial activities on quality and quantity of groundwater. This is fundamental to achieve the sustainable management of water resources.

(Source: Southern Institute for Water Resources Planning)

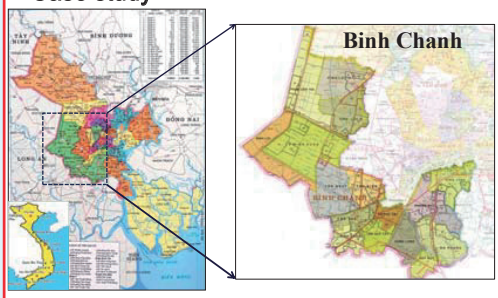
Objectives

- To clarify the mechanism of interaction between groundwater and surface water.
- To evaluate the effects of the urbanization and industrialization on groundwater resources.



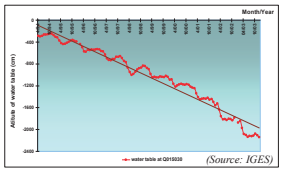
http://www.nzdl.org

Case study



(Source: www.hochiminh.gov.vn)

- Binh Chanh is the suburban district located in the west – southwestern of HCMC.
- An average annual precipitation is about 2.000 mm.
- This district was influenced by saltwater intrusion and land subsidence [3].
- There is no research on the interaction between groundwater and surface water.



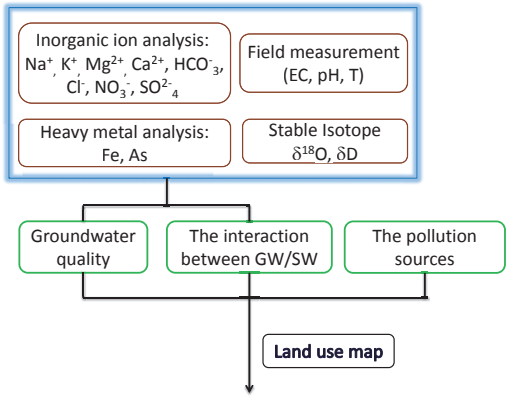
(Source: IGES)

Change of the water table with time at Binh Chanh Station

No	The flow component	Pleistocene aquifer (m^3/day)	Upper Pliocene aquifer (m^3/day)	Lower Pliocene aquifer (m^3/day)
1	Flow recharged from rainwater	309,530		
2	Flow recharged from Dong Canal	156,750		
3	Flow recharged from Sai Gon river	67,500		
4	Flows from northern and western boundaries of HCMC	22,540	181,170	94,030
5	Static flow	239,480	771,090	658,970
	Total	**796,000**	**952,000**	**753,000**

(Source: Department of Industry)

Research Framework



Evaluating the effect of urbanization and industrialization on groundwater

Acknowledgements

I would like to gratefully and sincerely thank my supervisor – Professor Maki Tsujimura for his guidance and many meaningful comments.

I would also like to thank Professor Vo Le Phu (University of Technology, Ho Chi Minh city) for his support and useful advices.

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Discussion and Future works

Stable isotopes of hydrogen (δD) and oxygen ($\delta^{18}O$) in groundwater as a valuable tool to study the source of water and its genesis.

Field survey

- ✓ Dry season: February 2013
- ✓ Rainy season: July 2013

Poster No.34

Mitigation of Socio-Environmental effects created by large development projects

MIAH Md Tofail
ID : 201225031
Supervisor : Naoko KAIDA

Recently, the incredible negative social and environmental impacts of enormous development projects have been observed including the protests made against these big projects. Today, loan providers like WB, ADB, JICA, DFID etc desire less social and environmental harm during formulation and implementation of large projects. Nowadays people are more reluctant to give up their possessions for any goods. In the case of land the situation has become more critical. It is now more challenging for any government to acquire land for any development projects. Due to high prices and rising demand, the land acquisition process requires greater planning and strategy development. For densely populated countries the task become more troublesome. It is very difficult to make all people happy and satisfied with the acquisition process. Sometimes angry people resist resettlement activities and development projects face uncertainties. So now special attention is required for such land acquisition and resettlement projects. During construction, the rehabilitation or widening of any road or bridge or dam construction project necessitates land acquisition as a prerequisite of that project. Severe negative social and environmental impacts have observed recently along with protest against development and acquisition. Recently, the Asian Development Bank has done a Special Assessment Study on the Social and Environmental Impacts of Developmental Projects. It may seen that, impacts are not properly identified due to weak consultation, lack of primary socio environmental base line data collection, inaccurate technical review and slow income restoration. As a result treatment and mitigation measures are also weak. Besides these fisheries are considered less important. Most of the time the social & environmental experts concerned are not deployed during planning and project formulation stage. In addition to this some inconsistency has occurred as a result of poor review capacity of the implementation agency. As a result, involuntary resettlement may occur which creates a global crisis. Sometimes, non-incorporation of resettlement components in the environmental assessment procedure does not comprise mitigation measures.

Keywords : Resettlement works are as vital as the main construction and should be done properly.

Mitigation of Socio-Environmental effects created by the large developing projects

Miah Md Tofail
Graduate School of Life and Environmental Sciences

Introduction

❑ Now a days, incredible negative social and environmental impacts of enormous development projects has been observed which made protest against those big projects.

❑How rural populations in Bangladesh and other developing countries were displaced during construction of large Road projects.

❑ Today, loan provider like WB, ADB, JICA, DFID etc desires less social and environmental harm during formulation and implementation of large projects.

❑ Needless to say, government and financing institutions are obligatory to do the resettlement activities following the global standards to diminish the crisis.

Background

➢At present peoples are much reluctant to give up their possession over any goods. In case of land the situation become more critical.

➢It is now become more challenging for any government to make land acquisition for any development projects.

➢Due to high prices and rising demand of land the acquisition needs more planning and strategy to perform.

➢It is very difficult to make all people happy and satisfied with the acquisition. Sometimes angry people resist the resettlement activities and put the developing project in to uncertainties.

➢ So special attention is required such land acquisition and resettlement project.

Proposed Compensation to be surveyed

Sl	Type of loss	Proposed Compensation Package
1.	Overall Migration.	i) Community housing with common facilities, security & utility services for the effected persons ii) Skill training facilities for vulnerable peoples for income restoration iii) Plantation, cultivation & fishing in the borrow pit or unutilized land through priority leasing.
2.	land	i) Compensation & additional grant for homestead, commercial and common property land. ii) Stamp duty and registration cost for new land purchase
3.	Crops & fish	i) Compensation for loss of crops, vegetables, fruits and fishes for 1 to 2 years based on categories.
4.	All type of structure (including separate kitchen & toilet)	i) Cash Compensation for structure loss based type and size.
5.	Disconnection of utilities.	i) Compensation to be determined by PVAT
6.	Loss of employment and business	i) 6 months income(recorded during survey) will be provided.
7.	Shifting of household belongings	i) Lump sum amount as compensation to be provided to the affected person.
8.	Vulnerable household in Governments land	i) Compensation will be provided accordingly. ii) Skill training are given.
9.	Education	i) Allowances will be to the school going children ii) Additional grant & support in case of school shifting.
10.	Health	i) Affected persons will be given health card, medical facilities for the entire project period.
11.	Environment	i) Affected people will be given some amount of money for certain time if they will face worst environment then previous at least project duration period.

Question

What kinds of compensation package are eagerly accepted among the effected people when they are asked to leave their land & houses for the sake of development project?

Objectives

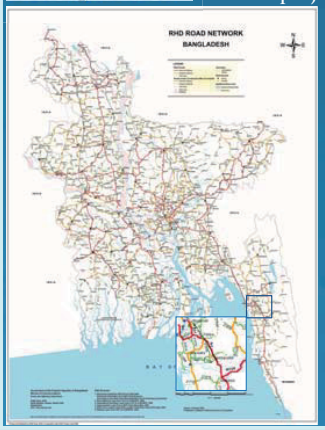
❖ Explore new ways to mitigate social & environmental effects during construction of a large road or similar gigantic projects.

❖ To perform reasonable voluntary resettlement with proper compensation to minimize the social impact.

❖ To recognize sustainable replacement of environmental changes occurred by the project and incurred environmental policy.

Study Area

Road Network Improvement and Maintenance project –II, RHD, Bangladesh.



I. Improvement of 212.7 Km road networks.
II. 754.26 acres of land acquisition is required.
III. 20,138 Number of persons are affected due to this project.
IV. Estimated value is 1570 million BDT(USD 20 million)for the compensation for land acquisition and resettlement.

Methodology

i. The survey enclosed stratified arbitrary sample of 100 households.
ii. Collection of primary and baseline data (like affected people, crops, infrastructure & assets, houses, enterprises etc.)
iii. Studying government policies, Value of compensation, mode of payment, competence and response of the recipients.
iv. Monitoring Government action during evacuation.
Collection of data after implementation of the project.
Analysis of those collecting data.

Expected findings

✓ Find out implementation of resettlement plan is satisfactory or not.

✓ The proposed compensation package within the same budget will be more acceptable to the affected person than the traditional compensation or not.

✓ Justified time frame of compensation and income restoration programs.

Poster No.35

Assessing medicinal plants as a linkage between health care, biodiversity and livelihoods: Cases from the Peruvian Amazon

Miki TODA

International communities have recognized that medicinal plants are in a unique position to link biodiversity conservation, sustainable development and health issues, especially in developing nations. While medicinal plants in developing countries can be a source of subsistence and income and provide accessible and affordable medicine, some medicinal plants contain chemical properties, which may cure serious diseases; they become a source of big cash, and are in demand worldwide.

From the perspective of conservation, the relationship between commercialization and overharvesting of medicinal plants has been studied and Medical Anthropology is interested in the interaction between use of medicinal plants and biomedical provision. However, the relationship between medicinal plants conservation, local livelihood and health care provision is rarely studied. The purpose of this study is to examine how these three aspects relating to medicinal plants interact with each other, intending to clarify the role of medicinal plants in biodiversity conservation and local livelihoods. The Peruvian Amazon was chosen for this study as the country currently faces rapid economic growth; yet increases in economic and social disparities, including health care provision occurs between urban and rural areas.

The informal meeting in two communities during a preliminary site visit revealed some adverse situations in a previous study. Sale of medicinal plants ceased; self-consumption of medicinal plants was declining; and people tended to rely on a health clinic, which is provided by the government. These findings led to further questions: such as under which conditions do people cease medicinal plant commercialization, to what extent does health clinic provision reduce use of medicinal plants, and if it affects harvesting and commercialization of medicinal plants. In order to answer these questions, the three levels of commercialization of medicinal plants; sale to the local, national and global market are introduced to examine the relationship with harvesting, and self-consumption. The provision of health clinics is also examined in relation to self-consumption, harvesting and commercialization.

The primary data will be collected through household surveys in selected communities in the Peruvian Amazon, scheduled for summer and winter in 2013.

Keywords: medicinal plant, biodiversity, conservation, livelihoods, health care, Peruvian Amazon

Assessing medicinal plants as the linkage between health care, biodiversity and livelihoods: Cases in Peruvian Amazon

Miki TODA

Background

The Facts:
- 50,000 species worldwide
- global demand US$23 billion (2008)
- source of new drug discovery

In developing countries -
- a source of subsistence and income
- medicine for 80% of population
- accessible and affordable medicine

International Expectation:
- an important role to link

biodiversity

sustainable development

health

8% of medicinal plants: threaten worldwide

The Facts:
- one of 17 megadiverse countries
- 60% of land = Peruvian Amazon
- 4th largest tropical rainforest

	Current Situation	Problems
Deforestation	low rate (0.2%)	increasing
Economy	rapidly growing	disparities: urban vs rural; Gini coefficient: 48% (2009)
Health sector	improving	low expenditure; insufficient in rural areas
Medicinal plants		being lost; no conservation effort; endemic species not fully assessed

Purpose

To assess the role of medicinal plants in biodiversity conservation and livelihoods through examining their linkage between sustainable development and health care system in Peruvian Amazon.

Key Words

Previous studies on medicinal plants related to biodiversity, livelihood and health issues revealed few key words.

Commercialization
Over harvesting
Self-Consumption

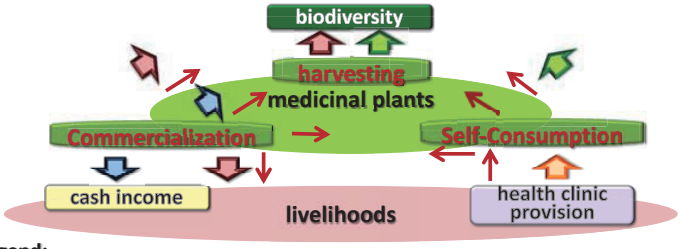
Objectives

* See "From Preliminary Site Visit" first.

- To examine if the level of commercialization influence harvesting, livelihoods, use of medicinal plants, in turn use of health clinic.
- To examine in what extend the provision of health clinic influence use of medicinal plants, in turn biodiversity.

Conceptual Framework

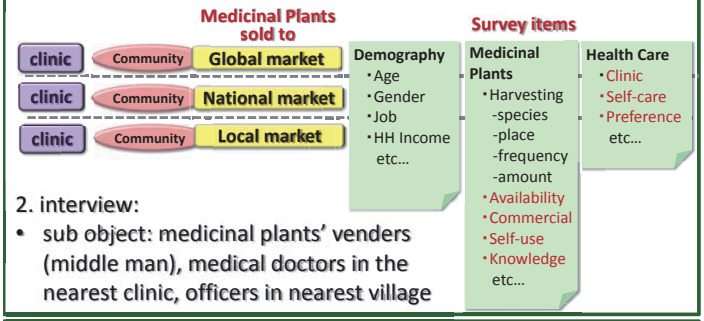
Previous studies show some aspects of linkage of medicinal plants between the key words relating to biodiversity, livelihoods and health.



Legend:
- previous studies: positive impact, negative impact, increase, decrease
- this study: research questions (objectives)

Methodology

1. household survey: questionnaire and interview
- main object: households in communities in Peruvian Amazon



2. interview:
- sub object: medicinal plants' venders (middle man), medical doctors in the nearest clinic, officers in nearest village

Study Sites

Amazon Biome & Peru

Amazon: approx. 700m ha
Amazon in Peru: approx. 70m ha
60% of Peruvian Land

Image: Earth Observatory Re-use of the image is permitted. http://earthobservatory.nasa.gov/Features/AmazonEVI/

study sites to be selected...

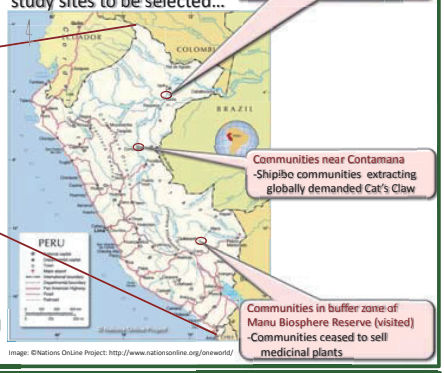


Image: ©Nations OnLine Project: http://www.nationsonline.org/oneworld/

Schedule

- preliminary site visit and hearing #2: Feb. – Mar. 2013
- main survey: summer and winter 2013 - 2014

From Preliminary Site Visit

Informal hearing during the preliminary site visit to communities in Peruvian Amazon revealed different situation from the literature.

Sites
- in a buffer zone of Manu biosphere reserve in the southern Peruvian Amazon
- Pilcopata village: 8 hr. drive from Cusco
- Santa Rosa de Huacaria community: 2 hr. walk from Pilcopata
- Queros community: 3 hr. walk from Pilcopata


Pilcopata


Santa Rosa de Huacaria


Queros

Background
- at least 5 years ago, medicinal plants were sold in the communities and the village.
- a program of participatory Forest Management using medicinal plants were conducted.

Interviewees
- Pilcopata: government officer, medical doctor in clinic, villagers
- Santa Rosa de Huacaria: the leader, the shaman, residents
- Queros: residents

Findings
- no regular sales of medicinal plants at communities
- no cultivation of medicinal plants in communities
- no medicinal plants sold in Pilcopata
- tendency to desire drugs from health clinic
- wants to learn medicinal plants use
- concerns of loosing knowledge of medicinal plants

Led to alter original research questions!
- required to see conditions of commercialization of medicinal plants
- required to closely look at the relation between use of medicinal plants and of health clinic → To "Objectives"

Poster No.36

Comprehensive analysis of the renewable energy promotion policy to reduce SO_2 and GHG emission in Chongqing, China

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Abstract

Chongqing is one of the regions most seriously damaged by acid rain and has been designated as an acid rain control zone by the national government. The main factor responsible for the serious increase in acid rain is SO_2 emission. Energy consumption remains heavily dependent on coal during the process of urbanization and industrialization, which contributes heavily to SO_2 emission. Inevitably, cities are confronted with the pressure of air pollutants and greenhouse gas reduction because of the dramatic increase in fossil fuel energy consumption.

Therefore, it is important to introduce new energy technologies to reduce both air pollutants (SO_2) and greenhouse gas emission through the design of effective new energy utilization mechanisms. This paper aims to simulate the impact of renewable energy utilization technology on environment improvement. For this purpose, we constructed a dynamic comprehensive evaluation model based on an Input-Output (I/O) model for the period 2010-2020. Use of computer simulations to consider social-economic activities and the relationship between energy consumption and pollutant emission were undertaken to show the total power generation from substitution ratios and the annual growth rate of GRP, the SO_2 and GHG emissions intensity reduction rate.

Keywords: Dynamic Input-Output model, Renewable energy, Social-Economic, Simulation

Comprehensive analysis of the renewable energy promotion policy to reduce SO_2 and GHG emission in Chongqing, China

Qian Zhou, Yoshiro Higano

Graduate School of Life and Environmental Science, University of Tsukuba

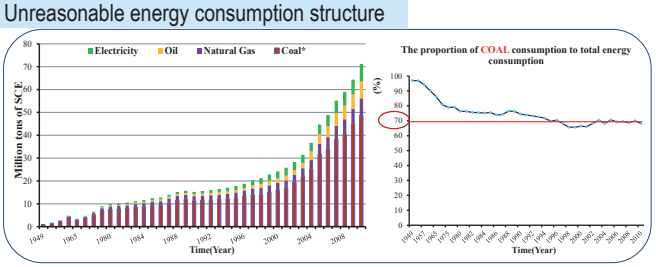
Strategic Funds for the Promotion of Science and Technology

Introduction

Current situation of study area

- Municipality
  - Economic Centre
  - Manufacturing Centre
  - Transportation Hub
- Large Area: 82.4 thousand Km^2
- Big population: 33.45 million
- Oldest heavy industrial city
- High economic growth rate: 17% (2010) NO.1

Unreasonable energy consumption structure

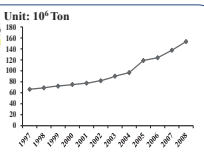


Environment problems

Acid rain situation in Chongqing

Index / Year	pH	Acid rain rate
2008	4.69	78%
2009	4.53	72.70%
2010	4.45	70.70%

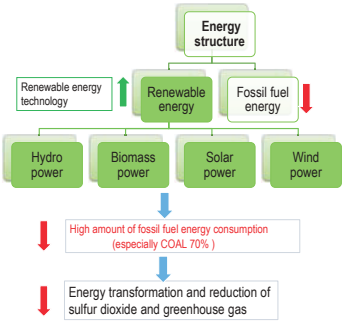
Severe acid rain area



Huge amount of Greenhouse gas emission

- The environmental problems are challenges which stress Chongqing urgent to make the transformation between new energy and fossil fuel energy
- New energy technologies and effective new energy utilization mechanisms must be identified

Objective



- Construct integrate evaluation model to comprehensively analyze impacts of new energy technologies and environmental economic policies to reduce SO_2 and GHG emission
- Find out the maximum potential of new energy utilization
- Put forward comprehensive environmental economic policies to realize sustainable development of regional economy

Methods

- **Literature Research**
- **Filed Investigation**
- **Model Construction and Simulation**
- Construct an optimization model (Input – Output model) (Value balance model, material balance model, energy supply - demand balance model)
- Formulate the comprehensive system as an optimization model which will be solved by the mathematical optimization software package, LINGO.

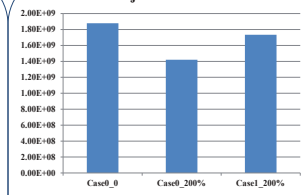
Result and discussion

Simulation case setting

	GHG emission constraint	New energy technology introduce
Case0_0	x	x
Case0_200%	o	x
Case1_200%	o	o

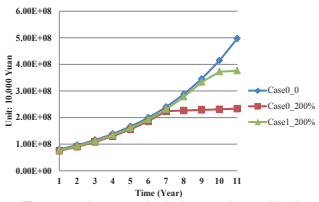
Case0_0: There is no GHG constraint, no new technology
Case0_200%: There is GHG constraint, no new technology
Case1_200%: There is GHG constraint and new technology

Objective value



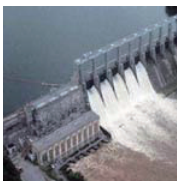
The economic output value is decreased caused by the GHG emission constraint. However, it is also increased because of introducing of new energy industry.

GRP development trends in the 3 cases from 2010 to 2020



The economic output value is decreased caused by the GHG emission constraint. However, it is also increased because of introducing of new energy industry.

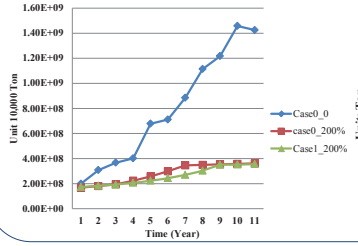
New energy technologies



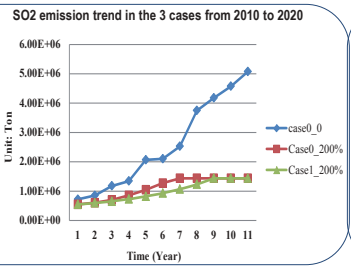
Small hydropower technology

Wind power technology

GHG emission trend in the 3 cases from 2010 to 2020



SO2 emission trend in the 3 cases from 2010 to 2020



- Analysis of simulation results shows there are profound positive impacts brought by the introduction of new energy technology.
- Energy shortage, SO_2 , GHG emission problems can be effectively solved by new energy utilization.
- In addition, new energy can effectively contribute to economic development, which is also indicated by the simulation.

Conclusion

- Comparing Case0_0 with Case0_200% and Case1_200%, we can come to the conclusion that new energy technologies have significant positive impacts on economic development and SO_2, GHG mitigation.
- Introduce new energy industry is an effective method that realize energy transformation and SO_2, GHG mitigation.

Further research

- Introduce economic-environmental policy.
- Construct comprehensive evaluate model and enlarge simulation model.
- Compare the efficiency of economic – environmental policy and new energy technology.

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Poster No.37

Comprehensive Evaluation of Policies for Water Quality Improvement and Effective Water Resource Utilization in Headwater Region of Liao River

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The headwater region of Liao River is an important commodity grain base and livestock breeding base of Jilin Province. It is also the Northeastern industrial revitalization implementation area of China. Huge water resource demand and water environmental burden has been caused by rapid economic development. Surface water and groundwater were highly developed and utilized, and a large amount of ecological water was occupied. Water quality in the whole basin is poor, especially in tributaries, the proportion of water quality below V-level is still large. Water pollution is mainly characterized by organic pollution. Main pollutants include COD, BOD5, NH3-N.

Through deep analysis of the factors causing the shortage of water resources and water pollution, this research can determine which factors or fields have potential for the introduction of related technologies and policies, and combine existing technologies and policies with new ones to establish a policy-technology system. Through construction of an integrated dynamic simulation model to evaluate relevant policies, this research can clarify the best trade-off between regional economic development and environmental protection as well as the effectiveness of policies and technology adoption.

According to current socio-economic status and combined with previous research, government planning and collated materials, the significance and purpose of this research can be determined. Based on the study of related literature and the introduction of policies and advanced technologies, an integrated model consisting of three sub-models that is suitable for the study area can be established. With the help of computer language, the operation and debugging of simulations can be conducted. Finally the simulated results will be analyzed and several recommendations will be proposed. Comprehensive analysis will be undertaken based on mathematical simulation.

Keywords: Water Quality Improvement, Water Resource Utilization, Integrated Dynamic Simulation Model, Environmental and Socioeconomic Policies, Input-Output Analysis

Comprehensive Evaluation of Policies for Water Quality Improvement and Effective Water Resource Utilization in Headwater Region of Liao River

Yang Wei
Supervisor: Yoshiro Higano
Graduate School of Life and Environmental Science, University of Tsukuba, Ibaraki, Japan

Strategic Funds for the Promotion of Science and Technology

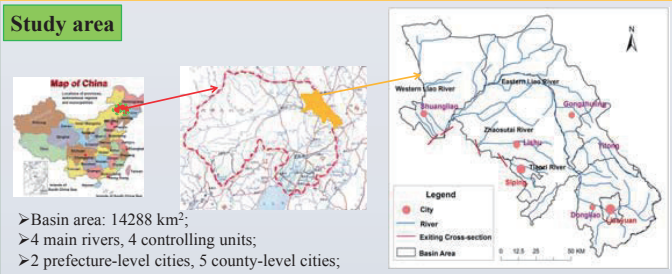
Abstract

With survey and data analysis of the study area, water shortage and water pollution are figured out, In order to solve environmental problems in the region, advanced technologies related to environmental economic policies and feasible watershed management system are considered and the effectiveness is analyzed. Mathematical model consisting of equations of behavioral and equilibrium conditions, energy and material balances, environmental constraints which are associated with society, economy and environment of the region is specified. Comprehensive analysis is made based on simulation with mathematical model. Policy proposal is made by clarifying best trade-off between regional economic development and environmental protection as well as effectiveness of policies and technologies adopted.

Key Words: Water Quality Improvement, Water Resource Utilization, Integrated Dynamic Simulation Model, Environmental and Socioeconomic Policies, Input-Output Analysis

Introduction

Study area



- Basin area: 14288 km^2;
- 4 main rivers, 4 controlling units;
- 2 prefecture-level cities, 5 county-level cities;
- Farmland: 4986 km^2, 34.9%, Population density:252 p/km^2;

Statement of Main Problems

1. The surface water and groundwater were **highly developed and utilized.**
   - A large amount of ecological water was occupied.
2. Water quality in the whole basin is poor, especially **in the tributary,** the proportion of water quality below **V-level is still large.**
3. Water pollution is mainly characterized with **organic pollution.** Main pollutants include **COD、BOD_5、NH_3-N.**

Causes of Problems

Resource processing industries with high water demand and heavy pollution account for large proportion.

Sewage pipe network construction is lagged, emission standard of sewage treatment plant is low(Ⅱ).

Lack of suitable management technologies and policies system

Livestock manure and rural household sewage were directly discharged, and garbage was piled up near the river.

Water conservation capacity is low, and soil erosion is serious.

Objective

To find out on which factors or fields there is the potential for introducing related technologies and policies

To combine the existing technologies and policies with newly introduced ones to establish a policy-technology system

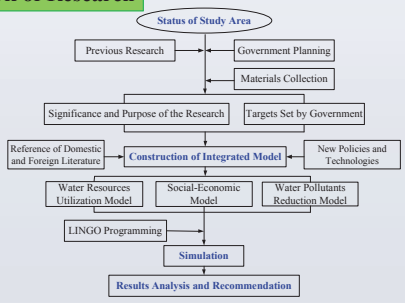
To clarify the best trade-off between regional economic development and environmental protection as well as effectiveness of policies and technologies adopted

Methodology

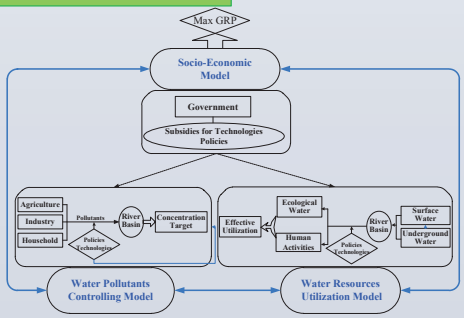
- Environmental Systematical Analysis, Environmental economics
- Input-output Analysis
- Optimization Modeling Based on LINGO Programming

Comprehensive Model Construction

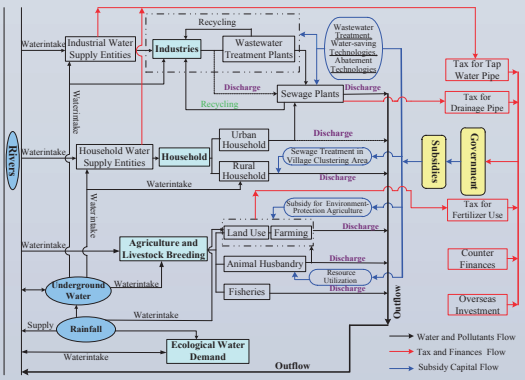
Framework of Research



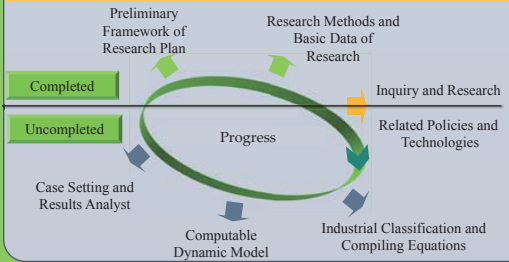
Concept of Simulation Model



Details of Integrated Model



Progress of Research



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Poster No.38

Evaluation of nitrate groundwater remediation at a long running permeable reactive barrier system using stable isotopic analysis

Junping LIU
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Nitrate is known to impose severe health issues such as methemoglobinemia and potential formation of carcinogens in the stomach and intestine. Nitrate contamination of waters, especially groundwater, is a direct result of excessive use of fertilizers, which leach into the groundwater or be carried by surface water and run off into other water bodies.

In order to deal with the nitrate-contaminated groundwater, the application of biological denitrification technology using denitrifying bacteria in in-situ passive systems has been widely used, such as permeable reactive barriers. A permeable reactive barrier (PRB) consists of placing in the path of a groundwater plume a porous reactive material able to remove the contaminants from the plume as it flows through it.

The South-to-North Water Diversion Project in China is one of the most famous water conservancy projects in the world and aims to deal with nitrate contaminated groundwater penetration into the main canal through the check valve, which is set to reduce the groundwater flow. A heterotrophic denitrification PRB has been installed in Jiaozuo, Henan province, China, which is located to the outboard of the main canal, with the measurement is 75m×3m×6m, the reactive medium is constituted of 4/9 walnut shell, 3/9 lignite and 2/9 ceramsite (volume ratio). This permeable reactive barrier has been run for more than one year and can achieve the nitrate removal efficiency of more than 90%.

Evaluation of a long-time running PRB performance is based on monitoring nitrate concentrations, along with pH and Eh, and major inorganic constituents, in ground water well transects across the PRB. PRB are often installed within existing contaminant plumes and therefore elevated concentrations of contaminants are observed down gradient of PRB for some time after the system has been installed, depending on the extent of initial contamination, ground water flow rates, desorption rates and type of the aquifer material.

In this study, the nitrate behavior in the area where PRB was installed will be identified, hydrogeochemical and hydrogeology processes around and inside the denitrification permeable reactive barrier will be evaluated, dynamics of nitrate pollutants in the barrier using stable isotope $\delta^{18}O$ and $\delta^{15}N$, consisting of the characterization and quantification of electron-accepting processes with the different depth will be identified, in order to estimate the sustainability and longevity of nitrate degradation processes.

Keywords: nitrate, groundwater, PRB, isotope, geochemistry

Evaluation of nitrate groundwater remediation at a long time running permeable reactive barrier system using stable isotopic analysis

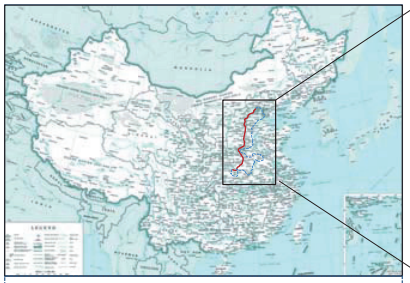
Liu Junping
Graduate School of Life and Environmental Sciences

Strategic Funds for the Promotion of Science and Technology

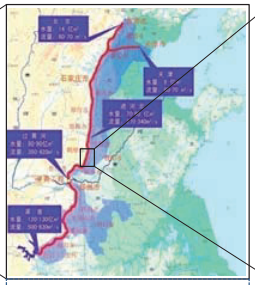
Introduction

Nitrate contaminated groundwater is a direct result of excessive use of fertilizers which could leach into the groundwater or be carried by the surface water and run offs into other water bodies

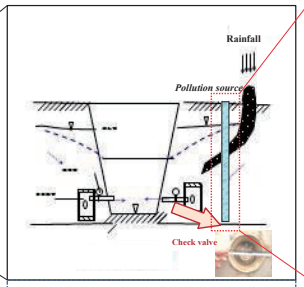
Nitrate — *Impose severe health issues such as methemoglobinemia and potential formation of carcinogens* → *Precipitation* → *Drinking groundwater*



Middle line project in South to North Water Diversion



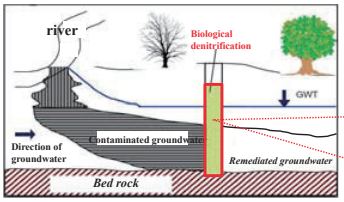
Main canal of middle line project

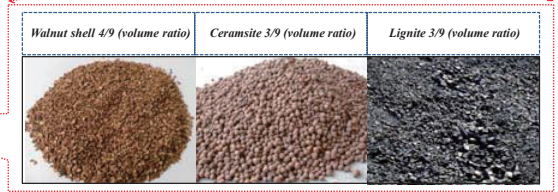


Profile of the canal and permeable reactive barrier

Groove excavation of permeable reactive barrier

A heterotrophic denitrification permeable reactive barrier has been installed in Jiaozuo, Henan province, China, which is located to the outboard of the main canal, with the measurement is 75m×3m×6m, the reactive medium is constituted of 4/9 walnut shell, 3/9 lignite and 2/9 ceramsite (volume ratio)





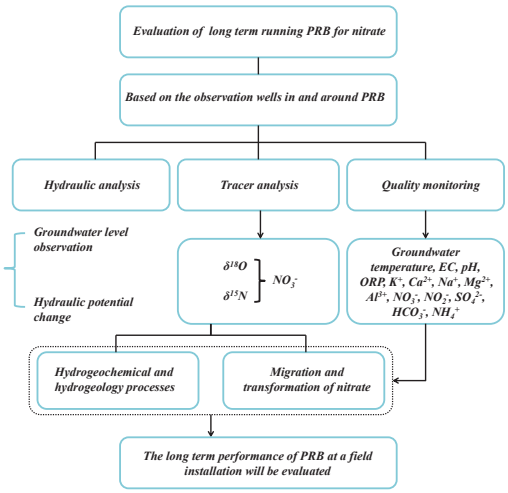
Objective and methods

Identify the nitrate behavior in the area where PRB was installed

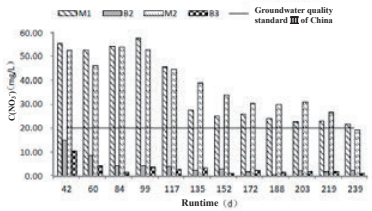
Evaluate hydrogeochemical and hydrogeology processes around and inside the denitrification permeable reactive barrier

To obtain profiles of hydro chemical and isotopic compositions in relation to PRB aquifer geology and depth. Clarify the depth-dependent behavior of NO_3^-

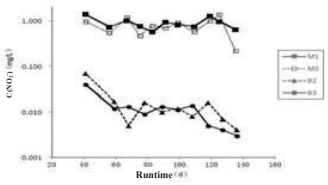
Evaluation of long term running PRB for nitrate, assess the transformation and migration of nitrate



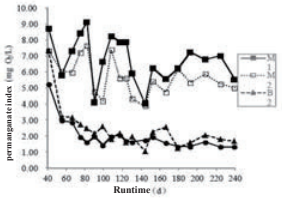
Previous research result (*Feng Haigang et al., 2011*)



Nitrate concentration inside and outside of PRB



Nitrite concentration inside and outside of PRB



Permanganate index inside and outside of PRB

This permeable reactive barrier has been run for more than one year and can achieve the nitrate removal efficiency of more than 90%. Nitrite concentration inside PRB is below 0.02 mg/L and permanganate index is below 2mg O_2/L, indicating denitrification happens, all of which meets the standards.

Poster No.39

Examination of Clean Water Technology: The assessment of main reactions of Aerobic Granular Sludge within high-strength organophosphate-contaminated waste water

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Introduction:

At present, water resources are abundant and clean in Japan since environmental security and law enforcement have gradually achieved restriction in toxic chemicals. However in many underdeveloped countries, the restriction for uses of water-soluble toxic herbicides and pesticides are not strict enough to inform all the producers of farmlands. The main focus of this study is the organic phosphates and phosphate groups which have been used in the third world, and their treatment method: granular sludge technology. The study also focuses on the behavior of granular sludge when it is exposed to human-made chemicals and the discovery of effective methods in granulation.

Materials and Methods:

The main source of granular sludge was provided by the water treatment facility in Kasumigaura, Ibaraki. The concentrated sludge bed was cultivated with synthetic waste water and sequencing batch-mode reactor (SBR). The cultivation period ranged from two to six weeks and the reactor will generate four cycles per day, without intermission. Cycles are controlled by timer and granules will form with sludge microbial that is high-density and flocculent. After the cultivation period, some granules will be tested with organophosphate contained-water to observe the reaction, with other cultivated granule remains in the SBR to compare the results.

Further observation

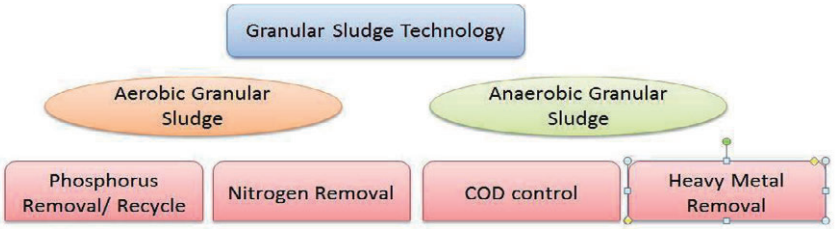
Granulation of concentrated sludge differs during the process of wastewater feeding. When wastewater components change dramatically, the formation, collapse time, and percentage in removal of chemicals will change. We will change the components of waste water feeding time to create the best setting to effect the chemical adhesion of granules.

Examination of Clean Water Technology: The assessment of main reactions of Aerobic Granular Sludge within high-strength organophosphate-contaminated waste water

Yuto Hamajima, EDL Program University of Tsukuba

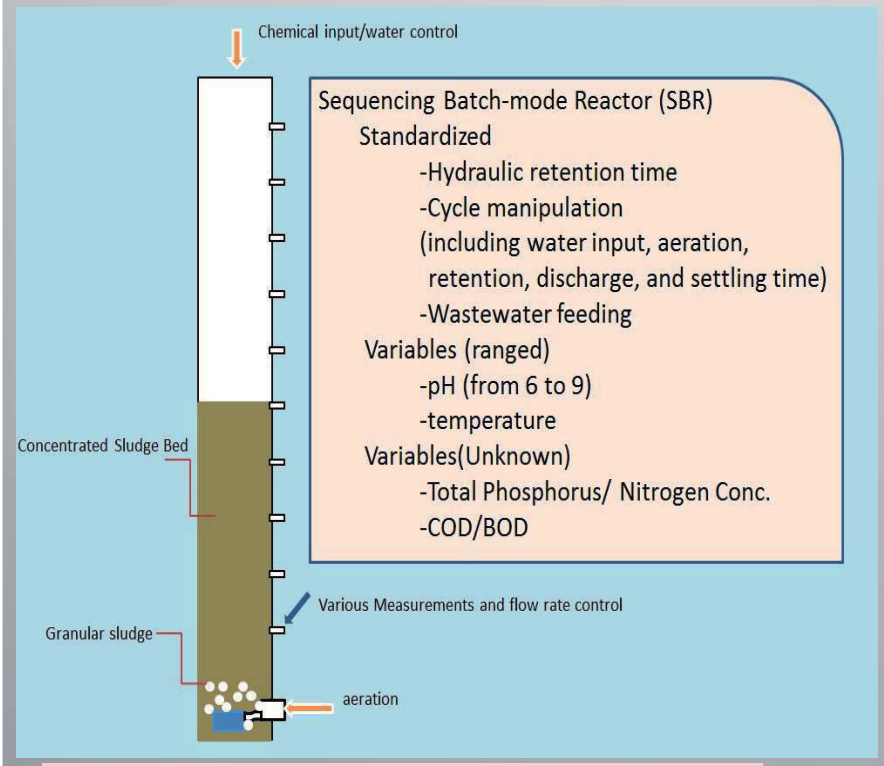
Strategic Funds for the Promotion of Science and Technology

Introduction



Research Objective

- To provide better understanding of sludge granulation and its reaction toward chemicals in waste water, especially with chemicals in pesticides and herbicides
- To improve granulation efficiency within high-strength waste water



Sequencing Batch-mode Reactor (SBR)

Standardized

- -Hydraulic retention time
- -Cycle manipulation (including water input, aeration, retention, discharge, and settling time)
- -Wastewater feeding

Variables (ranged)

- -pH (from 6 to 9)
- -temperature

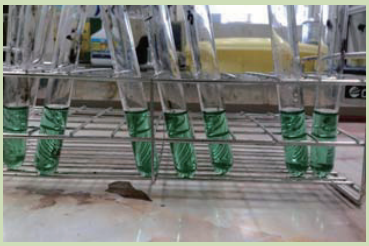
Variables(Unknown)

- -Total Phosphorus/ Nitrogen Conc.
- -COD/BOD

Standard Method for wastewater

In order to conduct proper measurement of COD, BOD, TN, TP, pH and other sources that are necessary in granular reaction, *the Standard Method for Water and Wastewater Treatment* has been examined.

Use of Spectrophotometer to determine the absorption of the spectra



Light absorbance differs in color difference

Future Reference

- Continuous examination of standard method for accurate determination in water contaminants are needed to establish the repetitiveness of the test
- the reaction of granular sludge to the addition of organophosphates via SEM microscope

Expected Results

- Organic Phosphates may appear its toxicity which it may interfere the granular formation/ high rate in collapse of granules in early stages
- COD, TP,TN measurement are still unstable in its obtained values – it needs higher accuracy
- The chance of discovery in better performance of granular formation using nutrient-abundant chemicals